EXECUTIVE SUMMARY

I-69, I-66/I-65 Spurs, and US 60 Connection Strategic Planning Corridor Study

Overview of Existing Conditions

William H. Natcher Parkway, Audubon Parkway, and US 60 Wendell Ford Expressway

May 2014

KENTUCKY TRANSPORTATION CABINET

Palmer ENGINEERING

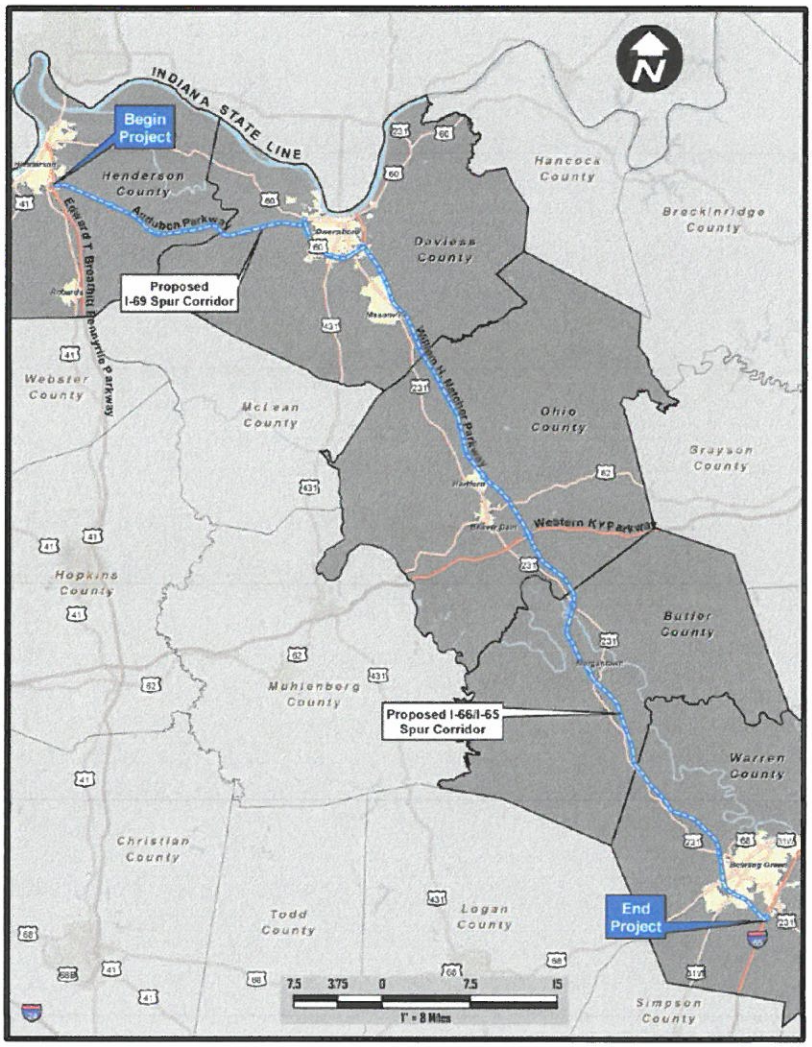

West Ky. Pkwy
Morgantown
Bowling Green

I-69 SPUR, I-66/I-65 SPUR, AND US 60 CONNECTION: HENDERSON TO BOWLING GREEN STRATEGIC CORRIDOR PLANNING STUDY

EXECUTIVE SUMMARY

Kentucky Transportation Cabinet – Division of Planning
MAY 2014

The Kentucky Transportation Cabinet (KYTC) has undertaken a strategic corridor planning study for the proposed interstate routes, Interstate 69 (I-69) Spur and Interstate 66/65 (I-66/I-65) Spur. The project corridor includes the Audubon Parkway from the Edward T. Breathitt (Pennyrile) Parkway in Henderson to Owensboro, Kentucky, US 60 in Owensboro, and the William H. Natcher Parkway from Owensboro to I-65 in Bowling Green, Kentucky. The corridor passes through Henderson, Daviess, Ohio, Butler, and Warren Counties.



