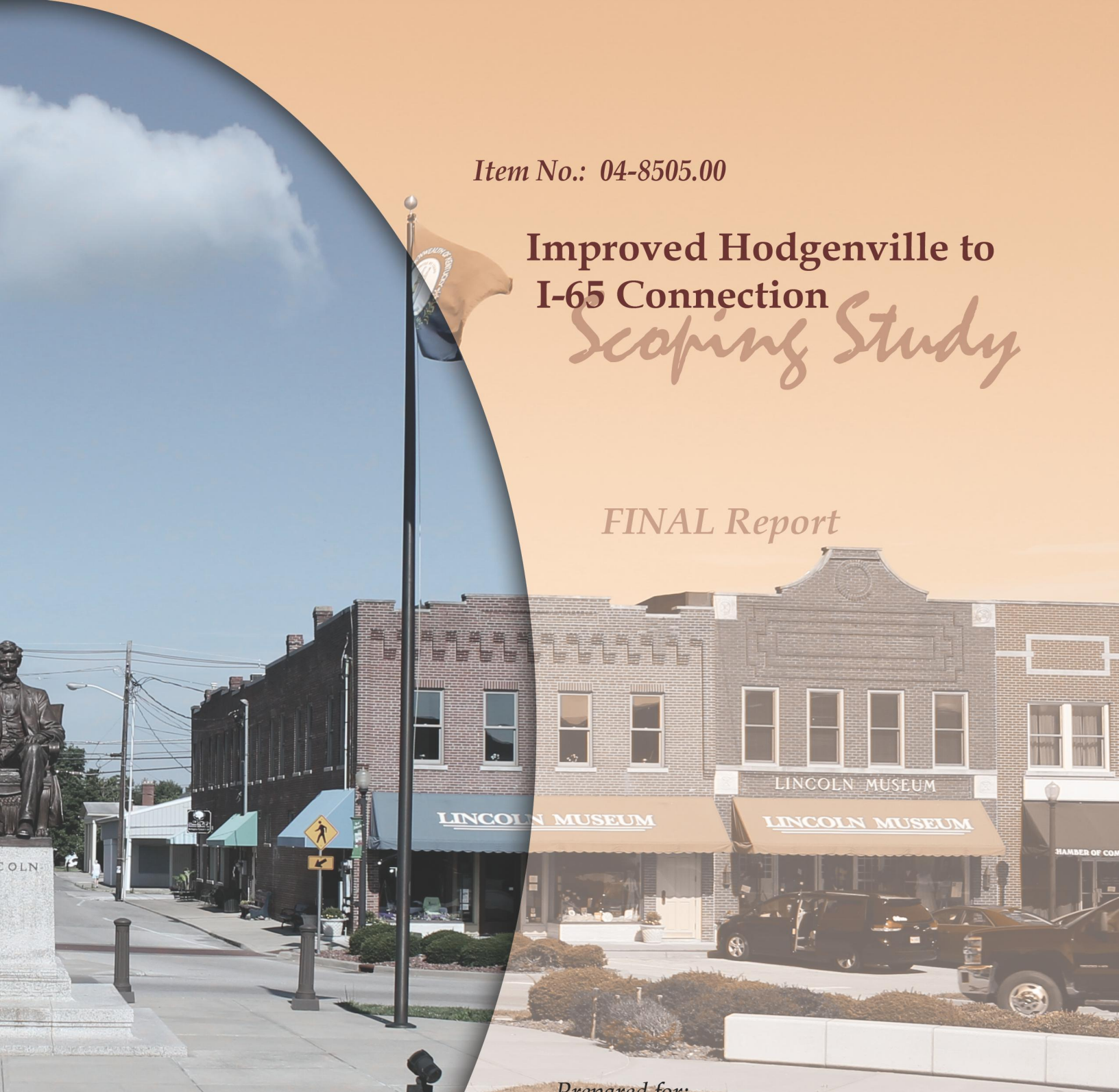
Item No.: 04-8505.00

Improved Hodgenville to I-65 Connection *Scoping Study*

FINAL Report



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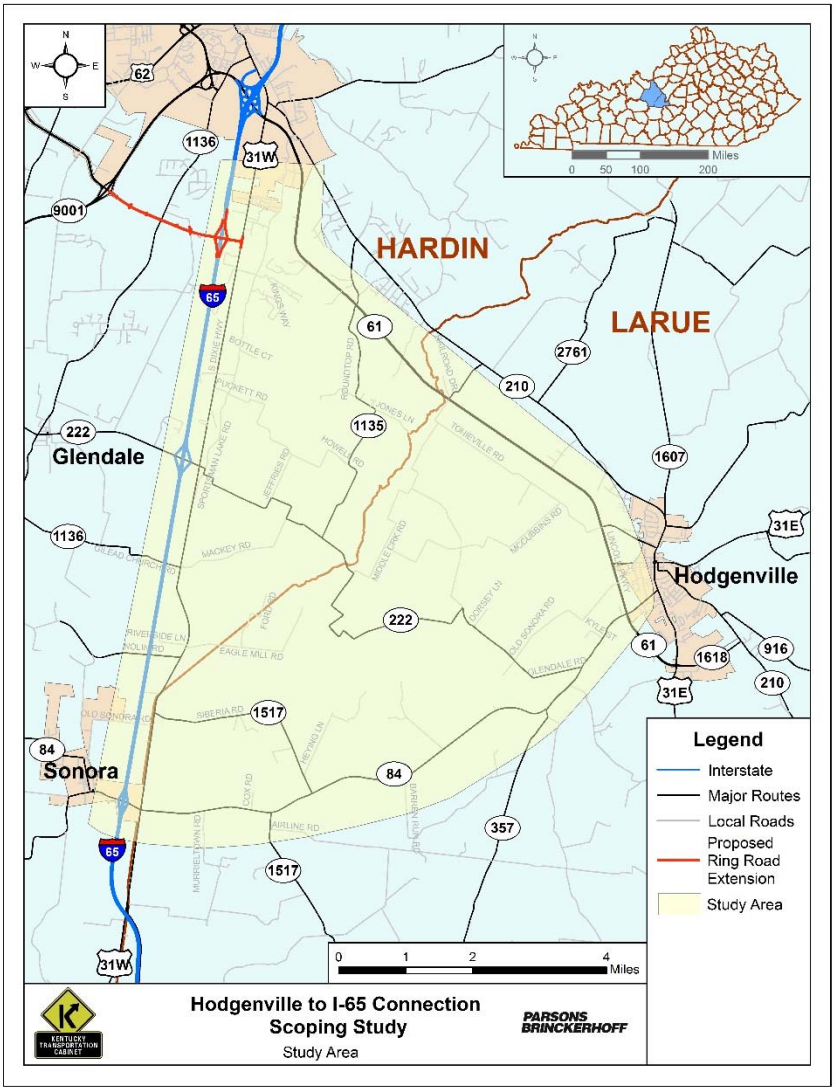
Introduction

Parsons Brinckerhoff was contracted by the Kentucky Transportation Cabinet (KYTC) to provide engineering services for the completion of a corridor planning study to identify and evaluate potential improvements to KY 222 and KY 84 and to develop a possible new connector route between KY 61 and I-65 in LaRue and Hardin Counties, Kentucky. This study has been listed in the KYTC Highway Plan as Item No. 04-8505.00. The study was initiated by local officials in LaRue County with the vision to provide an improved connection from Hodgenville to the Glendale Industrial site (or Glendale Megasite). The study area encompasses the area between I-65, KY 61, and KY 84 as shown in **Figure ES-1**.

The study includes identifying short-term improvements along existing routes (KY 222 and KY 84) where feasible that can be quickly and effectively implemented. It also focuses on long-term solutions that examine corridor-wide improvements to KY 222 and KY 84, as well as new route options including a connection from KY 222 to KY 61, and a possible extension of KY 3005 (Ring Road) to connect with KY 61.

Figure ES-1: Study Area



While KYTC has the ultimate responsibility for constructing and maintaining safe and efficient highways, KYTC desires to incorporate local official and stakeholder (LO/S) and public input into the evaluation and decision-making process. Therefore, this study was completed in coordination with input from the LO/S and the public.

Purpose and Need

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

Purpose

The purpose of the Improved Hodgenville to I-65 Connection Scoping Study is to identify a more reliable and safer connection between Hodgenville and I-65 / Glendale.

Need

Several needs have been identified that support transportation improvements in the study area. The supporting need is presented below.

Safety - Two spot locations within the study area have a critical crash rate factor (CCRF) equal to or greater than 1.0:

- KY 84 near I-65 - (CCRF = 2.74)
- KY 222 near I-65 - (CCRF = 1.18)

In addition, three fatal crashes occurred within the study area during the time period of analysis (January 2010 to December 2014).

Roadway Deficiencies - KY 84 has 36 noted vertical and 5 horizontal deficiencies. Within these areas, 22 out of 59 crashes occurred (37%). KY 222 has 65 noted vertical and 25 horizontal deficiencies. Within these areas, 3 out of 5 crashes occurred (60%).

Travel Time Reliability - Travel time reliability refers to a desire to have consistency in travel times day to day. KY 222 and KY 84 both have a volume to capacity ratio (v/c ratio) much less than 1.0 or 0.9. A v/c ratio of 1.0 is considered capacity in urban areas while a v/c ratio of 0.9 is considered capacity in rural areas. Therefore, operations on both roadways do not result in peak hour congestion.

The issue, however, with unexpected delays along these routes is that they are two-lane roads with limited passing opportunities. As noted, both have numerous deficient horizontal and vertical curves requiring drivers to slow down. Travel times on these routes vary depending on the number of vehicles, the vehicle mix, and weather. The average estimated travel time from I-65 at Glendale via KY 222 to Hodgenville is 14.0 minutes. The average estimated travel time from I-65 at Sonora via KY 84 to Hodgenville is 11.2 minutes. If drivers end up behind a slower moving vehicle such as a tractor or horse and buggy, travel times can increase between 35 to 50 percent (dependent on the length of time the vehicle must travel before able to pass).

Comparatively, KY 61 is a four-lane route with more opportunities for passing that connects Elizabethtown to Hodgenville. The average estimated travel time from I-65 near Elizabethtown via KY 61 to Hodgenville is 10.9 minutes.

Access - Access to and from Hodgenville and the I-65 / Glendale area is a concern given the existing options:

- KY 84: KY 84 is a two-lane route with lane widths ranging from 9 to 11- feet and narrow or limited shoulders. This route provides access from I-65 / Sonora to Hodgenville.
- KY 222: KY 222 is also a two-lane route with 9-foot travel lanes and minimal shoulders. This route is very disjointed and requires multiple turns to travel between I-65 at Glendale to KY 61 near Hodgenville. This route also has numerous horizontal and vertical deficiencies. This route does connect the I-65 / Glendale area to Hodgenville.
- KY 61: KY 61 is a four-lane, divided, partially access-controlled route. It provides access to Hodgenville from the Elizabethtown area.

Given these three different routes, access is dependent on driver location on I-65. KY 61 is the logical choice from Elizabethtown. Drivers will most likely choose to use KY 84 to travel to the Hodgenville area if they are travelling northbound on I-65. KY 84 is also signed as the route to the Abraham Lincoln Birthplace National Historical Park and Abraham Lincoln's Boyhood Home at Knob Creek. If drivers are in the Glendale area, they can either use KY 222 with its noted issues, or choose another route. It should also be noted that depending on route choice and direction of travel, portions of I-65 may also be used in conjunction with these three routes.

Connectivity - Currently, there is no continuous direct route from I-65 near the Glendale area to Hodgenville. KY 222 is the current route providing a connection near I-65 / Glendale; however the deficiencies and multiple turns result in slower speeds. The existing route also does not provide direct access from I-65 near the Glendale area to the major industrial employers in the area (Cumberland Products, Inc., Lincoln Tool, Inc., and Konsei USA, Inc.) located just north of Hodgenville along KY 61. Some truck traffic may be utilizing KY 84 for local access but it is not a designated truck route per the Kentucky Designated National Truck Network. According to the most recent counts (2013), 11.6% of vehicles using KY 84 are trucks.

KY 61 is the other alternate route that does provide direct access to the industrial employers located north of Hodgenville. For southbound traffic on I-65, this is the preferred route to access the industrial park. For northbound traffic on I-65, trucks must travel north to Elizabethtown, then turn south along KY 61.

Existing Conditions

A detailed inventory examined ongoing and identified transportation projects, existing roadway characteristics, traffic volumes, level of service (LOS), capacity, and crash rates. A summary of key points is as follows:

- In the KYTC FY 2014 – 2020 Highway Plan Item No. 4-198.00 is included. This project is to extend KY 3005 (Ring Road) from the Western Kentucky Parkway to I-65 (right-of-way and utilities costs = $4,450,000). State construction funds were not available at this time. This project is important

to consider as it would have connectivity implications on the possible extension of Ring Road from I-65 to KY 61 being studied in this project.

- A total of 41 locations along KY 84 and 90 locations along KY 222 have geometric curves that do not meet current design standards.
- KY 84 has existing traffic volumes (average daily traffic) ranging from 4,450 near the interchange with I-65 dropping to 1,730 moving eastward from the interchange. KY 222 has existing traffic volumes (average daily traffic) of less than 200.
- All segments of KY 84 and KY 222 are under capacity (less than 1.0 in urban areas or 0.9 in rural areas). The LOS for all segments are calculated to be LOS C or better. Therefore, there does not appear to be consistent capacity or level of service issues along the existing routes.
- There are two spot locations within the study area that have a CCRF equal to or greater than 1.0. The first is on KY 84 near I-65 (CCRF = 2.74). The second is on KY 222 near I-65 (CCRF = 1.18). Three fatal crashes occurred during the time period of analysis (January 1, 2010 through December 31, 2014). Two occurred on KY 84; the third occurred on KY 61.
- The LaRue County Industrial Park is located along KY 61, north of Hodgenville. The site includes several major industries in the county and results in truck traffic travelling through the study area.
- There are several properties listed on the National Register of Historic Places (NRHP) located along the KY 84 and KY 222 corridors. There are also two archaeological sites located within the study area that could be of potential concern.

Alternative Development and Analysis

Preliminary Analysis

A set of alternatives were developed initially as a result of direction by KYTC on the specific needs of this study. A no-build option is the baseline for comparison and should be carried forward as a viable alternative throughout the project development process.

The four initial build alternatives are as follows:

- Route No. 1: New corridor extending KY 3005 (Ring Road) from US 31W to KY 61
- Route No. 2: New corridor near the I-65 / KY 222 interchange to KY 61
- Route No. 3: Improve existing route KY 222 from I-65 to KY 84
- Route No. 4: Improve existing route KY 84 from I-65 to KY 61

Each alternative was considered for any fatal flaws that would prohibit it from progressing as a potential feasible option for further project development. Route No. 3 (Improve existing route KY 222) was recommended for elimination at this stage of the project for the following reasons:

- Low traffic volumes (ADT currently less than 200) and low projected future year traffic volumes (ADT 250)
- Very rural roadway serving primarily local traffic
- Current route disjointed with multiple turn movements

- Cost outweighs benefits based on the number of identified geometric deficiencies (65 vertical and 25 horizontal) compared to the traffic volume potentially served

Furthermore, this was confirmed independently by the LO/S at their first meeting. The group unanimously vocally agreed to eliminate improvements to KY 222 as an option, as well as noted it on their survey forms (eleven out of eleven responses).

KY 84 was further examined at this point to determine if there were any locations where spot improvements were warranted. **Table ES-1** lists these projects.

Table ES-1: KY 84 Spot Improvement Projects

Spot Improvement	Location	Project
84-A	KY 84 at US 31W near MP 26.00	Improve sightlines by moving utility poles
84-B	KY 84 at KY 357 at MP 6.56	Realign intersection
84-C	KY 84 at KY 222 at MP 7.39	Realign intersection
84-D	KY 84 near Milepoint 8.00	Realign curve
84-E	KY 84 at KY 61 at MP 8.44	Flashing yellow arrow for left turns and offset left turns
84-F*	KY 84 at Barren Run Creek Bridge at MP 3.33	Replace superstructure

*Note: 84-F was added to the list following the second LO/S meeting and public meeting.

Detailed Analysis

The remaining three alternatives and options were advanced to the next stage for detailed analysis and assigned a broader-based project identifier name. The naming convention became:

- Route No. 1: Ring Road Extension = Green Corridor
- Route No. 2: New Corridor to Hodgenville = Yellow Corridor
- Route No. 4: Improve Existing KY 84 = Orange Corridor

Figure ES-2 shows the revised map with the location of these corridors as well as the spot improvements. **Figure ES-3** provides more detail on the spot improvements.

A more detailed evaluation was then performed with respect to traffic operations, environmental impacts, and costs. **Table ES-2** provides a summary of these impacts.

