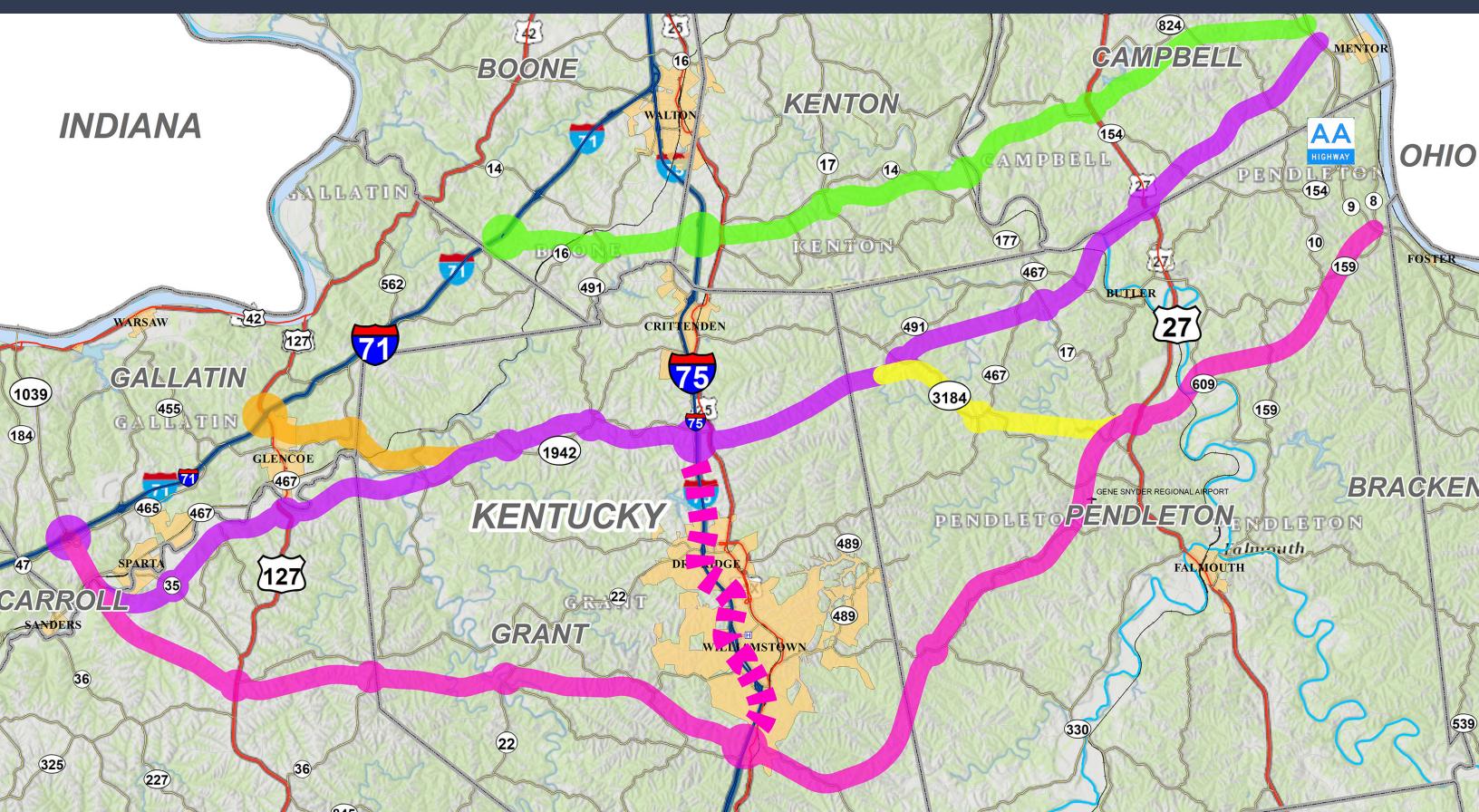




NORTHERN KENTUCKY OUTER LOOP STUDY

FINAL REPORT



Boone, Bracken, Campbell,
Gallatin, Grant, Kenton, Owen,
& Pendleton Counties, Kentucky

KYTC ITEM NO. 6-458
SEPTEMBER 2021





NORTHERN KENTUCKY OUTER LOOP STUDY

KYTC Item No. 6-458

September 2021



Kentucky Transportation Cabinet

In partnership with:

Stantec Consulting Services Inc.

In association with:

AECOM

Qk4

Rasor Marketing

Dunrobin Associates, LLC

Civil Design, Inc.

Corn Island Archaeology



EXECUTIVE SUMMARY

The Northern Kentucky Outer Loop Study (KYTC Item No. 6-458) was initiated by the Kentucky Transportation Cabinet (KYTC) to examine new conceptual transportation connections in the southern portions of Boone, Kenton, and Campbell Counties and northern portions of Gallatin, Owen, Grant, Pendleton, and Bracken Counties. Such connections would serve the growing need for east-west travel within the region, connecting communities to resources along the I-71 and I-75 corridors and providing local opportunities for growth within the counties served.

The Northern Kentucky Outer Loop Study is in the planning phase. This means that no decisions regarding specific roadway alignments were made during this study, but local input is being used to help shape next steps.

PURPOSE AND NEED

Northern Kentucky is one of the fastest growing regions in the Commonwealth. Significant commercial and residential development is occurring in Boone, Kenton, and Campbell Counties. The region has excellent interstate access through I-71, I-75, I-275, and I-471. Major north-south routes such as US 27, US 127, and the AA Highway (KY 9) are also present. Missing, though, is adequate east-west access south of I-275. This hampers future economic growth outside of the three northernmost counties. Access from the AA Highway to I-71 and I-75 is essential to this growth.

The Purpose and Need Statement describes what the project should accomplish. It forms the basis for the decision-making process: each alternative must meet the purpose and address the identified needs to be considered a viable solution.

The purpose of the Northern Kentucky Outer Loop project is to stimulate economic opportunities through regional mobility by providing a safer and more efficient east-west corridor between I-71 and the AA Highway (KY 9).

DEVELOPMENT OF ALTERNATIVES

Preliminary corridor concepts were developed and presented to project stakeholders. The preliminary concepts included six 2,000-foot-wide corridor bands within which a freeway-type facility could be constructed. These concepts were developed based on a multi-faceted approach that included considerations such as satisfying interchange spacing requirements, avoidance of known environmental resources, avoidance of heavily developed areas, and identification of more desirable locations to cross major streams such as the Licking River (i.e. locations with narrower floodplain widths). For comparison purposes, each concept is assumed to be a high-speed, four-lane divided facility with interchanges at interstates (fully-directional system interchanges) and major state routes (service interchanges). The eastern terminus options along the AA Highway were selected to allow a feasible future connection to the Ohio portion of the Cincinnati Eastern Bypass (CEB). The CEB concept was previously studied in the [Brent Spence Strategic Corridor Study](#) (KYTC Item No. 6-431); it is approximately 75 miles long and extends from I-71 in Boone County, Kentucky to I-75 just south of Lebanon, Ohio.

In response to feedback obtained from the stakeholders and the general public, seven alternatives (shown in **Figure ES-1**) were ultimately identified for preliminary screening, referred to as the level one evaluation. All conceptual corridors begin at one of three locations along I-71 and end at one of three locations along KY 9 (AA Highway).

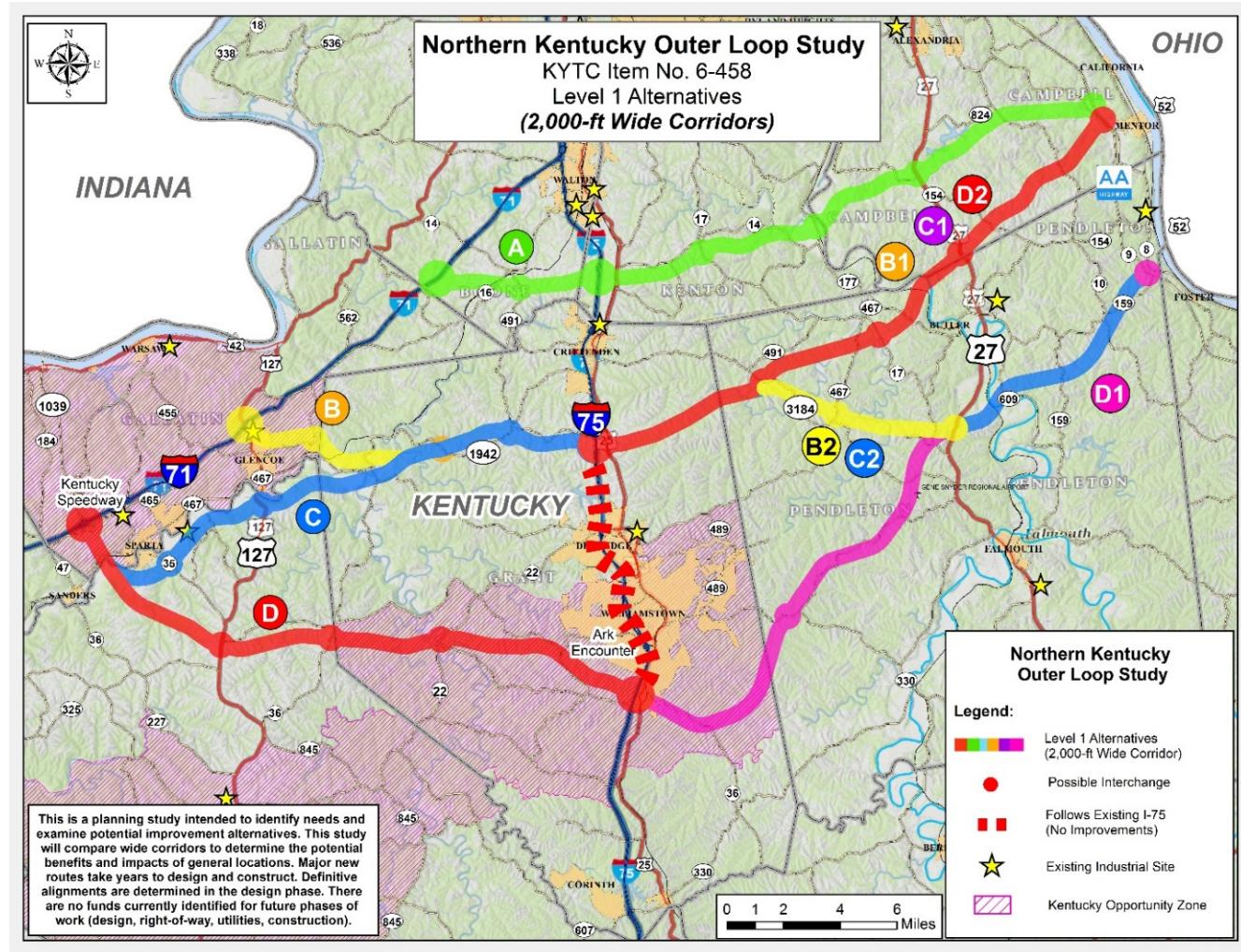


Figure ES-1: Level One Alternatives

PROJECT GOALS AND LEVEL ONE EVALUATION OF ALTERNATIVES

The costs, impacts, and benefits of the Level One Alternatives were evaluated to determine whether a concept merits advancement. To facilitate the evaluation, a two-tier screening process was developed. To facilitate the screening process, stakeholders helped identify the primary objectives of the Northern Kentucky Outer Loop Study. This effort resulted in six project goals. Evaluation criteria were then developed to assess how well each alternative satisfies the project goals as part of the Level One Evaluation of Alternatives. The six project goals are listed below.

- Provide for economic development opportunities
 - Enhance regional mobility
 - Improve safety

- Provide a cost-effective, constructible solution
- Provide the Kentucky portion of a future CEB
- Remain sensitive to local resources

As a result of the level one screening and the feedback received at the two stakeholder meetings held over the course of the level one screening process, Alternatives A, B1, D1, and D2 were advanced for more detailed evaluation. The following narrative illustrates why these four alternatives were selected from the seven considered to advance for more detailed level two evaluation.

Alternative A: Performed best in the project goals for enhancing regional mobility and providing a cost-effective, constructible solution. In addition, Alternative A showed one of largest potential increases in workforce accessibility, provided access to 18 existing industrial parks, had the largest projected traffic volumes between I-71 and I-75, showed the greatest potential for crash reduction, and had the lowest construction cost estimate.

Alternative B1: Out of the seven alternatives, Alternative B1 performed fourth best overall in the measures of effectiveness. In addition, Alternative B1 showed one of largest potential increases in workforce accessibility, had one of the largest increases in employment opportunities, passed through one Opportunity Zone and one Enhanced Incentive County, had the largest projected traffic volumes between US 27 and the AA Highway, and had one of the lower construction cost estimates.

Alternative D1: Performed best in the project goal for Economic Development. Additionally, Alternative D1 showed one of largest potential increases in workforce accessibility, showed one of the largest increases in employment opportunities, provided access to 18 existing industrial parks and 1,700 acres of shovel-ready sites, passed through two Opportunity Zones and one Enhanced Incentive County, and had the second largest projected traffic volumes between I-71 and I-75. This alternative did have the second highest construction cost estimate.

Alternative D2: Performed best in the project goal for Improve Safety and second best in the project goal for Economic Development. In addition, Alternative D2 provided access to 17 existing industries and 2,000 acres of shovel-ready sites, passed through two Opportunity Zones and one Enhanced Incentive County, and had the second largest projected traffic volumes between I-75 and US 27. This alternative did have the highest construction cost estimate.

LEVEL TWO EVALUATION OF ALTERNATIVES

For the four alternatives that advanced beyond the level one screening, additional engineering details were developed. This included more refined roadway alignments; preliminary bridge concepts and span arrangements; more detailed cost estimates for design, construction, right-way, and utility relocations; potential land use changes and economic development opportunities; and more detailed traffic forecasts.

The level two evaluation matrix, shown below in **Table ES-1**, summarizes each alternative's ability to satisfy the Draft Purpose & Need Statement and Project Goals. To help quantify the economic impacts,

Opportunity Zones:
Economically distressed communities where certain types of private investment may be eligible for tax incentives.

Enhanced Incentive County:
County eligible for enhanced tax incentives through the Kentucky Cabinet for Economic Development.

KYTC ran each alternative through the Transportation Economic Development Impact System (TREDIS). This tool estimates employment growth over a ten-year period (2030 to 2040) as well as the value added. This is the same program that is used in KYTC's Strategic Highway Investment Formula for Tomorrow (SHIFT) prioritization process for projects of Statewide importance.

Table ES-1: Level Two Evaluation Matrix

Concept	Alternative A	Alternative B1	Alternative D1	Alternative D2	
Economic Development					
Additional 2030-2040 Employment Growth with New Freeway (number of new jobs) ¹	443	163	221	182	
Additional 2030-2040 Value Added with New Freeway (2019 \$Millions) ¹	\$32	\$17	\$16	\$13	
Industrial Sites (within a 6-mile-wide corridor representing each alternative)					
Existing Sites	18	15	18	17	
Shovel-Ready (total site acreage)	617	1,403	1,711	1,951	
Enhance Regional Mobility					
Travel Time Savings (minutes)	26	24	21	14	
2040 Average Daily Traffic (No Ohio River Connection to Cincinnati Eastern Bypass)	I-71 to I-75	13,600	5,700	8,700	8,400
	I-75 to US 27	19,300	12,400	7,800	11,800
	US 27 to AA	2,800	6,000	5,300	5,500
2040 Average Daily Traffic (Includes New Ohio River Connection to Cincinnati Eastern Bypass)	I-71 to I-75	19,800	10,300	10,100	9,600
	I-75 to US 27	36,200	30,900	24,000	28,900
	US 27 to AA	27,100	29,700	26,300	27,900

Concept	Alternative A	Alternative B1	Alternative D1	Alternative D2
Cost-Effective Constructible Solution				
Total Cost (2019 \$Millions)	\$1,235	\$1,713	\$2,033	\$2,076
2030-2040 Benefit Related to Crash Reduction (2019 \$Millions)	\$7	\$2	\$7	\$4
2030-2040 Benefit Related to Travel Time Savings (2019 \$Millions)	\$475	\$309	\$233	\$184
Performs High in How Many Categories? (Cells Highlighted in Green)	11	3	5	4
Performs Medium in How Many Categories? (Cells Highlighted in Blue)	1	9	5	5
Performs Low in How Many Categories? (Cells Highlighted in Orange)	2	2	4	5

¹ Source: Transportation Economic Development Impact System (TREDIS)

CONCLUSIONS

The Northern Kentucky Outer Loop Study examined the benefits of building a new, multi-county freeway facility to improve east-west mobility and to provide economic development opportunities within the counties served. This study was not intended to select a preferred corridor for future implementation. Instead, the study undertook a tiered screening process to identify conceptually feasible corridors within which a freeway facility could be constructed, to perform a high-level evaluation of those concepts to arrive at a more manageable set of four potential options for more detailed evaluation, further study those four options to better understand the costs, benefits and opportunities, and to explore opportunities to advance segments of independent utility. Therefore, additional variations of the level one and level two alternatives could be considered in future project phases.

