

# Natural Historic Review



Scoping Study

# US 60 BRIDGE

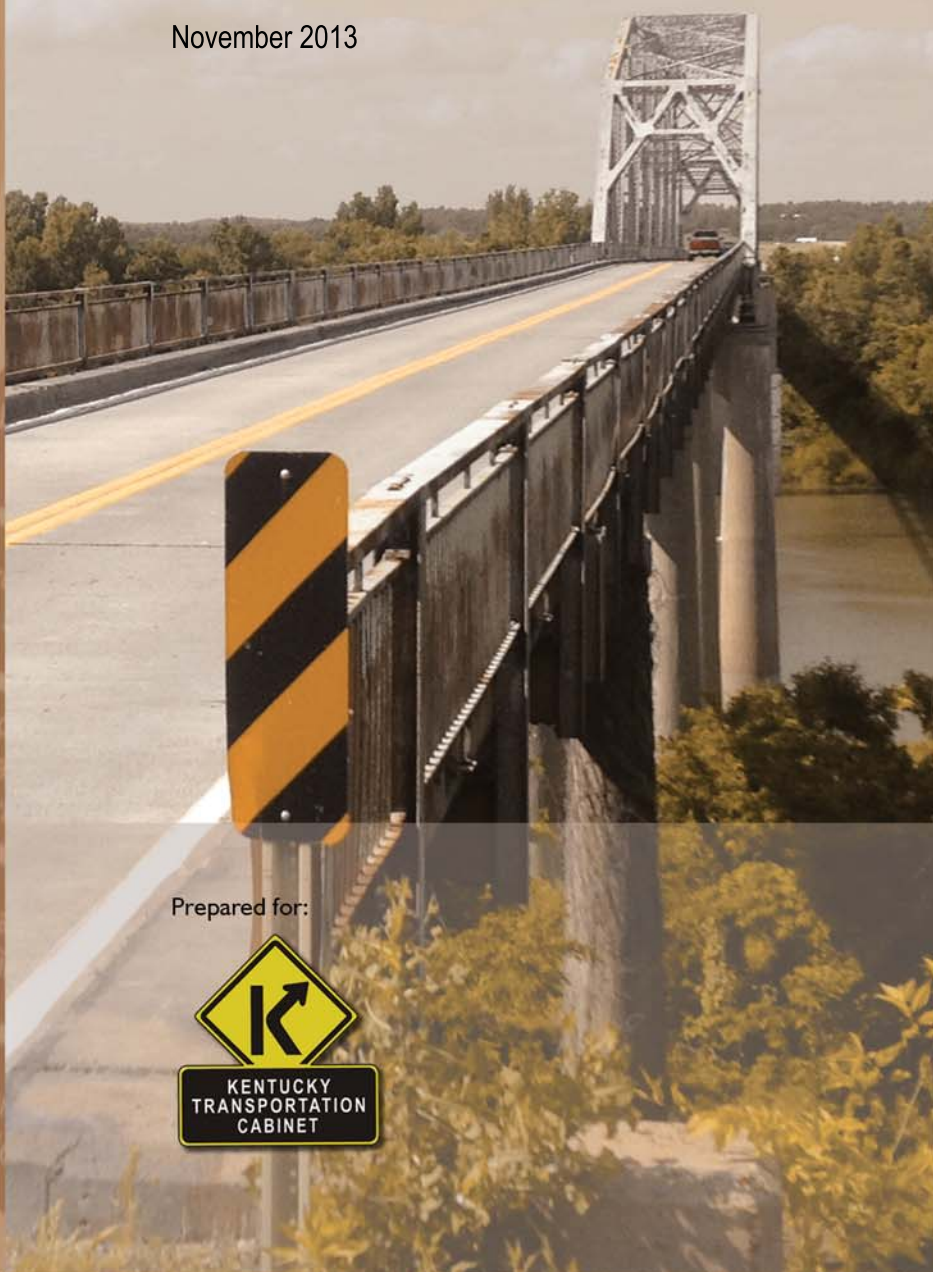
## *Replacement*

at Cumberland River

Livingston County, KY.

Item No.: 1-1142.00

November 2013



Prepared for:



Prepared by:

**PARSONS  
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## 1.0 Introduction

Parsons Brinckerhoff has been contracted by the Kentucky Transportation Cabinet (KYTC) to complete an alternatives study that investigated potential rehabilitation and/or replacement options for the existing US 60 bridge over the Cumberland River in Livingston County, Kentucky near the City of Smithland. Issues such as safety, connectivity, bridge sufficiency, environmental and human impacts and public input were all evaluated with respect to the replacement or rehabilitation of the bridge.

Members of the project team included KYTC District 1, KYTC Central Office Division of Planning and the consultant team which consisted of Parsons Brinckerhoff, Third Rock Consultants LLC, and Cultural Resource Analysts, Inc.

### 1.1 Study Objectives

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

1. Evaluate and document the existing conditions of the bridge as well as the study area encompassing the bridge and roadway approaches.
2. Compile a review of the existing environmental conditions.
3. Refine and utilize the Project Purpose and Need to measure project development and explore alternatives.
4. Provide opportunities for public involvement.
5. Develop, evaluate and refine potential improvement alternatives.
6. Evaluate maintenance of traffic options in conjunction with the alternatives analysis.
7. Provide conclusions / recommendation.
8. Document the study process for review by the KYTC.

While KYTC has the ultimate responsibility for constructing and maintaining safe and efficient highways, KYTC desires to incorporate stakeholder and agency input into the evaluation and decision-making process. Therefore, all eight of these study objectives were completed in coordination with a comprehensive public and agency involvement program.

### 1.2 Project Location and Study Area

The study area included the US 60 bridge itself as well as the roadway approaches on either side. It is bounded by KY 70 in the south to KY 2610 in the north and extends approximately a half mile to the east and west of the existing bridge. There has been consideration of a bypass around the City of Smithland, where the bridge is located; therefore a potential connection to a bypass was studied if a new bridge is recommended. **Figure 1** on Page 2 shows the study area.