STUDY PURPOSE

The primary purpose of this strategic corridor study is to review the existing conditions along the Audubon Parkway, Natcher Parkway, and US 60 to identify locations that do not meet current Association of State Highway Transportation Officials (AASHTO) and Federal Highway Administration (FHWA) highway design guidelines and related criteria. Evaluations include the degree to which these criteria are not met, their impact on safety and capacity, and identify options for making improvements to address identified deficiencies.

PROJECT BACKGROUND

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) Technical Corrections Act of 2008 designates the Audubon Parkway as a future I-69 Spur and the Natcher Parkway as a future I-66 Spur given these routes meet interstate standards and connect to an existing interstate.

STUDY ACTIVITIES

The study activities for the I-69 Spur, I-66/I-65 Spur, and US 60 Connection Strategic Corridor Planning Study included the following:

- Identify criteria and standards per AASHTO and the FHWA for designation as an interstate route;
- Collect data from the KYTC's Highway Information System, As-built plans, crash data, field observation and measurement, and other information provided by local Highway District office;
- Compare and analyze data collected with criteria and identify conditions and locations on the Audubon Parkway, Natcher Parkway, and US 60 that do not meet interstate criteria and standards;
- Develop improvement strategies and costs associated with improving these areas with identified deficiencies to meet criteria and standards for designation as an interstate highway.

KEY FINDINGS

The project routes consist of two travel lanes in each direction, a design speed of 70 miles-per-hour or greater for rural conditions and 50 miles-per-hour for urban conditions, and are fully controlled access facilities. However, some physical features of the project routes do not meet the criteria for an interstate facility. Attached to the end of this summary are figures identifying these physical features, which do not meet interstate criteria.

The following findings are based on available data and limited field reviews:

Operational Considerations and Safety

- Crash Analysis: For the crash analysis, a high crash segment was defined as having a critical crash rate factor greater than or equal to one. Crash segments with a critical crash rate factor between 0.9 and 0.99 are also identified in the report.
- Crash Analysis – Audubon Parkway: Compared to other Kentucky parkways, one segment in Henderson/Daviess County (MP 10.141 – 18.049) has a critical crash rate between 0.9 and 0.99.
- Crash Analysis – Audubon Parkway as an Interstate: Compared to Kentucky interstates, rather than state parkways, one high crash segment was identified along the Audubon Parkway located in Henderson/Daviess County (MP 10.141 – MP 18.049). The segment has a critical crash rate factor of 1.13.
- Additional Findings Related to Crash Analysis: Four crashes coded as *median cross-over* or *head-on* collisions occurred on the Natcher Parkway during the study period (2006-2010). No *median cross-over* or *head-on collisions* were recorded on the Audubon Parkway or US 60 during the study period. Two fatal crashes on the Audubon Parkway, one fatal crash on US 60, and eight fatal crashes on the Natcher Parkway were recorded during the study period (2006-2010).
- Current Traffic (2011): The current traffic (2011) for the Audubon Parkway ranges from 9,450 vehicles per day (vpd) near Henderson to 10,590 vpd near the US 60 interchange in Owensboro. On US 60, the traffic volumes range from 19,200 vpd near the Audubon Parkway interchange to 32,400 vpd between the US 231 and US 431 interchanges. On the Natcher Parkway, the traffic volumes range from 7,940 vpd at the Western Kentucky Parkway interchange to 20,400 vpd near the I-65 interchange in Bowling Green.
- Truck Percentages (2011): The existing truck percentages on the Audubon Parkway range from 19.5% at Owensboro to 21.1% at Henderson, Kentucky. On US 60, the truck percentages range from 10.1% to 12.4%. The existing truck percentages on the Natcher Parkway range from 19.9% in Morgantown to 32.9% north of the Western Kentucky Parkway interchange in Ohio and Daviess Counties.
- Future Traffic (2040) without Interstate Spur Designations: The projected annual growth rates range from 2.1% to 2.3% along the Audubon Parkway, from 1.5% to 2.3% on US 60, and from 0.9% to 3.1% on the Natcher Parkway. The growth rates resulted in a range from 18,400 vpd to 20,500 vpd on the Audubon Parkway, 36,100 vpd to 49,900 vpd on US 60, and 10,800 vpd to 49,500 vpd on the Natcher Parkway.
- Future Traffic (2040) with Interstate Spur Designations: The projected annual growth rates range from 2.3% to 2.6% along the Audubon Parkway, from 1.8% to 2.5% on US 60 and from 1.1% to 3.6% on the Natcher Parkway. The projected growth rates resulted in traffic volumes ranging from