Longer term, the selected corridor could provide the Kentucky portion of a future CEB. An Ohio Department of Transportation (ODOT) report on the proposed CEB was submitted to Ohio lawmakers on December 31, 2019¹. That agency concluded that “when the costs and time associated delivery of the CEB are evaluated with the known benefits identified in the KYTC [Brent Spence Strategic Corridor] study, it is ODOT’s opinion that no further expenditures of funding and staff time be put toward the CEB.” The report stated that “completion of the Brent Spence Bridge Corridor project [KYTC Item No. 6-17] should be the priority.”

¹ https://2050.oki.org/wp-content/uploads/2020/04/ODOT-2019-Report-to-Legislature_w_attach-Final.pdf

Given ODOT's current position on the CEB, the effect the Ohio connection has on the projected traffic volumes, the stakeholder feedback noting how critical the Ohio connection is to the project, the cost to construct the entire project, and that there are no future phases of this project funded in *Kentucky's FY 2020 – FY 2026 Highway Plan* or included in the *Ohio-Kentucky-Indiana Regional Council of Governments (OKI) 2040 Regional Transportation Plan* – any future development of this project could shift to the priority sections of independent utility. **Table ES-2** summarizes the cost estimate for the level two alternatives as well as the projected traffic and cost for the segment of the corridor with the highest traffic volume.

By utilizing the strategy of usable construction sections, this project could be built over time while improving east-west connectivity where traffic volumes warrant the improvement without the Ohio portion of the CEB. Should economic growth occur, the timeframe for completion of the entire project could be accelerated, but in the meantime, enough traffic will utilize these priority sections to provide independent utility.

Table ES-2: Priority Section Cost Estimates

Alternative	Total Project Cost (YOE)	Total Project Cost (\$2019)	Priority Section with Highest Traffic Volume	Priority Section 2040 VPD (No CEB)	Priority Section Cost Estimate (\$2019)
A	\$1.5 billion	\$1.2 billion	I-75 to US 27	19,300	\$599 million
B1	\$2.1 billion	\$1.7 billion	I-75 to US 27	12,400	\$793 million
D1	\$2.4 billion	\$2.0 billion	I-71 to I-75	8,700	\$1.1 billion
D2	\$2.5 billion	\$2.1 billion	I-75 to US 27	11,800	\$791 million

Figure ES-2 through **Figure ES-4** summarize the projected traffic volumes for all level two alternatives.

Seeing the effect the Ohio connection has on the projected traffic volumes, future phases of the project should also consider a two-lane initial/four-lane ultimate typical section. The initial two-lane roadway would provide one direction of travel for the ultimate four-lane freeway facility.

Even if the initial two-lane typical section is considered, it would be prudent to purchase right-of-way and relocate utilities needed to accommodate a future four-lane ultimate typical section in case large industries locate along the new connector and/or ODOT advances the Ohio portion of the CEB. For that reason, it is assumed this approach would not reduce the right-of-way or utility cost estimates. However, the two-lane initial typical section is estimated to reduce the initial construction cost estimate by approximately 35 percent, saving KYTC millions of dollars.

NEXT STEPS

If a build alternative or priority section advances for future consideration, the next step would be Preliminary Engineering and Environmental Analysis. Further funding will be necessary to advance an improvement concept to the design phase. No future phases of this project were funded in *Kentucky's FY 2020 – FY 2026 Highway Plan*.

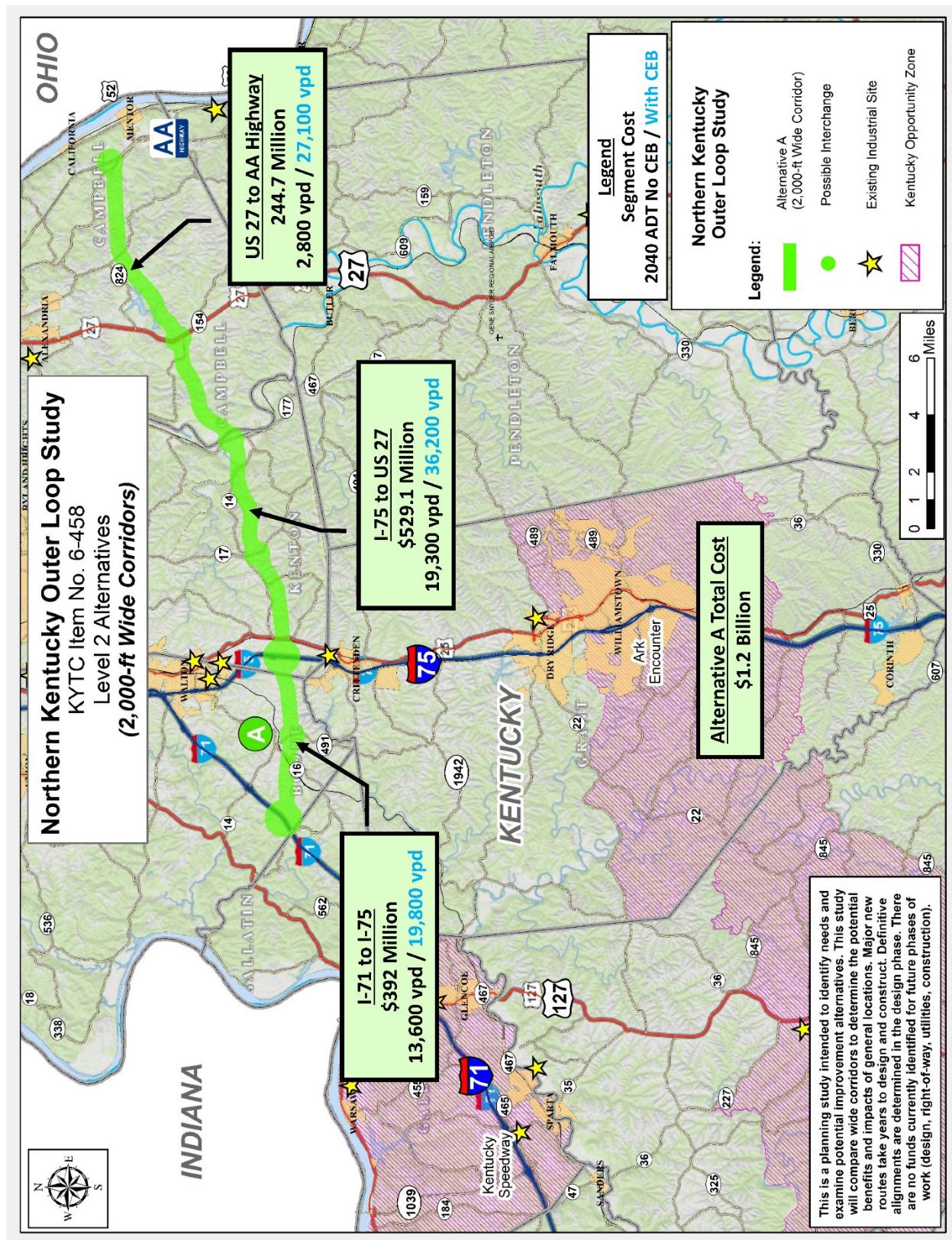


Figure ES-2: Alternative 2 Cost Estimate (\$2019) and Projected Traffic Volumes (Year 2040)

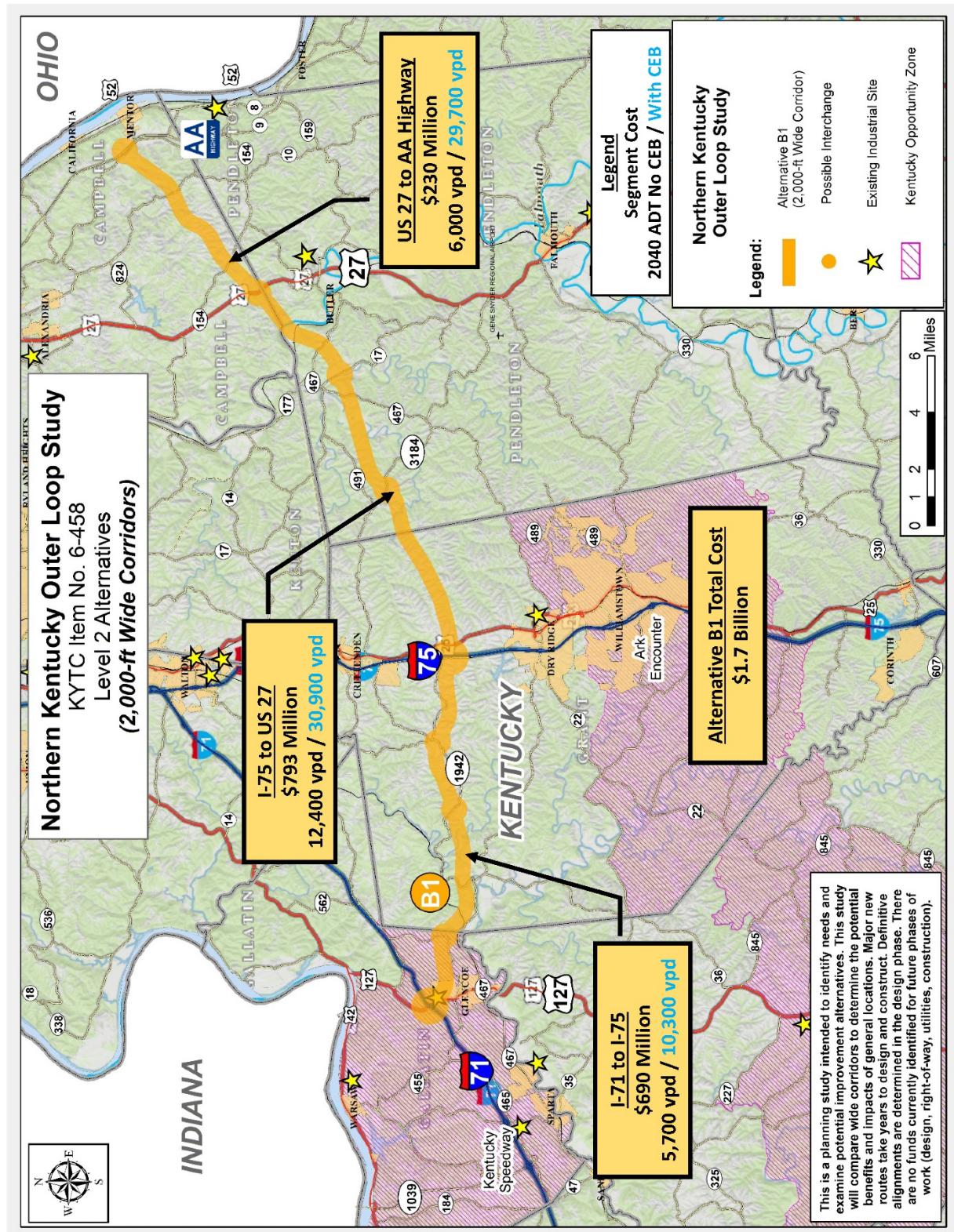


Figure ES-3: Alternative B1 Cost Estimate (\$2019) and Projected Traffic Volumes (Year 2040)

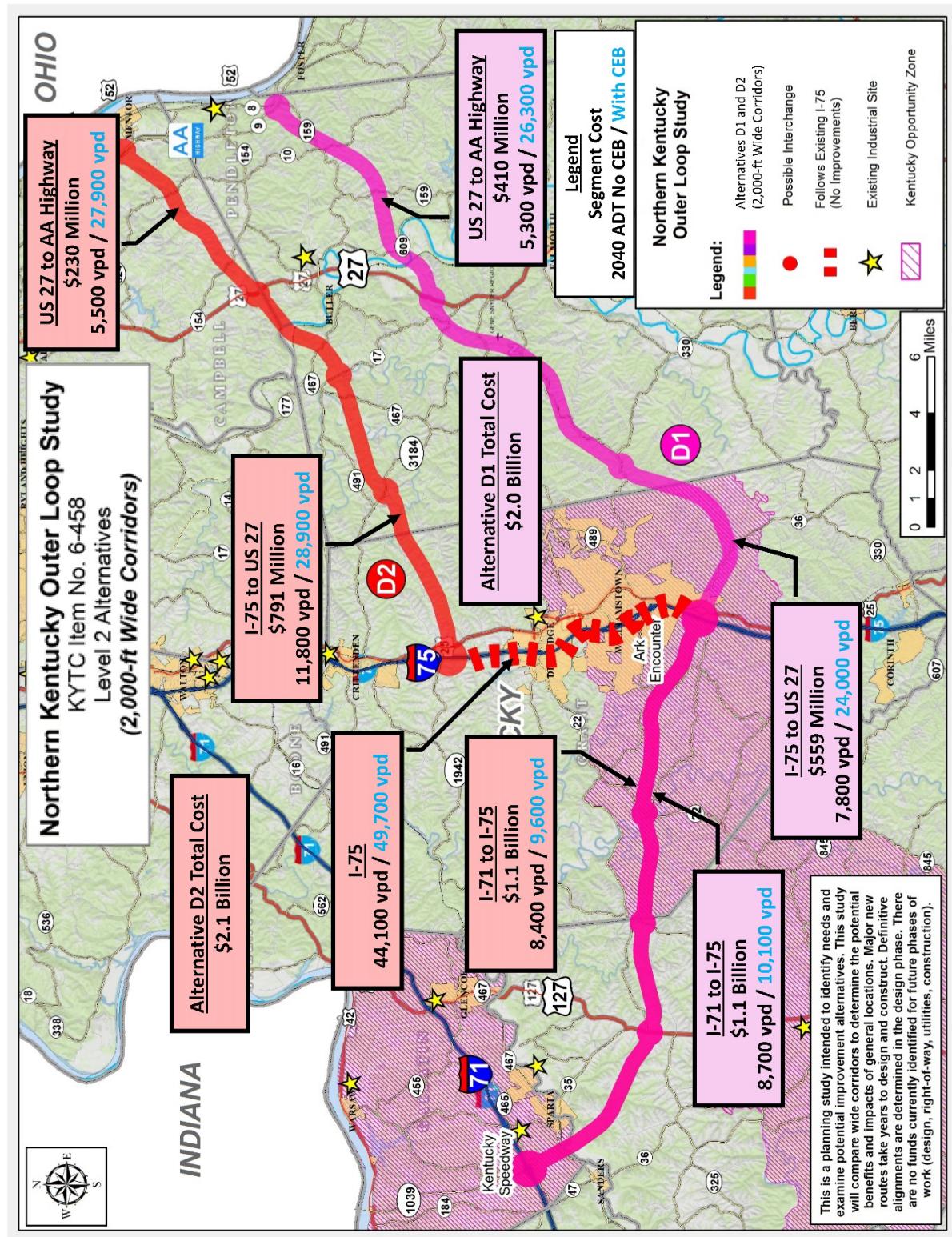


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1.0. Introduction

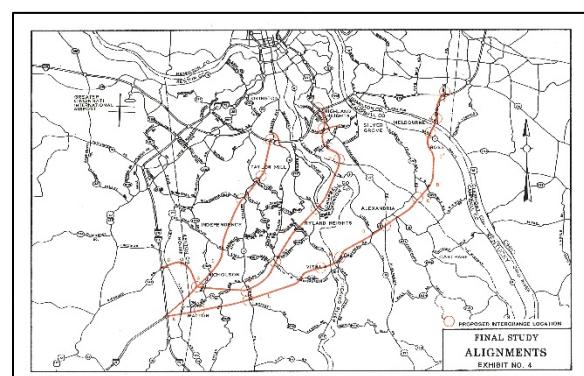
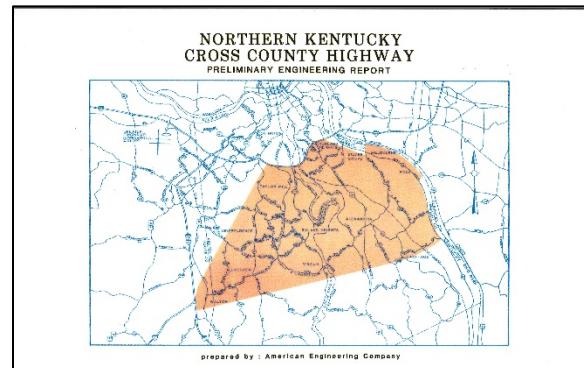
Northern Kentucky is one of the fastest growing regions in the Commonwealth². Significant commercial and residential development is occurring in Boone, Kenton, and Campbell Counties. The region is served with excellent interstate access through I-71, I-75, I-471, and I-275. Major north-south routes such as US 127, US 27, and the AA Highway (KY 9) are also present. Missing, though, is adequate east-west access south of I-275. This hampers future economic growth outside of the three counties previously mentioned. In fact, Gallatin, Grant, and Pendleton Counties are experiencing little or no growth, but with low land prices and proximity to the metropolitan Cincinnati area, future growth is inevitable. Improved access between the AA Highway and the I-71 and I-75 corridors is essential to this growth.

