US 60 Bridge Replacement Scoping Study, Livingston County, Kentucky

Executive Summary

Introduction and Study Area

Parsons Brinckerhoff was 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. Safety, connectivity, bridge sufficiency rating, environmental and human impacts and public input were all evaluated with respect to the replacement or rehabilitation options for the bridge.

The study area included the US 60 bridge as well as the roadway approaches to the north and south, KY 70 and KY 2610. **Figure ES1** shows the study area.

Figure ES1: Study Area

Draft Purpose and Need

The Purpose and Need statement for this study was developed through field reviews, stakeholder and public input, and from deficiencies identified in the Existing and Future Conditions technical analysis. The purpose of this project is to replace and/or rehabilitate the existing US 60 bridge (ID No. 070B00017N) while providing a safe, reliable roadway that gives due consideration to future transportation needs and appropriate corridor alternatives. The need comes from the deficiencies of the existing bridge on US 60, which are as follows:

- Functionally obsolete due to the narrow lane widths and shoulder widths on the bridge (10 feet and 1 foot respectively).
- A sufficiency rating of 32.7.
- On the most recent Structure Inventory and Appraisal Sheet, the deck geometry was rated 2 on a scale of 0-9, with the comment, “intolerable, replace”.

The following goals and objectives include providing a constructible and affordable structure that will improve safety and the substandard load capacity of the bridge, as well as maintain traffic flow during construction.

Existing and Future Conditions

A detailed existing conditions inventory was completed that examined existing roadway characteristics, bridge geometrics, existing and future traffic volumes, level of service (LOS), capacity, and crash rates. The key transportation issues identified from this analysis are summarized below:

- The US 60 bridge currently has two 10-foot driving lanes with one-foot shoulders.
- The most recent Structure Inventory and Appraisal (SI&A) Sheet (4/17/2012) classifies the bridge as functionally obsolete, and lists the deck condition rating as 7 (good), the deck geometry as 2 and the superstructure and substructure conditions as 5 (Fair).
- US 60 currently operates at LOS E between KY 70 and the bridge, and LOS C on the bridge and to the north. In 2038 it will remain at LOS E between KY 70 and the bridge, operate at LOS D on the bridge, and LOS C to the north.
- The critical crash rate along US 60 is greater than one, indicating that crashes have occurred at this location more than other similarly classified locations throughout the state. Twenty one total crashes occurred in the three year period from 2010 to 2012, and of those, single vehicle crashes accounted for over half of the crashes.

Both human and natural environmental overviews were performed. There are nine previously recorded archaeological sites, two of which are eligible for inclusion in the National Record of Historic Places (NRHP) and one that is potentially eligible. Soil data indicates undisturbed land forms that could possess additional prehistoric sites or extend boundaries of a known site. There is also 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.

Community facilities located in the study area include the Smithland Pentecostal Church, the Senior Citizen's Center, the Livingston County Fairgrounds and the Livingston County Ball Park. If the ball park is publically owned and developed with Federal funds (which is likely), any impacts to it could potentially constitute a Section 4(f) and/or a Section 6(f) impact. The Environmental Justice (EJ) review found the percentage of minority and population below the poverty line to be significantly below the state threshold for all of the census block groups; however two of the three block groups and one of the census tracts in the study area have elderly populations that are significantly higher than the state threshold. All three block groups in the study area have a significantly higher percentage of persons with disabilities (age 5 and over) than the state threshold. Census block groups were only available in 2000 census data, while 2010 census data was available on at the tract level. Further investigation at the design stage will be required to ensure the preferred alternative does not adversely impact EJ communities.

Public Involvement

The Public Involvement process included several key elements comprising two local official and stakeholder meetings, one public meeting and a resource agency consultation through a mailing. The stakeholders group was comprised of locally elected officials including the County Judge Executive, Mayor and other officials who represented or spoke for a jurisdiction or agency, as well as several

owners of local businesses. The public meeting was held on June 20, 2013 at the Livingston County Cooperative Extension Office. In total, 38 citizens signed in at the meeting and 19 of them provided feedback via survey. The top three preferred options from the alternatives include: 1) Repair and widen the structure or 2) build a new bridge to the east of the existing structure or 3) build a new bridge to the west of the existing structure. Another concern repeatedly brought up in the survey responses was the lack of an acceptable detour if the existing bridge was closed during construction. The resource agencies largely had no objections or indications that one or more of the alternatives could not be further developed.

Alternatives Development and Analysis

Initially, a total of seven alternatives were considered. These alternatives included:

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

These seven alternatives were narrowed down to the preferred alternative by a two-step process that first involved a preliminary analysis that determined which alternatives were feasible (physically, financially, environmentally and socio-politically), and then refined those to a smaller group with a subsequent analysis of the remaining alternatives in greater detail, to arrive at a recommendation.