19,500 vpd to 22,300 vpd on the Audubon Parkway, 38,200 vpd to 54,400 vpd on US 60, and 11,500 vpd to 56,900 vpd on the Natcher Parkway.

- Truck Percentages (2040): Future truck volumes were not forecast for this project.
- Level of Service (2011): The Audubon Parkway, Natcher Parkway, and US 60 currently operate at LOS C or better, which is acceptable to the AASHTO guidelines.
- Level of Service (2040): The Audubon Parkway is expected to operate at LOS B or better with or without interstate spur designation. US 60 is expected to operate at LOS D or better with or without interstate spur designation. The rural sections of the Natcher Parkway are expected to operate at LOS B or better with or without interstate spur designation. The urban sections of the Natcher Parkway are expected to operate at LOS D or better without interstate spur designation and LOS E or better with interstate spur designation.

Mainline Geometry/Typical Section

- Design Speed: The Audubon Parkway, US 60, and Natcher Parkway meet or exceed the minimum design speed guidelines for interstate highways in rural and urban areas.
- Lane Width: The lane width on the Audubon Parkway, US 60, and Natcher Parkway meet the minimum AASHTO guidelines for interstate design.
- Outside Shoulder Width: The Audubon Parkway, Natcher Parkway, and US 60 meet the AASHTO minimum outside shoulder width based on the current truck DDHV.
- Inside Shoulder Width: The AASHTO minimum inside shoulder width is met on the Audubon Parkway, Natcher Parkway, and US 60.
- Median Width: The Audubon Parkway, Natcher Parkway, and US 60 meet the rural 36-foot AASHTO minimum median width in rural areas and the 10-foot AASHTO minimum median width in urban areas.
- Clear Zones: Based on the provided information and limited field reviews, it is not possible to evaluate the applicability of the current design standards for clear zone on the Audubon Parkway, Natcher Parkway, and US 60. The fill and cut slopes provided in the typical sections vary from 1V:2H to 1V:4H, the median ditch slope varies from 1V:3H to 1V:12H, and the outside ditch slope is between 1V:3H and 1V:4H.
- Guardrail Placement and Condition: The guardrail leading end treatments on the Audubon Parkway, Natcher Parkway, and US 60 meet the current standards. Dome guardrail trailing end treatments on the Audubon Parkway, Natcher Parkway, and US 60 do not meet current standards. An evaluation of guardrail placement is not possible based on the information provided on the As-built plans.
- Superelevation: From the review of As-built plans, horizontal curves along the Audubon Parkway, Natcher Parkway, and US 60 appear to comply with the AASHTO criteria.
- Horizontal Alignment: The horizontal curvature for the Audubon Parkway, Natcher Parkway, and US 60 is acceptable and in compliance with the current AASHTO design guidelines.
- Vertical Alignment: All of the vertical curves along the Audubon Parkway and US 60 meet the current AASHTO guidelines. One vertical curve on the Natcher Parkway (MP 53.800) does not meet the guideline for the minimum length of vertical curves.
- Stopping Sight Distance: The minimum stopping sight distance guideline is not met for one vertical curve on the Natcher Parkway: MP 53.800.