The Northern Kentucky Outer Loop Study (KYTC Item No. 6-458) was initiated by the Kentucky Transportation Cabinet (KYTC) to examine new conceptual transportation connections in the southern portions of Boone, Kenton, and Campbell Counties and northern portions of Gallatin, Owen, Grant, Pendleton, and Bracken Counties. Such connections would serve the growing need for east-west travel within the region, connecting communities to resources along the I-71 and I-75 corridors and providing local opportunities for growth within the counties served.

1.1. Project History

The need for an improved east-west transportation connector in Northern Kentucky is certainly not a new idea. For more than 30 years, previous studies have examined this need and provided recommendations for where such a new connector roadway could be feasibly located.

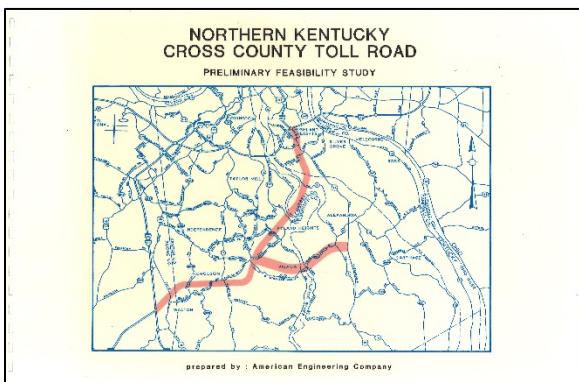
In 1987, KYTC completed a preliminary study for the Northern Kentucky Cross County Highway.³ This study explored options for a new freeway facility to “alleviate congestion on the existing interstate (I-71/I-75) corridor in Northern Kentucky”. The “cross county highway” (also referred to in the report as the “outer belt”) was thought necessary to help address a lack of capacity on the existing interstate system (I-75 was a four-lane facility south of I-71 at that time) and the traffic delays that resulted from a combination of traffic congestion and crashes. The then-proposed facility was touted as an opportunity to stimulate and enhance economic development within the entire region. The study focused on examining new corridors that would each begin at the I-71/I-75 merger in southern Boone County and connect to I-275 at KY 16 (Alternative A) or US 27/I-471 (Alternative B). One concept (Alternative C) was examined that extended across the Ohio River into Hamilton County, Ohio, terminating at I-275 at a new interchange near 8 Mile Road. Costs for these



² Northern Kentucky Chamber of Commerce

³ Preliminary Engineering Report for the Northern Kentucky Cross County Highway, KYTC (in partnership with American Engineering Company), 1987.

concepts ranged from \$115 million to \$230 million (in 1987 dollars). Alternative C was recommended as the preferred alternative, but subsequent studies did not advance this alternative for further analysis.



Given the high cost of the proposed Cross County Highway, in 1989 KYTC completed a preliminary feasibility study to implement the project as a toll road.⁴ The “Cross County Toll Road” was advanced to further study implementing Alternative B from the previous study. In addition to providing a 17-mile-long interstate connector between the existing I-71/I-75 interchange and the US 27/I-471 interchange, a 7-mile, two-lane roadway spur was included to provide a connection to US 27 south of Alexandria. The total cost for the new interstate connector and roadway spur was estimated at \$274 million (in estimated

1992 dollars to account for the then-proposed beginning of construction). The study suggested that tolling would result in a Capital Recovery Factor (ratio of the net annual revenues to the capital plus maintenance costs) of 0.5 over a 30-year period, suggesting that tolls could pay for approximately half the project cost.

In 2003, KYTC completed a Conceptual Feasibility Study for the Northern Kentucky Outer Loop (I-74).⁵ The study examined a corridor between the Markland Dam on the Ohio River near Warsaw in Gallatin County and the then-new cable-stayed bridge over the Ohio River west of Maysville in Mason County, shown on **Figure 1**. The following factors were considered part of the Purpose and Need for the conceptual project:

- To open new economic development and job growth opportunities for this depressed agrarian region via improved accessibility and reduced travel times.
- To provide a new alternate route that will accommodate both large trucks and commercial vehicles, mitigate geometric deficiencies of current facilities, and improve safety.
- To provide a high-level east-west roadway that would facilitate better access to: community services, existing high-level north-south roadways, and communities.

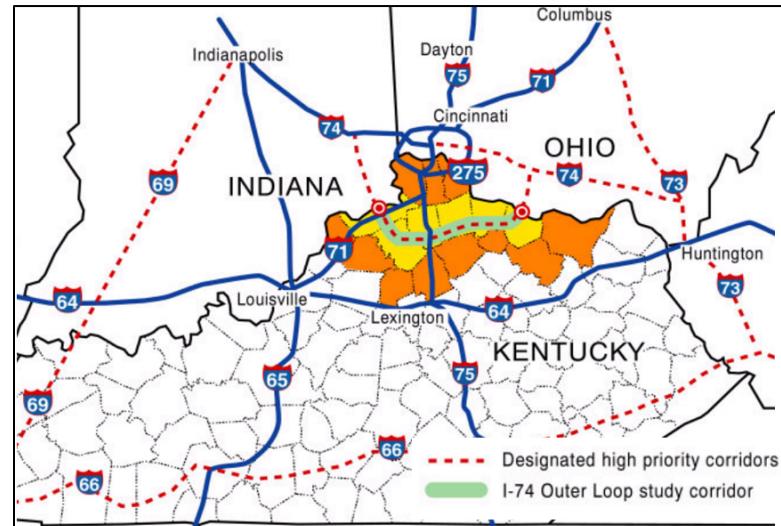


Figure 1. Conceptual I-74 Outer Loop for Northern Kentucky

⁴ *Feasibility Study for the Northern Kentucky Cross County Toll Road*, KYTC (in partnership with American Engineering Company), 1989.

⁵ *Conceptual Feasibility of Northern Kentucky Outer Loop (I-74)*, KYTC (in partnership with American Consulting Engineers, PLC), 2003.

The 80-mile corridor (Kentucky portion) would require support from the Indiana Department of Transportation (INDOT) and the Ohio Department of Transportation (ODOT) to ultimately provide a complete southern loop around Cincinnati. The Kentucky portion of this loop (80 miles in length) was estimated to cost approximately \$1.7 billion (in year 2000 dollars). The study determined the project costs "greatly outnumbered the road-user benefits" and without the supporting segments connecting to existing I-74 in Indiana and Ohio, the benefits were even less. However, the project was forecast to provide for economic development by creating 2,900 job years of work per annum resulting in \$150 million in earned wages per year.

An extensive public involvement program was undertaken to gage public sentiment towards the proposed Outer Loop. Using two basic means of soliciting public opinion, questionnaires and telephone surveys, the study found relatively strong regional support for the project. Of 200 returned questionnaires, 86 percent gave the Outer Loop a beneficial rating. From the 400 telephone surveys performed, 42 percent strongly favored and 40 percent somewhat favored the proposed highway.

In 2017, KYTC completed the *Brent Spence Strategic Corridor Study* (KYTC Item No. 6-431) to summarize traffic, cost, and impacts for future potential projects that will reduce congestion and increase mobility in Northern Kentucky.⁶ One strategy examined to achieve those goals was the development and evaluation of Brent Spence Bridge (BSB) bypass alternatives that would provide a new Ohio River crossing and divert traffic away from the congested I-71/I-75 corridor. Five bypass concepts were examined, shown in **Figure 2.** Concept 1, proposed by the Citizens for the Cincy Eastern Bypass, is approximately 75 miles long and extends from I-71 in Boone County, Kentucky to I-75 just south of Lebanon, Ohio. The study concluded that by 2040, Concept 1 is estimated to carry 25,000 to 46,000 vehicles per day (VPD), with approximately 36,000 VPD at the new Ohio River Crossing. The bypass would enhance economic development and cross-river capacity. While it does not defer the need for the *Brent Spence Bridge*

Replacement/ Rehabilitation Project (KYTC Item No. 6-17)⁷, it was determined that the Brent Spence Bridge bypass alternatives warranted further exploration as a project of independent utility.

Concept 1 was estimated to cost \$3.6 Billion in current year (2017) dollars and \$5.3 Billion in Year of Expenditure (YOE) dollars, assuming construction beginning in 2029 and the project being open to traffic

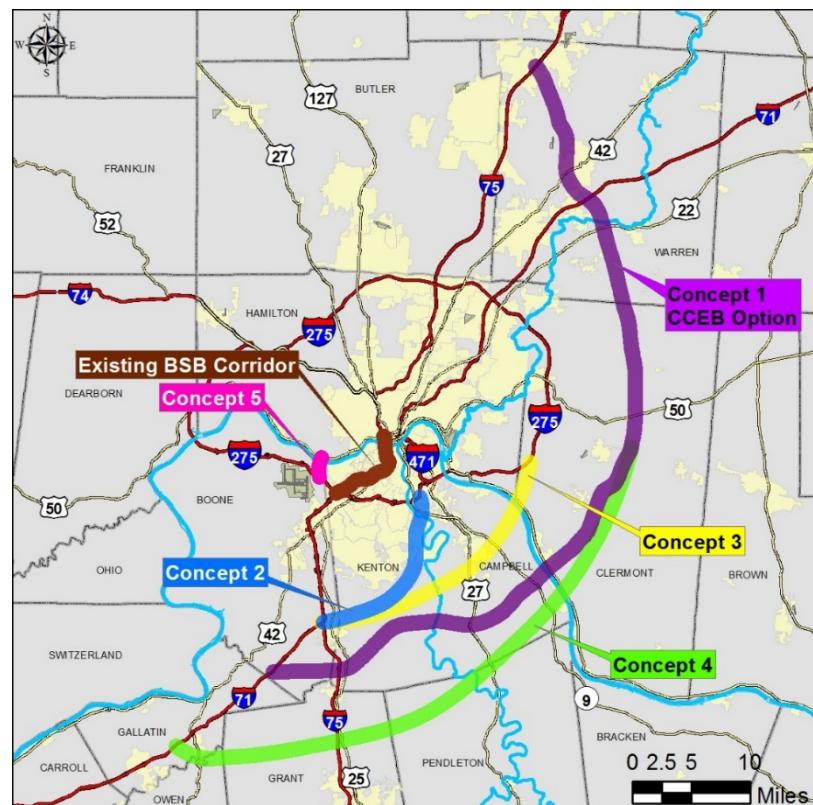


Figure 2. Brent Spence Strategic Corridor Study Bypass Concepts

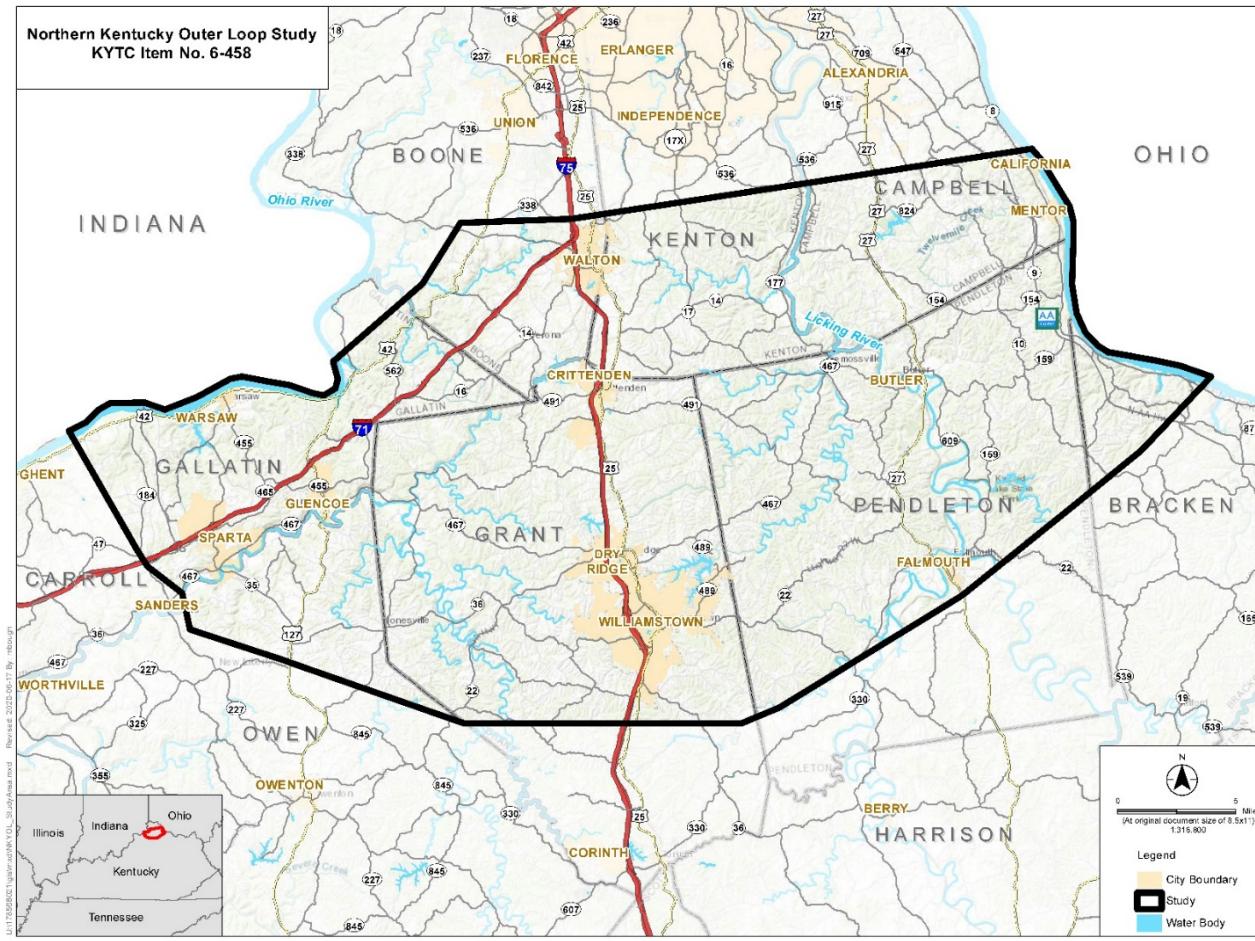
⁶ [https://transportation.ky.gov/Planning/Planning Studies and Reports/20171213 Final Report.pdf](https://transportation.ky.gov/Planning/Planning%20Studies%20and%20Reports/20171213_Final%20Report.pdf)

⁷ <http://www.brentspencebridgecorridor.com/documents/>

in 2032. Kentucky's share would be about \$2.2 Billion in YOE dollars. Because of the high cost, this Northern Kentucky Outer Loop Study was conducted to look at the benefits of building a Brent Spence Bridge bypass alternative in phases, starting with the Kentucky portions.