Figure ES-2: Proposed Alternatives

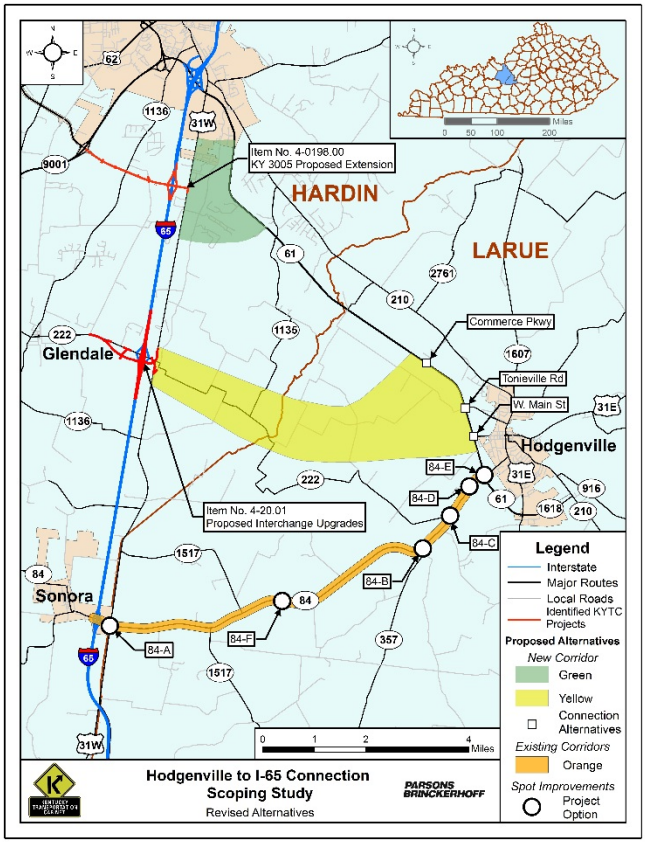


Figure ES-3: KY 84 Spot Improvements

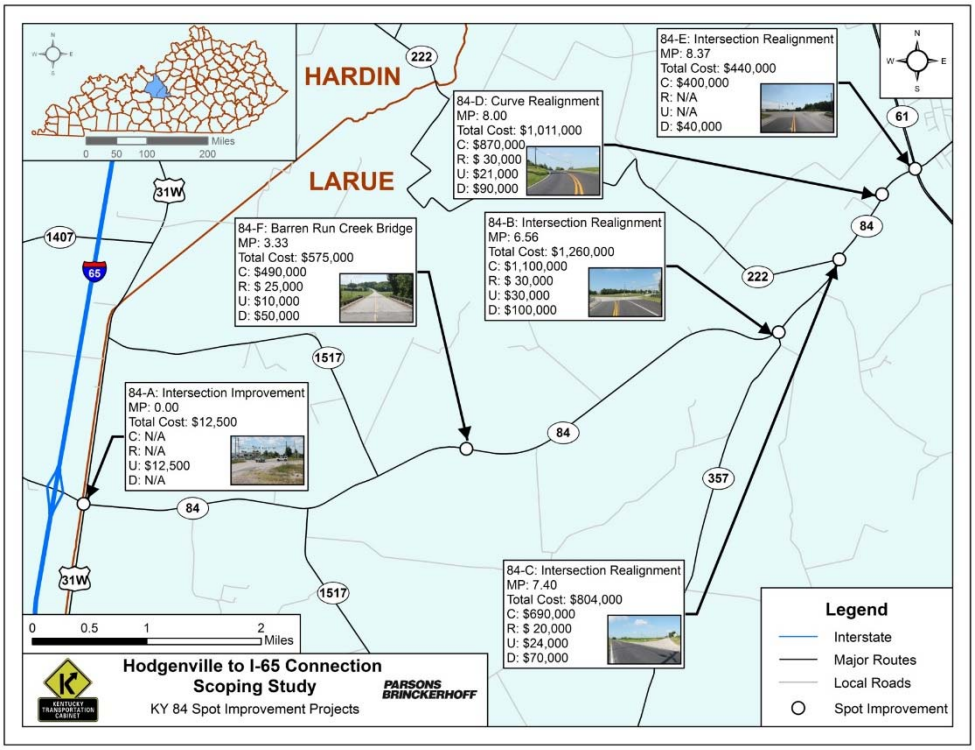


Table ES-2: Summary of Detailed Analysis

Alternative	Description	Length	2040 ADT	2040 LOS	V/C Ratio	Travel Time / Distance[1] (nin / miles)	Farmland Impact (Acres)	Planning-Level Cost Estimate[2]
Green	Extension of Ring Rd (KY 3005) from US 31W to KY 61	0.8	6,000	A	0.09	12.2 / 11.9	15	$5,040,000
Yellow	New corridor near the I-65 / KY 222 interchange to KY 61	7.2	2,300 – 4,500	C	0.15	8.9 / 8.2	115	$33,528,000
Orange	Improve existing KY 84 route from I-65 to KY 61	8.6	4,000 – 5,500	C	0.18	16.2 / 14.8	0	$34,420,000

*Note:

[1]Travel time analysis is based on a start point at the Glendale interchange (I-65 and KY 222) and an end point at the center of Hodgenville. All values are calculated based on distance and the posted speed limit (or proposed limit for new routes). They do not consider additional delay related to the interchanges with I-65 or the traffic signals in Hodgenville as all three routes would experience each of these delays. Therefore, these are relative comparisons and should not be considered actual travel times.

For reference, existing travel times from the same start and end point are as follows:

- I-65/KY 61 Route: 13.8 min (13 miles)
- KY 222/KY 84 Route: 14.0 min (11.4 miles)
- I-65/KY 84 Route: 16.2 min (14.8 miles)

[2] Planning cost estimates are in current year dollars (2015).

Recommendation

Based on the alternatives analysis, the project team discussion, and inputs from LO/S and the public, the corridor that best meets the purpose and need of the project is the Yellow Corridor. This recommendation however is only justifiable if and when the Glendale Industrial Site develops, increasing traffic demand for a new route beyond what is otherwise projected. All three corridors provide different benefits and have different impacts, as noted below:

- The Green Corridor, while a viable project, does not appear to fully meet the purpose and need for this study. Future development of the Green Corridor can take place independently as growth in that section of the study area warrants and completion of the roadway to the east and northeast occurs. However, should the need for direct connectivity between I-65 / Glendale and Hodgenville diminish, the Green corridor provides a cost-effective solution to the remaining needs.

- The Yellow Corridor appears to best meet the purpose and need of this project. It provides an improved connection between I-65 / Glendale and Hodgenville meeting much of the purpose and need. This is in contrast to the Green Corridor, which does not provide a more direct connection to Hodgenville from the Glendale area along I-65. At both of the LO/S meetings, all in attendance unanimously ranked this alternative as their preferred corridor in the survey form (11 out of 11 responses and 9 out of 9 responses). At the public meeting, it received the same number of responses as the Green Corridor from the response exercise. It received slightly less preference than the Orange Corridor through the survey form (25 responses compared to 35 responses).

  The typical section recommended at this planning stage is two, 12-foot lanes with a 10-foot shoulder (8-foot paved). This is subject to change per future design evaluation. The specific connection point with KY 61 shall be determined during the design phase, although it is recommended to consider either a connection with Tonieville Road (KY 3204) or near the LaRue County Industrial Park per comments made during the public meeting.

  Finally, considering the benefit / cost of the project, it does not appear to warrant further action until growth and development at the industrial park is realized and the requisite travel volume / traffic needed for this project takes place. The overall project cost (including all cost components) is $33,528,000 for a projected traffic usage of 2,300 vehicles per day without full build-out of the Glendale Industrial Site. This is much too low to justify the costs.

- The Orange Corridor, which would complete a major widening of KY 84, does not fully meet the purpose and need of this project and is not recommended for further project development. While it would improve the safety and roadway deficiencies components of the purpose and need through improved geometrics, it does not provide a more reliable connection between the Hodgenville and I-65 / Glendale area as it maintains its approximate current alignment. Northbound vehicles would benefit from an upgraded KY 84. Traffic from the Glendale area and

the industry along KY 61 would not benefit from this alternative to the same degree as the Yellow Corridor. However, some of the spot improvements identified in the study are recommended as they will address the geometric deficiencies and improve the safety of the route.

Further project development is recommended for the spot improvements at this time. Of the six spot improvement projects identified along KY 84, all six are viable. From a prioritization standpoint, improvements 84-A: KY 84 at US 31W (total cost of $12,500) and 84-D: KY 84 near Milepoint 8 (total cost of $1,011,000) are the high priority spots. This is based on input from the LO/S group and the public, and ultimately decided upon by the project team. The following are some considerations for the remaining spot improvement projects:

- 84-B: KY 84 at KY 357 Intersection Realignment - The realignment to make KY 84 the primary route is justified by traffic volumes but may not be warranted as a stand-alone project (i.e. not warranted unless KY 84 is widened).
- 84-C: KY 84 at KY 222 Intersection Realignment - The realignment of the approach of KY 222 to provide a better connection to KY 84 is a project that could be considered a stand-alone project but is not a high priority at this time.
- 84-E: KY 84 at KY 61 Intersection Realignment - Signal timing adjustments and an offset for left turns from KY 61 could be made to improve intersection operations. At the time of this documentation, KYTC District 4 has added this project to their list of in-house projects for 2016.
- 84-F: KY 84 at Barren Run Creek Bridge - This spot improvement project has the highest cost (total cost of $575,000) of the remaining projects not in the top two. It is possible that additional maintenance on the immediate approaches may alleviate some of the issues at a lower cost than the full bridge replacement project.

Currently, there is no funding in the 2014 KYTC Highway Plan for any future phases of project development. The 2016 KYTC Highway Plan includes $1,000,000 for the design phase of this project listed as Item No. 04-8505.00. An additional $675,000 (D: $125,000, R: $50,000, U: $100,000, C: $400,000) is listed for connector improvements Hodgenville to I-65 as Item No. 04-8909. Additional review in the design phase should provide the necessary evaluation (including public input) on the preferred treatment of the entire corridor, including any modifications to the typical section and specific connection points to I-65 and KY 61.

1.0 Introduction

Parsons Brinckerhoff was contracted by the Kentucky Transportation Cabinet (KYTC) to provide engineering services for the completion of a corridor planning study to identify and evaluate potential improvements to KY 222 and KY 84 and to develop a possible new connector route between KY 61 and I-65 in LaRue and Hardin Counties, Kentucky. This study has been listed in the KYTC Highway Plan as Item No. 04-8505.00. The study was initiated by local officials in LaRue County with the vision to provide an improved connection from Hodgenville to the Glendale Industrial site (or Glendale Megasite).

Members of the Project Development Team (PDT) included KYTC District 4, KYTC Central Office Division of Planning, the Lincoln Trail Area Development District (LTADD), and the consultant team, which consisted of Parsons Brinckerhoff; Third Rock Consultants, LLC; Cultural Resource Analysts, Inc.; and AEI, Inc. The LTADD provided input throughout the study process and assisted by providing a Socioeconomic Study.

1.1 Study Objectives

Based on the initial direction provided by KYTC, seven primary study objectives were developed:

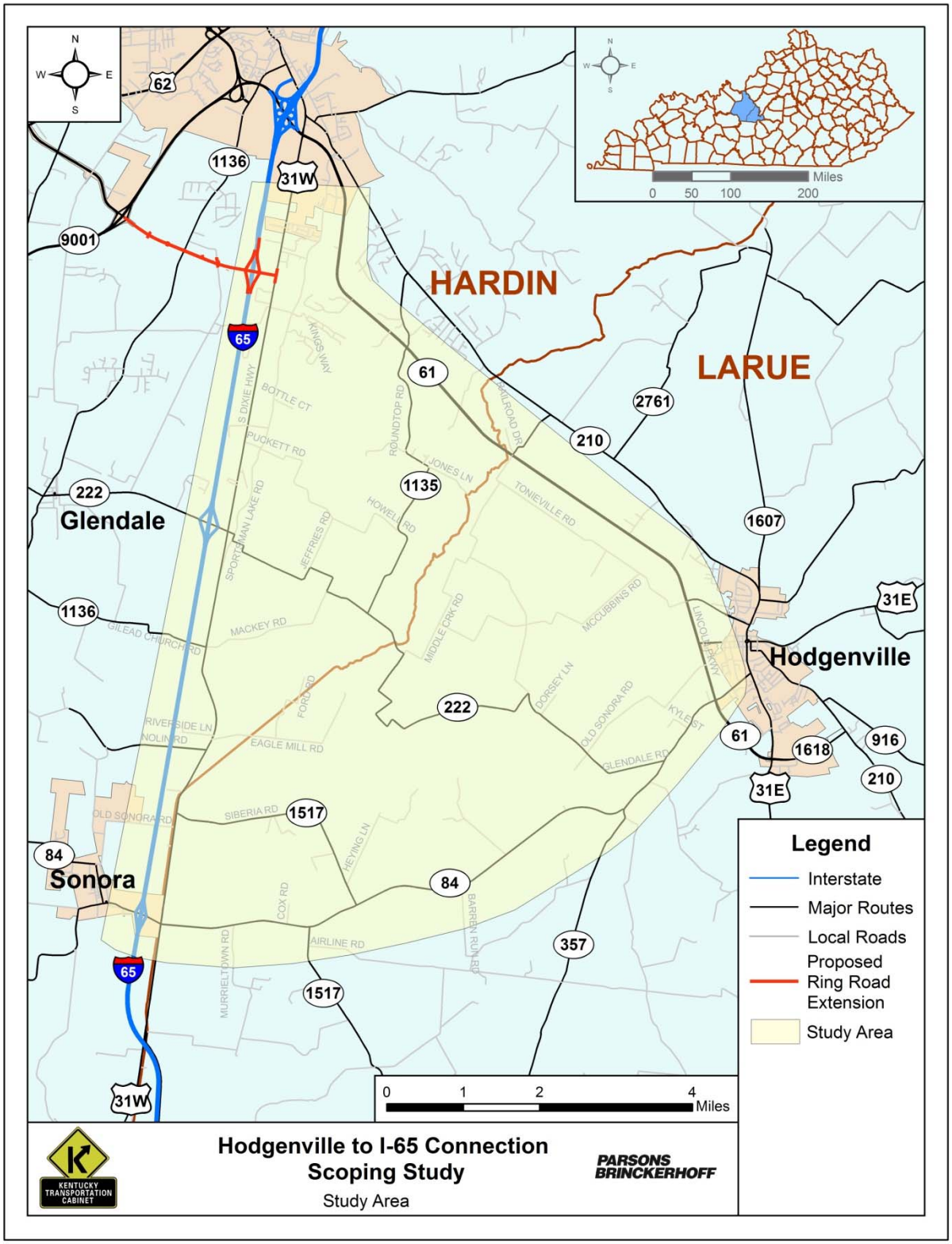
1. Identify roadway problems and / or deficiencies
2. Define the study's purpose and need
3. Examine current traffic, roadway, environmental, and safety conditions along the existing routes between I-65 and Hodgenville (KY 222 and KY 84)
4. Develop a list of improvements
5. Evaluate the list of improvements, considering Local Official / Stakeholder (LO/S) and public 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
7. Prioritize projects to allow for a phased implementation approach, if applicable

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

1.2 Project Location and Study Area

The study area boundary includes the area between I-65, KY 61, and KY 84. For evaluation of the existing routes (KY 222 and KY 84), the study limits are 500 feet on each side of the existing roadway centerline. The study area also overlaps with the intersections of KY 61 and I-65 to allow for any additional planning-level analysis required at the tie-in locations. **Figure 1** shows the study area.

Figure 1: Study Area



2.0 Purpose and Need

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

2.1 Purpose

The purpose of the Improved Hodgenville to I-65 Connection Scoping Study is to identify a more reliable and safer connection between Hodgenville and I-65 / Glendale.

2.2 Need

The following needs were identified over the course of the study. While the technical analysis is the primary mechanism for identifying project needs, discussions with the PDT, LO/S, and the public were helpful in refining the purpose and associated needs.

Safety - Two spot locations within the study area have a critical crash rate factor (CCRF) equal to or greater than 1.0:

- KY 84 near I-65 - (CCRF = 2.74)
- KY 222 near I-65 - (CCRF = 1.18)

In addition, three fatal crashes occurred within the study area during the time period of analysis (January 2010 to December 2014).

Roadway Deficiencies - KY 84 has 36 noted vertical and 5 horizontal deficiencies. Within these areas, 22 out of 59 crashes occurred (37%). KY 222 has 65 noted vertical and 25 horizontal deficiencies. Within these areas, 3 out of 5 crashes occurred (60%).

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The issue, however, with unexpected delays along these routes is that they are two-lane roads with limited passing opportunities. As noted, both have numerous deficient horizontal and vertical curves requiring drivers to slow down. Travel times on these routes vary depending on the number of vehicles, the vehicle mix, and weather. The average estimated travel time from I-65 at Glendale via KY 222 to Hodgenville is 14.0 minutes. The average estimated travel time from I-65 at Sonora via KY 84 to Hodgenville is 11.2 minutes. If drivers end up behind a slower moving vehicle such as a tractor or horse and buggy, travel times can increase between 35 to 50 percent (dependent on the length of time the vehicle must travel before able to pass).

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Access - Access to and from Hodgenville and the I-65 / Glendale area is a concern given the existing options:

- KY 84: KY 84 is a two-lane route with lane widths ranging from 9 to 11- feet and narrow or limited shoulders. This route provides access from I-65 / Sonora to Hodgenville.
- KY 222: KY 222 is also a two-lane route with 9-foot travel lanes and minimal shoulders. This route is very disjointed and requires multiple turns to travel between I-65 at Glendale to KY 61 near Hodgenville. This route also has numerous horizontal and vertical deficiencies. This route does connect the I-65 / Glendale area to Hodgenville.
- KY 61: KY 61 is a four-lane, divided, partially access-controlled route. It provides access to Hodgenville from the Elizabethtown area.

Given these three different routes, access is dependent on driver location on I-65. KY 61 is the logical choice from Elizabethtown. Drivers will most likely choose to use KY 84 to travel to the Hodgenville area if they are travelling northbound on I-65. KY 84 is also signed as the route to the Abraham Lincoln Birthplace National Historical Park and Abraham Lincoln's Boyhood Home at Knob Creek. If drivers are in the Glendale area, they can either use KY 222 with its noted issues, or choose another route. It should also be noted that depending on route choice and direction of travel, portions of I-65 may also be used in conjunction with these three routes.

Connectivity - Currently, there is no continuous direct route from I-65 near the Glendale area to Hodgenville. KY 222 is the current route providing a connection near I-65 / Glendale; however the deficiencies and multiple turns result in slower speeds. The existing route also does not provide direct access from I-65 near the Glendale area to the major industrial employers in the area (Cumberland Products, Inc., Lincoln Tool, Inc., and Konsei USA, Inc.) located just north of Hodgenville along KY 61. Some truck traffic may be utilizing KY 84 for local access but it is not a designated truck route per the Kentucky Designated National Truck Network. According to the most recent counts (2013), 11.6% of vehicles using KY 84 are trucks.

KY 61 is the other alternate route that does provide direct access to the industrial employers located north of Hodgenville. For southbound traffic on I-65, this is the preferred route to access the industrial park. For northbound traffic on I-65, trucks must travel north to Elizabethtown, then turn south along KY 61.

3.0 Existing Conditions

An inventory examined ongoing transportation projects, existing roadway characteristics, traffic volumes, level of service (LOS), capacity, and crash rates. Proposed transportation projects within the study area were also considered.