Bridges and Overpasses

- Lateral Clearance – Audubon Parkway: All of the mainline bridges on the Audubon Parkway meet the minimum lateral clearance. (The bridges at the Pennyrile Parkway and US 60 interchanges are not included.)
- Lateral Clearance – US 60: Four of the mainline bridges on US 60 do not meet the minimum lateral clearance requirement. (The bridges at the Audubon Parkway and Natcher Parkway are not included.)
- Lateral Clearance – Natcher Parkway: Of the 39 mainline bridges on the Natcher Parkway, 32 do not meet the minimum lateral clearance. (The bridges at the US 60 interchanges are not included.)
- Vertical Clearance – Audubon Parkway: All of the overpass bridges meet the minimum 16 foot vertical clearance requirement.

- Vertical Clearance – US 60: One overpass bridge does not meet the minimum 16-foot vertical clearance requirement (MP 11.611). The clearance is not met on the eastbound and westbound lanes on US 60.
- Vertical Clearance – Natcher Parkway: Of the 26 overpass bridges on the Natcher Parkway, 2 do not meet the minimum 16-foot vertical clearance requirement. They are located at MP 62.352 and MP 33.741.
- Functional Adequacy: Seventeen mainline bridges and culverts are identified as functionally obsolete; nine overpass bridges are identified as functionally obsolete.
- Sufficiency Rating: All Audubon Parkway, Natcher Parkway, and US 60 mainline and overpass bridges have a sufficiency rating greater than 60.0. Three culverts have a sufficiency rating less than 60.0.

Interchanges and Ramps

- Design Speed: Design speed for a majority of the interchange ramps was not provided on the as-built plans.
- Lane Width: Lane widths for the interchange ramps range from 15 feet to 16 feet, which is compliant with AASHTO guidelines.
- Shoulder Width: All of the interchange ramps on the Audubon Parkway, Natcher Parkway, and US 60 have 4-foot paved inside shoulders and 6-foot paved outside shoulders, which meet current practice.
- Horizontal Alignment: The minimum horizontal radius is met on all interchange ramps that were provided on the As-built plans.
- Vertical Alignment - Vertical Grade: The minimum vertical grade is met on all interchange ramps that were provided on the As-built plans.
- Vertical Alignment - Vertical Length of Curve: Eight ramp vertical curves do not meet the requirement for minimum length of curve that was calculated based on the minimum ramp design speed. On the Audubon Parkway, these ramps are located at the Pennyrile Parkway interchange (Exit 1) and US 60 interchange (Exit 24). On the Natcher Parkway, these ramps are located at the US 31 W interchange (Exit 6), the US 231 interchange (Exit 28) and the Western Kentucky Parkway interchange (Exit 43). On US 60, the Natcher Parkway and US 60 interchange also has vertical curves that do not meet the calculated minimum length of curve.
- Vertical Alignment - Stopping Sight Distance: Eight vertical curve ramps do not meet the minimum stopping sight distance requirement that was calculated based on the minimum ramp design speed. The vertical curves that do not meet the minimum stopping sight distance are located at the interchanges previously mentioned for vertical length of curve.
- Superelevation: Based on review of As-built plans, existing ramps appear to satisfy the AASHTO criteria for superelevation.
- Speed-Change Lanes: Many of the existing ramps on the Audubon Parkway, Natcher Parkway, and US 60 do not meet the minimum criteria for acceleration and deceleration lengths.
- Weaving Characteristics: The weaving situation within the Natcher Parkway and Western Kentucky Parkway will operate at LOS A in the northbound and southbound directions with future interstate spur traffic projections. The interchanges at Exits 9, 36, and 50 on the Natcher Parkway and Exit 10 on the Audubon Parkway are cloverleaf interchanges with weaving within the interchange.
- Interchange Spacing: On US 60, two locations do not meet the minimum interchange spacing. The interchange spacing between the Audubon Parkway interchange (Exit 10) and the KY 81 interchange (Exit 11) is less than one mile. The interchange spacing between the KY 81 interchange (Exit 11) and the Carter Road interchange (Exit 12) is also less than one mile. On the Natcher Parkway, one location does not meet the minimum interchange spacing requirements. The two interchanges (Exits 28 and 29) in Butler County are within three miles of each other.
- Interchange Control of Access: Two interchanges (Exit 5 and Exit 18) on the Audubon Parkway do not meet the minimum interchange control of access requirement. The minimum interchange control of access requirement is also not met at Exit 12 on US 60, and Exits 28 and 36 on the Natcher Parkway.
- Interchange Configuration: Currently, the Audubon Parkway and Natcher Parkway have four service interchanges that do not meet the recommended interstate interchange configuration. On the Audubon Parkway, the interchange is located at Exit 10. The remaining three interchanges are on