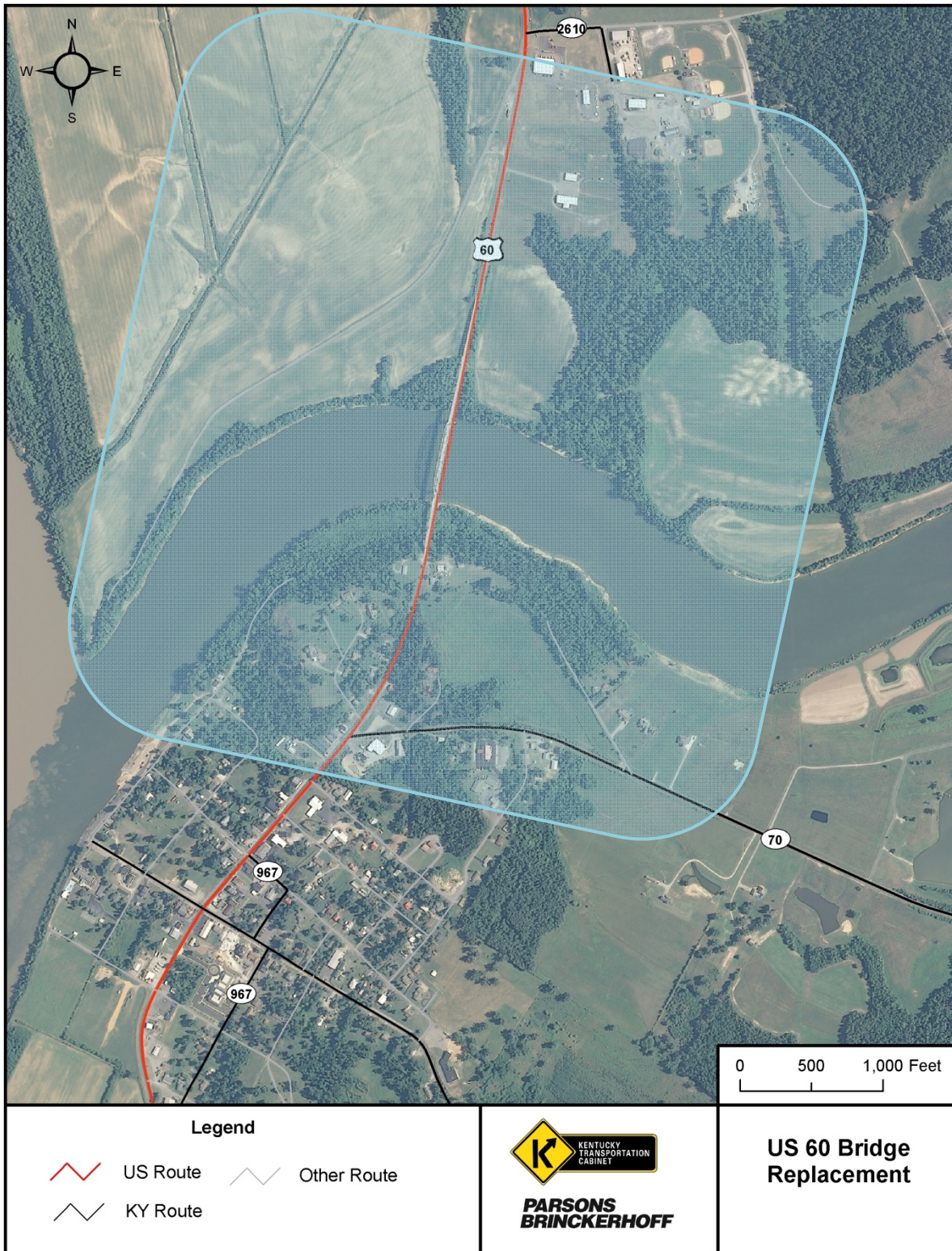


Figure 1: Study Area

### 1.3 Study Process

The study process used to evaluate potential alternatives consisted of four major elements: 1) Define the Purpose and Need of the study, 2) Develop alternatives, 3) Evaluate the alternatives, and 4) Recommend an alternative.

The subsequent chapters in this report follow these steps, beginning with the development of the Purpose and Need for the study. The following chapters contain the technical analysis and documentation used to confirm the Purpose and Need and then develop the alternatives. In addition to the technical analysis, public input and stakeholder feedback was gathered throughout the study process and is presented, followed by a discussion of the alternatives development procedure and evaluation. The final stage in the study process was to provide a recommendation, which is the final section in this report. The report also contains several appendices providing additional information on the geotechnical overview (performed by the KYTC), Environmental Justice (EJ) analysis (performed by the Pennyrile Area Development District (PADD)) as well as several letters, emails and other correspondence in relation to agency feedback from a mailing sent by the KYTC. These are summarized in the body of this report and the appendices provide the full documentation of these elements.

## 2.0 Purpose and Need

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

The Purpose and Need statement for this study was developed from issues identified in field reviews, through stakeholder and public input, as well as from deficiencies identified in the Existing and Future Conditions technical analysis (beginning on Page 5).

### 2.1 Purpose

The purpose of this project is to replace and/or rehabilitate the existing 81 year old, 1,818 foot single-span thru truss bridge (070B00017N) while providing a safe, reliable roadway and giving due consideration to future transportation needs and appropriate corridor alternatives.

### 2.2 Need

The existing bridge on US 60, MP 12.348, over the Cumberland River is functionally obsolete due to the narrow lane widths and shoulder widths on the bridge itself (10 feet and 1 foot respectively for a total of 22 feet curb to curb). The approaches to the bridge are slightly wider with 10 foot lanes and 5 to 6 foot shoulders. It has a sufficiency rating of 32.7 on a scale of 100. On the most recent FHWA Structure Inventory and Appraisal (SI&A) report (4/17/2012) the deck geometry was rated 2 on a scale of 0-9, with the comment, "intolerable – replace".

### 2.3 Goals and Objectives

The following goals and objectives were developed to balance environmental and community issues with transportation issues:

- To provide a constructible and affordable structure that will improve safety and the substandard load capacity of the functionally obsolete bridge.
- To maintain traffic flow during construction.

### 2.4 Purpose and Need Statement

To address the current structural deficiencies of the US 60 bridge while maintaining traffic flow during construction, for the purpose of providing a safe and reliable roadway that also accounts for future transportation needs of the public.



### 3.0 Existing and Future Conditions

A detailed inventory was completed that examined existing roadway characteristics, bridge geometrics and deficiencies, existing and future traffic volumes, level of service (LOS), capacity, and crash rates.

#### 3.1 Existing Roadway Characteristics

KYTC's Highway Information System (HIS) database was used to compile the existing roadway characteristics of US 60 in the study area. The highway characteristics summary is included as **Table 1** below.

Route	Section	Begin Milepoint	End Milepoint	Section Length (miles)	Functional Class	Facility Type	Lane Width (feet)	Shoulder Width (feet)	Median Type	Median Width (feet)	Posted Speed Limit (MPH)
US 60	1	12.062 (KY 70)	12.348 (southern end of bridge)	0.29	Rural Principal Arterial	2-Lane Undivided Highway	10	5	None	-	35
	2	12.348 (southern end of bridge)	12.695 (northern end of bridge)	0.34				1			55
	3	12.695 (northern end of bridge)	13.082 (Brumitte Rd)	0.39				6			55

**Table 1: US 60 Highway Characteristics Summary**

#### 3.2 Bridge Geometrics and Deficiencies

Data for the bridge geometrics and deficiencies came primarily from the following sources:

- National Bridge Inventory Appraisal Report,
- Original 1929 General Plan and Elevation Structural Drawings,
- Investigation Report for Lucy Jefferson Lewis Memorial Bridge over the Cumberland River (1969 Study).

The US 60 bridge over the Cumberland River was opened to traffic in November, 1931. The bridge is also known as the Lucy Jefferson Lewis Memorial Bridge and as the Smithland Bridge. It crosses the river at channel mile 2.8 from the confluence of the Cumberland River with the Ohio River just downstream from the Smithland Locks and Dam on the Ohio River.

The original construction drawings show the overall bridge length to be 1,814 feet - 7 ½ inches. The south approach is 445 feet – 9 ¾ inches long, the main span over the Cumberland River is 500 feet – 0 inches long and the north approach is 867 feet - 9 ¾ inches long. The south approach is comprised of five deck girder spans. The main span is a simple span through truss. The north approach is comprised of nine deck girder spans. The deck has two 10 foot lanes with 1 foot – 7 ½ inch curbs. The US 60 bridge geometrics are included as **Table 2** below.

Route	Section	Length	Structure Type	Deck Width (feet)	Sufficiency Rating	Structurally Deficient / Functionally Obsolete	Design Load	Inventory Load Rating	Condition Ratings
US 60	South Approach	445' - 9 3/4"	Deck Girder	20 feet between curbs. 2 - 10 foot lanes.	32.7	Functionally Obsolete	Custom Load Most Similar to AASHTO H20	HS 10.5	Deck: 7 – Good Superstructure: 5 – Fair Substructure: 5 - Fair
	Main Span over Cumberland River	500'-0"	Through Truss						
	North Approach	867' - 9 3/4"	Deck Girder						

**Table 2: US 60 Bridge Geometrics**



Charts 1 and 1B of the Cumberland River Navigation Charts produced by the US Army Corps of Engineers, Nashville District, provide river information and navigation clearances. Normal pool for the Cumberland River at the bridge is 302 feet elevation. Low steel elevation for the bridge is 388 feet, providing a vertical clearance at pool stage of 86 feet. Vertical clearance at regulated high water is 43 feet. The horizontal navigation clearance between the piers is 488 feet.

The most recent Structure Inventory and Appraisal (SI&A) Sheet (4/17/2012) lists the deck condition rating as 7 (good), although the deck geometry is rated 2 with the comment "Intolerable – Replace". The superstructure and substructure conditions were rated 5 (Fair). The bridge is classified as functionally obsolete (FO). The functionally obsolete classification is due to the narrow lane widths (10 feet) and shoulder widths (1 foot). The bridge is also posted with Type III Truck weight limit of 31 tons and has an inventory load rating of HS 10.5. As a matter of comparison, last such design load used by the Kentucky Transportation Cabinet, before switching to AASHTO mandated LRFD design, was HS 25. The original design load was very close to what became the AASHTO H 20.