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) or 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. This planning study is the fulfillment of the second PIF on that list.

Table 1: Project Identification Forms

County	PIF#	Date	Route	Description	Begin Milepoint	End Milepoint	Section Length (miles)	Costs
LaRue	04 062 D0084 70.10	9/29/2004	KY 84	KY 84 from KY 357 to KY 61	6.561	8.449	1.888	$9,900,000
LaRue and Hardin	04 062 D0222 10.00*	3/8/2007	KY 222	Planning study to identify a more reliable and safer connection between Hodgenville and Glendale	0.000	5.840	9.045	$200,000

*Note: The cost shown listed for the PIF was the cost estimation for the planning study and not actual construction dollars.

The KYTC's FY 2014 - FY 2020 Highway Plan also includes multiple projects in the study area:

- Item No. 4-18.00: Widen I-65 to six lanes (construction cost = $10,000,000); Federal Interstate Maintenance and National Highway System funds; at the time of this report this project was under construction
- Item No. 4-20.01: Improve the safety and increase the capacity of the I-65 / KY 222 interchange based on existing and future needs of the area (construction cost = $32,450,000); Construction funds not available
- Item No. 4-286.10: I-65 southbound port of entry for a commercial vehicle monitoring station (design cost = $550,000); Federal Interstate Maintenance funds
- Item No. 4-198.00: Extend Ring Road from the Western Kentucky Parkway to I-65 (right-of-way and utilities costs = $4,450,000); State construction funds not available

The *Glendale Area Transportation Study*, prepared in November 2008 by URS for the LTADD, examined short, medium, and long-range projects to improve the roadway system around Glendale and develop a

long-range plan for the area. The majority of the recommendations were for the Glendale area, which is west of the study area for this project. However, one of the long-range recommendations was to widen I-65 to six lanes.

3.2 Existing Roadway Characteristics

The KYTC Highway Information System (HIS) database was used to compile the roadway characteristics of the existing routes within the study area (KY 61, KY 84, and KY 222). The highway characteristics summary is included in **Table 2**.

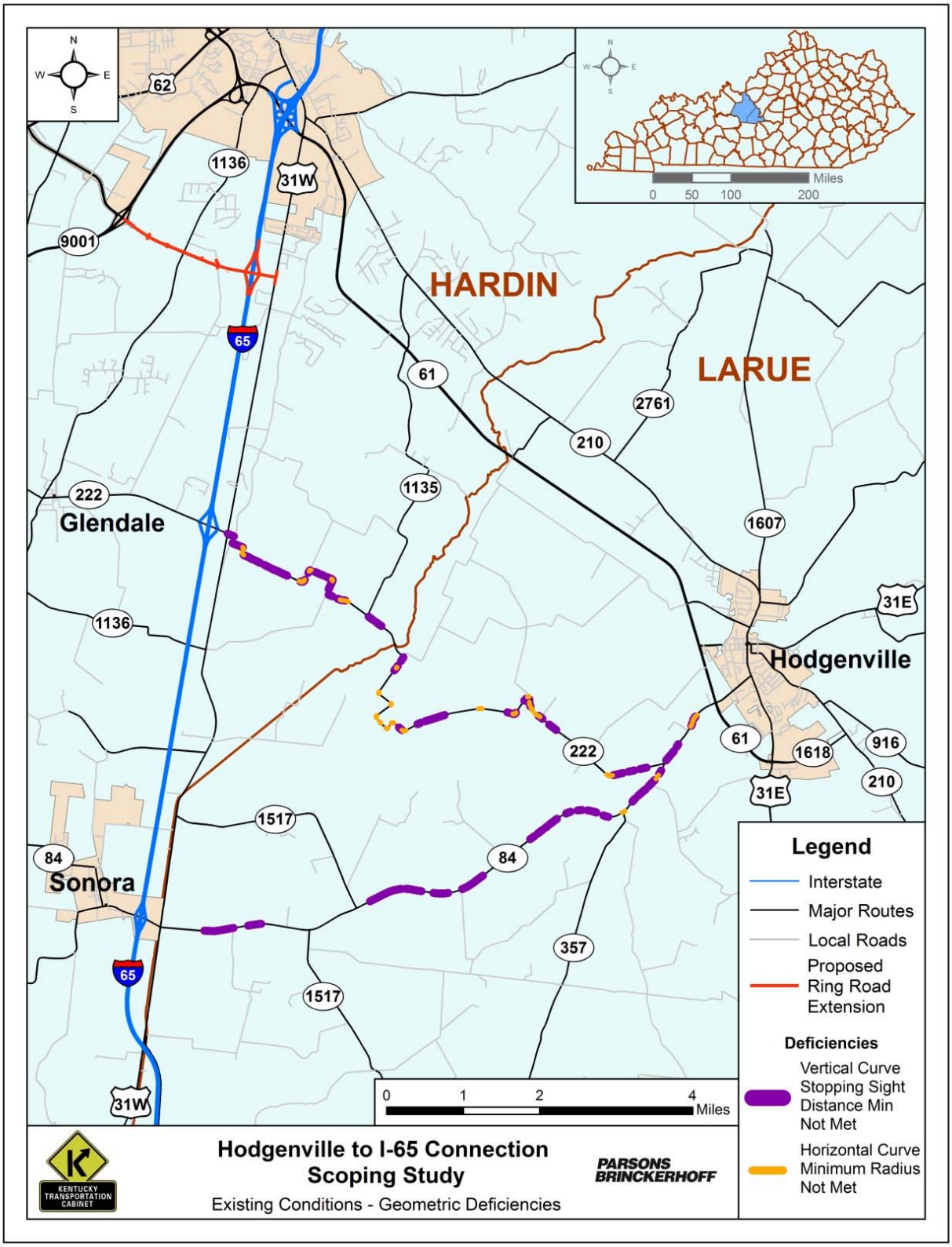
To document existing geometric horizontal and vertical deficiencies, archived project plans were downloaded from the KYTC website, with any missing sections or newer plans requested directly from KYTC. This allowed for a complete set of plan and profile sheets to be assembled for KY 84 and KY 222. The *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 where either vertical curvature does not meet current sight distance criteria or horizontal curvature does not meet minimum radius criteria. A full set of plan and profile sheets with identified deficiencies, key environmental features, and crash data is included in **Appendix A**. This was used to compare crash locations with geometric deficiencies to determine if there was any overlap.

A total of 41 locations along KY 84 and 90 locations along KY 222 have geometric curves that do not meet current design standards. **Figure 2** provides a summary of vertical and horizontal curve deficiencies. For exact locations of each deficiency, refer to the figures and the plan and profile sheets in **Appendix A**. KY 61 was not reviewed in detail for geometric deficiencies as none are expected due to the type and age of the facility.

Table 2: Existing Routes Highway Characteristics Summary

Section	Route	Begin Milepoint	End Milepoint	Section Length (miles)	Functional Class	Number of Lanes	Lane Width (feet)	Shoulder Width (feet)	Median Type	Median Width (feet)	Posted Speed Limit (mph)
1	KY 61	4.82	5.31	0.49	Urban Minor Arterial	4	12	Paved w/Bituminous Material	Depressed	20+	55
		Sportsman Lake Road	US 31W					10			
2	KY 61	0.00	4.82	4.82	Rural Minor Arterial	4	12	Paved w/ Bituminous Material	Depressed	20+	55
		LaRue County Line	Sportsman Lake Road					10			
3	KY 61	9.13	13.60	4.48	Rural Minor Arterial	4	12	Paved w/ Bituminous Material	Depressed	32	55
		KY 84 (Tanner Road)	Hardin County Line					10			
1	KY 84	25.75	26.04	0.29	Rural Major Collector	2	11	Combination	Undivided	0	35
		I-65 Bridge	LaRue County Line					1			
2	KY 84	0.00	1.96	1.96	Rural Major Collector	2	9	Paved w/ Bituminous Material	Undivided	0	55
		Hardin County Line	KY 1517 (Oak Hill Road)					2			
3	KY 84	1.96	6.56	4.60	Rural Major Collector	2	9	Stabilized	Undivided	0	55
		KY 1517 (Oak Hill Road)	KY 357 (Tanner Road)					2			
4	KY 84	6.56	7.39	0.83	Rural Major Collector	2	9	Stabilized	Undivided	0	55
		KY 357 (Tanner Road)	KY 222 (Glendale Road)					1			
5	KY 84	7.39	8.45	1.06	Rural Major Collector	2	9	Stabilized	Undivided	0	55
		KY 222 (Glendale Road)	(Lincoln Parkway)					1			
1	KY 222	6.47	6.75	0.29	Rural Minor Collector	2	9	Stabilized	Undivided	0	45
		I 65 Bridge	US 31W					5			
2	KY 222	6.75	0.18	3.39	Rural Local	2	9	Stabilized	Undivided	0	45
		US 31W	Middle Creek Road					5			
3	KY 222	0.18	5.84	5.67	Rural Local	2	8	Earth	Undivided	0	55
		Middle Creek Road	KY 84					2			

Figure 2: Existing Geometric Deficiencies



3.3 Existing Traffic Volumes, Level of Service, and Capacity

Traffic volumes in the study area were obtained using KYTC's traffic count system database. Traffic counts, along with roadway characteristics, were used to evaluate the existing capacity and level of service (LOS) of each roadway in the study area. Capacity and LOS are measures that are typically used to quantify traffic operations. Capacity is generally defined as the maximum number of vehicles per unit of time that can be accommodated on a highway or location under prevailing roadway conditions. LOS is a rating scale ranging from LOS A (free flow) to LOS F (at or over capacity).

Two-Lane Highway Analysis (KY 84 and KY 222)

A corridor LOS analysis was prepared for the two-lane highways (refer to **Table 2)** using the Highway Capacity Software (HCS) 2010 two-lane road analysis module, based on the *Highway Capacity Manual 2010* (HCM).[1] Three classes of roadways are 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 3 displays the evaluation criteria for each class of highway. The first section of KY 84 was considered to be a Class III highway given the level of development at the I-65 interchange. The remainder of KY 84 was evaluated as a Class II facility as it is classified as a collector. KY 222 was evaluated for the full length as a Class II highway, as it is classified as a local route.

Table 3: 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

Based on AASHTO geometric guidelines, LOS C is the appropriate threshold for rural collectors (KY 84) and LOS D is the appropriate threshold for rural local roads (KY 222).

[1] *Highway Capacity Manual 2010*, Transportation Research Board

Multilane Highway Analysis (KY 61)

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 4.** 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. Based on AASHTO geometric guidelines, LOS B is the appropriate threshold for rural arterials, while LOS C is the appropriate threshold for urban and suburban arterials. KY 61 transitions from urban / suburban to rural throughout the length of the study area.

Table 4: LOS Criteria for Multilane Highways

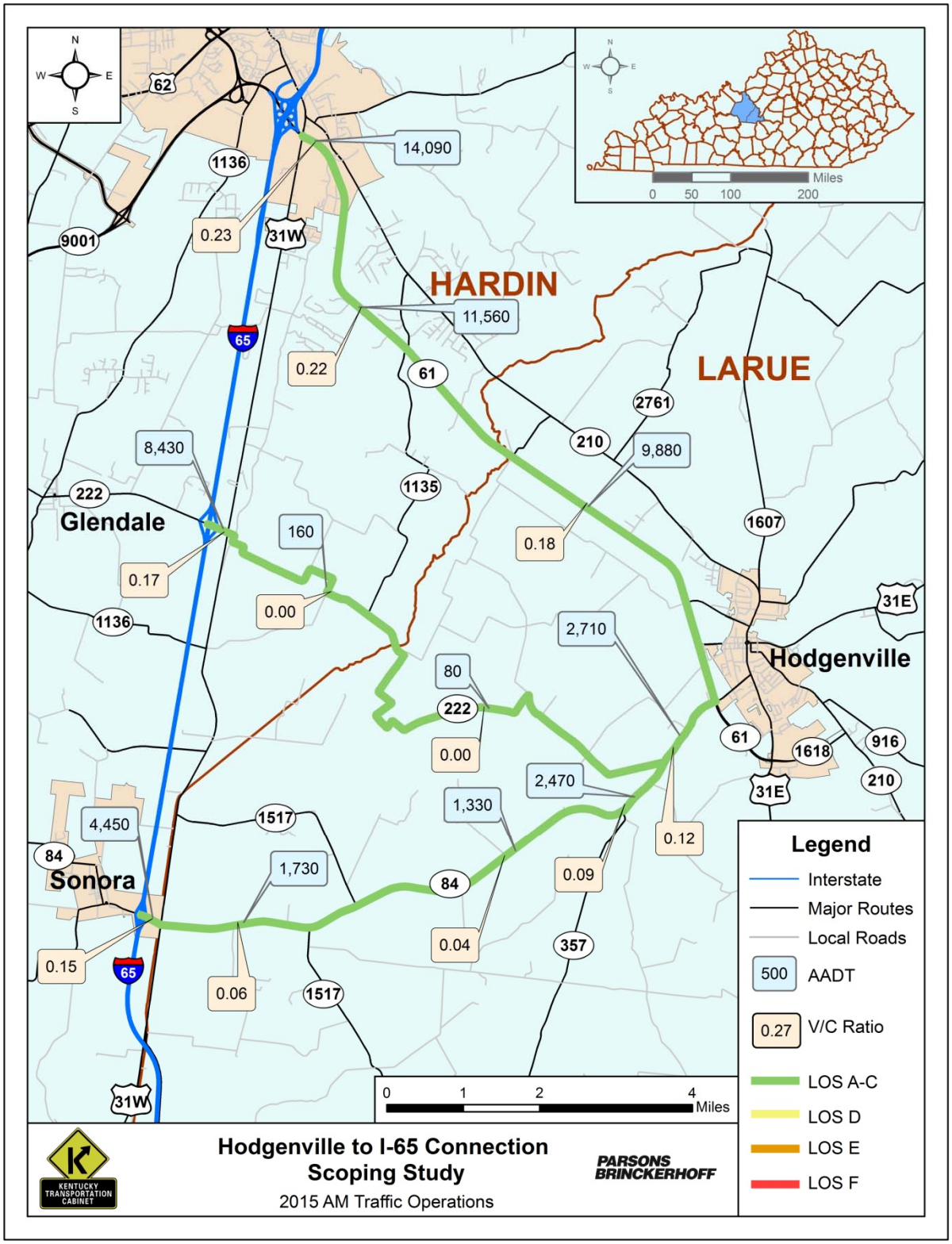
LOS	Density Range (pc/mi/ln)
A	0 - 11
B	> 11 - 18
C	> 18 - 26
D	> 26 - 35
E (55mph)	> 35 - 41
E (45mph)	> 35 - 45
F (55mph)	> 41
F (45mph)	> 45

Source: *Highway Capacity Manual, 2010*

Figures 3 and **4** shows the 2015 LOS and v/c ratios along the existing study area routes. Also shown are the average annual daily traffic volumes (AADT). **Table 5** provides this information by segment.

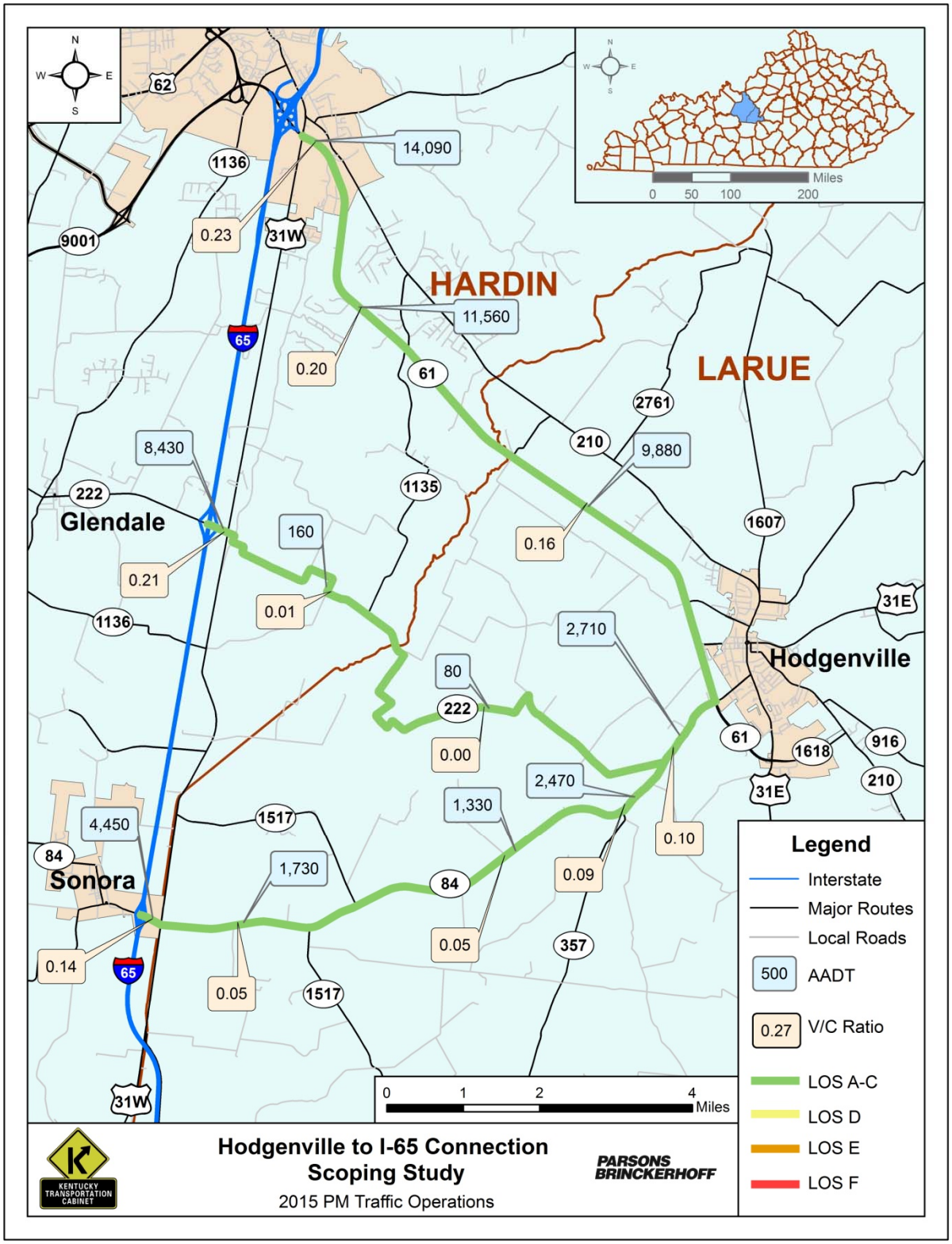
All segments are under capacity (a v/c ratio of 1.0 or more is considered at capacity in urban areas with a v/c ratio of 0.9 or more considered at capacity in rural areas). The LOS for all segments is calculated to be LOS C or better. There are no consistent capacity or LOS issues along the existing routes. Travel time reliability is likely more impacted by random events such as crashes, slow-moving vehicles, or alternative routing of I-65 traffic in the event of an incident on the interstate.