the Natcher Parkway located at Exit 9, Exit 36, and Exit 50. These four interchanges were locations for toll plazas before tolls were removed from the route.

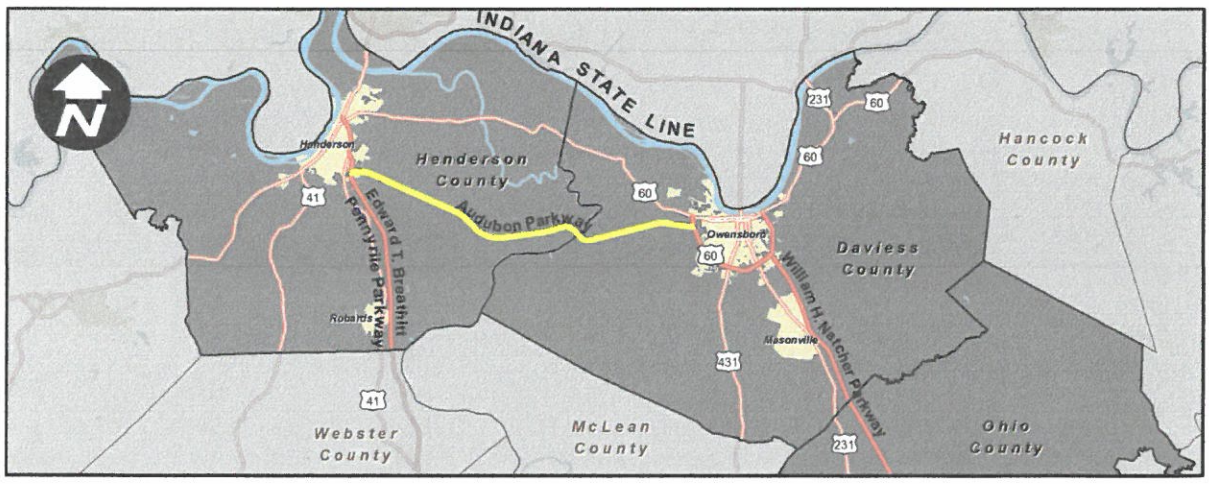
IMPROVEMENT STRATEGIES AND COSTS

The range of improvement strategies under consideration are No Build, Necessary Upgrades and Spot Safety Improvements, and Fully Compliant Reconstruction. These strategies represent incremental levels of infrastructure investment needed to implement I-69 Spur and I-66/I-65 Spur in Central and Western Kentucky.

- **No Build** – The Audubon Parkway, Natcher Parkway, and US 60 would continue to provide connectivity for the future interstate spur traffic but would not meet interstate criteria. The Audubon Parkway, Natcher Parkway, and US 60 would remain as they currently exist without the interstate spur designation. This alternative would not require any additional funding for the construction related to upgrading the facilities to current interstate standards.
- **Necessary Upgrades and Spot Safety Improvements** - Key safety and operational concerns would be addressed. Under this improvement strategy the Audubon Parkway, Natcher Parkway, and US 60 would be upgraded to meet some, but not all current interstate standards. Design exceptions and variances would be required for those design features that do not meet current criteria or standards. Design exceptions and design variances would require further study to determine if a design exception is deemed appropriate by the KYTC and the FHWA. New infrastructure and improvements along the parkways and US 60 would be proposed to upgrade necessary features and improve safety for those locations that are not addressed by design exceptions and variances.
- **Fully Compliant Reconstruction** – This improvement strategy would involve improvements within existing right of way or with minimum right of way acquisition necessary for making the existing parkways and US 60 fully compliant with minimum AASHTO criteria for interstate routes.