An investigation report was submitted on September 30, 1969 by Hazelet & Erdal Consulting Engineers. The subject of the report was movement of Piers B, North Pier (NP) 1 and North Pier (NP) 2. These are the truss support pier and first two approach piers respectively on the north bank of the river. According to the report, movement of the piers began soon after construction and opening of the bridge and continued through the thirty-eight years from 1931 to the time of the report. Drawings were produced in 1940 for installation of a steel shoring tower around pier NP1. The report also documents a downstream deadman anchor and cable bracing Pier NP1 from further upstream movement. The 1969 report recommends replacement of Piers B and NP1. Drawings were issued in 1970 for replacement of those piers.

### 3.3 Traffic Volumes, Level of Service (LOS) and Capacity

A Traffic Forecast Report (dated October 5, 2012) was prepared by KYTC for use in this project. The report includes existing (2012) and future (2038) year forecasts. The 2010 Highway Capacity Software (HCS) two-lane highway analysis module was used to evaluate Level of Service (LOS) and capacity of US 60 in the existing and future years.

LOS is used to provide a rating scale for congestion and operations of a roadway. LOS A represents a free flowing facility with little time spent following another vehicle and plenty of opportunities for passing on a two-lane facility. Percent time following increases and opportunities to pass and travel speeds decrease with level of service down to LOS F which represents a congested roadway that is over capacity with no opportunities to pass and low travel speed.

Using this method, there are three classes of two-lane highways: Class I highways which include higher speed arterials and daily commuter routes, Class II which are lower speed access routes to Class I highways, or scenic / recreational routes, and Class III which serve moderately developed areas with a mix of local and through traffic, with a higher density of unsignalized roadside access points than a purely rural area. US 60 was evaluated as a Class I highway. **Table 3** shows the LOS criteria for two-lane highways.

LOS	Class I Highways		Class II Highways	Class III Highways
	Average Travel Speed (mph)	Percent Time Spent Following	Percent Time Spent Following	Percent of Free Flow Speed
A	>55	≤35	≤40	>91.7
B	>50-55	>35-50	>40-55	>83.3-91.7
C	>45-50	>50-65	>55-70	>75.0-83.3
D	>40-45	>65-80	>70-85	>66.7-75.0
E	≤40	>80	>85	≤66.7

Source: Highway Capacity Manual 2010

**Table 3: LOS Criteria for Two-Lane Highways**

As shown in **Table 3**, the criteria for evaluating a Class I highway includes the average travel speed and the percent time spent following other vehicles. LOS D is the threshold for desirable traffic operations in this study, based on the AASHTO Policy on Geometric Design of Highways and Streets. LOS D corresponds to an average travel speed less than 45 but greater than 40 mph and has a percent time spent following between 65 and 80 percent. **Tables 4** and **5** (on Page 8) show the traffic volumes and LOS for US 60 in the study area in the years 2012 and 2038, respectively.

Route	Section	Begin Milepoint	End Milepoint	DHV	% Trucks	Speed Limit	Estimated Travel Speed	Volume to Capacity Ratio	% Time Spent Following	LOS
US 60	1	12.062 (KY 70)	12.348 (southern end of bridge)	265	15%	35	26.9	0.18	61.5%	E
	2	12.348 (southern end of bridge)	12.695 (northern end of bridge)	265	15%	55	46.8	0.18	61.5%	C
	3	12.695 (northern end of bridge)	13.082 (Brumitte Rd)	265	15%	55	47.7	0.18	58.3%	C

**Table 4: US 60 2012 Traffic Volumes and LOS**

Route	Section	Beginning Description	Ending Description	DHV	% Trucks	Speed Limit	Estimated Travel Speed	Volume to Capacity Ratio	% Time Spent Following	LOS
US 60	1	12.062 (KY 70)	12.348 (southern end of bridge)	370	15%	35	25.8	0.25	67.2%	E
	2	12.348 (southern end of bridge)	12.695 (northern end of bridge)	370	15%	55	45.7	0.25	67.2%	D
	3	12.695 (northern end of bridge)	13.082 (Brumitte Rd)	370	15%	55	46.3	0.25	65.0%	C

**Table 5: US 60 2038 Traffic Volumes and LOS**

 LOS A-C  
 LOS D  
 LOS E-F

Notes:  
 DHV is from KYTC Traffic Forecast Report, October 5, 2012  
 % Trucks and Buses were estimated to be 15%  
 % RVs were estimated to be 0%  
 Speed Limit Obtained from Highway Information System

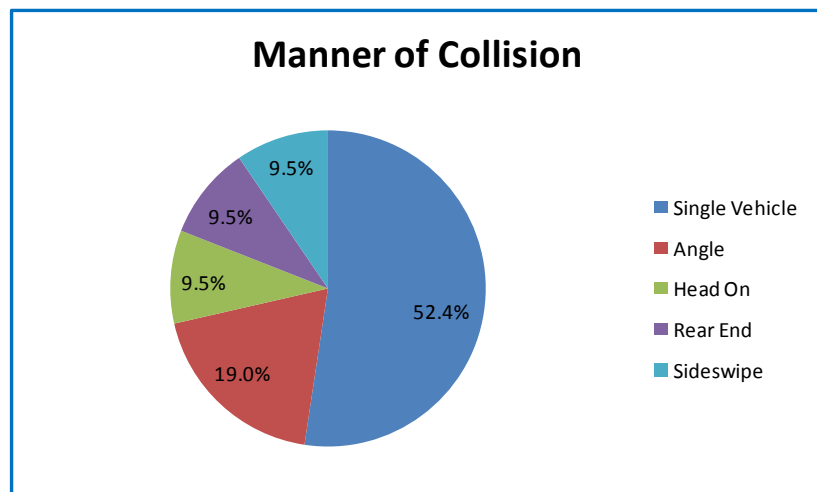
### 3.4 Crash Analysis

#### Crash Analysis Methodology

The Kentucky Transportation Cabinet provided crash data for a three-year period from January 1, 2010 through December 31, 2012. The crash rate along US 60 throughout the study area was computed using the methodology provided in the crash analysis report periodically published by the Kentucky Transportation Center (KTC).<sup>1</sup> The crash rate is based on the number of crashes along the segment of US 60, the average daily traffic on that segment, the time frame of the analysis, and the length of the section. It is expressed in terms of crashes per 100 million vehicle-miles and is compared to a statewide critical crash rate<sup>2</sup> 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. If the factor is greater than one it indicates that crashes do not appear to be occurring at random.

The section crash rate is also compared directly to the statewide average crash rate presented in the KTC crash report. The statewide averages consider all crashes for a specified period that are listed in the Collision Report Analysis for Safer Highways (CRASH) database maintained by the Kentucky State Police 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 crash analysis performed for US 60 shows in **Table 6** on Page 10, that the critical crash rate is greater than one, indicating that crashes do not appear to be occurring at random. **Figure 2** (shown here) shows the various manners of collision for the 21 crashes that occurred in the three year period.



**Figure 2: Manner of Collision**

<sup>1</sup> Analysis of Traffic Crash Data in Kentucky (2007 – 2011), Kentucky Transportation Center Research Report KTC-12-13/KSP2-11-1F.

<sup>2</sup> 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.



Route	Section	Begin Milepoint	End Milepoint	Total Crashes	Average Daily Traffic	Statewide Average Crash Rate	Section Crash Rate	Statewide Critical Crash Rate	Critical Crash Rate Factor	Manner of Collision	Light Condition	Weather
US 60	1	12.062 (KY 70)	13.082 (Brumitte Rd)	21	4,900	167	696	346	2.01	Single Vehicle (52%)	At Night - No Lights (52%)	Clear (71%)

**Table 6: Crash Rate Analysis for US 60 from 2010 to 2012**

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

Notes:

Analysis Period: 3 Years (January 1, 2010 to December 31, 2012)

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

For the Manner of Collision, Light Condition, and Weather, the type and percentage reflect the most commonly occurring type

Sources:

Crash data for January 1, 2010 to December 31, 2012 from KYTC Data

Statewide Rates from KTC Research Report KTC-12-13/KSP2-11-1F. Analysis of Traffic Crash Data in Kentucky (2007 – 2011)

The crash analysis shows that:

- Single vehicle crashes accounted for over half of the crashes, and of those, 4 were collisions with a fixed object, 3 were collisions with an animal, 2 ran off the roadway, 1 was a collision with a non-fixed object and 1 was a collision with a pedestrian,
- 71% of all of the crashes occurred in clear weather,
- 52% occurred at night, with no lighting,
- 48% occurred in daylight.