Figure 3: 2015 LOS and V/C Ratios in the AM Peak Period



Note: AADT = Annual Average Daily Traffic

Figure 4: 2015 LOS and V/C Ratios in the PM Peak Period



Note: AADT = Annual Average Daily Traffic

Table 5: Existing Traffic Volumes and Level of Service

Route	County	Section	Begin Milepoint	End Milepoint	Section Length (miles)	Functional Class (class description)	Truck Percentage	Most Recent AADT	Count Station	Year	AM Peak Hour Volume	AM Peak Period V/C Ratio	AM Peak Period LOS	PM Peak Hour Volume	PM Peak Period V/C Ratio	PM Peak Period LOS
KY 61	Hardin	1	4.82 Sportsman Lake Road	5.31 US 31W	0.49	Urban Minor Arterial	5.4%	14,090	047B16	2012	1,198	0.23	A	1,198	0.23	A
KY 61	Hardin	2	0.00 LaRue County Line	4.82 Sportsman Lake Road	4.82	Rural Minor Arterial	6.6%	11,560	47270	2013	1,065	0.22	A	1,109	0.20	A
KY 61	LaRue	3	9.13 KY 84 (Tanner Road)	13.60 Hardin County Line	4.48	Rural Minor Arterial	5.0%	9,880	62750	2012	918	0.18	A	893	0.16	A
KY 84	Hardin	1	25.75 I-65 Bridge	26.04 LaRue County Line	0.29	Rural Major Collector	6.4%	4,450	47342	2015	333	0.15	B	440	0.14	C
KY 84	LaRue	2	0.00 Hardin County Line	1.96 KY 1517 (Oak Hill Road)	1.96	Rural Major Collector	8.5%	1,730	62531	2013	145	0.06	A	169	0.05	A
KY 84	LaRue	3	1.96 KY 1517 (Oak Hill Road)	6.56 KY 357 (Tanner Road)	4.60	Rural Major Collector	8.5%	1,330	62555	2014	105	0.04	A	133	0.05	A
KY 84	LaRue	4	6.56 KY 357 (Tanner Road)	7.39 KY 222 (Glendale Road)	0.83	Rural Major Collector	4.6%	2,470	62553	2012	253	0.09	B	240	0.09	B
KY 84	LaRue	5	7.39 KY 222 (Glendale Road)	8.45 (Lincoln Parkway)	1.06	Rural Major Collector	4.6%	2,710	062A41	2014	268	0.12	C	262	0.10	B

Table 5: Existing Traffic Volumes and Level of Service (cont.)

Route	County	Section	Begin Milepoint	End Milepoint	Section Length (miles)	Functional Class (class description)	Truck Percentage	Most Recent AADT	Count Station	Year	AM Peak Hour Volume	AM Peak Period V/C Ratio	AM Peak Period LOS	PM Peak Hour Volume	PM Peak Period V/C Ratio	PM Peak Period LOS
KY 222	Hardin	1	6.47 I 65 Bridge	6.75 US 31W	0.29	Rural Minor Collector	-	8,430	47255	2014	529	0.17	C	637	0.21	C
KY 222	Hardin	2	6.75 US 31W	9.96 LaRue County Line	3.39	Rural Local	-	160	47275	2015	13	0.00	A	18	0.01	A
KY 222	LaRue	3	0.00 Hardin County Line	0.18 Middle Creek Road	0.18	Rural Local	-	160	47275	2015	13	0.00	A	18	0.01	A
KY 222	LaRue	4	0.18 Middle Creek Road	5.84 KY 84	5.66	Rural Local	-	80	62557	2012	9	0.00	A	11	0.00	A

3.4 Crash Analysis

Crash data was obtained for this study from the Kentucky State Police Collision Analysis database for a five-year period from January 1, 2010 through December 31, 2014. All reported crashes were mapped along the corridor on the plan and profile sheets included in **Appendix A**. The crash record data set is included in **Appendix B** for reference. Along all study area routes (KY 61, KY 84, and KY 222), 238 crashes occurred during the five-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).[2] 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, the length of the section, and whether the section is classified as urban or rural. It is expressed in terms of crashes per 100 million vehicle-miles and is compared to a statewide critical crash rate[3] 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 occurrence.

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 6**. In the initial analysis, evaluation sections were determined by roadway characteristics and traffic volumes (broken out when there was a logical split). Two of the segments were less than 0.3 mile in length, which makes them spots instead of segments by definition. The spots are denoted by an asterisk (*) next to the section number in **Table 6**. Both of the spots were found to have a CCRF of greater than 1.0.

[2] *Analysis of Traffic Crash Data in Kentucky (2009 – 2013),* Kentucky Transportation Center Research Report KTC- KTC-14-07/KSP2-13-1F.

[3] 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.

Table 6: Crash Rate Analysis (2010 to 2014)

Route	Section	Begin Milepoint	End Milepoint	Total Crashes	Average Daily Traffic	Section Length (miles)	Statewide Average Crash Rate (FC based on Table A-1)	Section Crash Rate	Statewide Critical Crash Rate (Appendix D or E)	Critical Crash Rate Factor
KY 61 Hardin	1	4.82 Sportsman Lake Road	5.31 US 31W	38	14,090	0.49	191	305	214.46	1.42
	2	0.00 LaRue County Line	4.82 Sportsman Lake Road	40	11,560	4.82	191	39	158.19	0.25
KY 61 LaRue	3	9.13 KY 84 (Tanner Road)	13.60 Hardin County Line	36	9,880	4.48	191	45	162.56	0.27
KY 84 Hardin	1*	25.75 I-65 Bridge	26.04 LaRue County Line	33	4,550	0.29	238	8	0.87	4.59
KY 84 LaRue	2	0.00 Hardin County Line	1.96 KY 1517 (Oak Hill Road)	14	1,730	1.96	238	227	444.16	0.51
	3	1.96 KY 1517 (Oak Hill Road)	6.56 KY 357 (Tanner Road)	27	1,330	4.60	238	242	414.77	0.58
	4	6.56 KY 357 (Tanner Road)	7.39 KY 222 (Glendale Road)	5	2,470	0.83	238	133	509.19	0.26
	5	7.39 KY 222 (Glendale Road)	8.45 (Lincoln Parkway)	13	2,710	1.06	238	249	462.39	0.54
KY 222 Hardin	1*	6.47 I 65 Bridge	6.75 US 31W	22	8,430	0.29	266	15	1.22	1.18
	2	6.75 US 31W	0.18 Middle Creek Road	7	160	3.39	219	708	847.17	0.84
KY 222 LaRue	3	0.18 Middle Creek Road	5.84 KY 84	3	80	5.67	219	363	738.10	0.49

Critical Crash Rate Factor >1, Section Crash Rate Exceeds Statewide Critical Rate (High Crash Rate Section)
Critical Crash Rate Factor <1, Section Crash above Statewide Average for Facility Type
Critical Crash Rate Factor <1, Section Crash Rate Lower Than Statewide Average Rate

Notes:
Analysis Period: 5 Years (1/1/2010 to 12/31/2014)

Crash rates are expressed in crashes per 100 MVM (100 million vehicle miles traveled)

Exposure (M) = [(ADT) x (365) x (Time Frame of Analysis (Years)) x (Section Length)]/100,000,000

Section Crash Rate = Total Crashes/Exposure

Critical Crash Rate Factor = Section Crash Rate/Statewide Critical Crash Rate

ADT = Average Daily Traffic; MVM = Million Vehicle Miles

Sources:

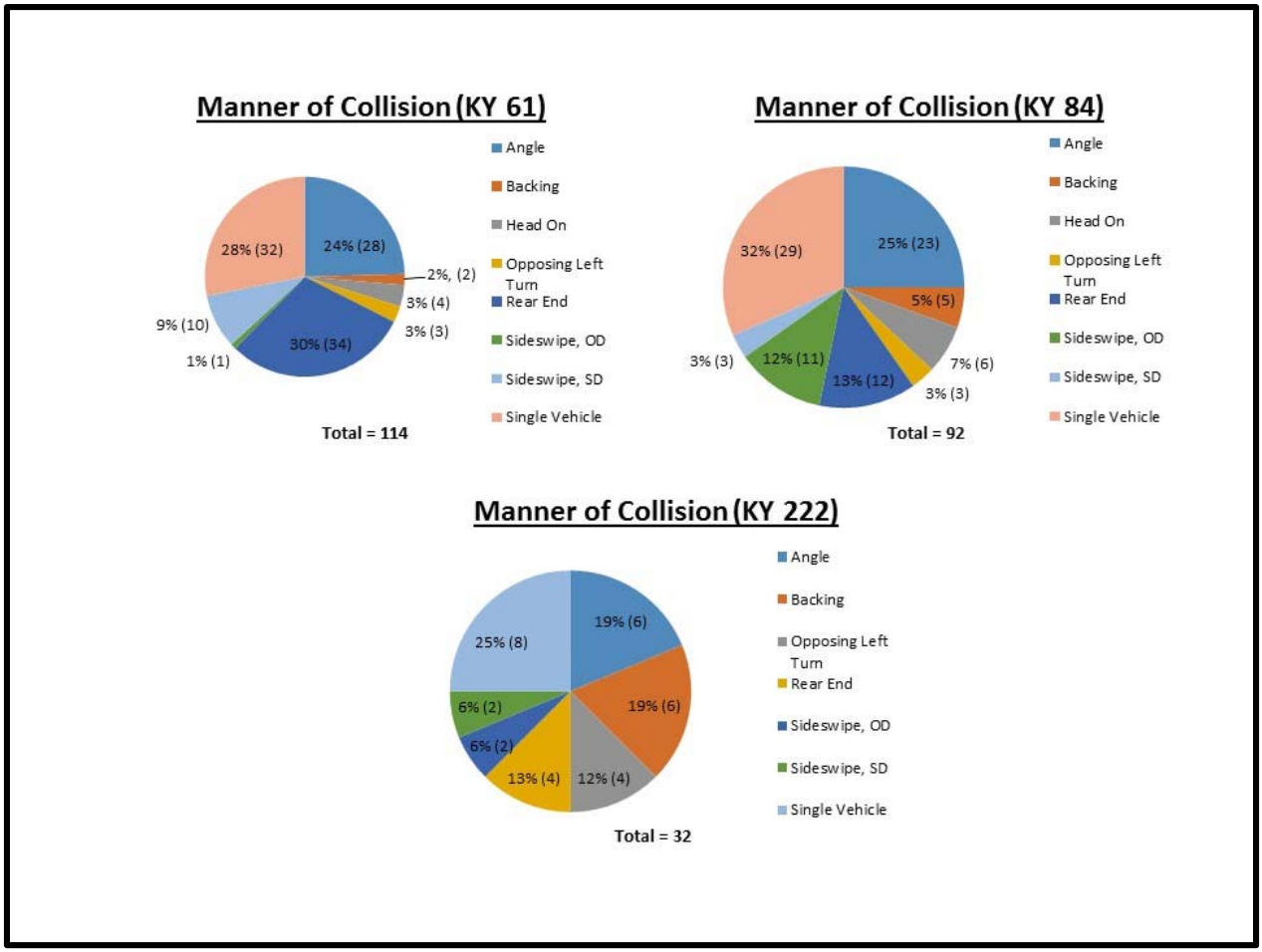
Crash data for 1/1/2010 to 12/31/2014 from KYTC Data

Statewide Rates from KTC Research Report KTC-14-07/KSP2-13-1F, *Analysis of Traffic Crash Data in Kentucky (2009-2013)*

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 5** demonstrates results of the crash data review and the manner of collision for all crashes by route. The crash analysis shows the following:

- Single vehicle crashes accounted for the largest share of crashes on KY 84 and KY 222.
- Rear end crashes were the most frequent crash type on KY 61.
- Angle, rear end, and single vehicle crashes represented a frequent crash type for all three routes evaluated.

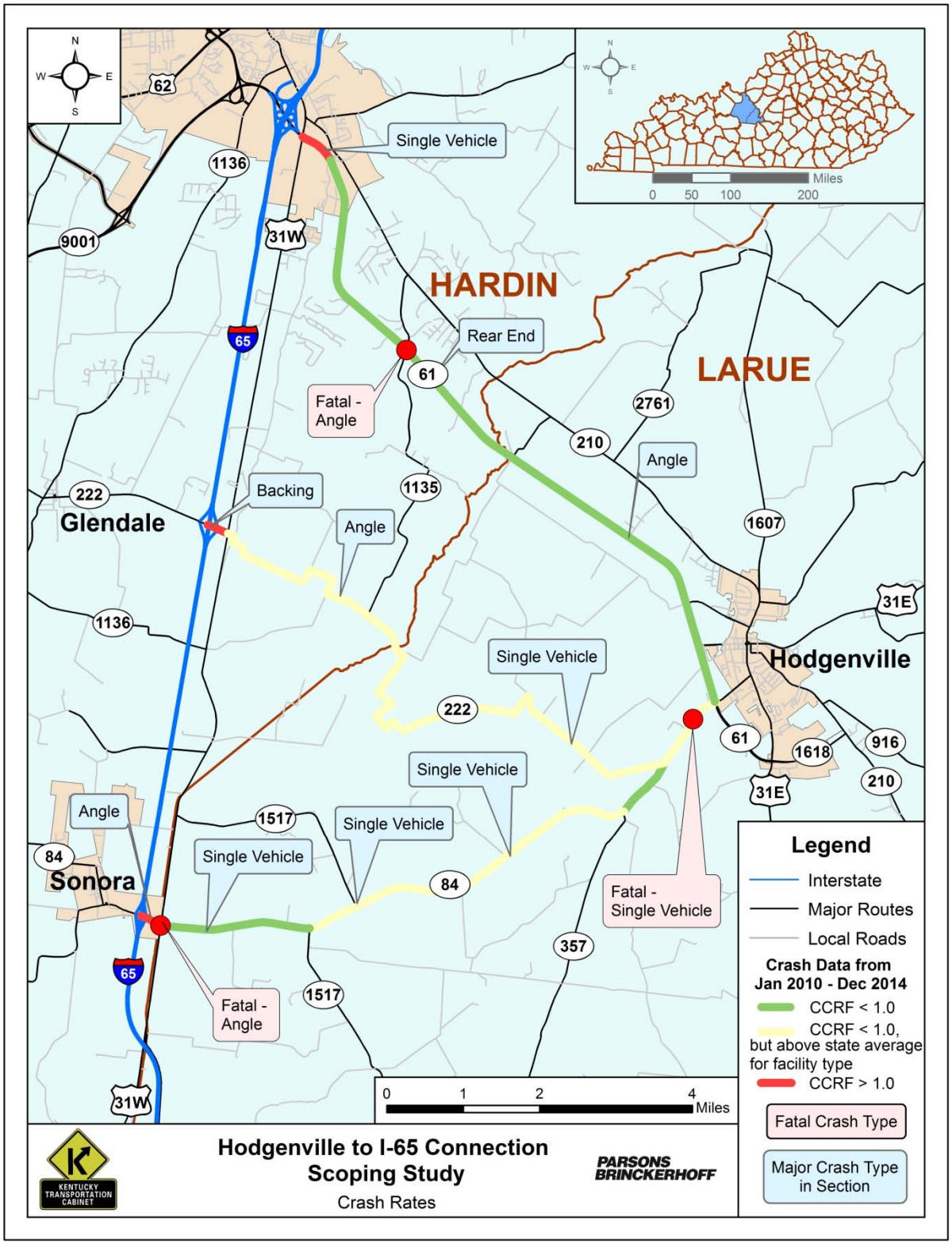
Figure 5: Manner of Collision



Further review of the crash data showed that 66% of all crashes occurred in clear weather. In addition, 64% occurred during daylight hours.

A review of the severity of the collisions showed that out of the 238 crashes, 22% (53 crashes) resulted in an injury and 1% (3 crashes) resulted in a fatality. The remainder of the collisions resulted in property damage only. As shown in **Figure 6**, three fatal crashes occurred throughout the study area.

Figure 6: Study Area Crash Rates



3.5 Multimodal Facilities (Bicycle, Pedestrian, Transit, Truck, and Freight)

Bicycle and Pedestrian Facilities

Based on a review of existing data sources through HIS, there are no designated bicycle or pedestrian facilities within the study area. However, there is some usage data for bicyclists available from Strava (https://www.strava.com). Strava lets the user track their ride (location and route) via an iPhone, Android or dedicated GPS. That data can be translated to a heat map that shows which routes people are utilizing. Based on this data, some bicyclists utilize portions of KY 84 and KY 222 for their travel routes.

Transit Facilities

There are no fixed transit routes; nor is there passenger rail service within the study area.

Truck and Freight Facilities

According to the Kentucky Designated National Truck Network, KY 61 is a designated truck route. This means that motor vehicles with increased dimensions (STAA vehicles) may operate on the designated routes only. Other state-maintained routes may be utilized for the purpose of access to terminals. This is likely the case along KY 84 and KY 222. NSU Corp. is located off of KY 84 near the intersection of KY 84 and US 31W. Other truck traffic was observed during site reviews including a number of farm-related grain trucks as well as freight trucks travelling along KY 84 and KY 222.