1.2. Study Area

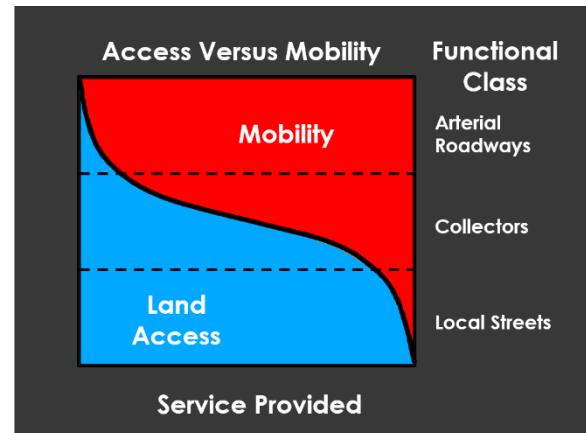
This study examined potential alternatives for new transportation connections in the southern portions of Boone, Kenton, and Campbell Counties, as well as the northern portions of Gallatin, Owen, Grant, Pendleton, and Bracken counties, specifically potential east-west concepts that connect I-71 and the AA Highway (KY 9). The study area is shown in **Figure 3**.



1.3. Existing Transportation Network

Functional classification is the grouping of roads, streets, and highways into integrated systems ranked by the level of mobility for through movements and access to adjoining land. This grouping acknowledges that roads serve multiple functions and provides a basis for comparing roads fairly. Functional classification can be used for, but is not limited to, the following purposes:

- Provide a framework for highways serving mobility and connecting regions and cities within a state.
- Provide a basis for assigning jurisdictional responsibility according to the roadway's importance.
- Provide a basis for development of minimum design standards according to function.
- Provide a basis for evaluating present and future needs.
- Provide a basis for allocation of limited financial resources.



Roadways serve competing needs. On one end of the spectrum, roadways provide access to adjacent land. Generally, local roads and streets provide the highest level of land accessibility. On the other end of the spectrum, arterial roadways provide a higher level of mobility – the ability to efficiently travel longer distances. Interstates and freeways are at the highest end of the mobility spectrum as they provide only limited access to adjacent roadways via interchanges and do not provide direct parcel access. Collector roadways tend to fall somewhere in between, providing balance between land access and mobility. Poor traffic operations and high crash rates are often experienced when a roadway that is not designed for a high level of mobility or a high level of access is forced to accommodate service beyond its limits.

Figure 4 shows the functional classification of major roadways within the study area. There are two interstates providing regional north-south connectivity in the study area: I-75 stretches across Kentucky from Tennessee to Ohio and I-71 connects Louisville to Walton and the northern Kentucky area. Twelve miles north of the I-71/I-75 interchange, I-275 provides an east-west connection near the Ohio River. Missing, though, is adequate east-west access south of I-275.

Other important roadways, which are functionally classified as arterials, include the following:

- US 27 – This route provides a north-south connection between Lexington and Newport adjacent to I-75 in the middle of the study area.
- US 127 – This route provides a north-south connection between Frankfort and I-71 adjacent to I-75 in the western portion of the study area.
- KY 9 (AA Highway) – The only principal arterial within the study area, this route provides a north-south connection in the eastern portion of the study area. It stretches from Grayson in the south to Newport near the Ohio River.

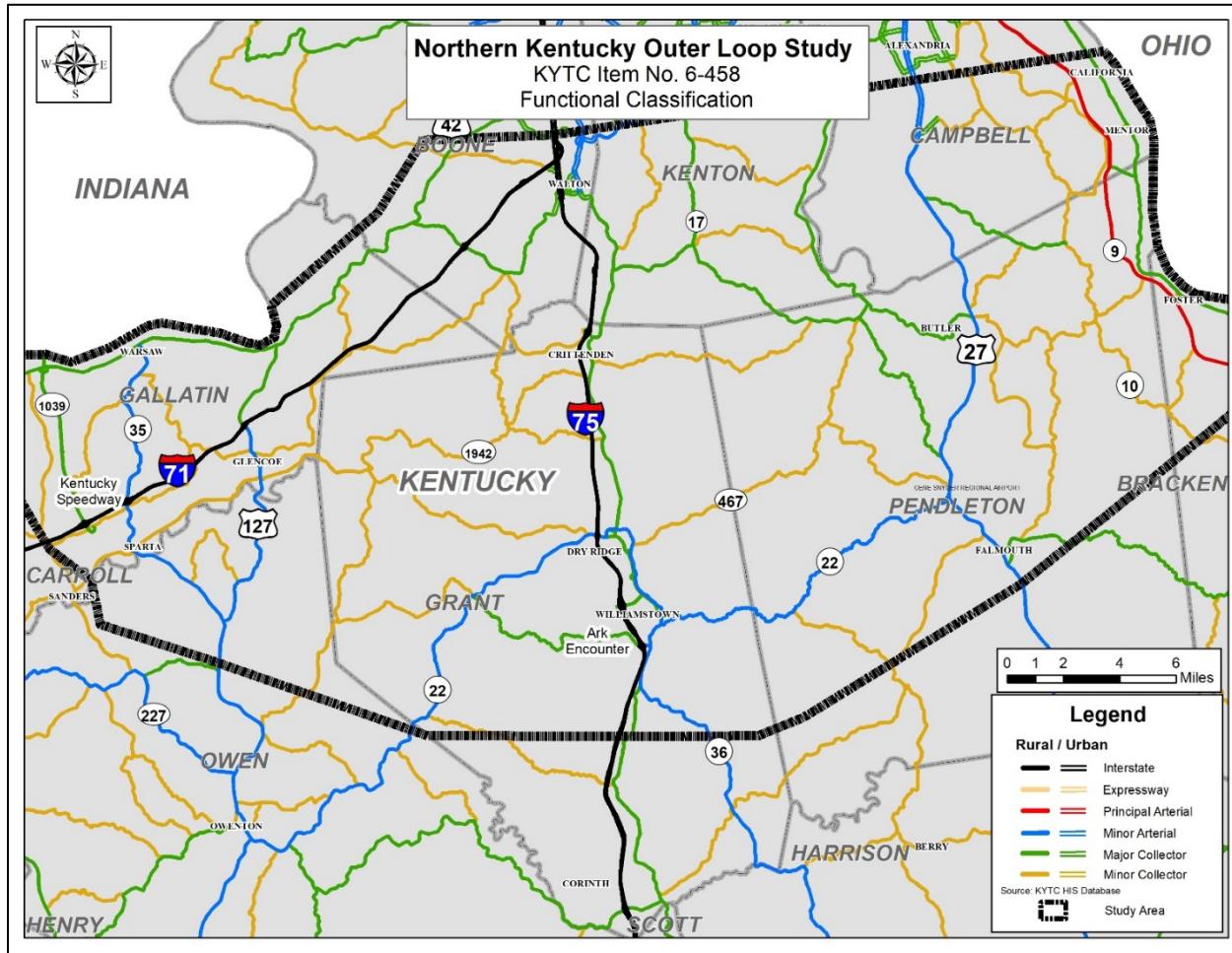


Figure 4. Functional Classification of Study Area Roadways

- KY 22 – This route provides an east-west connection between Owenton and US 27 in the center of the study area.
 - KY 35 – This route provides a north-south connection between I-71 and the Ohio River in the western portion of the study area.
 - KY 36 – This route provides a north-south connection between Cynthiana and Williamstown in the southern portion of the study area.
 - KY 227 – This route provides an east-west connection between Carrollton and US 127 in the western portion of the study area.



KY 22

Note that each of the arterial roadways listed above, with the exception of KY 22 (a minor arterial) and to a lesser extent KY 227, primarily serve north-south travel through the study area. Hence, long-distance east-west trips are not adequately served through the area.

In accordance with the Surface Transportation Assistance Act of 1982 (STAA), Kentucky has established a network of highways on which commercial vehicles with increased dimensions may operate. These "STAA" vehicles include semi-tractor trailers with 53-foot-long trailers and single-unit trucks with a total length of at least 45 feet. These designated truck routes are shown on **Figure 5**. There are no east-west routes in the study area designated as Federal or State truck routes.

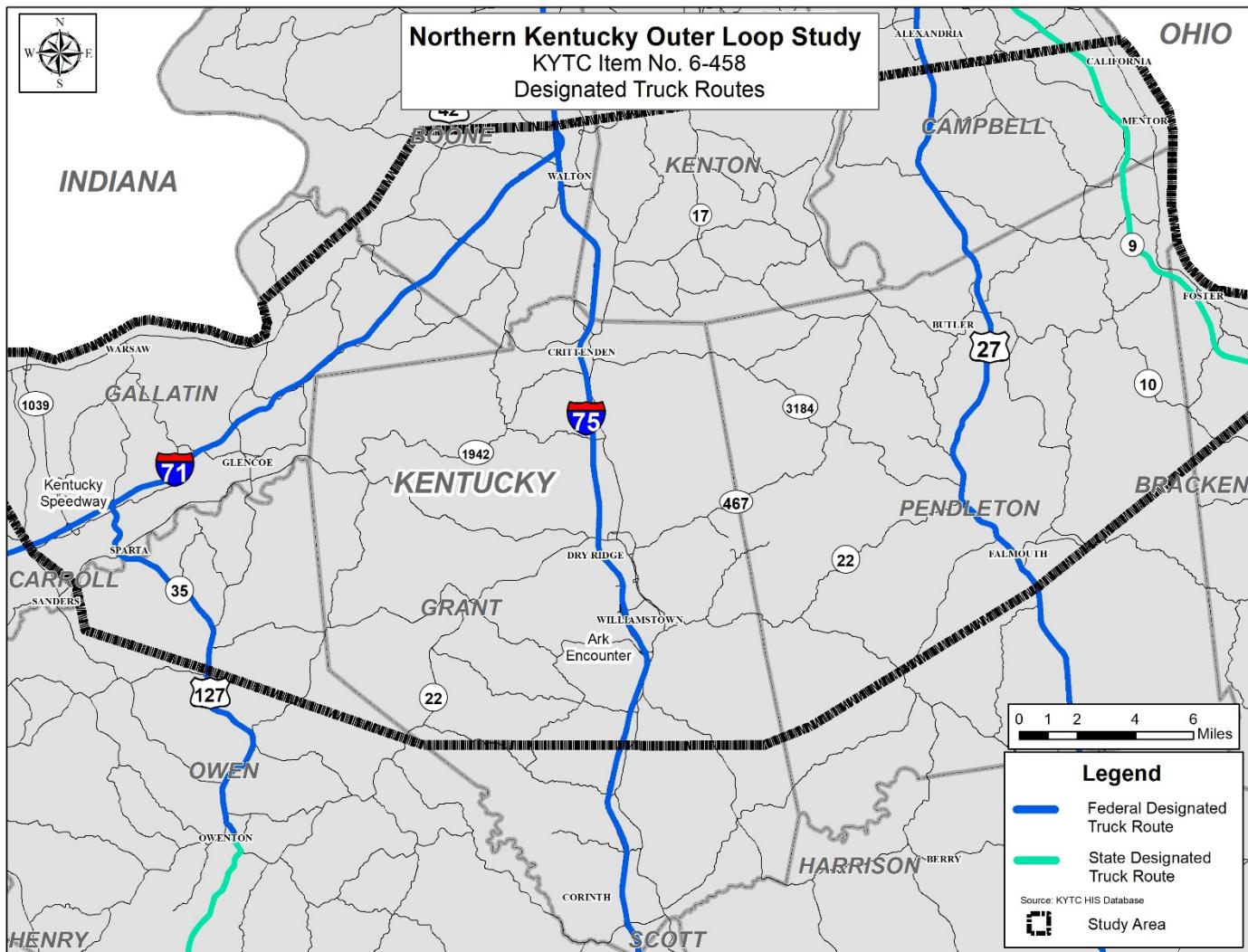


Figure 5. Designated Truck Routes

Existing Roadway Geometrics

The current number of lanes and estimated lane widths along study area roadways are shown on **Figure 6**. Current KYTC design guidelines recommend a minimum of 11-foot-wide lanes on rural arterials and rural collectors with a 55-mph design speed⁸. Several study area roadways, including all east-west routes, have less than 11-foot-wide lanes. In addition, most of the east-west routes have shoulder

⁸ <https://transportation.ky.gov/Organizational-Resources/Policy%20Manuals%20Library/Highway%20Design.pdf>

widths less than four feet wide, while the recommended usable shoulder width for such roadways is five to eight feet.

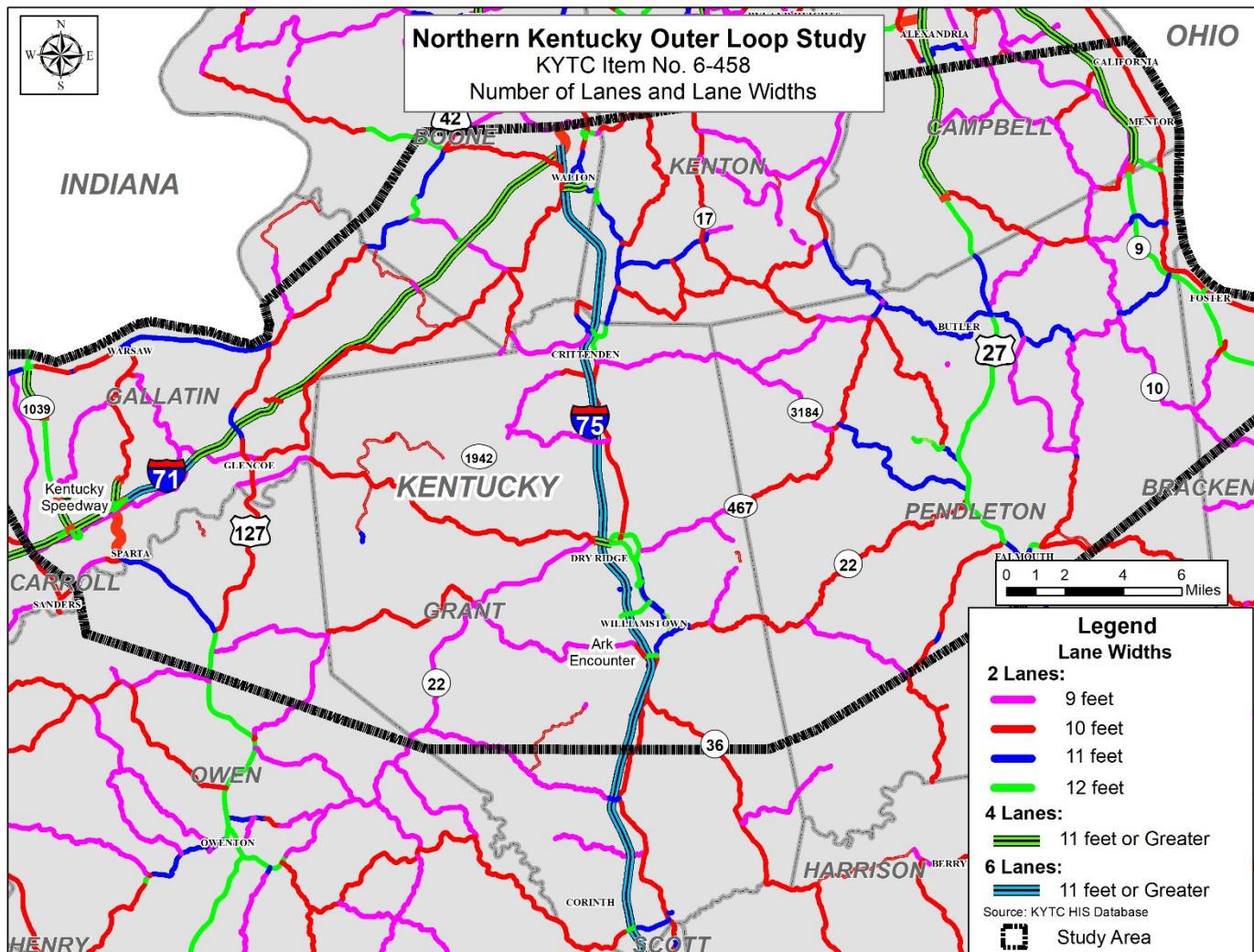


Figure 6. Number of Lanes and Lane Width

Existing Traffic Volumes

The most current average daily traffic (ADT) volumes from KYTC's traffic count stations are shown on Figure 7. I-75 carries the heaviest traffic volumes, ranging from 42,000 VPD to the south to 107,000 VPD north of the I-71 interchange. I-71 also carries a significant traffic volume ranging from 33,500 to 39,500 VPD. Other heavily traversed north-south arterials such as US 27 carry up to 19,000 VPD in the northern portion of the study area. The east-west route with the highest ADT is KY 22, with 2,700 VPD near I-75.