Further review of individual crash records showed that for the single vehicle collisions, many were a result of driver error (i.e. driver fatigue or the influence of drugs and alcohol). Collisions with animals were also a factor for several crashes. The crash that involved a pedestrian was the result of a first responder being struck while out in the roadway. As the majority of the crashes reviewed are not related to documentable geometric issues, there are not any recommendations for altering the future design of the Smithland side of the approach due to crashes. The fact that 52% occurred at night could be an indication that improving lighting could reduce crashes.

### 3.5 Bicycle Facilities

An investigation was undertaken as to whether US 60 and/or the US 60 bridge are included on any bike routes within the study area. This was done by researching cycling clubs within the area. There are not any cycling clubs in the City of Smithland but there are three which are present in western Kentucky. The closest club is in Paducah, Kentucky (18 miles), second with respect to proximity is Madisonville, Kentucky (65 miles) and the third can be found in Utica, Kentucky (103 miles). In addition to these clubs, there are also two local bicycle shops in western Kentucky that are home to cycling teams which frequently have group rides throughout the week and on the weekends. The closest shop is in Paducah while the second shop is in Grand Rapids, Kentucky. Conversation with the bike shop employees in Paducah indicated that the cyclists avoid US 60, US 62 and US 68 as there is no infrastructure suitable for cyclists (wide shoulders or bike lanes) in place.

Even with a lack of infrastructure, cycling is still documented (via the internet through a popular online route mapping website) just north of Smithland and along the river up to Cave-In-Rock State Park. In total there are three routes that have been created and published since 2010 on this site. One of the three routes passes through the study area along US 60 through Smithland to KY 453. The other two stay north of the city and travel around the loop created by KY 133, KY 135, KY 137 and KY 1608. If infrastructure were provided, there is a possibility that recreational or organized cycling groups may utilize them in the future. This should be considered for not only the bridge, but for any future improvements to US 60.

## 4.0 Environmental Overview

An environmental overview was performed with respect to the following:

- Cultural historic architecture (**Appendix A**),
- Archaeological resources (**Appendix B**),
- Aquatic and terrestrial species (**Appendix C**),
- Underground storage tanks (UST) and hazardous materials concerns (**Appendix C**),
- Air quality (**Appendix C**),
- Traffic noise (**Appendix C**),
- Community facilities (public parks, schools, churches, potential 4(f) and 6(f) resources) (**Appendix C**),
- Environmental justice (EJ) (**Appendix D**).

### 4.1 Cultural Historic Architecture

The Cultural Historic Overview found, in a search of records maintained by the Kentucky Heritage Council, there are three previously recorded cultural historic sites located in the area of potential effect (the study area plus a 0.5 mile radius from the center of the bridge). One site is the Gower House, which is listed on the National Record of Historic Places (NRHP). The other two sites are the Conant House and Rocky Hill site, whose eligibility for listing is undetermined, due to the Conant House being no longer extant and the inability to determine the exact location of Rocky Hill. Also, the US 60 bridge over the Cumberland River has not been formally recorded for the Kentucky Heritage Council but was determined eligible for listing in the NRHP in two bridge surveys: the 1997 Survey of Truss Suspension and Arch Bridge in Kentucky and the 1996 Historic Highway Bridges in Kentucky.

### 4.2 Archaeological Resources

The archaeological records review found there is a high potential for encountering prehistoric and historic archaeological resources in the study area. There are nine previously recorded archaeological sites, two of which are eligible for inclusion in the NRHP and one that is potentially eligible. The Gower House, a NRHP listed property, has an associated archaeological site. Soil data indicates undisturbed land forms that could possess additional prehistoric sites or extend boundaries of known sites. Floodplains and terrace landforms on the north side of the Cumberland River have the highest potential for containing prehistoric archaeological sites.

### 4.3 Aquatic and Terrestrial

Correspondence with various agencies found there is a known or potential occurrence of 36 species that are either endangered, threatened or of special concern in the study area, and 11 federally listed endangered species. The federally listed species include two mammals, the gray and Indiana bat, one bird, the interior least tern, and eight mussels: the clubshell, fat pocketbook, orangefoot pimpleback, ring pink, spectaclecase, sheepnose, pink mucket and rough pigtoe.

In addition, there are 24 species that are listed as either endangered, threatened or of special concern by the state. State endangered species include the southeaster myotis, pocketbook, pyramid pigtoe, Ohio shrimp, western false gromwell, hoary mock orange, and lake sturgeon.

There are only two wetland areas found on the National Wetland Inventory (NWI) mapping, the first is a lake and the second is a forested/shrub wetland. There are also three unnamed tributaries of the Cumberland River in the study area. Two are intermittent streams south of the Cumberland River and one is a perennial stream to the north. Approximately 0.62 miles of the Cumberland River is located in the study area. There are no Outstanding State Resource Waters or Wild Rivers within the study area. The areas adjacent to the Cumberland River and the unnamed tributaries are designated as 100-Year Floodplain.

There are no special designation lands within the study area.

#### **4.4 Underground Storage Tanks (UST) and Hazardous Material Concerns**

An electronic review of applicable environmental databases found one UST site in the study area that was removed from the property in 1997 as well as 25 orphan sites that could potentially be located within the study area. A field reconnaissance found two above ground storage tanks (ASTs) and one site with the potential for a UST. If it is determined there is an impact, further investigation is recommended for these sites and the 25 orphaned sites once the preferred alternative is carried to the next stage of project development.

Other environmental concerns include lead contamination in the soil, under the approaches of the existing US 60 bridge, due to multiple paintings of the bridge prior to 1978 when lead paint was banned. Additional research is recommended regarding past bridge maintenance activities.

#### **4.5 Air Quality**

The study area is located in the Paducah (KY) – Cairo (IL) Interstate Air Quality Control Region, which is in attainment for all criteria, transportation-related pollutants. The proposed project is not expected to negatively impact the ambient air quality in the study area.

#### **4.6 Traffic Noise**

Potential sensitive noise receptors in the study area include residences in Smithland, including the Cumberland Valley View Apartments, as well as scattered rural residences, the Livingston County Ball Fields, Livingston County Fairgrounds, Livingston County Extension Office, Smithland Pentecostal Church and the Senior Citizens Center.

#### **4.7 Community Facilities**

Community facilities located in the study area include the Smithland Pentecostal Church, the Senior Citizen's Center, the Livingston County Fairgrounds, Livingston County Extension Office, and the Livingston County Ball Park. Since the ball park is publically owned and likely developed with Federal monies, any impacts could potentially constitute a Section 4(f) and/or a Section 6(f) impact.



## 4.8 Environmental Justice

An Environmental Justice (EJ) Review was prepared by the Pennyryle Area Development District (PADD) for the study area, and examined the potential disproportionate adverse community impacts on selected groups (minority, low-income, elderly and disabled). Year 2000 census data from the area was examined at the census tract and census block group level, as the 2010 census data is currently only available for these select groups at the tract level. There are two census tracts and three census block groups that make up and surround the study area. The analysis found the minority and population below the poverty line percentages are significantly below the state threshold for all of the census block groups. Two of the three block groups and one of the census tracts have elderly populations that are significantly higher than the state threshold. All three block groups have a significantly higher percentage of persons with disabilities (age 5 and over) than the state threshold. These block groups were taken into consideration in the alternatives analysis. **Table 7**, as shown below, summarizes the findings of the EJ Review. The entire report can be found in **Appendix D**. During further project development stages, more in-depth EJ analysis will need to be undertaken in conjunction with right-of-way acquisition.