4.0 Environmental Overview

An overview was conducted to determine the general characteristics of the human and natural environment in the study area. The analysis addressed the following:

- General socioeconomic characteristics
- Environmental overview summary (**Appendix C**)
- Cultural / historic (**Appendix C**) and archaeological characteristics
- Environmental Justice (EJ) / Socioeconomic Study (**Appendix D**)

4.1 Socioeconomic Overview

4.1.1 Population Growth

Hardin and LaRue Counties have both experienced population growth since 2000 and are expected to continue to grow through the year 2040. **Table 7** shows population data from the 2000 and 2010 U.S. Census respectively for Hardin and LaRue Counties. The 2000 U.S. Census showed Hardin County having a population of 94,174. This increased to 105,543 by 2010 and is projected grow to 132,691 by 2040. The 2000 U.S. Census showed a population of 13,373 in LaRue County, increasing to 14,193 by 2010 and 15,286 by 2040.

Table 7: Study Area Populations

County	Year 2000	Year 2010	Year 2040	% Growth (2000 – 2010)	% Growth (2010 – 2040)
Hardin County	94,174	105,543	132,691	10.8%	20.5%
LaRue County	13,373	14,193	15,826	5.8%	10.3%

Source: U.S. Bureau of the Census, Decennial Surveys

4.1.2 Local Economy

Unemployment information was obtained from the Kentucky Career Center.[4] In April 2015, Hardin County's unemployment rate was 4.7%, and LaRue County's unemployment rate was 5.0%, both of which are close to the April 2015 average rate for Kentucky, which was 4.8%.

The top two industries in Hardin County are retail trade (18%) and health care and social assistance (14.3%). Hardin County employment includes a mix of various industries as shown on **Table 8**.

[4] Kentucky Career Center. https://kylmi.ky.gov/vosnet/analyzer/results.aspx?session=labforce.

Table 8: Hardin County Employment by Major Industry (2012)

Hardin County	Percentage
Accommodation and food services	8.1%
Administrative and support and waste management and remediation services	4.1%
Agriculture, forestry, fishing and hunting	0.1%
Arts, entertainment, and recreation	1.0%
Construction	8.4%
Educational services	0.8%
Finance and insurance	6.7%
Health care and social assistance	14.3%
Industries not classified	4.8%
Information	1.4%
Management of companies and enterprises	0.4%
Manufacturing	3.0%
Mining, quarrying, and oil and gas extraction	0.2%
Other services (except public administration)	10.1%
Professional, scientific, and technical services	8.6%
Real estate and rental and leasing	4.4%
Retail trade	18.0%
Transportation and warehousing	2.6%
Utilities	0.4%
Wholesale trade	2.6%

Similar to Hardin County, there are a variety of industries in LaRue Counties. Other services (except public administration) is the largest category of employment at 15.2%, followed by Construction at 13.1%, and Retail trade at 12.2%. LaRue County employment by major industry is shown in **Table 9.**

Table 9: LaRue County Employment by Major Industry (2012)

LaRue County	Percentage
Accommodation and food services	6.3%
Administrative and support and waste management and remediation services	5.1%
Agriculture, forestry, fishing and hunting	0.0%
Arts, entertainment, and recreation	2.1%
Construction	13.1%
Educational services	0.0%
Finance and insurance	5.9%
Health care and social assistance	8.0%
Industries not classified	6.8%
Information	0.4%
Management of companies and enterprises	0.0%
Manufacturing	7.2%
Mining, quarrying, and oil and gas extraction	0.0%
Other services (except public administration)	15.2%
Professional, scientific, and technical services	8.4%
Real estate and rental and leasing	1.7%
Retail trade	12.2%
Transportation and warehousing	2.5%
Utilities	0.4%
Wholesale trade	4.6%

Tables 10 and **11** identify large private employers in Hardin and LaRue Counties, respectively. The largest private employers in Hardin County are Akebono Brake and Metalsa Structural Products, Inc. The largest private employers in LaRue County are Nationwide Uniform Corp. and NSU Corp.

Table 10: Major Employers in Hardin County

Kentucky Business & Industry Facilities Name	Year Established	Emp.	Product Description
U S Cavalry	N/A	75	Direct marketing, military and law enforcement equipment/apparel; e-commerce
UPS Supply Chain Solutions	2001	112	Third-party distribution
Accumetric LLC	1970	110	Sealants and adhesives for construction, industrial, HVAC, pool and spas. Fire stopping sealants and accessories
Flint Group	1980	240	Organic pigments and printing Inks
Dow Corning Corp	1963	218	Silicone sealants, adhesives
E M B Corp	1972	62	Motor start relays; snap and slow make and break switches, molded plastic components
News-Enterprise Inc	1969	85	Newspaper publishing and printing
Scotty's Contracting & Stone	1949	74	Asphalt paving materials
Standard Register Co	1972	105	Pressure-sensitive labels, screen printed labels, and tags
Mouser Custom Cabinetry LLC	1955	212	Wood kitchen, bath and family room custom and semi-custom cabinetry produced from select hardwoods: alder, knotty alder, cherry, hickory, knotty pine, maple, red oak, quarter-sawn white oak, knotty cherry, bamboo, wenge, and zebrawood.
Akebono Brake - Elizabethtown Plant	1988	1,300	Automotive disc and drum brakes and brake components
AGC Automotive Americas	1988	518	Automobile glass
Fischbach USA	1992	87	Plastic injection molding - plastic cartridges and accessories used to hold sealants and adhesives. Collapsible aluminum cartridges.
Metalsa Structural Products Inc	1994	764	Stamping/forming, hydro forming, and assembly of the Ford F-150, Lincoln Navigator, Ford Expedition frames, Stampings for Toyota and GM frame components plus e-coating systems
Remington Arms Company LLC	1994	57	Research and development; firearms and ammunition
Knight's Mechanical LLC	1980	110	Process piping, sheet metal fabrication, industrial welding, steel fabrication, equipment setup, design build, and bid projects
Altec Industries Inc	1997	540	Aerial unit trucks for telecommunications and utility companies, telescopic aerial devices
R B T Services Inc	1997	61	Railcar, truck and barge bulk product transloading equipment and accessories
Summit Polymers Inc	1999	260	Injection molded thermoplastics and auto interior components
ASG Amaray	2003	95	Injection molded packaging and products, secondary operations: Thermal welding, pad printing, foil stamping, part assembly, in-mold labeling
Gates Corporation	1964	165	Motorcycle and industrial belting
Pepsi Beverages Company	1968	80	Soft drinks
Cardinal Health	2006	475	Customer service center
Akebono Brake Corporation	2006	106	North American co-headquarters
First Financial Service Corporation	1923	115	Headquarters - corporate office
iPay Solutions	2001	320	Electronic payment processing
STC Management Group LLC	2004	100	Headquarters
Flex Films USA Inc	2011	109	Flexible packaging manufacturer
Hardin County Industries	1971	130	Specialized services for industry
Keyboard Corporation, The	1984	71	Commercial warehouse and distribution
Hendrickson USA LLC	2014	60	Manufacturer and supplier of medium and heavy-duty suspension systems, axle systems, springs and stabilizers, and bumper and trim components.

Table 11: Major Employers in LaRue County

Kentucky Business & Industry Facilities Name	Year Established	Emp.	Product Description
MasterBuilt Cabinets	1972	35	Custom wooden kitchen, bath, and other room cabinets. Multi-unit housing cabinets, HUD Severe Use Cabinet line certified by the KCMA. Plastic laminate countertops, solid surf
Nationwide Uniform Corp	1961	220	Security, police and postal uniforms
Walters Cabinets Inc	1974	20	Custom-made wood cabinetry for kitchens, baths, entertainment centers, wet bars, laundry rooms, bookcases, etc.
Zak Ltd	1990	50	White oak barrels
NSU Corp	1997	103	Automobile muffler components; quietening agents
Cumberland Products Inc	1991	34	Packaging and distribution of paint-related materials for the automotive aftermarket.
Konsei USA Inc	2005	65	Automotive parts, factory automation systems, and air grippers

4.2 Environmental Overview Summary

An environmental summary was prepared for the study area. The summary, shown in **Figures 7** and **8,** identifies noise activity receptors, land uses, endangered species habitats, sinkholes, hydric soils, wetlands, floodplains, cemeteries, hazardous material sites, oil/gas wells, and landfills. The study area was divided into four corridors for the environmental analysis: Two of the corridors are existing (KY 84 and KY 222) with a 500-foot buffer on each side of the existing roadway centerline. The other two corridors are much wider areas because of the potential of locating a new roadway. A Supplemental Environmental Summary was prepared in addition to the maps in **Figures 7** and **8** and is included in **Appendix C.**

4.2.1 Aquatic Resources

Throughout the study area there are 100-year floodplains along larger streams and rivers. Potential wetlands are also present throughout. From the windshield survey that was performed, the majority of wetlands were farm ponds. Numerous streams are also located within the study area, including the North Fork of the Nolin River, the South Fork of the Nolin River, Middle Creek, and Barren Run.

4.2.2 Threatened and Endangered Species

Three federally listed bat species are known to live in Hardin and LaRue Counties:

- Indiana bat (*Myotis sodalis*)
- Gray bat (*Myotis grisescens*)
- Northern long-eared bat (*Myotis septentrionalis*)

Potential roost trees were observed in the windshield surveys of several of the corridors, and streams and rivers are potential foraging habitats and travel corridors for these species. Karst features in the area could also provide winter hibernacula habitat.

Figure 7: Environmental Constraints (Exhibit 1)

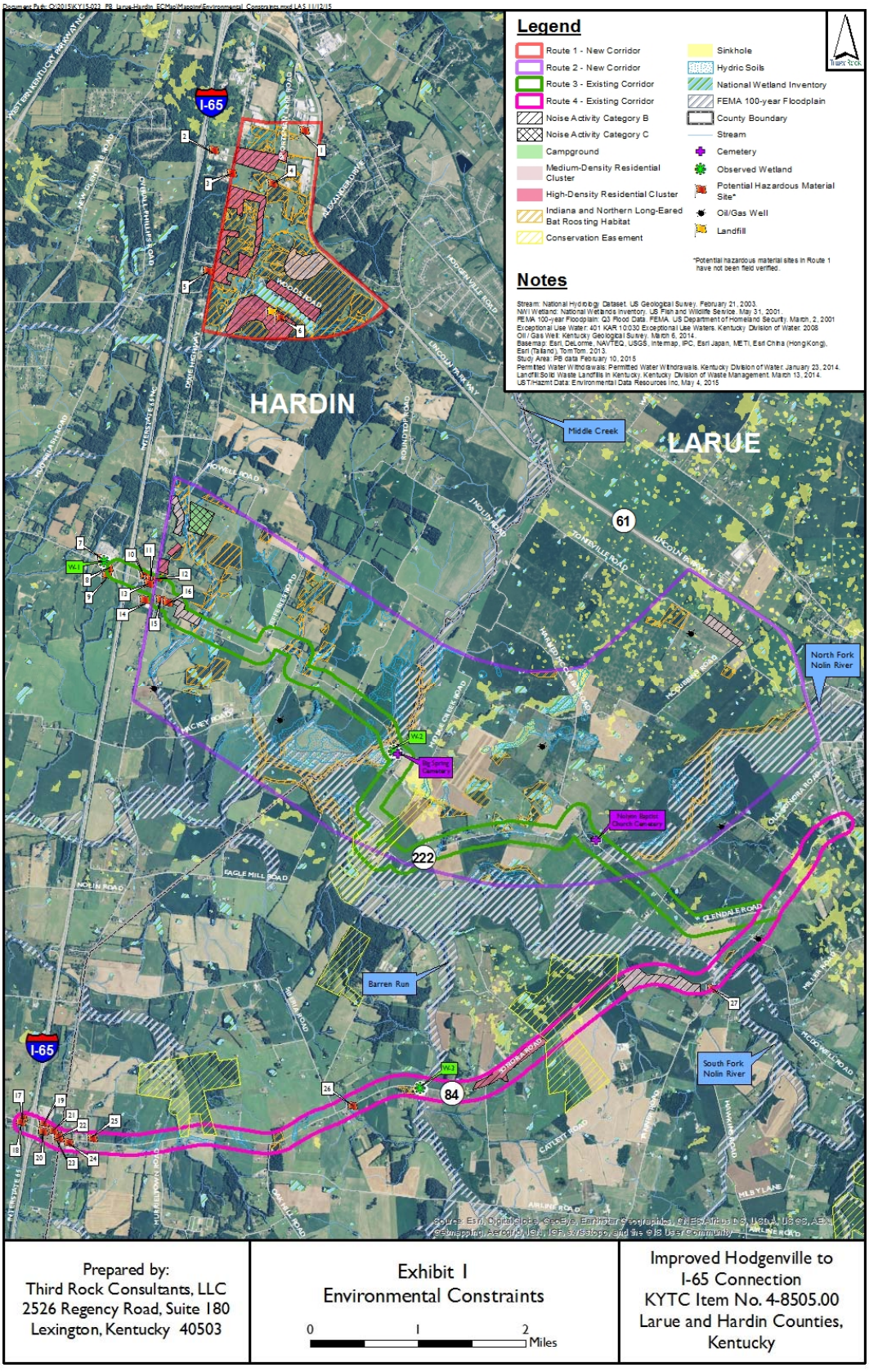
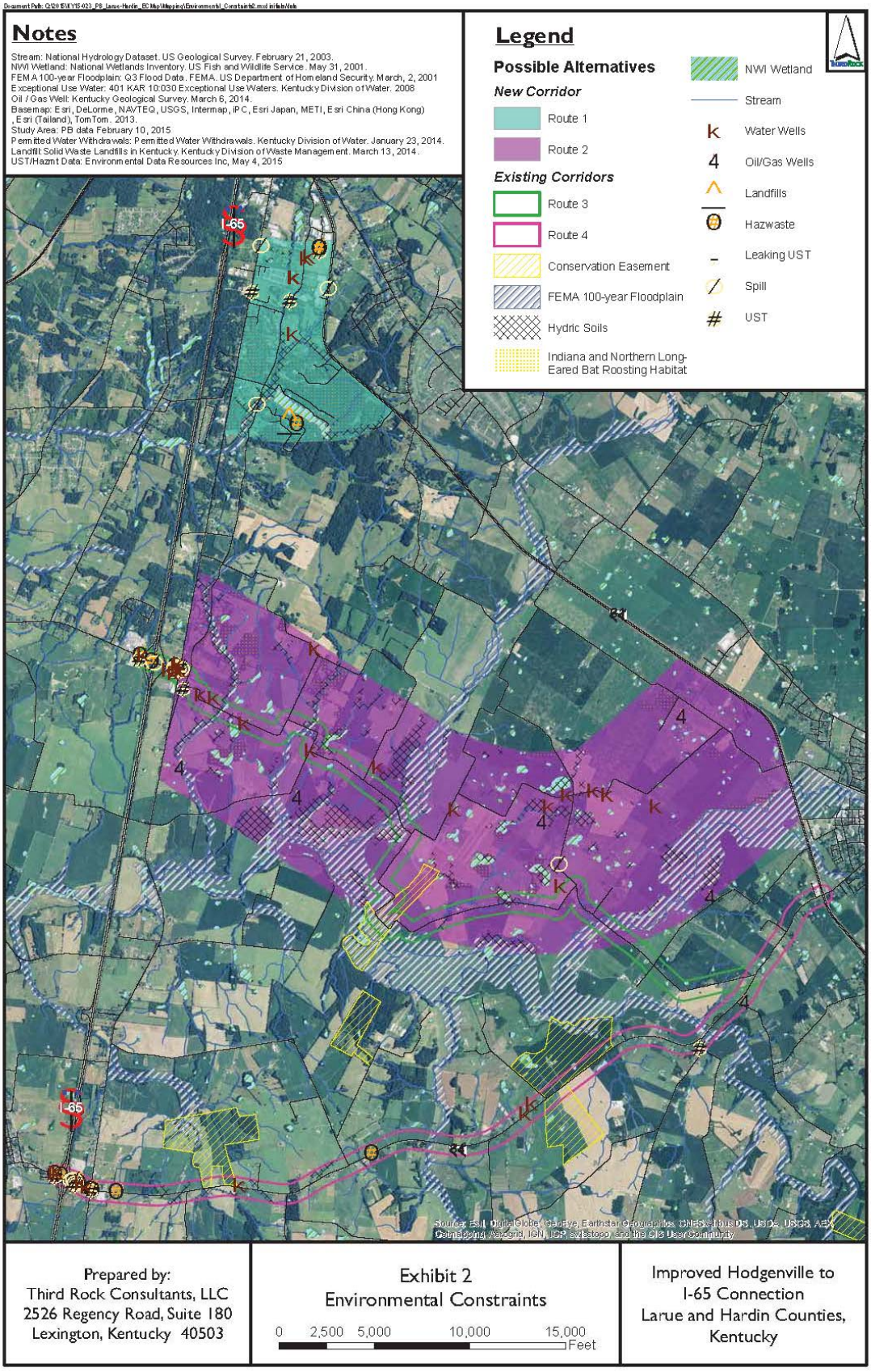


Figure 8: Environmental Constraints (Exhibit 2)



Ten federally listed mussel species are known to live in Hardin and LaRue Counties:

- Clubshell (*Pleurobema clava*)
- Fanshell (*Cyprogenia stegaria*)
- Fat pocketbook (*Potamilus capax*)
- Northern riffleshell (*Epioblasma torulosa rangiana*)
- Orangefoot pimpleback (*Plethobasus cooperianus*)
- Rabbitsfoot (*Quadrula cylindricl cylindrica*)
- Rayed bean (*Villosa fabalis*)
- Rough pigtoe (*Pleurobema plenum*)
- Sheepnose (*Plethobasus cyphus*)
- Snuffbox (*Epioblasma triquetra*)

The South Fork and North Fork of the Nolin River, Middle Creek, and Barren Run are potential habitat for these species.

4.2.3 Traffic Noise

The study area contains Category B and C noise-sensitive receptors; however, the majority of the study area is Category F, agricultural lands without noise sensitivity. The Category B and C noise-sensitive receptors are shown in **Figure 7.** Category B noise receptors include residences that are located mostly along KY 222 and KY 84. Category C noise receptors include cemeteries and churches along KY 222.