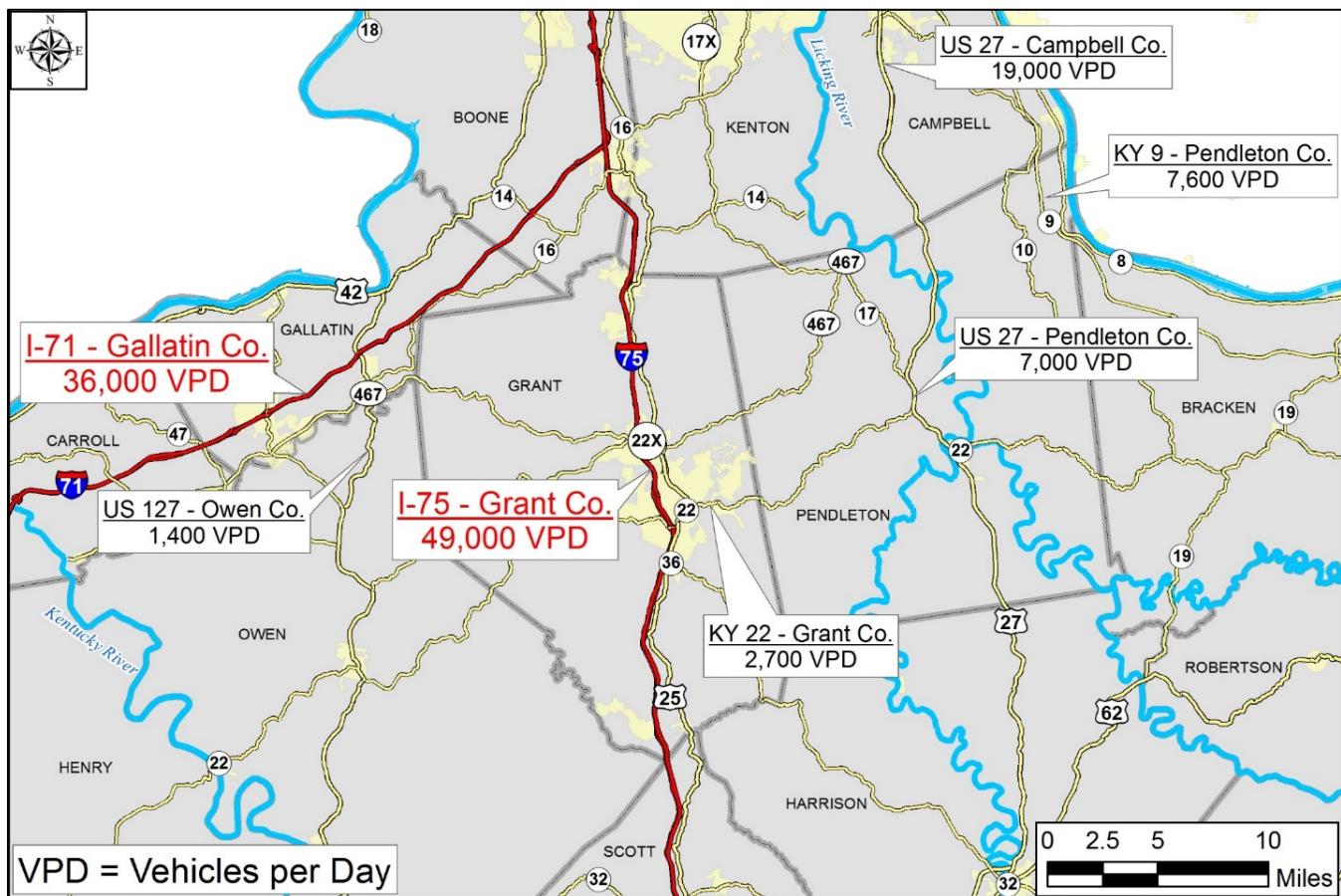


Figure 7. Average Daily Traffic (ADT) Volumes from KYTC's Traffic Count Stations

Safety Analysis

Crash data were collected along existing roadways within the study area for a three-year period between January 1, 2016 and December 31, 2018. A total of 12,048 crashes were reported within the study area, as shown in **Figure 8**.

Crashes were geospatially referenced and compared to statewide data according to methodology defined by the Kentucky Transportation Center in *Analysis of Traffic Crash Data in Kentucky (2014-2018)* to identify locations experiencing above-average crash rates. For each roadway segment, analysts examined the number of crashes, traffic volume, rural/urban, number of lanes, and segment length to determine the critical rate factor (CRF). The CRF is one measure of the safety of a road, expressed as a ratio of the crash rate at the location compared to the critical crash rate for similar roadways throughout the state. A CRF of 1.0 or greater may indicate that crashes could be occurring due to circumstances not attributed to random occurrence. There are 280 segment locations with CRF values greater than 1.0, including many of the east-west routes as shown in **Figure 9**. A summary of the high crash segments is provided in **Appendix A**.

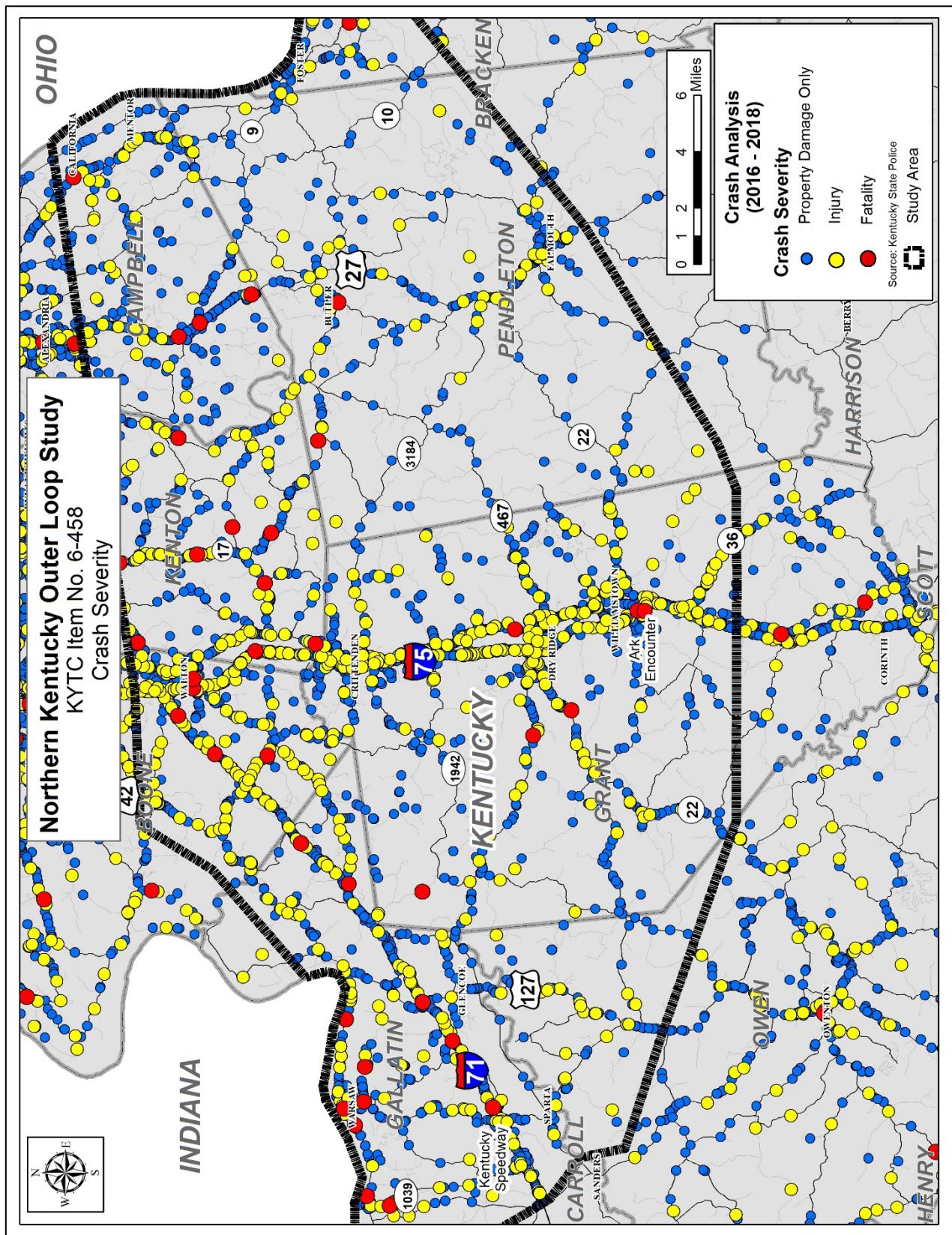


Figure 8. Crash History

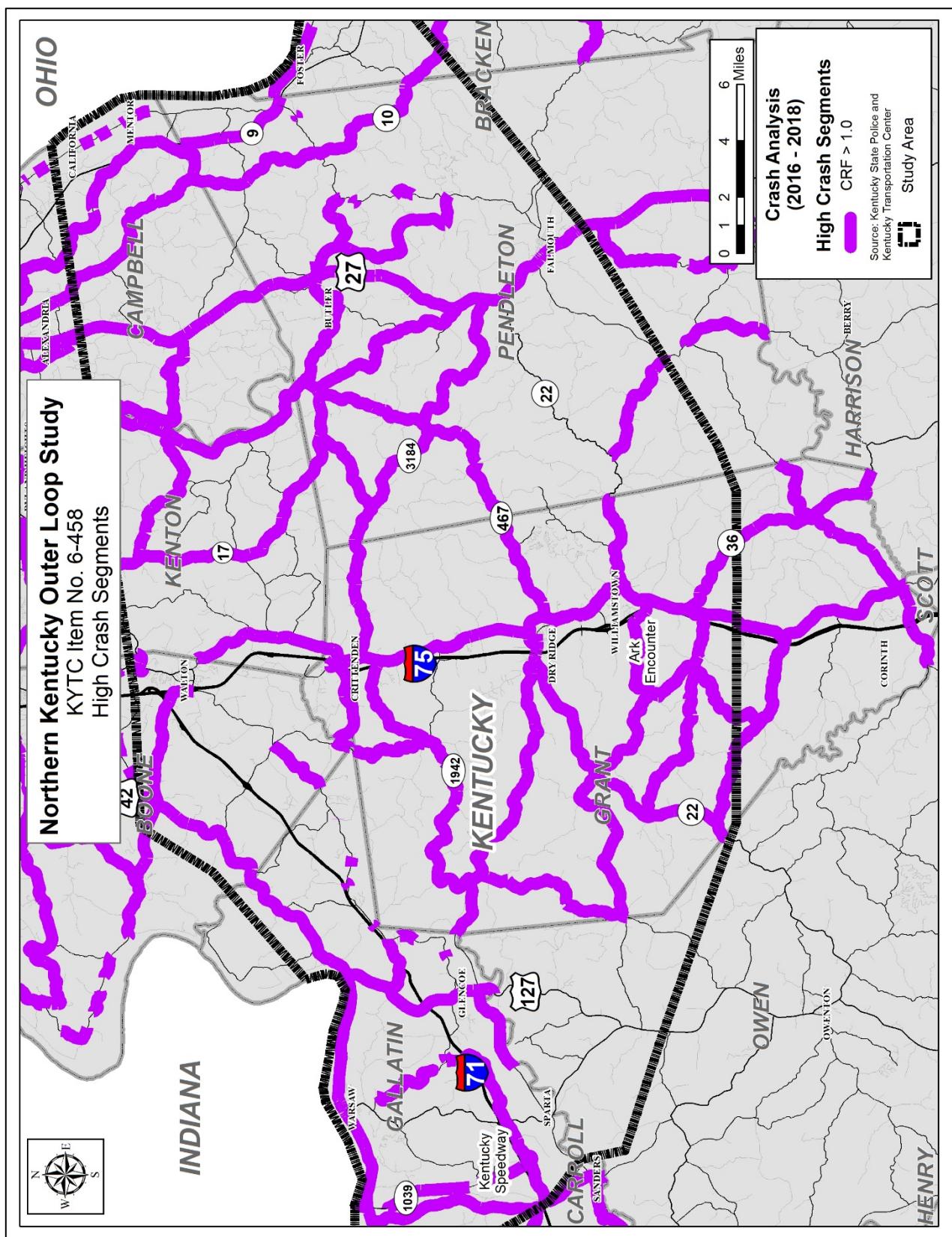


Figure 9. High Crash Roadway Segments

2.0. Stakeholder Meeting No. 1

Stakeholder engagement was a critical element of the study. Given the extremely large study area, conventional, open house public meetings would be difficult to host in a manner that reaches the entirety of the intended audience. Instead, online engagement via a project website (<https://nkyouterloopstudy.org/>) was supplemented with smaller, in-person meetings with a diverse array of stakeholders, including local and state elected officials, emergency responders, and members of the business community. This stakeholder group helped serve as a surrogate for the public at large, providing an opportunity for the exchange of ideas and solicitation of input at key milestones throughout the study.

For the first round of in-person engagement, two stakeholder meetings were held at the Grant County Courthouse in Williamstown, Kentucky on December 5, 2018 and December 12, 2018. The same information, primarily focusing on study goals and existing conditions, was presented at both meetings. The December 5th meeting had 25 attendees and the December 12th meeting had 33 attendees.

A news release was also distributed after the first round of stakeholder meetings to regional news outlets and garnered news coverage, which generated website traffic and feedback through the project email account. A complete summary of the study's public outreach and the feedback received is included in **Appendix B**.

2.1. Stakeholder Opinion on Potential Project Goals

At each meeting, attendees participated in a facilitated group exercise to provide stakeholder views of project goals and perceived benefits, both at the local (county) level and at the regional level. Below are the three basic themes that were voiced related to the conceptual development of a new east-west transportation corridor in Northern Kentucky, and the variety of points made under each.

1. Economic Development
 - Increased accessibility for tourism and regional destinations
 - Improved freight movement
 - New / improved access for developable land
 - Expands available labor pool / workforce for growing employment bases in Boone, Kenton, and Campbell counties
 - Increases property values and tax base
2. Improved Safety
 - Reduced traffic on existing routes with higher-than-average crash rates
 - Reduced congestion on major arterials (including trucks), resulting in safer travel options
 - Safer connections to existing routes (interchanges)
 - Improved emergency response
3. Community Benefits
 - Provides the Kentucky portion of an ultimate Cincinnati Eastern Bypass, increasing connectivity to southern Ohio
 - Reduced congestion, especially on the I-75 corridor
 - Enhanced regional mobility
 - Enhanced school access / improved connectivity between schools

2.2. Stakeholder Opinion on Potential Level One Alternatives

At the first stakeholder meetings, attendees were shown early thoughts on potential 2,000-foot-wide east-west concepts that connect I-71 and the AA Highway to help solicit feedback. The following comments were received:

- Kenton County preferred the corridors south of their county. KY 536 serves as an east-west connection in central Kenton County and multiple projects are underway to improve that corridor. There is a strong desire to maintain the agricultural landscape in the southern parts of the county.
- Grant County and Campbell County suggested a preference for the corridor which starts at I-71, approximately five miles north of the Owenton US 127 interchange (exit 62), crosses I-75 one-and-a-half miles south of the Crittenden KY 491 interchange (exit 166) and ends at the AA Highway near milepoint 2.6 in Campbell County.
- Ohio representatives from Clermont County expressed some concern over the proposed connection at the AA Highway and whether an eventual Ohio River Crossing could provide access to SR 32 and avoid the East Fork State Park.