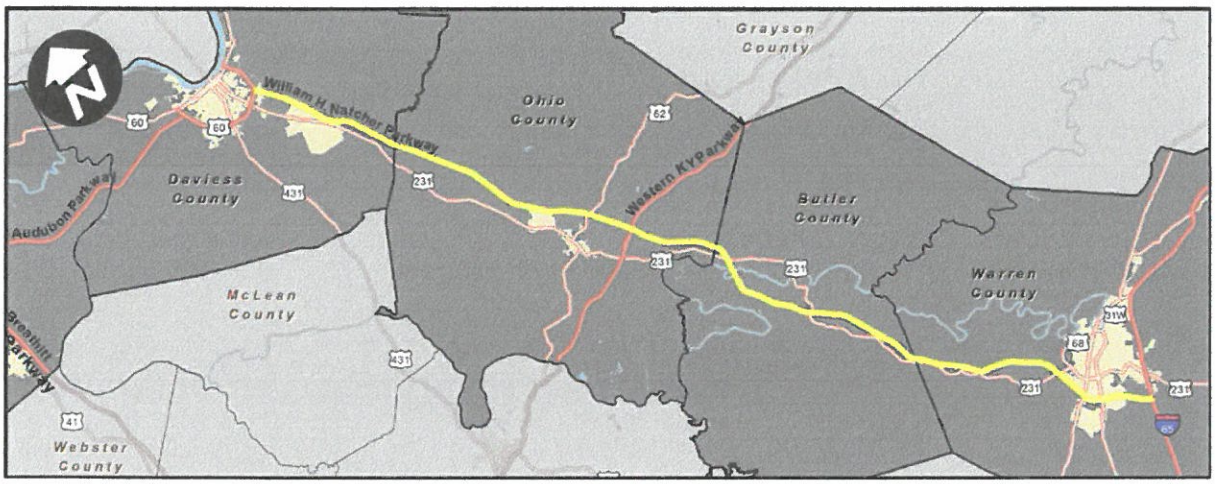
Based on the study, there are four possible interstate route designation options for the Audubon Parkway, Natcher Parkway, and US 60. Options for I-66 Spurs specifically are not included because at this time no active KYTC I-66 projects are within the study area. These possible interstate route designation options are presented below.

- **<u>Option 1 - I-69 Spur</u>**



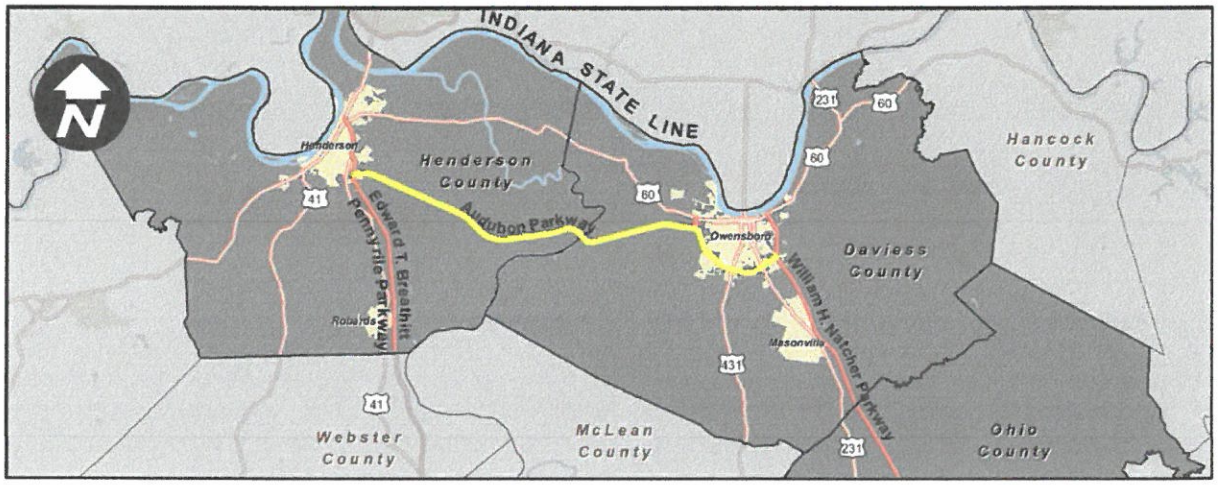
This option designates the I-69 Spur to follow along the Audubon Parkway from Henderson to the US 60 interchange in Owensboro. The interstate spur would begin at I-69 south of Henderson and would terminate at the US 60 interchange in Owensboro. At the time of this report, the I-69 alignment through Henderson is under evaluation, and the intersecting location with the Audubon Parkway is undetermined. The Audubon Parkway cannot be designated as an interstate spur until it connects with a route that has been designated as I-69.