4.2.4 Hazardous Materials / Underground Storage Tanks (UST)

There are 52 potential UST / hazardous materials sites in the study area. These areas are shown in **Figure 8** and are listed in the Supplemental Environmental Summary in **Appendix C**.

4.3 Cultural / Historic and Archaeological Resources

4.3.1 Cultural/ Historic Resources

A cultural historic records review and windshield survey was completed for this study to identify National Register of Historic Places (NRHP) listed and eligible / potentially significant properties within the study area that should be considered as project plans are further developed. Of particular significance to note is the following:

- Along KY 84: Two properties listed on the NRHP (Thomas Patterson House; William Phillips House) and two eligible / potentially significant properties for the NRHP (Gothic Revival House; School #35)
- Along KY 222: One property listed on the NRHP (Nolynn Baptist Church and Cemetery) and three eligible / potentially significant properties for the NRHP (J.P. Shannon House; House; Big Spring Cemetery)
- Within General Study Area: Two properties listed on the NRHP (John Stuart House; School #24) and one eligible / potentially significant site (Camp Nevin NRHP Historic District)

In general, sites located along KY 84 are removed from the right-of-way and would likely not be affected by improvements proposed for this corridor. Any improvements to KY 222 or adjustments to the existing alignment of KY 222 could affect several of the noted properties (in particular, the house located at the intersection of KY 222 and Jeffries Road and the Big Spring Cemetery located approximately 0.6 miles northwest of the intersection of KY 222 and Middle Creek Road). Both of these properties have been identified as potentially eligible.

4.3.2 Archaeological Resources

A review of archaeological records found eight previously surveyed and documented sites. Two of these could be of concern for further project development depending on the location of project improvements. One could impact improvements to the existing KY 84 corridor. The second area of concern could impact development of a new corridor through the middle of study area. A thorough archaeological reconnaissance should be performed in these corridors before any development occurs.

4.4 Environmental Justice / Socioeconomic Study

A Socioeconomic Study was prepared by the Lincoln Trail Area Development District (LTADD) for the project area. It examined the potential disproportionate adverse community impacts on selected groups (minority, low-income, elderly, and disabled). The primary source of data for this report was the U.S. Census Bureau's 2010 Census, the U.S. Census Bureau's 2009 – 2013 American Community Survey, the Kentucky State Data Center, local elected officials, community leaders, and field observations.

The review is intended to identify areas of concern that may be affected by potential projects proposed by this study and to meet federal requirements regarding consideration of Environmental Justice (EJ) and other issues as defined in the National Environmental Policy Act (NEPA). According to the 2010 Census, three Census Tracts and five Block Groups encompass the population of the study area. The conclusion is that four of the five block groups that intersect the study area have at least one disadvantaged population. Census Tract 960102, Block Group 2 in LaRue County (located to the west of KY 61) does not contain any disadvantaged population. With regard to the other analysis areas, potential impacts to these populations should be considered for further analysis prior to the commencement of any project(s). **Table 12** summarizes the findings of the Socioeconomic Study indicating which unit of analysis has what type of concern(s). The entire report can be found in **Appendix D.** During future project development stages, more in-depth EJ analysis will need to be undertaken.

Table 12: Environmental Justice Summary

Census Tract / Block Group	Minorities	Poverty	Over 65	Disability
001600 / 1 (Hardin)	X			
001600 / 3 (Hardin)			X	
001600 / 4 (Hardin)		X		X
960300 / 3 (LaRue)				X
960102 / 2 (LaRue)				

Source: LTADD

5.0 Initial Project Development Team Meeting and LO/S Coordination

5.1 Project Development Team Meeting #1

To facilitate the project development process, three in-person meetings were held with the Project Development Team (PDT). The PDT consisted of KYTC, the LTADD, and the consultant team. These meetings were held to discuss project issues, study progress, LO/S meetings, issues and goals, development of alternatives, alternatives evaluation, and the conclusions of the study. The meeting minutes for all three meetings are included in **Appendix E**. The first meeting is discussed in the following section. The other two meetings are discussed at the appropriate time in the study to maintain a chorological document of study progress.

Staff from KYTC, the LTADD, and PB met on June 30, 2015 at the KYTC District 4 office. The purpose of this meeting was to provide an overview of the existing conditions, discuss initial ideas for corridors, and preview the materials to be discussed at the LO/S meeting being held later that day. Key action items from this meeting included the following:

- Incorporating a tourism component to the purpose and need statement
- Considering the elimination of improvements to the existing KY 222 route

5.2 LO/S Meeting #1

Meetings with LO/S are important as they are likely to be knowledgeable about transportation problems in the community while also providing local input for evaluating project needs. Two meetings were held with locally elected officials and stakeholders of LaRue and Hardin Counties. The invitation list was assembled with the help of the LTADD in an attempt to receive input from representatives across varied disciplines within the counties. Copies of the invitation lists are included with the meeting documentation in **Appendix F**.

The first LO/S meeting was held on June 30, 2015, at the Lincoln Museum in downtown Hodgenville, Kentucky. A general overview of the project and the existing conditions analysis (traffic operations, safety analysis, and environmental overview) were presented. Preliminary ideas for corridors were presented to the group, including an extension of KY 3005 (Ring Road), a new middle route to connect to Hodgenville, and improvements along the existing KY 84 corridor. Nineteen LO/S attended, including representatives of businesses (NSU Corp.; Eagle Thermoplastics, Inc.; Petro), public agencies (fire, police, emergency medical services (EMS)), and the National Park Services. The Mayor of Hodgenville also attended, as did a state representative and representatives of the City of Elizabethtown and Hardin County Planning. Through verbal discussion, a board exercise, and a follow-up survey, input on the project development process, issues, and corridors was received from the attendees. Overall, the group was unanimously in favor of not making improvements to KY 222 and constructing a new route through the middle of the study area.

6.0 Alternatives Development

A set of alternatives were developed initially as a result of direction provided by KYTC on the specific needs of this study. Per that direction, four build alternatives were to be considered to determine their feasibility in meeting the purpose and need and to determine if a preferred recommendation existed. A no-build option is the baseline for comparison and should be carried forward as a viable alternative throughout the project development process.

The four initial build alternatives are as follows:

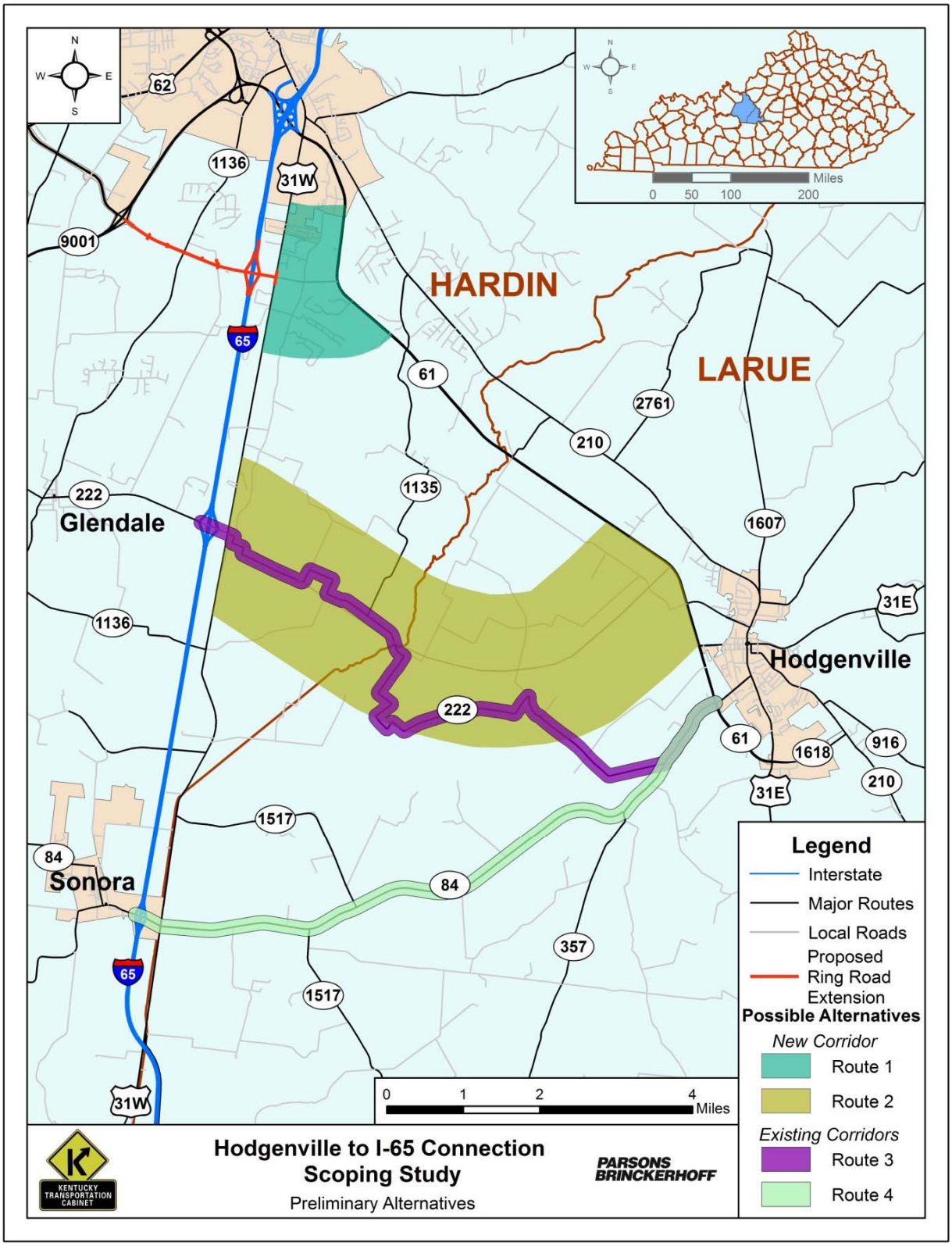
- Route No. 1: New corridor extending KY 3005 (Ring Road) from US 31W to KY 61
- Route No. 2: New corridor near the I-65 / KY 222 interchange to KY 61
- Route No. 3: Improve existing route KY 222 from I-65 to KY 84
- Route No. 4: Improve existing route KY 84 from I-65 to KY 61

The area of evaluation for the potential location of a new corridor extends approximately 1 mile from the centerline of the corridor band, effectively providing an area 2 miles in width for evaluation. Along the existing routes, the area of evaluation extends 500 feet on each side of the existing roadway centerline.

Figure 9 shows the four identified routes listed above. Routes No. 1 and 2 would consist of new roadway, while Routes No. 3 and 4 are improvement options to existing routes. For improvements to existing routes, **Appendix A** contains plan and profile sheets that were used to identify geometric deficiencies for improvement on a corridor-wide basis, as well as identification of possible spot improvement locations. The improvements on existing routes would include overall highway improvements to address identified deficiencies. The consideration of widening the roadway depended on traffic analysis and benefit versus cost, as well as how and if potential spot improvements could be completed as stand-alone projects to improve safety and / or operations in the short-term time frame.

Some considerations relative to the development of alternatives include number of lanes, typical section widths, and connection points. To provide continuity for Route No. 1, it was decided by the PDT at the first meeting to maintain a similar typical section as that of the previously designed portion from the Western Kentucky Parkway to US 31W. This includes a 32-foot depressed median with four, 12-foot lanes and a 10-foot shoulder (8-foot paved). The specific typical section for Route No. 2 was not determined, with the exception that it generally would be two lanes based on existing and estimated future traffic volumes. A similar decision was made regarding the number of lanes for Routes No. 3 and 4 to maintain the two existing lanes and widen the roadway section with improved lane widths and wider shoulders. Detailed typical sections specific to each alternative were developed as part of the alternative refinement process.

Figure 9: Preliminary Alternatives



7.0 Preliminary Analysis

The preliminary analysis began with the four alternatives presented in Chapter 6. Each alternative was screened for any fatal flaws that would prohibit it from progressing as a potential feasible option for further project development. Examples of fatal flaws can be cost considerations that make the project prohibitive, environmental features that would greatly inhibit further development of the project, or poor utilization (such as low traffic volumes) that would lead to a low benefit cost ratio. This also considers that there are better, more viable alternative options.

Considerations and areas of concern for each alternative are listed below.

Route No. 1: New corridor extending KY 3005 (Ring Road) from US 31W to KY 61

Considerations	Areas of Concern
Approximately 1 mile of new roadway	Connection point to KY 61 would be closer to Elizabethtown than Hodgenville
Logical termini / connectivity	High-density residential clusters located within the corridor
	Indiana and northern long-eared bat roosting habitat
	Hydric soils present
	High cost / mile for new construction

Route No. 2: New corridor near the I-65 / KY 222 interchange to KY 61

Considerations	Areas of Concern
Approximately 7 miles of new roadway	10 potential hazardous materials sites at western terminus area
Logical termini / connectivity	Indiana and northern long-eared bat roosting habitat
	Hydric soils present
	Floodplain
	Sinkholes
	Four archaeological sites along US 31W
	Impacts to farmland
	Cost for new construction

Route No. 3: Improve existing route KY 222 from I-65 to KY 84

Considerations	Areas of Concern
Improvements to existing route	Narrow existing roadway (9-foot lanes)
Lower-cost spot improvements possible	Numerous turns
2015 ADT less than 200	65 vertical geometric deficiencies; 25 horizontal deficiencies
	10 potential hazardous materials sites at western terminus area
	2 cemeteries along route
	1 observed wetland along route

Route No. 4: Improve existing route KY 84 from I-65 to KY 61

Considerations	Areas of Concern
Improvements to existing route	Narrow existing roadway (9-foot lanes)
Lower-cost spot improvements possible	36 vertical geometric deficiencies; 5 horizontal deficiencies
	9 potential hazardous materials sites at western terminus area
	Numerous streams
	1 observed wetland along route
	Sinkholes near eastern terminus
	1 archaeological site at KY 61 intersection

Route No. 3 (Improve existing route KY 222) was recommended for elimination at this stage of the project for the following reasons:

- Low traffic volumes (ADT currently less than 200) and low projected future year traffic volumes (ADT 250)
- Very rural roadway serving primarily local traffic
- Current route disjointed with multiple turn movements
- Cost outweighs benefits based on the number of identified geometric deficiencies (65 vertical and 25 horizontal) compared to the traffic volume potentially served

Furthermore, this was confirmed independently by the LO/S at their first meeting. The group unanimously vocally agreed to eliminate improvements to KY 222 as an option, as well as noted it on their survey forms (eleven out of eleven responses).

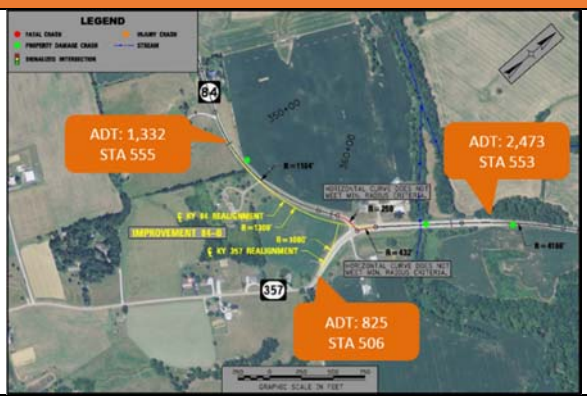
The remaining three alternatives and options were advanced to the next stage for detailed analysis.

Route No. 4 was further developed at this stage to include spot improvements:

84-A: - KY 84 at US 31W near MP 26.00

Issues	Project: Improve sightlines by moving utility poles
• Identified by LO/S as having safety concerns • CCRF west of intersection on KY 84 = 2.74 • Sight distance • Fatal crash occurred at this intersection (failed to yield right-of-way) • Utilities close to roadway	

84-B: - KY 84 at KY 357 at MP 6.56

Issues	Project: Realign intersection
• Geometrically deficient horizontal curve • Roadway alignment does not follow primary traffic flow movement	

84-C: - KY 84 at KY 222 at MP 7.39

Issues	Project: Realign intersection
• Skewed intersection • Truck maneuvers on narrow roads • Gas substation adjacent to intersection	

84-D: - KY 84 near MP 8.00

Issues	Project: Realign curve
• Geometrically deficient horizontal and vertical curves (two each) • Fatal crash location (too fast for conditions / struck ditch and earth embankment)	

84-E: - KY 84 at KY 61 at MP 8.44

Issues	Project: Flashing yellow arrow for left turns and offset left turns
• Two high-speed routes intersecting • Multiple lanes for vehicles to cross turning to / from KY 84	

An additional spot improvement was added to the list along KY 84 as the project progressed. This location was identified from the second LO/S meeting and noted during the public meeting. For consistency purposes of identifying all the spot improvements, this additional project is presented below.