3.0. Draft Purpose & Need Statement and Project Goals

The Purpose and Need Statement describes what the project should accomplish. It forms the basis for the decision-making process: each alternative must meet the purpose and address the identified needs to be considered a viable solution. The following draft purpose and need statement and project goals were developed based on the existing conditions analysis from **Section 1.3** and the feedback received at the first Stakeholder Meetings described in **Section 2**.

The purpose of the Northern Kentucky Outer Loop project is to stimulate economic opportunities through regional mobility by providing a safer and more efficient east-west corridor between I-71 and the AA Highway (KY 9).

Based on input from the first round of Stakeholder Meetings, the Project Team drafted the following Project Goals:

- Enhance regional mobility
- Improve safety
- Provide a cost-effective, constructible solution
- Provide for economic development opportunities
- Provide the Kentucky portion of a future Cincinnati Eastern Bypass
- Remain sensitive to local resources

4.0. Evaluation of Level One Alternatives

The costs, impacts, and benefits of a potential new east-west connection between I-71 and the AA Highway were evaluated to determine whether such a concept merits advancement. To facilitate the evaluation, a two-tier screening process was developed. **Figure 10** illustrates the steps in development and evaluation of the level one alternatives.

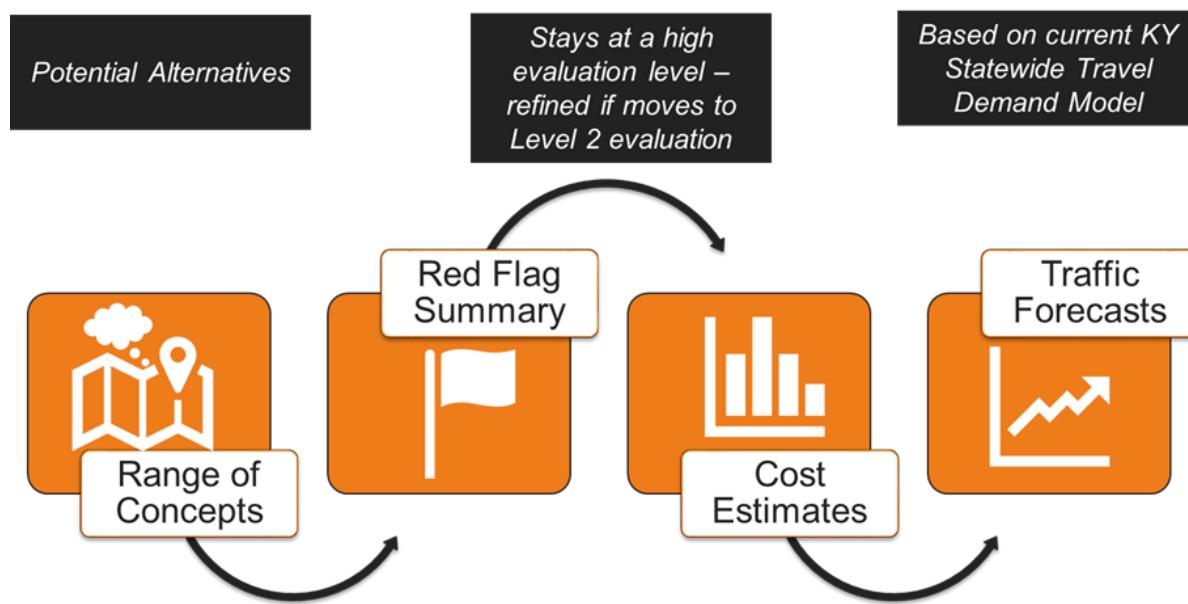


Figure 10. Level One Evaluation Process

4.1. Level One Alternatives

Preliminary corridor concepts were developed and presented to project stakeholders. The preliminary “level one” concepts included six 2,000-foot-wide corridor bands within which a freeway-type facility could be constructed. These concepts were developed based on a multi-faceted approach that included considerations such as satisfying interchange spacing requirements, avoidance of known environmental resources, avoidance of heavily developed areas, and identification of more desirable locations to cross major streams and the Licking River (i.e. locations with narrower floodplain widths.) For comparison purposes, each concept is assumed to be a high-speed, four-lane divided facility with interchanges at interstates (fully-directional system interchanges) and major state routes (service interchanges) intersecting the path. The eastern terminus options along the AA Highway were selected to allow a feasible future extension into Ohio.

In response to feedback obtained from the stakeholders and the general public, seven alternatives (shown in **Figure 11** and described below) were ultimately identified for level one evaluation. Each corridor begins at one of three locations along I-71 and ends at one of three locations along the AA Highway. These corridors are described below.

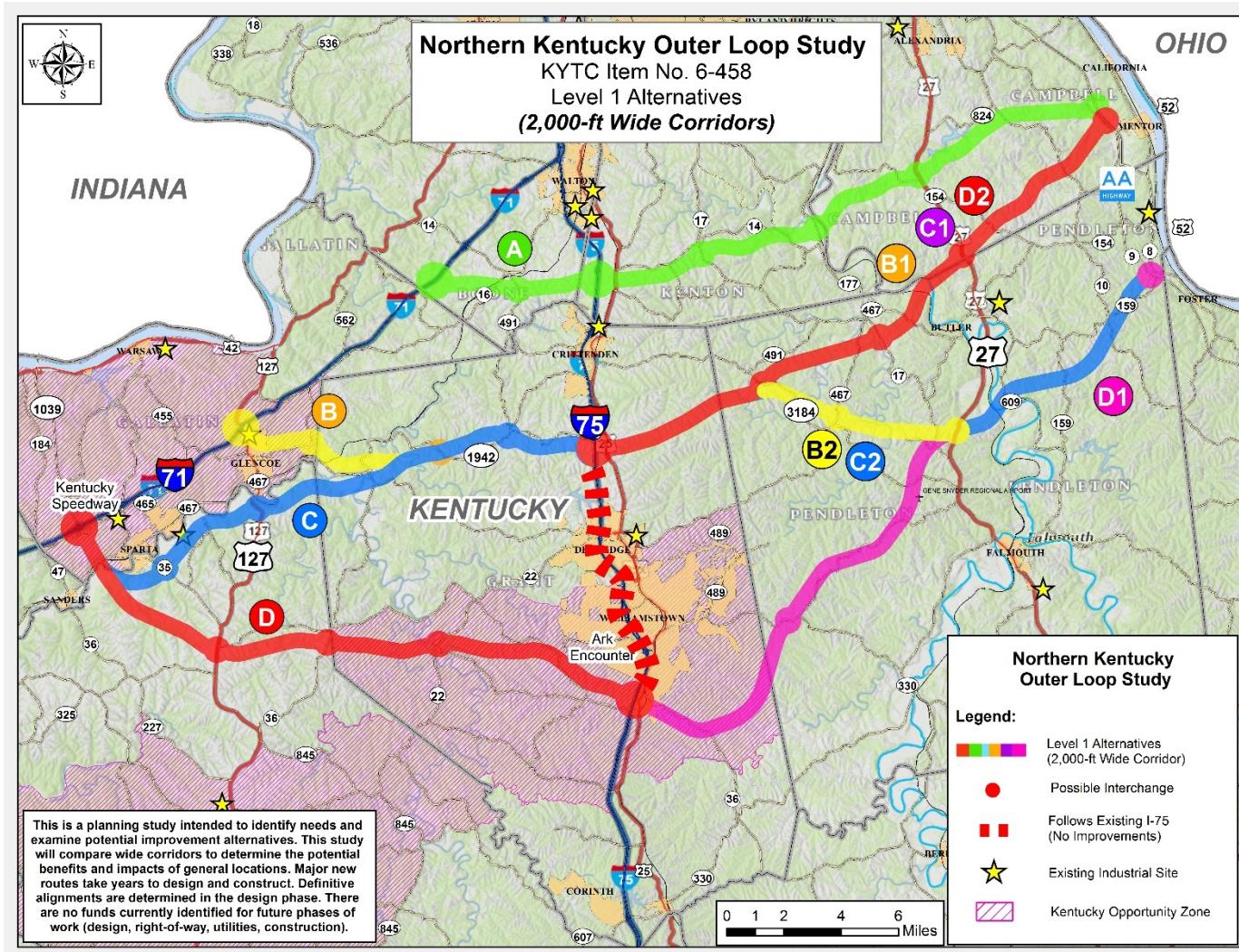


Figure 11. Level One Alternatives

Alternative A

- Starts at I-71, approximately two miles south of the existing Walton KY 14 interchange (exit 72), crosses I-75 two miles north of the Crittenden KY 491 interchange (exit 166) and parallels KY 14 before ending at the AA Highway in Campbell County near milepoint 2.6.
- Generally coincides with the Kentucky portion of the proposed Cincinnati Eastern Bypass.
- Approximately 25 miles in length.
- Two system interchanges would be required, at I-71 and I-75, with five service interchanges.

Alternative B1

- Starts at the Owenton US 127 interchange (exit 62), crosses I-75 3.2 miles north of the Dry Ridge KY 22 interchange (exit 159), and ends at the AA Highway in Campbell County between California and Mentor near milepoint 2.1.
- Approximately 36 miles in length.
- Two system interchanges would be required, at I-71 and I-75, with seven service interchanges.

Alternative B2

- Starts at the Owenton US 127 interchange (exit 62), crosses I-75 3.2 miles north of the Dry Ridge KY 22 interchange (exit 159), and ends at the AA Highway in Pendleton County near milepoint 0.6 (just west of the Bracken County line). The western half of Alternative B2 matches Alternative B1.
- Approximately 36 miles in length.
- Two system interchanges would be required, at I-71 and I-75, with six service interchanges.

Alternative C1

- Starts at I-71 at the existing Vevay (Indiana) KY 1039 interchange (exit 55), parallels KY 467 to I-75, crossing approximately 3.2 miles north of the Dry Ridge KY 22 interchange (exit 159), and ends at the AA Highway in Campbell County between California and Mentor near milepoint 2.1.
- Approximately 43 miles in length.
- Two system interchanges would be required, at I-71 and I-75, with eight service interchanges.

Alternative C2

- Starts at I-71 at the existing Vevay KY 1039 interchange (exit 55), parallels KY 467 to I-75, crossing approximately 3.2 miles north of the Dry Ridge KY 22 interchange (exit 159), and ends at the AA Highway in Pendleton County near milepoint 0.6 (just west of the Bracken County line). The western half of Alternative C2 matches Alternative C1.
- Approximately 43 miles in length.
- Two system interchanges would be required, at I-71 and I-75, with seven service interchanges.

Alternative D1

- Starts at I-71 at the existing Vevay KY 1039 interchange (exit 55), runs southeast to I-75 about two miles south of the Williamstown KY 36 interchange (exit 154), and ends at the AA Highway in Pendleton County near milepoint 0.6 (just west of the Bracken County line).
- Approximately 48 miles in length.
- Two system interchanges would be required, at I-71 and I-75, with six service interchanges.

Alternative D2

- Starts at I-71 at the existing Vevay KY 1039 interchange (exit 55) and runs southeast to I-75 about two miles south of the Williamstown KY 36 interchange (exit 154). From this point, Alternative D2 runs concurrent with existing I-75 through Williamstown to a point about 3.2 miles north of the Dry Ridge KY 22 interchange (exit 159) at which point it continues east on new alignment to the AA Highway in Campbell County between California and Mentor near milepoint 2.1. The western half of Alternative D2 matches D1 and the eastern half matches Alternative B1.

- Approximately 44 miles in length, excluding the nine-mile section that follows existing I-75.
- Three system interchanges would be required, one at I-71 and two at I-75, with approximately seven service interchanges.

4.2. Level One Environmental Inventory

A tiered screening process was used to assist the Project Team in narrowing the universe of alternatives that could be advanced for more detailed analyses. The level one screening identified environmental resources of significance, potential jurisdictional features, and other environmental areas of concern that should be considered during project development. Natural and human environment resources within the study area were identified from a literature/database review. The complete document is included in **Appendix C** with a side-by-side comparison of each alternative shown in **Section 4.6**.

A summary of the potential red flag issues includes the following:

Section 4(f) Resources includes federal, state, or locally owned parks open to the public; all wildlife/waterfowl refuges; and any historic resources meeting National Register of Historic Places (NRHP) eligibility criteria. Each of these sites are protected from transportation use by Section 4(f) of the Department of Transportation Act. It requires project impacts to these resources to be avoided, minimized, or mitigated if impacts cannot be avoided. While some Section 4(f) resources are small or lie along the outer edge of corridor, others are large and would be difficult to avoid. Specifically, Mullins Wildlife Management Area (WMA) in southwestern Kenton County and AJ Jolly Park in southern Campbell County cover roughly half the corridor width for Alternative A.

AJ Jolly Park is also protected as a **Section 6(f) resource**. Because Land and Water Conservation Fund grants were invested in the property, additional requirements dictate its treatment if right-of-way within the boundaries must be acquired.

Historic Resources are also protected by Section 106 of the National Historic Preservation Act. While no large historic districts or sites currently listed on the NRHP were identified within the 2,000-foot corridors during the level one analysis, investigations in level two reveal additional constraints. NRHP-eligible resources merit the same level of protection but were not evaluated in level one. The focus in level one was to examine already-listed resources.

Outstanding State Resources Waters (OSRW), associated with the Licking River and its tributaries, would likely be impacted by any of the level one alternatives. Numerous streams, floodplains, and wetlands exist throughout the study area as well.

Community Resources, including neighborhoods, businesses, low-income or minority “environmental justice” (EJ) populations, a school, churches, and a fire station, would likely be impacted by any of the level one alternatives. More detailed investigations as part of the level two analysis provide more information about potential impacts.

Threatened and Endangered Species Habitats for federally protected species in northern Kentucky counties cover a wide range of ecological settings. Forests, streams, and caves provide habitat for listed bats; healthy rivers and streams provide habitat for a variety of mussel species. Running Buffalo clover thrives in a variety of habitats potentially occurring within the corridors – cemeteries, floodplains, forests, fencerows, etc. Braun’s rock-cress prefers steep slopes with limestone outcrops. Extensive surveys and coordination with US Fish and Wildlife Service (USFWS) will be required to identify and resolve potential impacts associated with any build alternative.

Large **Agricultural Districts** exist along each level one alternative. Alternatives D1 and D2, through the southern section of the study area, would have the fewest impacts on agricultural districts. Future detailed assessments of soil type and land use, in coordination with the Natural Resource Conservation Service (NRCS), may identify the need for additional farmland mitigation measures.

US Environmental Protection Agency (USEPA)-monitored **hazardous material (HazMat) sites** shown range from National Pollutant Discharge Elimination System (NPDES) construction permits to registered facilities producing hazardous chemicals.

4.3. Geotechnical Overview

A geotechnical overview of the study area was completed based upon research of available published data and experience with highway design and construction within the region. The purpose of the overview was to provide a general summary of the bedrock, soil, and geomorphic features likely to be encountered in the study area and to identify geotechnical features that should be considered during project development. Potential red flag issues are summarized below, and the complete document is included in **Appendix D**.

The potential roadway corridors are located in the Outer Bluegrass physiographic region of Kentucky. The Outer Bluegrass is characterized by highly dissected topography including deeper valleys with few areas of flat land. Surface drainage is directed towards named and unnamed tributaries of the Licking River to the east of I-75, and to Eagle Creek located east of I-71 within the western portion of the alignments.