	Minority %	Persons Below Poverty Level %	Persons 65 and Over %	Population by Disabilities Age 5 and Over %
<b>United States</b>	24.86%	12.05%	12.43%	28.83%
<b>Kentucky</b>	9.92%	15.37%	12.49%	21.63%
<b>Livingston Co.</b>	1.63%	10.14%	14.92%	20.08%
<b>BG 4 (North of Bridge)</b>	1.24%	8.20%	17.39%	42.86%
<b>BG 2 (South of Bridge)</b>	1.42%	10.86%	17.15%	56.70%

**Table 7: Environmental Justice Summary**

## 5.0 Public Involvement

The Public Involvement Program for this study was comprised of several key elements designed to encourage participation and obtain feedback from the stakeholders in Livingston County. The key aspects included: two meetings with local officials/stakeholders, one public meeting, and one resource agency mailing. The process and methods for public involvement are outlined in this chapter. The results and feedback from implementation of the Public Involvement Program are provided throughout the entire report, particularly in the development and evaluation of alternatives.

### 5.1 Local Officials and Stakeholder Coordination

Meetings were held with locally elected officials and other stakeholders in Livingston County and the City of Smithland. Locally elected officials included the judge executive, mayor and other officials who represented or spoke for a jurisdiction or agency such as the Post Office, Emergency Management, School Board, etc. Several owners of local businesses were included in the group as well. Two meetings were held to obtain feedback on the information compiled for the project. Brief summaries of the meetings are given below, and meeting minutes, as well as the letter sent out to stakeholders are provided in **Appendix E**.

The first meeting was held on May 2, 2013 at the KYTC District 1 Office. A general overview of the project and the existing conditions analysis were presented. Specific feedback was obtained from the group regarding bridge, roadway, safety and environmental issues. The Purpose and Need of the project was discussed and participants were invited to provide thoughts on potential alternatives. Some of the main concerns were:

- The integrity and longevity of the bridge,
- Safety, particularly that of school buses and trucks crossing the very narrow bridge,
- Detours and the gas money associated with additional travel if the bridge were to be closed (the detour is 70 miles),
- The connectivity the bridge provides the community, specifically for fire / police / EMS, education, postal service and daily life.

The second meeting was held on August 6, 2013 at the KYTC District 1 Office. A review of general project information and existing conditions was given. New information obtained, such as Environmental Justice and the geotechnical overview were also presented. The alternatives analysis was discussed, and the stakeholders were asked to provide feedback on the alternatives. [Note: A full listing and description of the alternatives are provided in Chapter 6 of this document.] The general consensus from the stakeholders was that Alternative 4 (bridge replacement downstream) is preferred because it is immediately adjacent to the existing bridge, would not require a bridge closure and has the fewest known impacts.

### 5.2 Public Meeting

A public meeting was held to provide an opportunity for those citizens interested in the project to review documented existing conditions as well as initial alternatives development. The meeting was held on June 20, 2013 at the University of Kentucky's Livingston County Cooperative Extension Office.

In total 38 citizens signed in at the meeting and 20 provided feedback via survey. Of those 20 surveys, 12 were collected at the meeting via paper survey, one was returned via mail and seven were collected via an internet survey tool after the meeting. The top three preferred options from the alternatives included: 1) repair and widen the structure or 2) build a new bridge either to the east or 3) west of the existing structure. Other concerns which were repeatedly brought up by many of the survey respondents were the lack of an acceptable detour route if the existing bridge was closed during construction. The connectivity and accessibility provided by this bridge is critical to the daily function of day to day life and should not be eliminated before another acceptable option is available.

A copy of the public involvement meeting summary is included in **Appendix F**. Full documentation of the meeting can be found in the official public meeting record which is a separate stand-alone document.

### 5.3 Resource Agency Mailings

Information outlining the study area as well as the potential area for impacts along with a list of refined alternatives developed from the study with a map was mailed to interested agencies for input relative to project impacts and future development. The list of respondents included:

- US Coast Guard,
- US Forest Service,
- US Department of Agriculture,
- US Fish and Wildlife,
- KY Department of Education,
- KY Department of Fish and Wildlife,
- KY Department of Environmental Protection,
- KY Division of Water,
- KY Division of Waste Management,
- KY Energy and Environment Cabinet,
- KY Tourism, Arts and Heritage Cabinet,
- Livingston County Public Schools,
- Scenic KY,
- KY Education and Workforce Development Cabinet,
- U.S. Army Corps of Engineers.

Most of the agencies detailed some concerns regarding future project development, construction, and/or the need for future coordination with their agency or the need for a permit. Overall, the agencies largely had no objections or presented a position that would indicate one or more of the alternatives could not be further developed. Most pointed out the need for some sort of environmental study and document, either an environmental analysis (EA) or an environmental impact statement (EIS) as there are known threatened, rare and/or endangered species in the area; including plants and animals as well as cultural and/or historic resources. There are also potentially some underground storage tanks, as well as hazardous waste sites that need to be avoided. The school system supported a

new bridge and expressed concerns about having a long detour route if the bridge was shut down. The Coast Guard, U.S. Army Corps of Engineers, and other agencies pointed out the need for various permits and other regulatory compliance which will all be part of future project development. The Corps also requested to participate in future project development as a cooperating federal agency.

A copy of the recipient list and their responses can be found in **Appendix G**.

#### **5.4 Project Team Meetings**

Several meetings were also held with the KYTC and the consultant team to discuss project issues including the public meetings, issues and goals, development of alternatives and the conclusions of the study. The meeting minutes from these meetings are included in **Appendix E**.



## 6.0 Alternatives Development

Initially, a total of seven alternatives were considered. The alternatives were developed based on the initial scoping discussion and evaluation of the existing conditions taking into account existing bridge information, traffic volumes, operations, safety, and environmental constraints. These alternatives included:

- Do nothing,
- Alternative 1: Bridge rehabilitation in place,
- Alternative 2: Superstructure replacement on existing or rehabilitated substructure,
- Alternative 3: Bridge replacement upstream,
- Alternative 4: Bridge replacement downstream,
- Alternative 5: Bridge replacement with bypass (east),
- Alternative 6: Bridge replacement with bypass (west).

### 6.1 Evaluation Methodology

These seven alternatives were narrowed down to a recommended alternative via a two-step process. First, a preliminary analysis determined the most feasible alternatives (physically, financially, environmentally and socio-politically). Once alternatives were advanced, analysis was performed in greater detail, to arrive at a recommendation. The following chapters discuss the preliminary and detailed analysis that was performed on the seven alternatives to arrive at a recommendation.

## 7.0 Preliminary Analysis

The preliminary analysis began with the seven alternatives listed in the previous section. Each was given an overall evaluation with respect to physical, financial, environmental and socio-political impacts. In this analysis, Alternatives 5 and 6 were eliminated for the following reasons:

Alternative 5 – Bridge Replacement with Bypass (East):

- Floodplain impacts,
- Potential impact to the Livingston County Ballpark,
- Potential issues with aerial power lines,
- Approximately 3 new miles of construction (current construction cost is \$2.3 million per mile) plus right-of-way and utility costs,
- Low projected traffic use (6,900 vehicles per day in 2040, 2,800 on bypass, 4,100 on US 60).