In the preliminary analysis, Alternatives 5 and 6 were eliminated due to floodplain impacts, significant impacts to community facilities and business and residential properties, the 3-5 miles of new construction that would be required and the cost associated with that, and low projected traffic use.

At this point, Alternative 3 was split into two alignments, 3A and 3B. 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 ES2** 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.

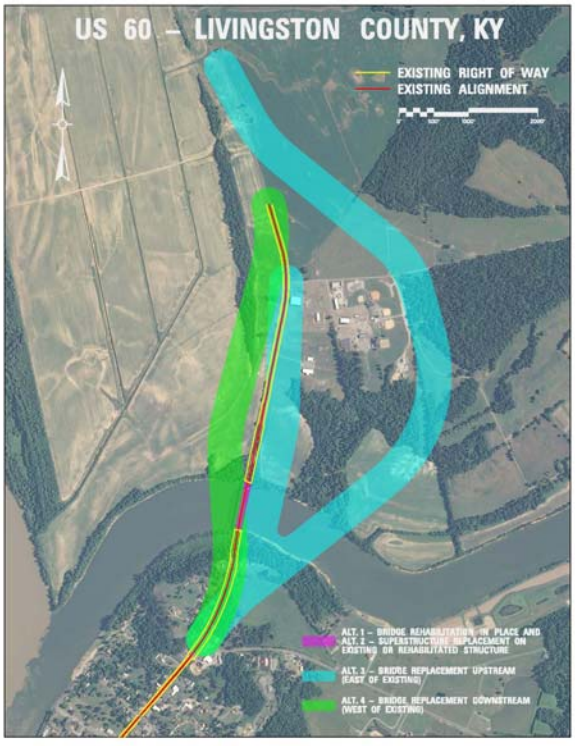

Figure ES 2: Level 2 Alternatives

The detailed analysis examined the remaining four build alternatives in more detail. The traffic operations and safety analysis showed no difference between the alternatives with regards to future year LOS and volume to capacity ratio (V/C); however Alternatives 2, 3A, 3B and 4 could reduce total crashes on the bridge by three per year according to the Highway Safety Manual Crash Modification Factor analysis. Alternatives 3A, 3B and 4 have more community impacts, as Alternatives 1 and 2 involve simply replacing the existing bridge. Alternative 3A would impact the UK Agricultural Extension office. Alternatives 3A, 3B and 4 have archaeological impacts and could potentially have Environmental Justice impacts. These three alternatives also impact floodplains and the Indiana Bat roosting habitat. Alternatives 3A and 3B also impact streams.

The different alternatives will each require a unique maintenance of traffic (MOT) plan. The public involvement phase of the project made it clear that any closure of the bridge would have a significant negative impact on the community due to the long (70 mile) detour that is the only viable option if the bridge is closed for construction. Alternative 1 would require temporary or night time and weekend closures and Alternative 2 would require a bridge shut down of 5-10 days. Alternatives 3A, 3B and 4 would not require any closure as a new bridge and its approaches could be constructed while the existing bridge remains in operation.

Current year planning level cost estimates were calculated for all four build alternatives, as shown in **Table ES-1**. The total cost is a combination of the bridge design and construction, the design and construction of the roadway approaches, right of way and utilities. It should be noted that the maintenance of traffic was 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.

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	**$0**
1	Bridge Rehab in Place	$3,980,000	$39,800,000	$10,000	$0	$0	$100,000	**$43,890,000**
2	Superstructure Replacement on Existing / Rehab Structure	$4,160,000	$41,600,000	$10,000	$0	$0	$100,000	**$45,870,000**
3A	New Bridge Upstream (East) Near Existing	$3,900,000	$39,000,000	$85,000	$2,000,000	$450,000	$850,000	**$46,285,000**
3B	New Bridge Upstream (East) Further from Existing	$4,300,000	$43,000,000	$50,000	$4,100,000	$1,000,000	$500,000	**$52,950,000**
4	New Bridge Downstream (West)	$3,900,000	$39,000,000	$35,000	$2,400,000	$650,000	$350,000	**$46,335,000**

Table ES-1 – Planning Level Costs

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 in regard 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.

Because of these 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. All costs are shown below in **Table ES-2.**

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	**$49,500,000**
4	New Bridge Downstream (West)	$4,000,000	$40,000,000	$240,000	$2,400,000	$1,650,000	$1,350,000	**$49,640,000**

Table ES-2: Revised Cost Estimates for Preferred Alternatives

Upon completion of this study, the next step is Phase I design. 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 accurate cost to put into the plan to ensure that adequate funds will be available for future design and construction phases.