A portion of the Alternative B2 and C2 roadway corridors is near the Pendleton County Landfill (operated by Rumpke Waste and Recycling). As part of the siting requirements for a solid waste landfill, the minimum buffer zone would be 250 feet from any property line.

A review of the geologic mapping of the northern Kentucky study area where the roadway corridors are being considered indicates that there is a low potential for karst activity or new development of sinkhole occurrences.

Roadway construction within the Kope Formation and areas of steep terrain have been known to be prone to landslides and will need to be constructed with close compliance to the KYTC standard specifications for road construction. In general, landslide-prone areas are mapped in southern Kenton County and throughout Campbell County, but mostly near the Ohio River. Other documented slides have been addressed by KYTC along US 25 which is the route that generally parallels I-75 in Grant and Kenton Counties.

A review of geologic mapping does not indicate the presence of any known fault lines which would affect roadway construction in the region. However, the corridor alternatives will be likely affected by seismic activity from the New Madrid and Wabash Valley source zones and/or “local” seismic events such as the Sharpsburg 5.2-magnitude earthquake registered in 1980. A comprehensive geotechnical investigation will be required to determine the site class but Site Class B/C can be expected.

It should be anticipated that chemically or mechanically stabilized roadbed will be required on most new roadway construction because, left untreated, subgrade materials lack sufficient strength to accommodate pavement structure.

4.4. Level One Traffic Forecasts

The Kentucky Statewide Travel Demand Model (KYSTM version 17), which is maintained by the KYTC Division of Planning, was used to develop traffic forecast estimates for this study. The process by which this was performed is summarized in a technical memorandum in **Appendix E**. At the time of the analysis, the KYSTM had been updated to reflect a 2017 base year and a 2040 forecast horizon year. The specific revisions include updates to the model's socioeconomic data, including updated population, household, and employment data.

The boundaries of 12 Traffic Analysis Zones (TAZs) were split to reflect the probable redistribution based on potential alignments. TAZs form the geographical basis for delineating and organizing the socioeconomic data used by the model to generate the vehicular trips that are assigned to the roadway network. Household and population data, as well as employment and school enrollment, are stored in each of the model's internal zones. These socioeconomic data are used to generate the vehicular trips that are distributed and assigned to the road network. The resulting traffic forecasts are shown in **Section 4.6**.

4.5. Level One Construction Cost Estimates

Each alternative assumes the construction of a fully controlled-access freeway facility on new alignment, matching the typical section shown in **Figure 12**. This matches the typical section used for the Cincinnati Eastern Bypass (CEB). The mainline design speed is 70 mph.

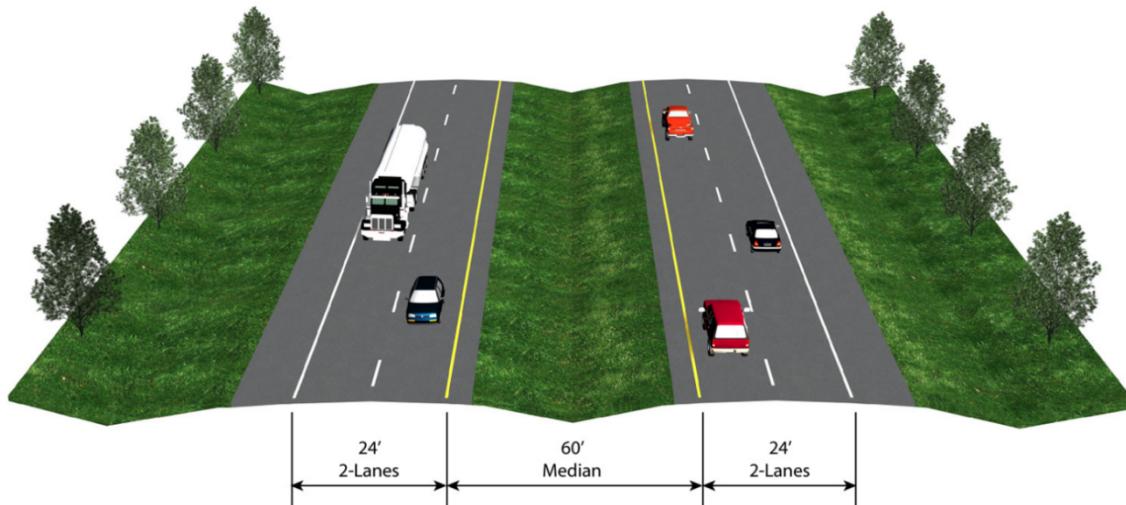


Figure 12. Conceptual Typical Section for Level One Alternatives

Planning-level unit costs were used to develop preliminary opinions of probable cost for each of the concepts. Level one unit cost assumptions are shown in **Table 1** with a side-by-side comparison of the construction cost estimate for each alternative shown in **Section 4.6**. The level one construction costs include a 25 percent contingency.

Table 1. Level One Construction Unit Costs

Item	Cost	Unit
Pavement	\$ 90	square yard
System Interchange	\$ 30,000,000	each
Service Interchange	\$ 10,000,000	each
Traffic Signal	\$ 100,000	each
Earthwork	\$ 1,000,000	mile
Maintenance of Traffic	\$ 500,000	mile
Structures	\$ 200	square foot

4.6. Level One Screening Criteria

Stakeholders from the two December 2018 meetings in Grant County helped identify the primary objectives of the Northern Kentucky Outer Loop Study. This effort resulted in six project goals. Evaluation criteria were then developed to assess how well each alternative satisfies the project goals. The six project goals and their corresponding level one measures of effectiveness are listed below.

Provide for economic development opportunities

- Measures of Effectiveness:
 - Workforce Expansion – estimated number of households in 2040 within a 60-minute drive from each county seat (off-peak travel evaluated using the KYSTM)
 - Employment Opportunities – estimated number of jobs in 2040 within a 60-minute drive from each county seat (off-peak travel evaluated using the KYSTM)
 - Opportunity Zones Served⁹ – number of federal Opportunity Zones, economically-distressed communities where certain types of private investment may be eligible for tax incentives, directly served by an alternative
 - Enhanced Incentive Counties Served¹⁰ – number of state Enhanced Incentive Counties directly served by an alternative (Owen and Pendleton counties). Enhanced Incentive Counties, identified by the Kentucky Cabinet for Economic Development, must meet one of the following three criteria:
 - County average annual unemployment rate exceeding the state average in the five preceding calendar years
 - County average unemployment rate greater than 200 percent of the statewide rate for the preceding year
 - County is identified as one of the 60 most distressed counties based on three-year unemployment, education attainment, and road quality
 - Industrial Sites Served – number or acreage of existing, proposed, and planned industrial development sites within a 6-mile-wide corridor of the alternative

⁹ <https://www.eda.gov/opportunity-zones/>

¹⁰ <https://ced.ky.gov/kyedc/pdfs/KBIFactSheet.pdf>

Enhance regional mobility

- Measures of Effectiveness:
 - Travel Time Savings – The No-Build and Build travel times from the KYSTM along with the eight-county average hourly wage of \$24.05 (according to the Bureau of Labor Statistics) were used to determine the travel time benefits for each alternative. The travel time savings was quantified as a 10-year wage savings (2030-2040).
 - Traffic Volumes with and without new Ohio River Crossing – estimated 2040 traffic demand for each alternative, both with and without a new Ohio River crossing and connecting with the Cincinnati Eastern Bypass Alternative in Clermont County, Ohio (evaluated using the KYSTM)

Improve safety

- Measures of Effectiveness:
 - Potential Crash Reduction – potential crash reduction of the total number of non-interstate crashes reported over the last three years (2016-2018) within a 6-mile-wide corridor of each alternative. Safety performance functions (SPF) were first used to predict the baseline crash frequency for each alternative. These SPFs are mathematical equations used to predict the number of crashes based on roadway characteristics such as traffic volume, lane and shoulder width, and traffic control, among others. Crash modification factors (CMF) were then applied to estimate the expected number of crashes after implementing roadway improvements.
 - Existing High Crash Segments – total mileage of roadway segments with a high crash rate reported over the last three years (2016-2018) within six miles of each alternative
 - Improve Accessibility to Existing Emergency Response Services – number of emergency services (hospitals, fire stations, police stations, etc.) located within six miles of each alternative

Provide a cost-effective, constructible solution

- Measures of Effectiveness:
 - Length – total mileage of new construction (shown for reference only)
 - Number of System Interchanges – number of potential new system interchanges (shown for reference only)
 - Number of Service Interchanges – number of potential new service interchanges (shown for reference only)
 - Construction Cost – estimated 2018 construction cost based on planning-level unit costs (to be refined in Level 2)
 - Number of Parcels – total number of parcels touched by each 2,000-foot-wide corridor (to be refined in Level 2)

Provide the Kentucky portion of a future Cincinnati Eastern Bypass

- Measure of Effectiveness:
 - Does the alternative provide a good connection to AA Highway in Kentucky and US 52 in Ohio? – all alternatives provide feasible connections to the AA Highway in Kentucky and US 52 in Clermont County
 - Does the alternative provide for a connection in Ohio that will not disturb East Fork State Park? – all alternatives can connect to corridors either east or west of East Fork State Park in Clermont County

Remain sensitive to local resources

- Measure of Effectiveness:
 - Potential Impacts to Community Features – total features/acreage within each 2,000-foot corridor
 - Potential Impacts to Natural Resources – total features/acreage within each 2,000-foot corridor

The complete level one evaluation matrix is shown in **Table 2**.

Table 2. Level One Evaluation Matrix

Concept	Alt A	Alt B1	Alt B2	Alt C1	Alt C2	Alt D1	Alt D2
Economic Development							
Workforce: Counties with >1% Increase in Households within 60-Minute Drive	Kenton, Campbell, Owen, Bracken	Gallatin, Owen, Grant, Pendleton	Gallatin, Grant, Pendleton, Bracken	Owen, Grant, Pendleton	Grant, Pendleton, Bracken	Gallatin, Owen, Grant, Pendleton	Gallatin, Owen, Grant
Employment: Counties with >1% Increase in Jobs within 60-Minute Drive	Campbell	Campbell, Grant, Pendleton	Grant, Pendleton	Campbell, Grant, Pendleton	Grant, Pendleton	Campbell, Grant, Pendleton	Campbell, Grant
Number of Opportunity Zones	0	1	1	1	1	2	2
Number of Enhanced Incentive Counties	0	1	1	1	1	1	1
Industrial Sites (within a 6-mile-wide corridor representing each alternative)							
Existing Industry	18	15	17	15	17	18	17
Shovel-Ready (total site acreage)	617	1,403	1,403	1,403	1,403	1,711	1,951
Secondary (total site acreage) ¹	2,445	2,459	149	2,711	401	432	2,742
Preliminary (total site acreage) ²	750	548	58	3,388	2,898	3,935	4,451

Concept		Alt A	Alt B1	Alt B2	Alt C1	Alt C2	Alt D1	Alt D2
Enhance Regional Mobility								
Travel Time Savings (minutes)		10 to 20						
2040 Average Daily Traffic (No Ohio River Connection to Cincinnati Eastern Bypass)	I-71 to I-75	13,600	5,600	5,700	4,900	5,000	8,600	8,300
	I-75 to US 27	19,300	12,300	6,600	11,900	6,800	7,800	11,700
	US 27 to AA	2,800	6,000	4,000	5,700	4,000	5,300	5,500
2040 Average Daily Traffic (Includes New Ohio River Connection to Cincinnati Eastern Bypass)	I-71 to I-75	19,400	10,200	9,500	9,400	8,600	10,000	9,600
	I-75 to US 27	35,900	30,700	22,500	30,200	22,600	24,000	28,800
	US 27 to AA	27,100	29,600	24,700	29,400	24,600	26,300	27,900
Improve Safety	Within a 6-mile-wide corridor representing each alternative.							
Potential Crash Reduction Per Year (crashes) ³		200	121	93	140	111	107	171
High Crash Roadway Segments (miles)		85	112	122	125	136	121	132
Emergency Response Services Near Potential Interchange		5	4	3	4	3	4	5
Cost-Effective Constructible Solution								
Length (miles)		25	36	36	43	43	48	44
System Interchanges		2	2	2	2	2	2	3
Service Interchanges		5	7	6	8	7	6	7
Est. Construction Cost (2018 \$Millions)		\$950	\$1,230	\$1,150	\$1,330	\$1,250	\$1,470	\$1,540
Parcels within 2,000-ft Corridor		461	539	488	557	606	668	593

Concept	Alt A	Alt B1	Alt B2	Alt C1	Alt C2	Alt D1	Alt D2
Sensitive to Local Resources	Within a 2,000-foot-wide corridor representing each alternative.						
Community Features							
Schools	1	0	0	0	0	1	0
Civic Buildings (Fire, Police, EMS, etc.)	0	1	1	1	1	0	0
Churches	0	1	0	1	1	2	2
Cemeteries	2	0	0	0	0	1	1
NRHP-Listed Historic Resources	1	1	1	2	2	0	1
National/State Parks	0	0	0	0	0	0	0
City/County Parks (acres)	158	1	1	1	1	0	0
Private Recreation Areas (acres)	0	2	0	2	0	0	2
Natural Resources							
Outstanding State Resource Waters	1	3	3	2	2	1	2
Length of Streams (1,000s feet)	160	235	239	276	280	286	298
Other Waterbodies (acres)	49	23	32	34	43	46	37
Priority Watersheds (acres)	0	230	230	2,888	2,888	1,665	1,665
NWI Wetlands (acres)	141	178	187	249	258	260	256
100-Year Floodzones (acres)	375	323	275	622	575	455	538
Water Wells	17	32	37	1	6	2	2
Sinkholes	1	0	0	0	0	7	7
Wildlife Management Area (acres)	21	0	0	0	0	0	0
Critical Habitat for T&E Species	0	0	0	0	0	0	0
Forested Areas (acres)	3,009	5,152	5,201	6,031	6,080	6,425	5,903
Agricultural Districts (acres)	904	1,309	1,023	1,584	1,299	359	773

Concept	Alt A	Alt B1	Alt B2	Alt C1	Alt C2	Alt D1	Alt D2
Other Environmental Considerations							
Oil/Gas Wells	0	18	18	6	6	3	3
Underground Storage Tanks (UST)	8	24	29	14	19	13	8
EPA-Monitored HazMat Sites	28	28	26	28	28	15	13
Performs "High" In How Many Categories (Cells Highlighted in Green)	25	17	14	15	12	21	19
Performs "Medium" In How Many Categories (Cells Highlighted in Blue)	6	15	14	13	13	8	11
Performs "Low" In How Many Categories (Cells Highlighted in Orange)	12	11	15	15	18	14	13

¹ Secondary sites are missing one or even a few of the key elements, usually related to utility infrastructure.

² Preliminary sites are sites without a lot of infrastructure or have environmental or ownership issues.

³ Rural 2 Lanes to Rural 4 Lane Divided Parkway. CMF = 0.64. Source KY SPF's.



High Performers in Category

Medium Performers in Category

Low Performers in Category

4.7. Level One Evaluation Summary

Based on the level one evaluation, Alternatives A, B1, D1, and D2 scored high in the greatest number of categories. The following summarizes the results of the previous sections and illustrates why these four alternatives scored best.

Alternative A: Performed best in the project goals for enhancing regional mobility and providing a cost-effective constructible solution. In addition, Alternative A showed one of largest potential increases in workforce accessibility, provided access to 18 existing industries, had the largest projected traffic volumes between I-71 and I-75, showed the greatest potential for crash reduction, and had the lowest construction cost estimate.

Alternative B1: Performed fourth best overall in the measures of effectiveness. In addition, Alternative B1 showed one of largest potential increases in workforce accessibility, showed one of the largest increases in employment opportunities, passed through one Opportunity Zone and one Enhanced Incentive County, had the largest projected traffic volumes between US 27 and the AA Highway, and had a relatively construction cost estimate.