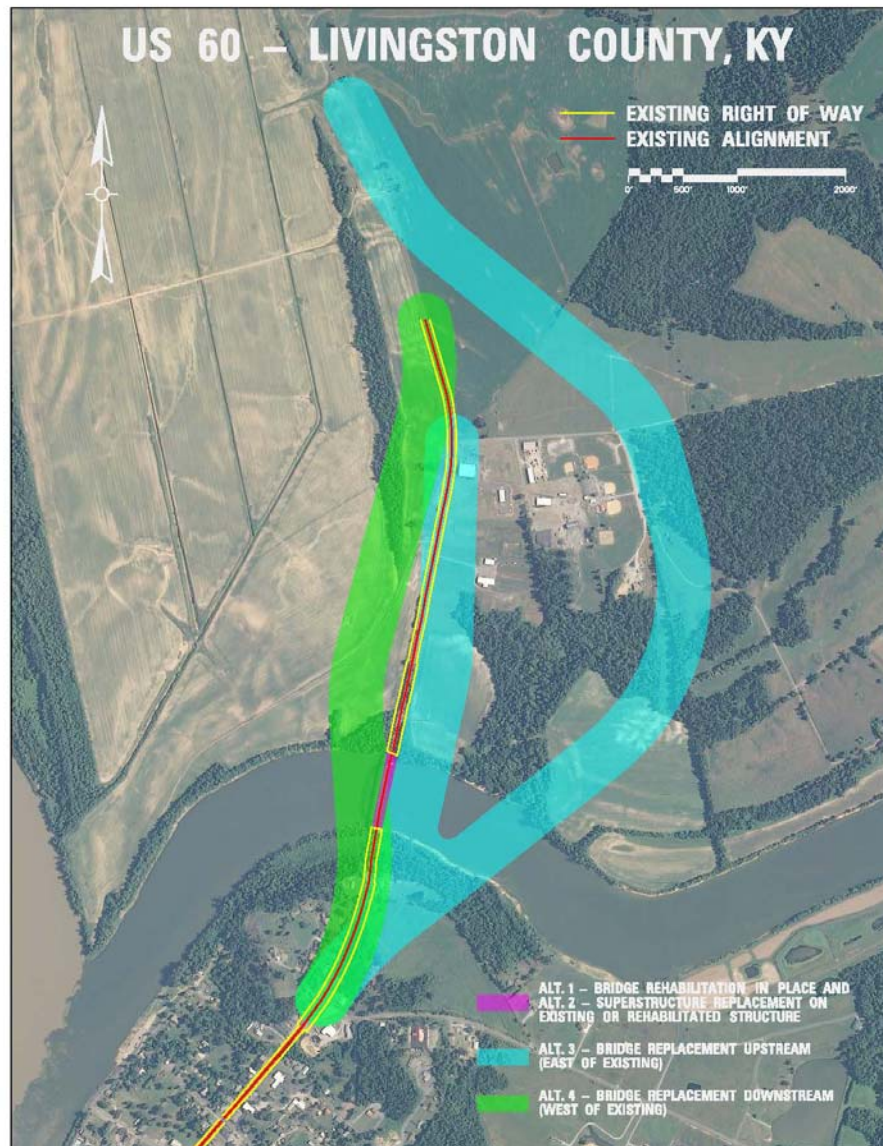
Alternative 6 – Bridge Replacement with Bypass (West):

- Significant floodplain impacts,
- Significant impact to residential / business property (approximately 10-20 properties impacted including the NRHP listed Gower House),
- Approximately 3-5 new miles of construction (current construction cost is \$2.3 million per mile) plus right-of-way and utility costs,
- Low projected traffic use (6,900 vehicles per day in 2040, 2,800 on bypass, 4,100 on US 60).

The do nothing and Alternatives 1 through 4 were moved forward for further detailed evaluation. This is discussed in the next chapter.

## 8.0 Detailed Analysis

At this point, Alternative 3 was split into two alignments, 3A and 3B. This was to bypass the impacts to the ball fields that the original Alternative 3 would have created. Alternative 3A is a new bridge just upstream of the existing bridge and 3B is a new bridge further upstream of the existing bridge. **Figure 3** shows the remaining four alternatives. Alternatives 1 and 2 are shown in magenta, 3A and 3B are shown in blue, and 4 is shown in green.



**Figure 3: Level 2 Alternatives**

The detailed analysis examined the remaining four build alternatives in more detail, and considered additional impacts such as operations and safety, community and environmental impacts, capital costs and maintenance of traffic.

### 8.1 Traffic Operations and Safety

A traffic operations and safety analysis was performed and is summarized below in **Table 8** for the remaining alternatives.

Alt. #	Description	Traffic Operations and Safety			
		Length (miles)	Future Year Level of Service (LOS)	Future Year v / c ratio	Safety
0	Do Nothing	-	D	0.26	No Impact
1	Bridge Rehab in Place	0.4			No Impact
2	Superstructure Replacement on Existing / Rehab Structure	0.4			May Reduce Total Crashes by 3 per year
3A	New Bridge Upstream (East) Near Existing	1.2			May Reduce Total Crashes by 3 per year
3B	New Bridge Upstream (East) Further from Existing	2.2			May Reduce Total Crashes by 3 per year
4	New Bridge Downstream (West)	1.3			May Reduce Total Crashes by 3 per year

**Table 8: Traffic Operations and Safety Analysis**

- Notes:
- LOS and v/c ratios are based on 2038 ADT = 6,900 (same for all Alternatives) and 19.0% Trucks
  - Changing the lane width and shoulder width had little to no impact on the LOS and v/c ratio

	Positive Impact
	Moderate Impact
	Less Desirable Impact

Because Alternatives 3A, 3B and 4 involve building a new bridge, these alternatives will have a greater length of roadway impact. The future level of service and volume to capacity ratios are the same (because there are no changes in capacity) among all of the build alternatives. From a safety perspective, however, Alternatives 2, 3A, 3B and 4 have the potential to reduce crashes within the bridge segment, according to Highway Safety Manual (HSM) Crash Modification Factor (CMF) analysis. The CMF for lane width on rural two-lane roadway segments calculation was used to determine the

reduction in crashes per year. This calculation uses a relationship between lane width and AADT to calculate the CMF, and can be found in Table 13-2 and Figure 13-1 in the HSM.

## 8.2 Community and Environmental Impacts

Through an environmental overview, cultural and archaeological review and Environmental Justice analysis, the community and environmental impacts were assessed. **Table 9**, on Page 23, shows the results of these studies.

Alternatives 3A, 3B and 4 have more community impacts, as Alternatives 1 and 2 involve simply replacing the existing bridge, which was determined to be eligible for listing in the NRHP. Alternative 3A would impact the UK agricultural Extension office. Alternatives 3A, 3B and 4 have archaeological impacts and could potentially have Environmental Justice (EJ) impacts. These three alternatives also impact floodplains and the Indiana Bat roosting habitat, although 3B has major impacts, while 3A and 4 have a moderate impact. Alternatives 3A and 3B also impact streams.

Alt. #	Description	Environmental								
		No. of Streams Impacted	Floodplains Impacts (Acres)	No. of Known Historic Sites	No. of Known Archeological Sites	No. of Properties Impacted	Community Facilities	Environmental Justice Impacts	Indiana Bat Roosting Habitat	Potential UST / HAZMAT Site Impacts
0	Do Nothing	0	None	0	0	0	None	None	None	None
1	Bridge Rehab in Place	0	Minimal	1 (US 60 Bridge is NRHP Eligible)	0	0	None	Minimal	Minimal	None
2	Superstructure Replacement on Existing / Rehab Structure	0	Minimal	1 (US 60 Bridge is NRHP Eligible)	0	0	None	Minimal	Minimal	None
3A	New Bridge Upstream (East) Near Existing	1	Moderate	0	5	UK Agriculture Extension Office	UK Agriculture Extension Office	Potential Impacts to Ederly and Disabled	Moderate	None
3B	New Bridge Upstream (East) Further from Existing	2	Major	0	4	None	None	Potential Impacts to Ederly and Disabled	Major	None
4	New Bridge Downstream (West)	0	Moderate	0	5	None	None	Potential Impacts to Ederly and Disabled	Moderate	AST (Potential Backup Generator for a Water or Sewer Pump Station)

**Table 9: Community Impact Analysis**

- Notes: - No Alternatives impact known wetlands  
 - All Alternatives cross the Mussel / Gray Bat Foraging Habitat

	No Impact / Minimal Impact
	Moderate Impact
	Major Impact



### 8.3 Geotechnical Overview

KYTC performed a geotechnical overview for the study area. The geological report investigated the proposed alternatives presented at the public meeting. The report suggests that reuse of the existing structure does not appear desirable. Numerous retrofits have been performed on this bridge in the past including actions needed to address movement of the bridge mentioned by the District staff and documented in historic report and bridge condition surveys. With respect to a new alignment, due to the possibility of seismic activity in area, drilled shafts would be the preferred foundation type. Further, the possibility of impacts with barge traffic will also need to be considered in the design of the structure. With respect to embankment construction, it is suggested that a slope no steeper than 2H:1V be allowed for soil cuts over 10 feet and embankments built from natural soil as high as 60 feet. Additionally, the report notes that the amount of scoring and bank stability issues present along the Cumberland River should also be considered during the design of a new structure. The full geotechnical overview can be found in **Appendix H**.