84-F: - KY 84 at Barren Run Creek Bridge at MP 3.33

Issues	Project: Replace superstructure
• Narrow bridge (9-foot lanes) • Geometric deficiencies -Year built: 1953 -Year of last inspection: 2013 -Sufficiency Rating: 72.8% -NBI Rating: Structurally Deficient • Winter weather crashes	

7.1 Project Development Team Meeting #2

Following the initial analysis of the alternatives, the second PDT meeting was held on September 1, 2015. The second meeting was held as an interim working meeting to review the LO/S input, discuss refinements to the remaining alternatives, and prepare for the upcoming public meeting. Key action items from this meeting included the following:

- Leaving the alternatives shown as wide bands and labeling them by color (rather than number) to keep the study at a high planning level when presenting to the public
- Requesting feedback from the public as to the optimal connection point for a new middle route connector to KY 61
- Updating the traffic forecasts to test the independent utility of the remaining scenarios (an addendum document was created as part of this effort and included in **Appendix G**)

8.0 Detailed Analysis

After the preliminary analysis, Routes No. 1, 2, and 4 were retained as feasible alternatives and were re-named at this point to assign a broader-based project identification name. The naming convention became:

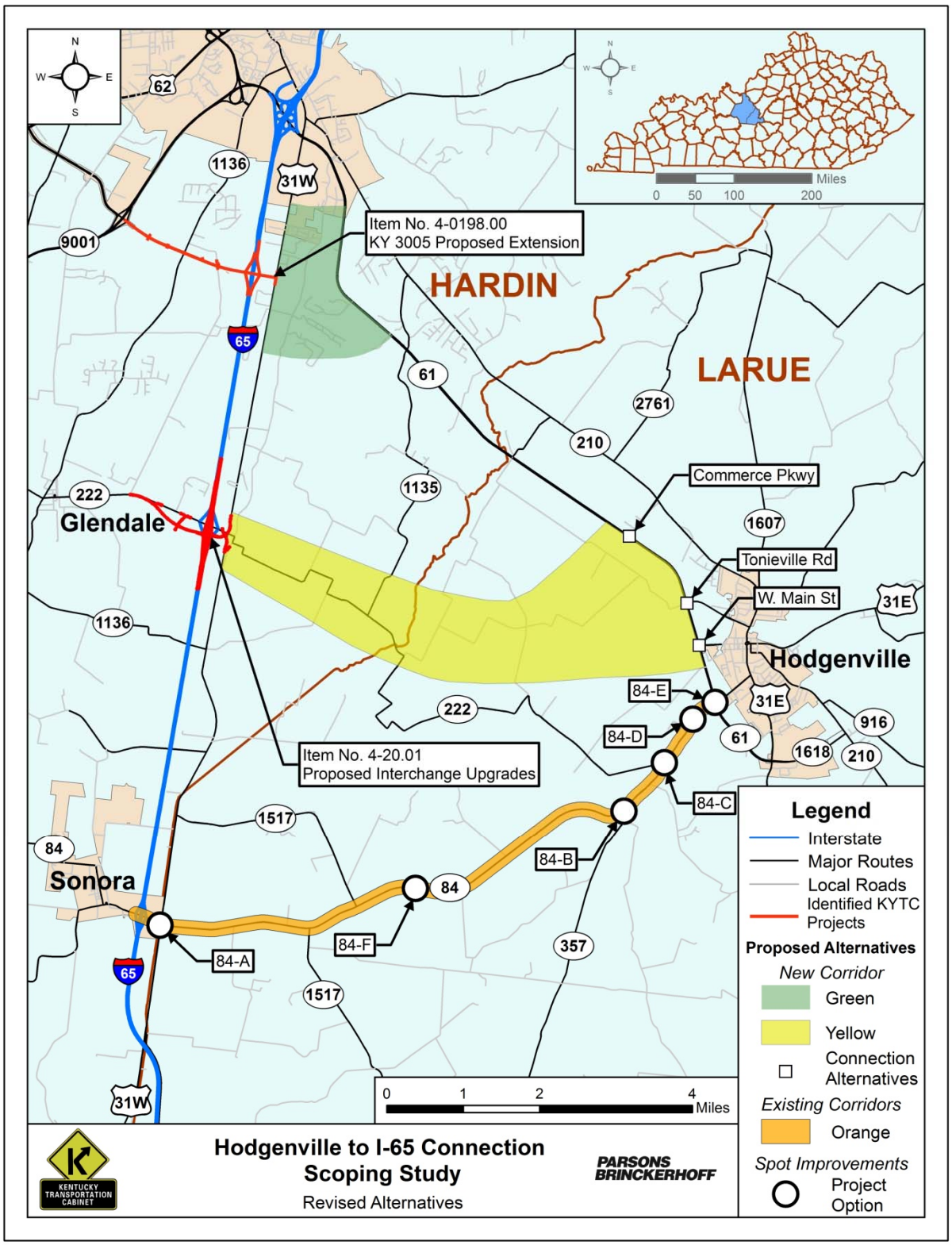
- Route No. 1: Ring Road Extension = Green Corridor
- Route No. 2: New Corridor to Hodgenville = Yellow Corridor
- Route No. 4: Improve Existing KY 84 = Orange Corridor

Figure 10 shows the revised map with the location of these corridors as well as the relative location of spot improvements along KY 84.

One change that was made to the Yellow Corridor (New Corridor to Hodgenville) was modifying the east portion of the corridor band to accommodate an undetermined connection point to KY 61. Potential connection points include: closer to the LaRue County Industrial Park, directly to the primary street into town (W. Main Street or KY 2426), or between these two locations at Tonieville Road (KY 3204).

A more detailed evaluation was then performed with respect to traffic operations, environmental impacts, and costs. The following sections details the evaluation criteria and how the alternatives performed in each of those categories.

Figure 10: Revised Alternatives



8.1 System / Traffic Operations

The utility of each alternative was evaluated in relation to traffic volumes, the resulting impacts to traffic operations, and system travel time savings. Traffic volumes were forecasted for each alternative by KYTC and summarized in a Traffic Forecast Report for this study (**Appendix G**). **Figure 11** provides an overview of the projected traffic volumes for the future year 2040. The forecast provided independent utilization of each corridor and included a low-growth and high-growth scenario. Traffic projections related to this study are highly dependent on growth at the Glendale Industrial Site. Therefore, the Scenario A growth run with no industry in Glendale was noted as a low-growth scenario. The Scenario B growth run with industry and the site built out was noted as a high-growth scenario. These projected volumes were used to perform a capacity analysis of the corridors and to determine the relative impact on traffic operations. The higher volumes were used in the capacity analysis to provide a "worst-case scenario" for operations. The travel time comparisons are based on the travel length and speed for each segment. These provide direct comparison of travel on all corridors for common trip points (I-65 and KY 222 interchange to the center of Hodgenville).

Table 13 summarizes this information. Some key points to consider from this table include the following:

- The Green Corridor is projected to carry the highest traffic volumes (6,000) of the three alternatives.
- All corridors have more than adequate capacity for the future year traffic volumes. The two-lane corridors (Yellow and Orange) operate at LOS C due to lack of passing opportunities.
- The shortest route to get from I-65 to Hodgenville is the Yellow Corridor, which is also the most direct path.
- Travel times are essentially the same for the Orange Corridor compared to the existing route along KY 84. The overall improvements to the corridor do not result in capacity changes or modifications to the speed. The improved geometrics, wider lanes and shoulders, and spot improvements may help with travel time reliability.

Figure 11: Future Year (2040) Traffic Growth Projections

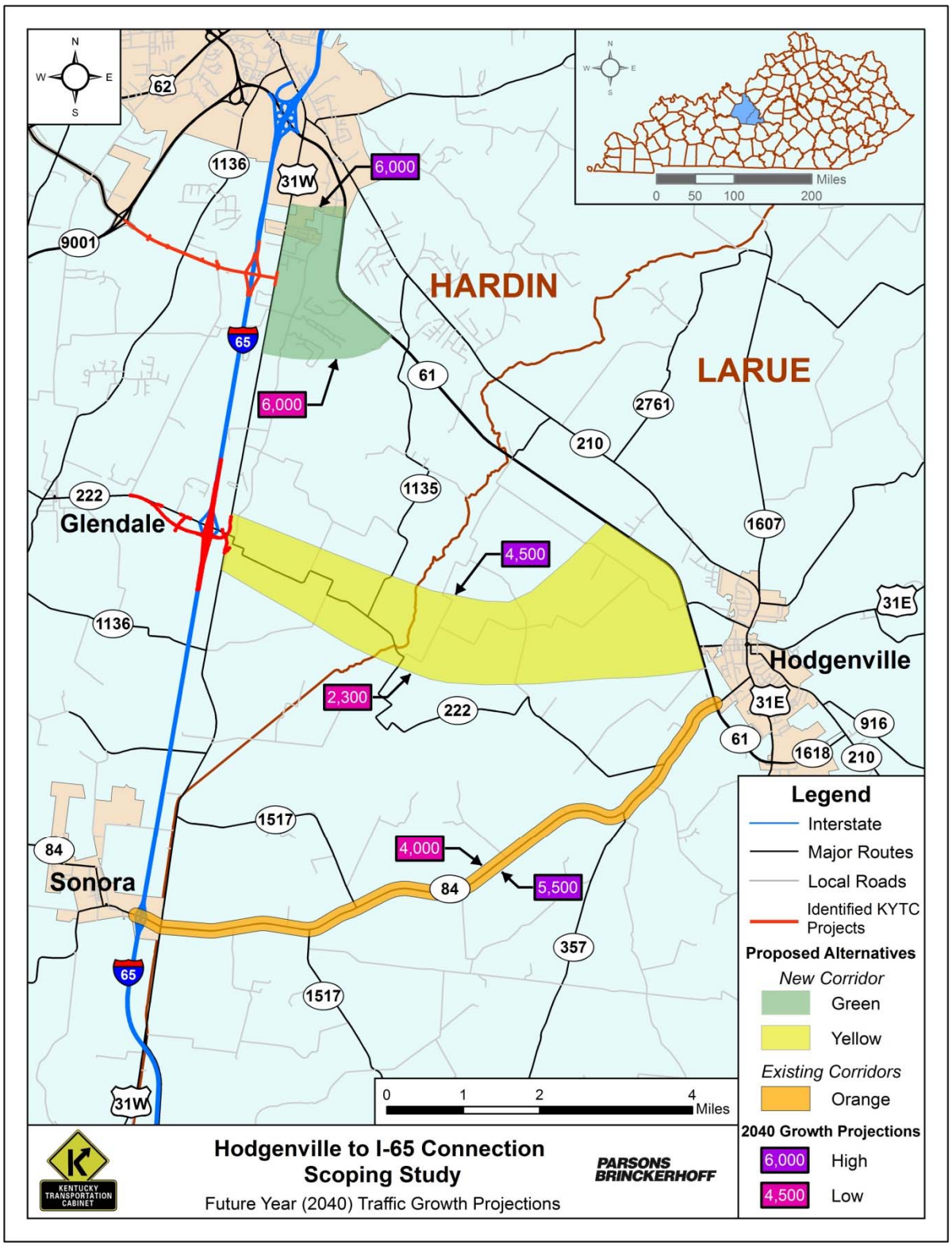


Table 13: System / Traffic Operations

Alternative	Description	Length (miles)	2040 ADT	2040 LOS	V/C Ratio	Travel Time / Distance* (min / miles)
Green	Extension of Ring Rd (KY 3005) from US 31W to KY 61	0.8	6,000	A	0.09	12.2 / 11.9
Yellow	New corridor near the I-65 / KY 222 interchange to KY 61	7.2	2,300 - 4,500	C	0.15	8.9 / 8.2
Orange	Improve existing KY 84 route from I-65 to KY 61	8.6	4,000 - 5,500	C	0.18	16.2 / 14.8

*Note:

Travel time analysis is based on a start point at the Glendale interchange (I-65 and KY 222) and an end point at the center of Hodgenville. All values are calculated based on distance and the posted speed limit (or proposed limit for new routes). They do not consider additional delay related to the interchanges with I-65 or the traffic signals in Hodgenville as all three routes would experience each of these delays. Therefore, these are relative comparisons and should not be considered actual travel times.

For reference, existing travel times from the same start and end point are as follows:

- I-65/KY 61 Route: 13.8 min (13 miles)
- KY 222/KY 84 Route: 14.0 min (11.4 miles)
- I-65/KY 84 Route: 16.2 min (14.8 miles)

8.2 Environmental Impacts

A summary table (**Table 14**) was compiled to determine the relative impact(s) of each corridor on identified environmental features. The summary table is based on a relative line through the corridor with a width equal to the typical section width. It is intended to be representative of the impacts that would likely be associated with a specific alignment (once it is chosen).

The Yellow Corridor has the most potential for impacts as this corridor extends through primarily undeveloped land. This includes the potential for impacts to wetlands, bat roosting habitats, and an archaeological site.

Not listed in the table, but which merits noting at this project stage, are conservation easements that encroach into the Yellow and Orange Corridors. From a search of the National Conservation Easement Database, there is one recorded easement near the southern end of the Yellow Corridor. Two easements are located within the Orange Corridor band. For the exact locations of these easements, refer to the Environmental Constraints map (**Figure 7**).

A geotechnical overview was completed for the three corridors. A summary of the findings is provided below (and on **Table 14**) with the full geotechnical documentation included in **Appendix H**.

The study area is located in the Elizabethtown and Tonieville quadrangles. The formations within the study area show it is underlain by Quaternary-aged alluvium, slumped deposits, and Mississippian-aged deposits of the Ste. Genevieve and St. Louis Limestone Formations. These formations are susceptible to developing karst-related issues. Mapping indicates each corridor has a high potential for karst issues. One fault was noted from the review of geologic mapping. It is a series of northwest-to-southeast trending faults that are a part of the Pennyrile Fault System. The fault crosses the Green Corridor near the intersection of Budco Lane and US 31W on the western side and south of the intersection of Harvest Drive and KY 61 on the eastern side.

Table 14: Environmental Impacts

Alternative	Description	No. of Streams	Potential Wetland Impacts (acres)	Floodplain Impacts (acres)	Bat Roosting Habitat Impacts	No. of Known Historic Sites	No. of Known Archaeological Sites	Environmental Justice Impacts	No. UST / Hazmat Sites	Geotechnical Impacts
Green	Extension of Ring Rd (KY 3005) from US 31W to KY 61	1	0	0	4+	0	0	1	0	Crosses a fault line / karst topography
Yellow	New corridor near the I-65 / KY 222 interchange to KY 61	5	32	< 0.1	7	0	1	3	4	Karst topography
Orange	Improve existing KY 84 route from I-65 to KY 61	13	4	2	3	0	0	0	1	Karst topography

8.3 Community Impacts

A summary table (**Table 15**) was compiled to compare impacts associated with community features. For the study area, those features included tourism, trucking / industrial / business impacts, and farmland impacts. Tourism is a key economic component for Hodgenville as the area is promoted as the birthplace of Abraham Lincoln. Providing and improving access to tourist sites from the Interstate system is important to local officials and stakeholders. Another key consideration is provision of reliable and fast connections for the major industrial manufacturers in the area. Finally, as was noted during the public meeting, large sections of the study area are used for farming, and there is concern among the farming community regarding impacts to farmland resulting from any proposed new routes or roadway improvements.

As described in **Table 15**, the following community impact categories would be affected:

- Tourism Impact - The Yellow Corridor provides the most direct connection to Hodgenville. The other corridors provide some improved connection to the area.
- Trucking / Industrial / Business Impact - The Green Corridor provides the best access to the LaRue County Industrial Park; however, the Yellow Corridor may provide good access depending upon where the connection point to KY 61 is located.
- Farmland Impact - The Yellow Corridor has the greatest impact to farmland (estimated 115 acres) as it primarily extends through undeveloped areas. It should be noted this estimate is based on an assumed typical section width and right-of-way through the corridor. It does not encompass the entire acreage of farmland shown in the band on **Figure 10**.

Table 15: Community Impacts

Alternative	Description	Tourism Impact	Trucking / Industrial Business Impact	Farmland Impact (Acres)
Green	Extension of Ring Rd (KY 3005) from US 31W to KY 61	Alternative Elizabethtown / I-65 northern connection	Connectivity to Industrial Park on KY 61	15
Yellow	New corridor near the I-65 / KY 222 interchange to KY 61	New direct connection from I-65 to Hodgenville	Improved access to Hodgenville	115
Orange	Improve existing KY 84 route from I-65 to KY 61	Improved direct I-65 southern connection	Improved access to Hodgenville	0

8.4 Cost

Cost estimates for design and construction were calculated for each corridor. Right-of-way and utility costs were estimated by KYTC District 4 based on acreage and quantity estimates of impacts provided by Parsons Brinckerhoff. All costs are shown in current year (2015) dollars in **Table 16**.

Typical sections upon which the construction costs were based for the Green, Yellow, and Orange Corridors are included for reference in **Figures 12, 13, and 14,** respectively. The Green Corridor follows a similar section as proposed in the Phase I design plans for KY 3005 (extension from the Western Kentucky Parkway to US 31W – Item No. 4-0198.00). The Orange Corridor has a slightly different typical section at the beginning of the project from the I-65 bridge to US 31W based on the I-65 widening project (Item No. 4-17.00).

Cost estimates with all associated components (design, right-of-way, utilities, and construction) were also developed for the spot improvements. Similar to the methodology for the corridors, the right-of-way and utility costs were provided by KYTC District 4 based on acreage and quantity estimates of impacts provided by Parsons Brinckerhoff. **Figure 15** shows the costs associated with each project.