- **Option 2 - I-66/I-65 Spur**



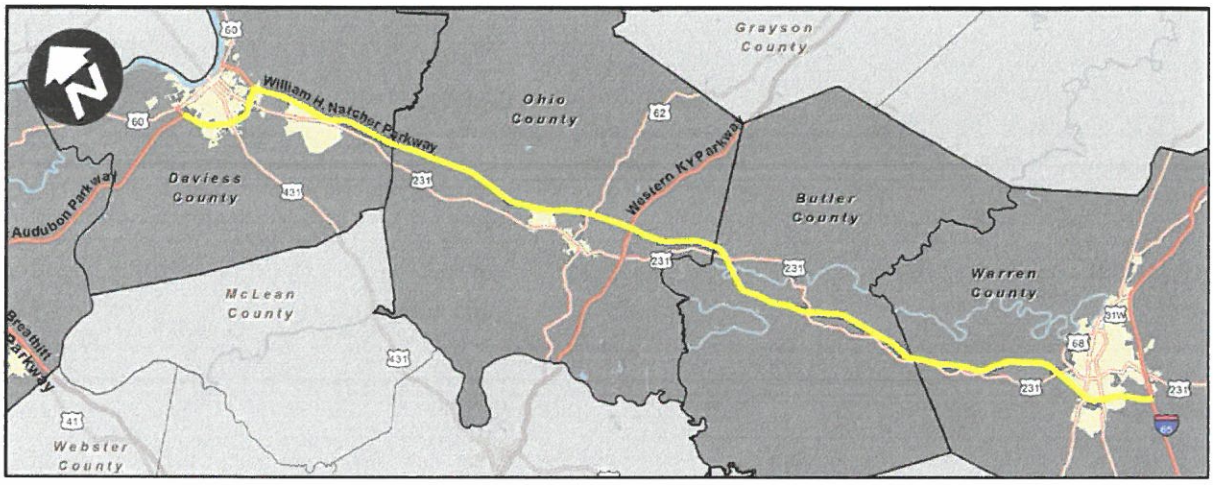
This option designates the I-66/I-65 Spur along the Natcher Parkway from I-65 in Bowling Green to the US 60 interchange in Owensboro. The I-66/I-65 Spur would begin at the existing I-65 and Natcher Parkway interchange and terminate at the existing Natcher Parkway and US 60 interchange at the east side of Owensboro.

- **Option 3 - I-69 Spur including US 60**



The third option designates the Audubon Parkway and US 60 as I-69 Spur. Similar to Option 1, the I-69 Spur would follow along the Audubon Parkway from south of Henderson to the US 60 interchange in Owensboro. The spur would continue along US 60 and terminate at the US 60 and Natcher Parkway interchange on the east side of Owensboro. At the time of this report, the I-69 alignment through Henderson is under evaluation, and the intersecting location with the Audubon Parkway is undetermined. The Audubon Parkway and US 60 cannot be designated as an interstate spur until the Audubon Parkway connects with a route that has been designated as I-69.