### 8.4 Cost

Planning-level construction costs were also calculated at this stage of the analysis, and are shown in **Table 10**, on Page 25. The total cost is a combination of the bridge design and construction, the design and construction of the highway approaches, right-of-way and utilities. It should be noted that the maintenance of traffic (MOT), whether it be detours or temporary approaches/structures were included in the cost of the bridge construction. This, along with the fact that new bridge piers would be built on dry land and not in the water, accounts for much of the reason for the minimal cost differential between alternatives. A detailed explanation of the assumptions and components of the bridge costs can be found in **Appendix I**. This separate, more detailed, analysis of the bridge replacement costs is provided to assist with the next phase of project development as there are more components/specific costs to consider in the cost estimate for the actual bridge replacement as opposed to the approaches (which is more straightforward highway design).

Alt. #	Description	Bridge Phase Cost (\$)		Approach Phase Cost (\$)		Right of Way	Utilities	Total Cost (\$)
		Design	Construction	Design	Construction			
0	Do Nothing	\$0	\$0	\$0	\$0	\$0	\$0	<b>\$0</b>
1	Bridge Rehab in Place	\$3,980,000	\$39,800,000	\$10,000	\$0	\$0	\$100,000	<b>\$43,890,000</b>
2	Superstructure Replacement on Existing / Rehab Structure	\$4,160,000	\$41,600,000	\$10,000	\$0	\$0	\$100,000	<b>\$45,870,000</b>
3A	New Bridge Upstream (East) Near Existing	\$3,900,000	\$39,000,000	\$85,000	\$2,000,000	\$450,000	\$850,000	<b>\$46,285,000</b>
3B	New Bridge Upstream (East) Further from Existing	\$4,300,000	\$43,000,000	\$50,000	\$4,100,000	\$1,000,000	\$500,000	<b>\$52,950,000</b>
4	New Bridge Downstream (West)	\$3,900,000	\$39,000,000	\$35,000	\$2,400,000	\$650,000	\$350,000	<b>\$46,335,000</b>

**Table 10: Planning Level Cost Estimates**

- Notes:
- Planning cost estimates are in current year dollars (2013)
  - All roadway alternatives assume a typical section of two 12' lanes and 8' graded shoulders
  - Design costs are based on 10% of construction costs
  - Right of Way and Utility costs provided by KYTC District 1
  - Repairs in place will extend the life of the bridge for approximately 20 years
  - Scouring and movement of piers near the pier will remain an ongoing problem for 0 and 1
  - The bridge will remain functionally obsolete with 10' lanes and barriers that do not comply with current standards for 0 and 1
  - Bridge lengths derived from overall length similar to existing bridge with river span increased to move construction from waterline and address scour of existing bridge
  - Bridge costs based on July 2010 US 60 over TN River Bid and preliminary estimates of substructure widening

## 8.5 Maintenance of Traffic

The different alternatives will require unique maintenance of traffic (MOT) plans. The various MOT plans are discussed below:

- Alternative 1 – Alternative 1 considers repair and rehabilitation of the existing superstructure and substructure to extend the useful service life of the bridge. Maintaining traffic in one lane while working in the second is judged to be neither feasible nor safe. This alternative will require temporary detours or night and weekend closures while the repair work is being performed.
- Alternative 2 – This alternative considers replacing the existing superstructure on the existing alignment with selective reuse of existing substructure units. For this site, the new superstructure would be constructed alongside the existing bridge while the existing bridge piers and abutments would be modified and strengthened as needed to accept the new superstructure. During this work the existing bridge would remain in service, however due to deficiencies in load carrying capacity, use of the bridge by the contractor would be impacted. Once the new superstructure is completed on temporary substructure it would be open for traffic while the existing superstructure is removed and the existing substructure is reinforced and rehabilitated. Once accomplished, the existing bridge can be closed to traffic and the new span slid into its permanent position. This process would require a shutdown of 5-10 days.
- Alternatives 3 and 4 – Alternatives 3A, 3B and 4 all consider construction of a new bridge on an adjacent alignment while traffic is maintained on the existing structure. Therefore, bridge closure will not occur for these three alternatives.

These are described in more detail in the detailed bridge costs in **Appendix I**.

It is important to note that during the public meeting, stakeholders, including local public officials and industry representatives, expressed the significant negative impact that closure of nearby existing Ledbetter Bridge to all but passenger vehicles has had on the local economy. The Ledbetter Bridge lies on the same route south of the City of Smithland. They further said that closure of the Smithland Bridge would be even more damaging. Therefore, maintenance of traffic was taken into significant consideration in the analysis of alternatives and selection of a preferred alternative.

## 9.0 Recommendation

Alternative 4 is the preferred alternative of the Project Team based on the alternative analysis and the input of the Project Team, stakeholders and general public of Smithland and Livingston County. This alternative was selected for various reasons, including:

- The cost of building a new bridge is comparable to rehabilitating the existing bridge,
- New piers could be constructed on dry ground to provide cost savings, easier navigation for barges, and prevent future scouring issues,
- Downstream construction avoids moving overhead power lines,
- Minimal construction required for the new approaches,
- No significant stream impacts,
- No significant community facilities impacted.

There remain several unknown issues with regards to the geotechnical characteristics and Environmental Justice issues with Alternative 4. A full investigation into these issues is warranted but remains outside the existing scope of this planning project. It should be noted that if further geotechnical or Environmental Justice investigation reveals that Alternative 4 is not feasible, Alternative 3A is the second choice, identified by the Project Team.

### 9.1 Revised Cost Estimate

Due to the unknown geotechnical and Environmental Justice issues, the cost estimates for Alternatives 3A and 4 were revised. Additional funds were allocated for construction and right of way, as well as utilities. It is anticipated that removal of the overhead power lines for Alternative 3A would add an additional \$1,000,000 in utility costs. Alternative 4 may require the movement of a back-up generator for a water or sewer pump station, which could cost up to an additional \$500,000. The revised cost estimate for Alternative 3A is \$49,500,000, and for Alternative 4 is \$49,640,000. The details of these estimates can be found in **Table 11**, on Page 28.

### 9.2 Typical Sections

The typical section for the approaches on US 60 both north and south of the bridge include two 12-foot travel lanes and 10-foot shoulders, with 8-feet paved. A typical section is shown in **Figure 4** (on page 29). The US 60 bridge typical section also consists of two 12-foot travel lanes with 10-foot shoulders, and is shown in **Figure 5** (on page 30). It should be noted that while the bridge typical section is shown as a truss in the figure, the bridge type has not yet been determined, and is subject to change.