Table 16: Planning-Level Cost Estimates

Alternative	Description	Design (D)	ROW (R)	Utilities (U)	Construction (C)	Total
Green	Extension of Ring Rd (KY 3005) from US 31W to KY 61	$500,000	$1,100,000	$240,000	$3,200,000	**$5,040,000**
Yellow	New corridor near the I-65 / KY 222 interchange to KY 61	$2,500,000	$2,200,000	$1,810,000	$27,018,000	**$33,528,000**
Orange	Improve existing KY 84 route from I-65 to KY 61	$2,500,000	$1,400,000	$2,540,000	$27,980,000	**$34,420,000**

Notes:
Planning cost estimates are in current year dollars (2015)
Right-of-way and utility costs provided by KYTC District 4
Construction and design costs determined by Parsons Brinckerhoff

Figure 12: Green Corridor Typical Section

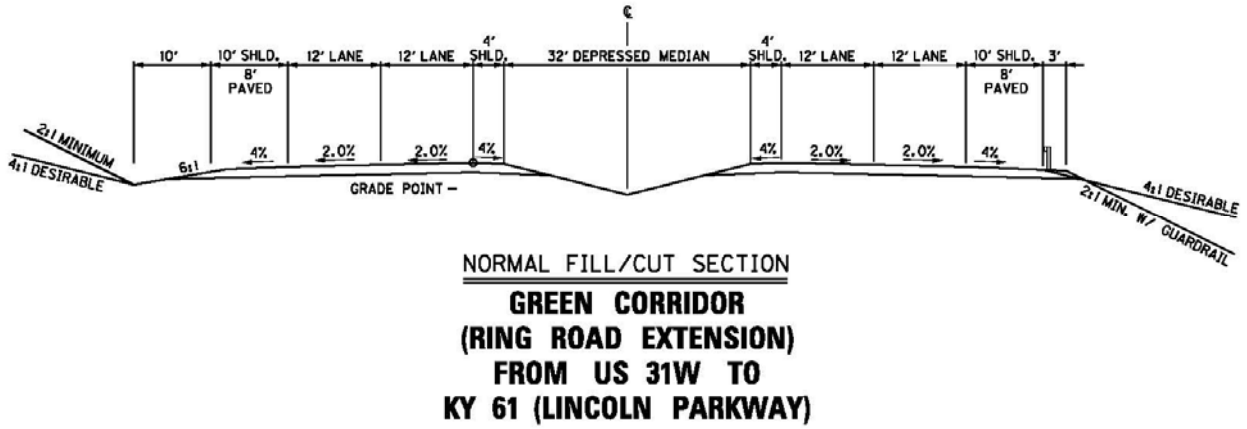
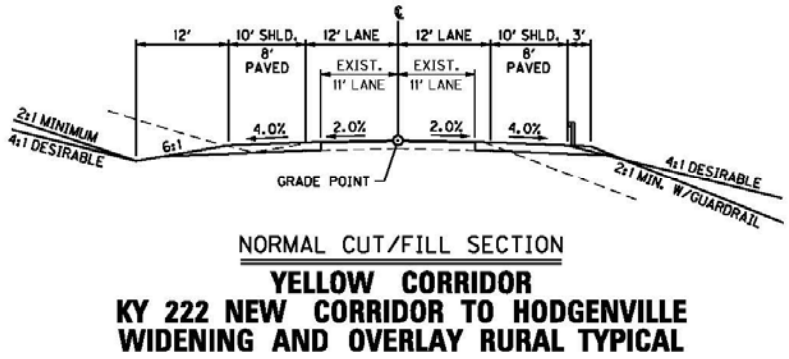


Figure 13: Yellow Corridor Typical Section



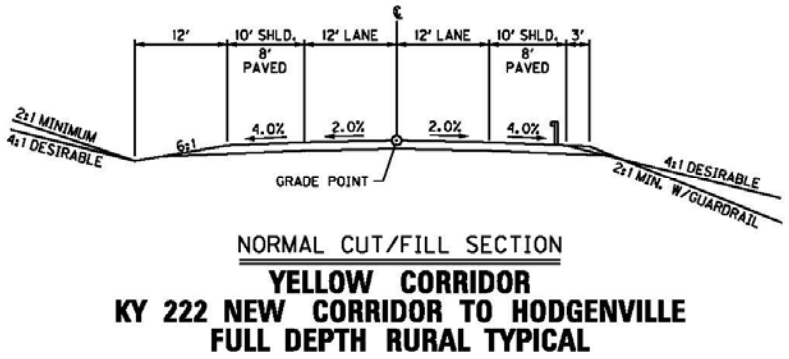
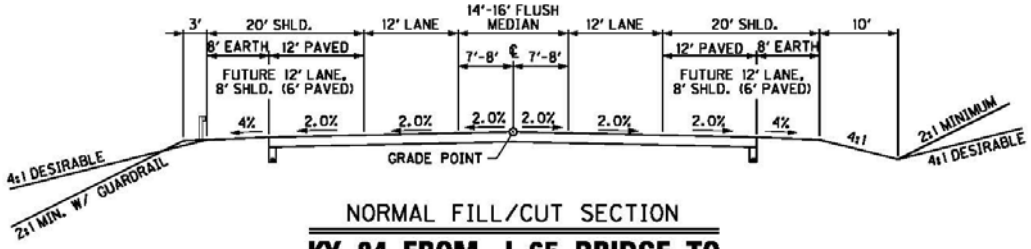
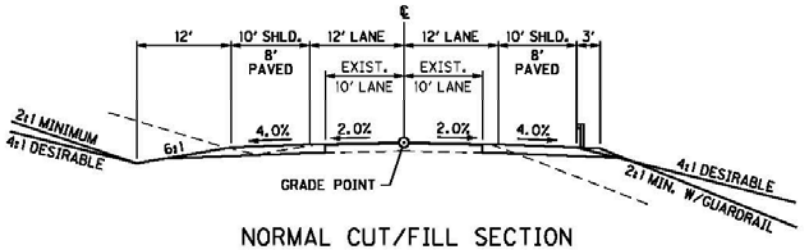


Figure 14: Orange Corridor Typical Section



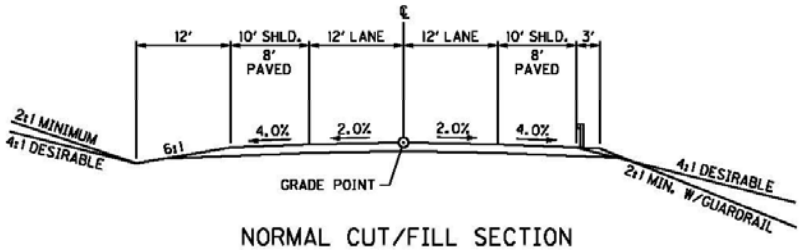
NORMAL FILL/CUT SECTION

KY 84 FROM I–65 BRIDGE TO US 31W (FROM KYTC PROJECT, ITEM NO. 4–17.00)



NORMAL CUT/FILL SECTION

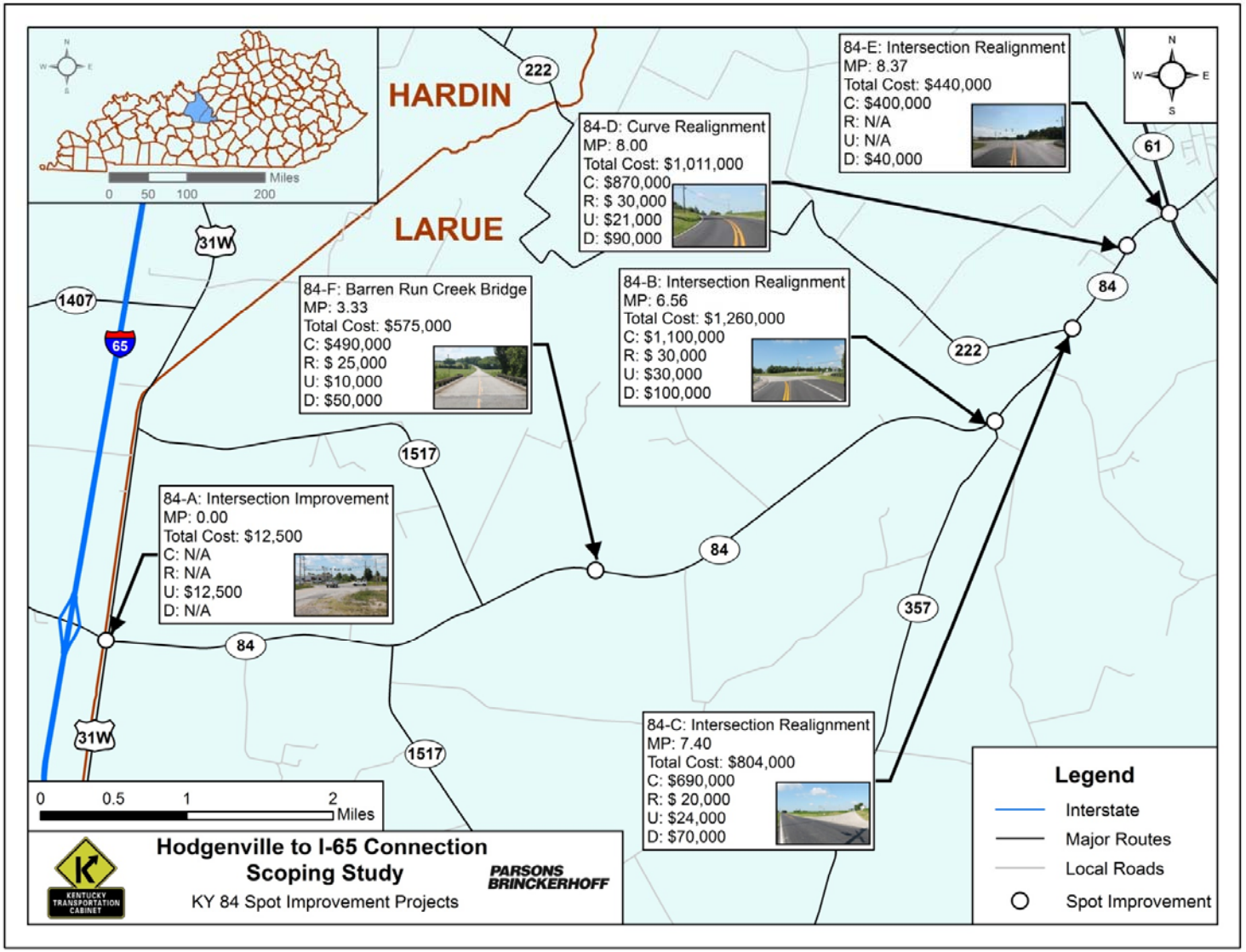
ORANGE CORRIDOR KY 84 FROM US 31W TO KY 61 (LINCOLN PARKWAY) WIDENING AND OVERLAY RURAL TYPICAL



NORMAL CUT/FILL SECTION

ORANGE CORRIDOR KY 84 FROM US 31W TO KY 61 (LINCOLN PARKWAY) FULL DEPTH RURAL TYPICAL

Figure 15: Spot Improvements



9.0 Additional LO/S Coordination and Public Outreach

9.1 LO/S Meeting #2

A second meeting was held toward the end of the project development process on October 27, 2015. Ten LO/S were in attendance, including representatives of Eagle Thermoplastics, Inc.; EMS; and the police department. The Mayor of Hodgenville and the LaRue County Judge–Executive were also in attendance. This meeting was held prior to the public meeting to present the LO/S more detailed information on study findings with an intent to specifically receive their feedback.

9.2 Public Meeting

One public meeting was held toward the end of the study process to inform the public of the purpose and need of the project, present existing conditions, and receive feedback on spot improvements to existing routes and gauge opinion regarding new corridor alternatives. The meeting was held on October 27, 2015 at the First Baptist Church in Hodgenville, Kentucky. There were 91 attendees with 87 surveys completed relative to the study (either at the meeting, through the mail, or online). The meeting included stations for discussion (existing conditions, purpose and need, and alternatives), and a formal presentation. In general, the concerns expressed by the public were related to the costs of the projects and impacts to farmlands. Specific feedback regarding prioritization of projects also was provided.

As part of this section, the results of the public meeting prioritization exercise and survey information are included to provide the community's response to the study information. At the meeting, attendees were given dots and asked to place one on their preferred corridor (Green, Yellow, or Orange) with a second set of dots distributed to prioritize the spot improvements. Participants were also provided a survey to identify their preferred corridor as well as prioritize spot improvements. Some attendees may have done both. The results for the selection of the preferred corridor are included in **Table 17**. The results of the spot improvement prioritization are included in **Table 18**. Spot Improvement 84-F was later added as a result of feedback from the public meeting.

Table 17: Public Meeting Preferred Corridor Feedback

Alternative	Description	Dot Exercise # of Responses	Survey Form # of Responses
Green	Extension of Ring Rd (KY 3005) from US 31W to KY 61	22	26
Yellow	New corridor near the I-65 / KY 222 interchange to KY 61	22	25
Orange	Improve existing KY 84 route from I-65 to KY 61	16	35

For those that selected the Yellow Corridor as their preferred corridor, a follow-up question was asked to identify their preferred intersection with KY 61. The feedback indicated a tie between a connection with Tonieville Road (KY 3204) and one near the LaRue County Industrial Park, each with 18 responses.

Table 18: Public Meeting Spot Improvement Prioritization

Spot Improvement	Description	Dot Exercise Rank	Survey Form Rank
84-A	KY 84 at US 31W Intersection Improvement	1	1
84-B	KY 84 at KY 357 Intersection Realignment	5 (tied with 84-E)	3
84-C	KY 84 at KY 222 Intersection Realignment	3 (tied with 84-D)	4
84-D	KY 84 near Milepoint 8 Curve Realignment	3 (tied with 84-C)	2
84-E	KY 84 at KY 61 Intersection Improvement	5 (tied with 84-B)	5

10.0 Conclusions and Recommendations

10.1 Project Development Team Meeting #3

The third (and final) PDT meeting was held several weeks following the second LO/S meeting and the public meeting. This enabled all survey data to be collected and compiled for presentation. The meeting also focused on any revisions to the alternatives and concluded with discussion on study recommendations. These recommendations are presented in the following section.

10.2 Recommendations

Based on the alternatives analysis, the PDT discussion, and inputs from LO/S, and the public, the corridor that best meets the purpose and need of the project is the Yellow Corridor. This recommendation however is only justifiable if and when the Glendale Industrial Site develops, increasing traffic demand for a new route beyond what is otherwise projected.

The following figure (**Figure 16**), provides a summary assessment of the comparison of the three corridors to the identified needs of the project. The needs are listed across the top, with the corridors listed below that met that need. A no-build option remains the baseline for comparison of these corridors and is considered as a viable alternative.

Figure 16: Summary of Project Needs Compared to Corridors

Safety	Roadway Deficiencies	Travel Time Reliability	Access	Connectivity
•Yellow •Orange	•Yellow •Orange	•Yellow •Green	•Yellow	•Yellow

The Yellow and Orange Corridors satisfy the safety need as the Yellow Corridor would reduce traffic volumes (and the associated crash exposure) on KY 84 and the Orange Corridor includes improvements to identified horizontal and vertical deficiencies. Both the Yellow and Green Corridors would improve travel time reliability. The Green Corridor would include a 4-lane section, thereby providing full passing opportunity. The Yellow Corridor includes a new roadway with improved passing opportunities compared to the existing routes through the study area (KY 222 and KY 84). Only the Yellow Corridor improves access to / from the I-65 / Glendale site. This corridor ties directly into this location whereas the other two are located to the north and south of this area. The Yellow Corridor is the only one that satisfies the need for direct connectivity to / from the I-65 Glendale site. As shown by this chart, only the Yellow Corridor meets all identified needs for this study.

All three corridors provide different benefits and have different impacts, as noted:

- The Green Corridor, while a viable project, does not appear to fully meet the purpose and need for this study. Future development of the Green Corridor can take place independently as growth in that section of the study area warrants and completion of the roadway to the east and northeast occurs. However, should the need for direct connectivity between I-65 / Glendale and Hodgenville diminish, the Green corridor provides a cost-effective solution to address some of the remaining needs.

- The Yellow Corridor appears to best meet the purpose and need of this project. It provides an improved connection between I-65 / Glendale and Hodgenville, meeting much of the purpose and need. This is in contrast to the Green Corridor, which does not provide a more direct connection to Hodgenville from the Glendale area along I-65. At both of the LO/S meetings, all in attendance unanimously ranked this alternative as their preferred corridor in the survey form (11 out of 11 responses and 9 out of 9 responses). At the public meeting, it received the same number of responses as the Green Corridor from the response exercise. It received slightly less preference than the Orange Corridor through the survey form (25 responses compared to 35 responses).

  The typical section recommended at this planning stage is two, 12-foot lanes with a 10-foot shoulder (8-foot paved). This is subject to change per future design evaluation. The specific connection point with KY 61 shall be determined during the design phase, although it is recommended to consider either a connection with Tonieville Road (KY 3204) or near the LaRue County Industrial Park per comments made during the public meeting.

  Finally, considering the benefit / cost of the project, it does not appear to warrant further action until growth and development at the industrial park is realized and the requisite travel volume / traffic needed for this project takes place. The overall project costs s $33,528,000 for a projected traffic volume of 2,300 vehicles per day without full build-out of the Glendale Industrial Site. This is much too low to justify the costs.

- The Orange Corridor, which would complete a major widening of KY 84, does not fully meet the purpose and need of this project and is not recommended for further project development. While it would improve the safety and roadway deficiencies identified in the purpose and need through improved geometrics, it does not provide a more reliable connection between the Hodgenville and I-65 / Glendale area as it maintains its approximate current alignment. Northbound vehicles would benefit from an upgraded KY 84. Traffic from the Glendale area and industries along KY 61 would not benefit from this alternative to the same degree as the Yellow Corridor. However, some of the spot improvements identified in the study are recommended as they would address the geometric deficiencies and improve the safety of the route.

Further project development is recommended for the spot improvements at this time. Of the six spot improvement projects identified along KY 84, all six are viable. From a prioritization standpoint, improvements 84-A: KY 84 at US 31W (total cost of $12,500) and 84-D: KY 84 near Milepoint 8 (total cost of $1,011,000) are the high priority spots. This is based on input from the LO/S group and the public, and ultimately decided upon by the PDT. The following are some considerations for the remaining spot improvement projects:

- 84-B: KY 84 at KY 357 Intersection Realignment - The realignment to make KY 84 the primary route is justified by traffic volumes but may not be warranted as a stand-alone project (i.e. not warranted unless KY 84 is widened).
- 84-C: KY 84 at KY 222 Intersection Realignment - The realignment of the approach of KY 222 to provide a better connection to KY 84 is a project that could be considered a stand-alone project but is not a high priority at this time.
- 84-E: KY 84 at KY 61 Intersection Realignment - Signal timing adjustments and an offset for left turns from KY 61 could be made to improve intersection operations. At the time of this documentation, KYTC District 4 has added this project to their list of in-house projects for 2016.
- 84-F: KY 84 at Barren Run Creek Bridge - This spot improvement project has the highest cost (total cost of $575,000) of the remaining projects not in the top two. It is possible that additional maintenance on the immediate approaches may alleviate some of the issues at a lower cost than the full bridge replacement project.

Currently, there is no funding in the 2014 KYTC Highway Plan for any future phases of project development. The 2016 KYTC Highway Plan includes $1,000,000 for the design phase of this project listed as Item No. 04-8505.00. An additional $675,000 (D: $125,000, R: $50,000, U: $100,000, C: $400,000) is listed for connector improvements Hodgenville to I-65 as Item No. 04-8909. Additional review in the design phase should provide the necessary evaluation (including public input) on the preferred treatment of the entire corridor, including any modifications to the typical section and specific connection points to I-65 and KY 61.

11.0 Contacts / Additional Information

Written requests for additional information should be sent to:

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Frankfort, Kentucky 40622

Additional information regarding this study can also be obtained from:

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(270) 766-5066
KevinM.Young@ky.gov

Improved Hodgenville to I-65 Connection

Scoping Study

KENTUCKY TRANSPORTATION CABINET