- **Option 4 - I-66/I-65 Spur including US 60**



This option designates the Natcher Parkway and US 60 as I-66/I-65 Spur. Similar to Option 2, the I-66/I-65 spur would follow along the Natcher Parkway from I-65 in Bowling Green to the US 60 interchange in Owensboro. The spur would continue on US 60 and terminate at the US 60 and Audubon Parkway interchange on the west side of Owensboro.

The following table provides a range of preliminary cost estimates for the interstate route designations. As noted, the Necessary Upgrades and Spot Safety Improvement Strategy would require design exceptions and variances for those design features that do not meet interstate standards. The Fully Compliant Reconstruction Strategy improves all geometric deficiencies and does not require any design exceptions or variances. The cost range provided illustrates the cost variation between the improvement strategies. The lower cost estimate represents the Necessary Upgrades and Spot Safety Improvement Strategy, and the upper cost estimate represents the Fully Compliant Reconstruction Strategy. After further analysis of the identified deficiencies, KYTC will need to recommend strategies to the Federal Highway Administration to bring the deficiencies into compliance with interstate criteria. Available options include addressing the required improvements through construction, requesting design exceptions/variances, committing to future improvements as part of the on-going maintenance and operation of the facility. It is anticipated that some combination of these approaches will be used. Thus, as projects for implementation of improvement strategies are initiated, additional engineering analyses and studies will be needed to further refine the specifics for improvements and to document the recommendations

Interstate Designation Option	Interstate Miles	Cost [1] (million)			Cost per Mile (million)		
1. I-69 Spur - Audubon Parkway	**23.4**	$13.99	-	$14.73	$0.60	-	$0.63
2. I-66/I-65 Spur - Natcher Parkway	**70.2**	$66.21	-	$75.87	$0.94	-	$1.08
3. I-69 Spur - Audubon Parkway & US 60	**30.1**	$65.17	-	$87.15	$2.17	-	$2.90
4. I-66/I-65 Spur - Natcher Parkway & US 60	**76.9**	$117.39	-	$148.29	$1.53	-	$1.93
	Necessary Upgrades and Spot Safety Improvement Strategy						
	Fully Compliant Reconstruction Strategy						

[1] Cost for routine maintenance is not depicted in estimate

Table ES-1 - Cost Comparison of Potential Alternatives

SUMMARY

Information presented herein is a ***first look planning-level study*** to identify deficiencies and impediments for interstate spur designation and to identify a range of improvement strategies needed to upgrade the Audubon Parkway, Natcher Parkway, and US 60 to satisfy applicable interstate criteria. After further analysis of the identified deficiencies, KYTC will need to recommend strategies to the

Federal Highway Administration to bring the deficiencies into compliance with interstate criteria. Available options include addressing the required improvements through construction, requesting design exceptions/variances, committing to future improvements as part of the on-going maintenance and operation of the facility. It is anticipated that some combination of these approaches will be used. Thus, as projects for implementation of improvement strategies are initiated, additional engineering analyses and studies will be needed to further refine the specifics for improvements and to document the recommendations.

For example, the following may be areas for further analysis:

- Operational Considerations – Roadway conditions not shown in crash data may be contributing to crash history. Additional analyses during preliminary engineering may provide additional insight that could refine the scope of needed improvements at a given location.
- Mainline Geometry and Typical Section – Analyses for mainline geometry and typical section were evaluated using As-built plans supplemented with limited field reviews of existing conditions. Actual design features may require further verification with detailed field surveys of the roadway cross-section during preliminary engineering for implementing improvement strategies.
- Interchanges and Ramps – Most of the interchange ramps are deficient, and some design features were illegible on the As-built plans. Therefore, as interchanges are identified for improvement, geometric features (i.e. superelevation rate, horizontal and vertical alignments, design speed, etc.) should be further analyzed.