Alt. #	Description	Bridge Phase Cost (\$)		Approach Phase Cost (\$)		Right of Way	Utilities	Total Cost (\$)
		Design	Construction	Design	Construction			
3A	New Bridge Upstream (East) Near Existing	\$4,000,000	\$40,000,000	\$200,000	\$2,000,000	\$1,450,000	\$1,850,000	<b>\$49,500,000</b>
4	New Bridge Downstream (West)	\$4,000,000	\$40,000,000	\$240,000	\$2,400,000	\$1,650,000	\$1,350,000	<b>\$49,640,000</b>

**Table 11: Revised Planning Level Cost Estimates**

- Notes:
- Planning cost estimates are in current year dollars (2013)
  - All roadway alternatives assume a typical section of two 12' lanes and 8' graded shoulders
  - Design costs are based on 10% of construction costs
  - Right of Way and Utility costs provided by KYTC District 1

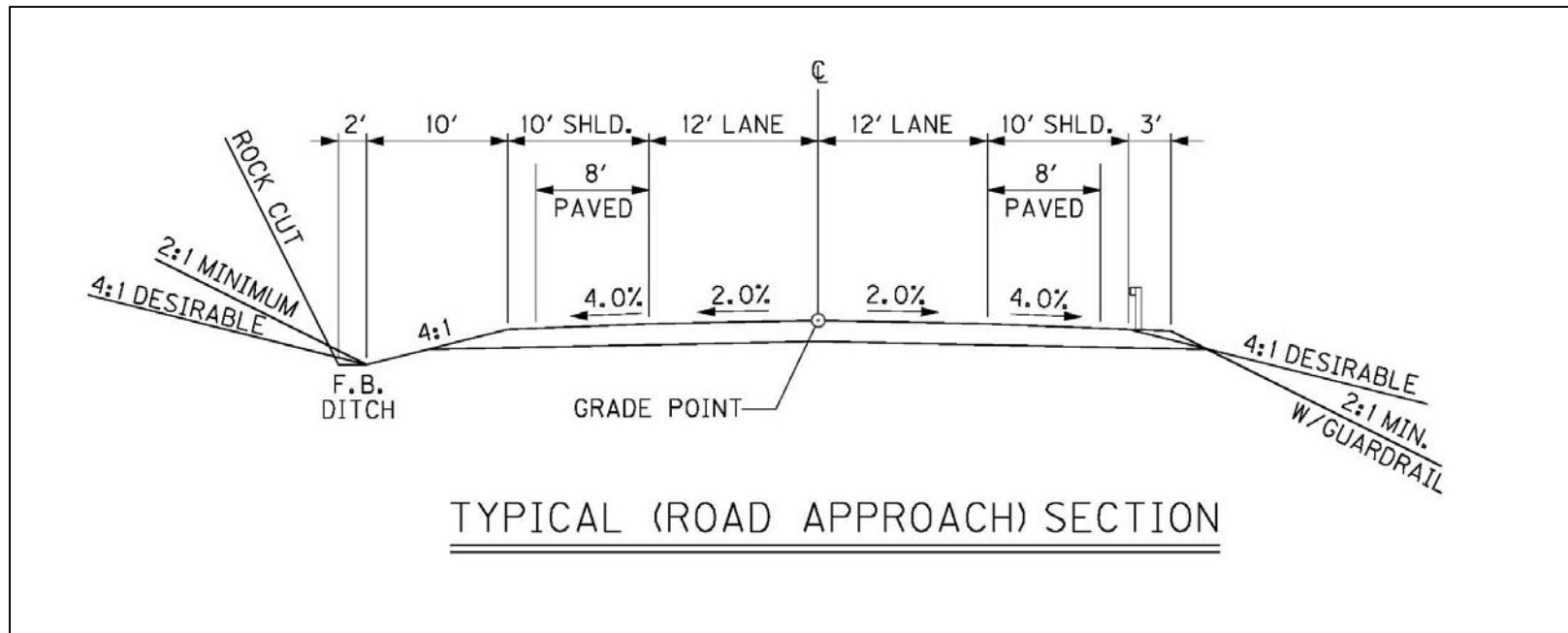


Figure 4: Roadway Approach Typical Section



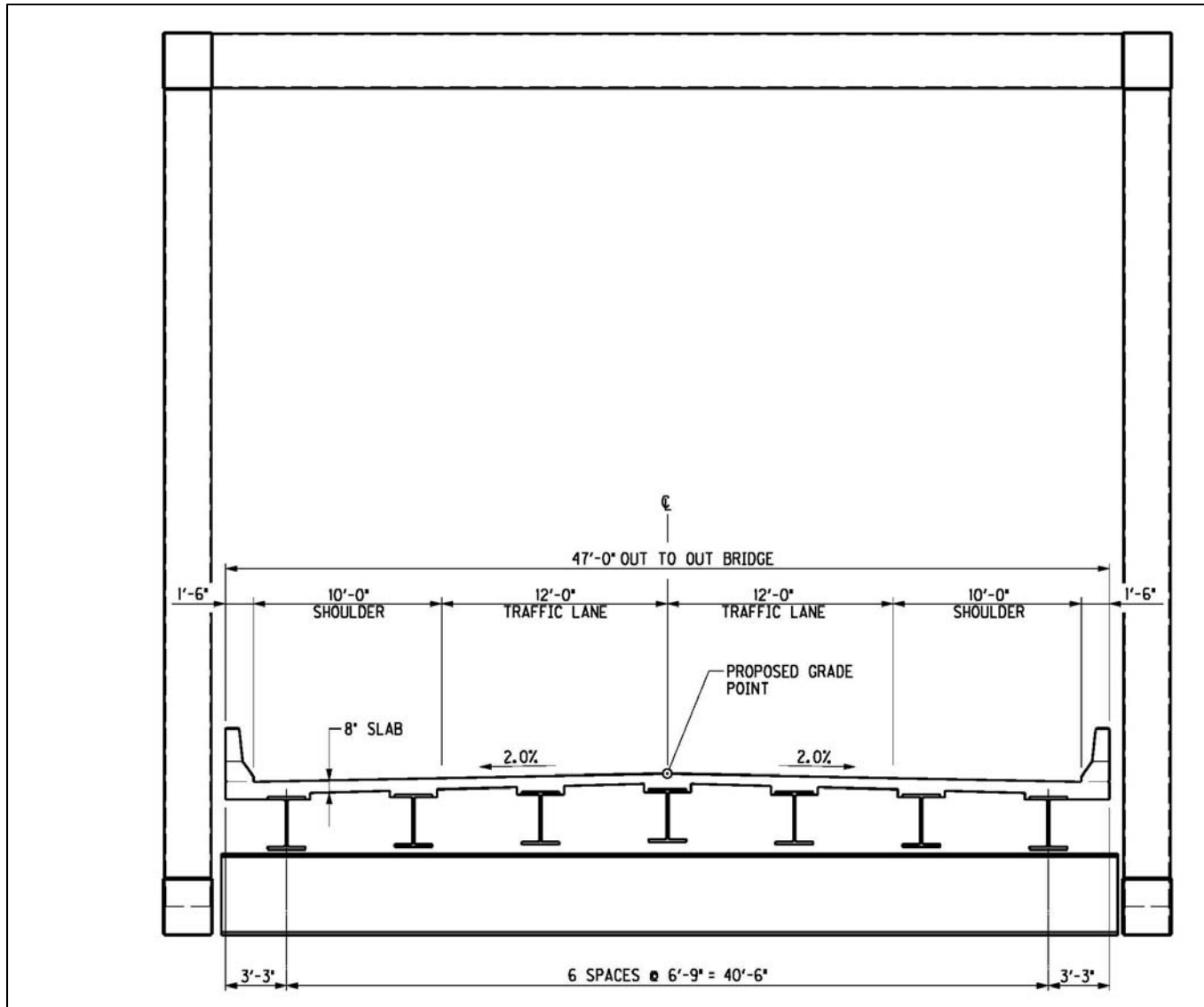


Figure 5: Typical Bridge Section

A four-lane bridge was considered, in the event that US 60 would be widened to four lanes in the future. However, due to low current and projected future traffic volumes in the study area, as well as the increased costs, a two-lane bridge was chosen as the appropriate typical section at this time.

### **9.3 Funding / Next Steps**

Upon completion of this study, the next step is Phase I design. This will include the NEPA process and the additional environmental analysis as discussed in this report. The cost estimate for Alternative 4 was submitted to the KYTC for inclusion in the 2014 6-Year Highway Plan. The project was previously listed in the 2012 6-Year Plan, and some funding has already been allocated for design and construction. This study provided a more detailed and updated cost estimate to put into the plan to ensure that adequate funds would be available for future design and construction phases.

## Study Process

## Need

### Safety:

- Lanes on existing bridge are narrow (lots of "mirror swapping")
- Lots of school traffic (scary passing trucks)
- Longevity and integrity to bear heavy loads (rock trucks)

## Purpose



The pu  
project

## Cultu

Rocky Hill

Gowd House

# US 60 BRIDGE

*Replacement* at Cumberland River