Alternative D1: Performed best in the project goal for Economic Development. In addition, Alternative D1 showed one of largest potential increases in workforce accessibility, showed one of the largest increases in employment opportunities, provided access to 18 existing industries and 1,700 acres of shovel-ready sites, passed through two Opportunity Zones and one Enhanced Incentive County, and had the second largest projected traffic volumes between I-71 and I-75. This alternative did have the second highest construction cost estimate.

Alternative D2: Performed best in the project goal for Improve Safety and second best in the project goal for Economic Development. In addition, Alternative D2 provided access to 17 existing industries and 2,000 acres of shovel-ready sites, passed through two Opportunity Zones and one Enhanced Incentive County, and had the second largest projected traffic volumes between I-75 and US 27. This alternative did have the highest construction cost estimate.

5.0. Stakeholder Meeting No. 2

Two additional stakeholder meetings were held on March 8, 2019. The first was in the morning at the Grant County Courthouse in Williamstown, Kentucky and the second in the afternoon at the Northern Kentucky Chamber of Commerce in Fort Mitchell, Kentucky. Between the two meetings, 41 stakeholders were in attendance and provided feedback on the level one evaluation of alternatives. In general, stakeholders concurred with the level one evaluation results and advancing Alternatives A, B1, D1, and D2 forward to the level two evaluation. Some additional comments from the Northern Kentucky Chamber included:

- Kenton County has designated land in Richwood which may be the next industrial center and should be considered as part of the evaluation matrix
- Lack of utilities for all proposed routes is a concern, especially south of Alternative A
- Job creation and access to jobs should be prioritized, especially for alternatives that help increase mobility and support other parts of the region that struggle to meet workforce needs
- Consideration for a future Ohio connection and crossing of the Ohio River is critical
- The Northern Kentucky Outer Loop Study and the Brent Spence Bridge Project (KYTC Item No. 6-17) are not mutually exclusive
- KY 536 is a critical east-west connector. That project must continue to be fully funded and completed as quickly as possible

A news release was also distributed after the second round of stakeholder meetings to regional news outlets, which generated website traffic and feedback through the project email account. More than 250 emails were captured, and feedback represented a diverse set of opinions. A complete summary of the study's public outreach and the feedback received is included in **Appendix B**.

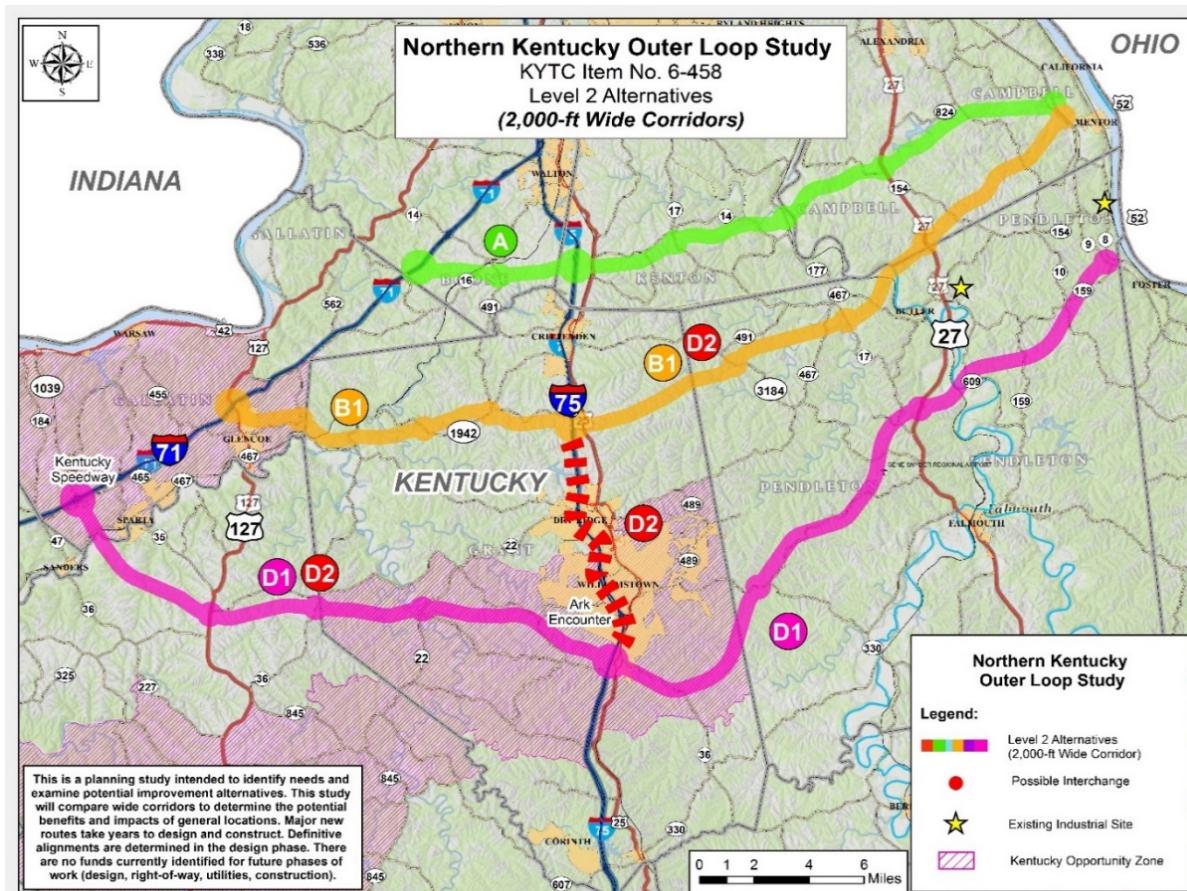


Figure 13. Level Two Alternatives

6.0. Evaluation of Level Two Alternatives

As a result of the level one screening and the feedback received at the two stakeholder meetings, four alternatives (shown in **Figure 13**) were advanced for more detailed evaluation. It is important to note the Northern Kentucky Outer Loop Study represents the initial planning phase of a major transportation undertaking. Therefore, additional variations would likely be considered in the next phase (preliminary design), but the Project Team focused the study resources on evaluation of four corridor alternatives.

For the four alternatives that advanced beyond the level one screening, additional engineering details were developed. This includes more refined roadway alignments; preliminary bridge concepts and span arrangements; more detailed cost estimates for design, construction, right-way, and utility relocations; potential land use changes and economic development opportunities; and more detailed traffic forecasts. **Figure 14** illustrates the steps in development and evaluation of the level two alternatives.

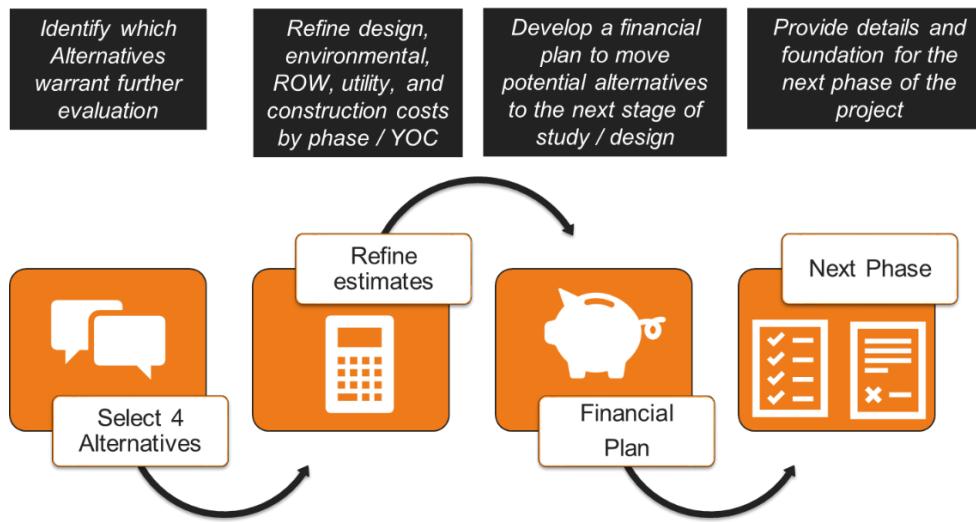


Figure 14. Level Two Evaluation Process

6.1. Level Two Environmental Inventory

For the level two assessments, level one environmental data were supplemented with additional information gathered from:

- Coordination with the Kentucky Heritage Council (KHC) and the Office of State Archaeology (OSA) to identify known historic and prehistoric sites previously inventoried.
- Windshield surveys to identify potential NRHP-eligible structures, districts, and likely environments to contain archaeological deposits.
- Collection of demographic data from the Census Bureau to identify potential EJ populations: low-income and/or minority population clusters.
- Reviews of county comprehensive planning documents to understand how the proposed corridor(s) fit within regional transportation and land use visions.
- Windshield surveys to identify additional community resources or other environmentally sensitive features.

Based on this assessment, key constraints in the region will include:

- Section 4(f) properties — public parks, wildlife/waterfowl refuges, and historic resources
- Natural habitats for Threatened and Endangered species, including forests and streams
- Community resources — schools, churches, civic buildings, businesses, and homes; and
- Agricultural districts/farm impacts

Additionally, community impacts, including home and business relocations, are important environmental considerations, which are discussed in **Section 6.3**. General information about potential EJ population clusters is presented. However, to fully understand the extent of likely impacts, a more in-depth analysis and coordination with affected property owners will be necessary.

If any projects are selected for implementation using federal funds, detailed environmental studies and public and stakeholder involvement will be required, documented in the appropriate class of

environmental document (likely an Environmental Impact Statement, or EIS) to satisfy the National Environmental Policy Act (NEPA) and other environmental legislation.

Table 3 compares potential impacts of level two alternatives within the 2,000-foot corridors. The full Environmental Overview is included in **Appendix C**, which contains detailed level two corridor maps. Site-specific archaeological data are not mapped in this publication as dictated by federal regulation.

Table 3. Level Two Comparison of Environmental Features within the 2,000-foot Corridor

	Alt. A	Alt. B1	Alt. D1	Alt. D2
Community Features				
Schools	None	Sherman Elem.	None	Sherman Elem.
Civic Buildings	None	Mt. Zion	None	None
Churches	Piner Baptist	Mt. Zion Bapt.; Grassy Creek Bapt.	Pisgah UMC; Cherry Grove Pen; Short Creek Bapt.	Pisgah UMC; Grassy Creek Bapt.
Known Cemeteries	2	2	3	2
Potential EJ Clusters	2	1	1	1
Historic Resources				
-NRHP-Listed	1	1	None	1
-Potential/Eligible	17	8	18	11
Known Archaeological Sites	1	None	5	5
Parks & Recreational Sites	AJ Jolly, 158 ac	Mt. Zion Park, >1 ac	None	None
Natural Resources				
Outstanding State Resource Waters (OSRW)	Licking River	UT Big Sugar Cr; S Fork Grassy Cr; Licking River	Brushy Fork; Licking River	S Fork Grassy Cr; Licking River
Length of Streams (1,000s feet)	160	235	286	298
NWI Wetlands (acreage)	141	178	260	256
100-Year Floodzones (acreage)	375	323	455	538
Wildlife Management Areas	Mullins, 21 ac	None	None	None
Forested Areas (acreage)	3,009	5,151	6,425	5,903
Agricultural Districts (acreage) ¹	905	1,248	352	763
Other				
Oil/Gas Wells	None	18	3	3
Known USTs & potential hazmat sites	37	53	28	22
Large Utilities Infrastructure			Substation	
-Transmission Lines	5	7	9	7
-Oil/Gas Pipelines	3	None	1	1

¹ District limits updated since Level 1 analysis; Grant County limits not yet digitized so footprints estimated.

6.2. Level Two Traffic Forecasts

As part of the level two traffic forecast development, the project team examined current socioeconomic conditions in the study area counties and the potential for growth with and without the four alternatives. Baseline population growth anywhere outside of the northern counties of Boone and Kenton is expected to be minimal or negative through 2040. Specifically, Campbell County is expected to lose population between 2010 and 2040 while Pendleton, Carroll and Owen counties are all expected to see population grow annually by less than 0.5 percent over the same period, as shown in **Figure 15**. Boone County, however, is expected to experience an annual population growth of 2.1 percent per year, as shown in **Figure 16**.

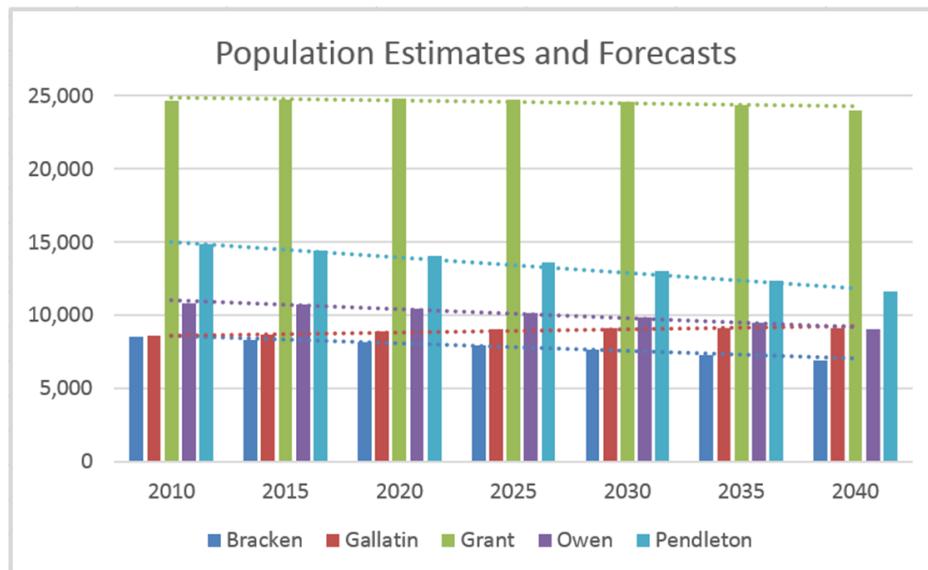


Figure 15. Kentucky Data Center Population Estimates for Bracken, Gallatin, Grant, Owen, and Pendleton Counties

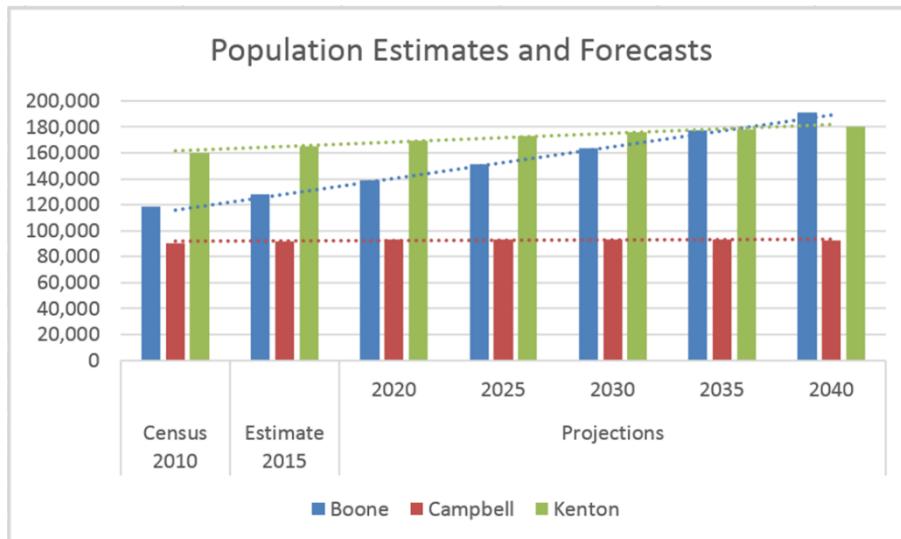


Figure 16. Kentucky Data Center Population Estimates for Boone, Campbell, and Kenton Counties

An analysis was conducted to estimate the remaining “developable land” within each county. For purposes of this effort, developable land is shovel-ready and excludes any already developed land, bodies of water, wetlands, right of ways, and steep slopes. Developable land is an important indicator for the future development opportunities within a county as shovel-ready land is more attractive to developers than land that requires extensive conditioning – it is essentially the path of least resistance to future development. A summary of the developable land by county is shown in **Figure 17**.

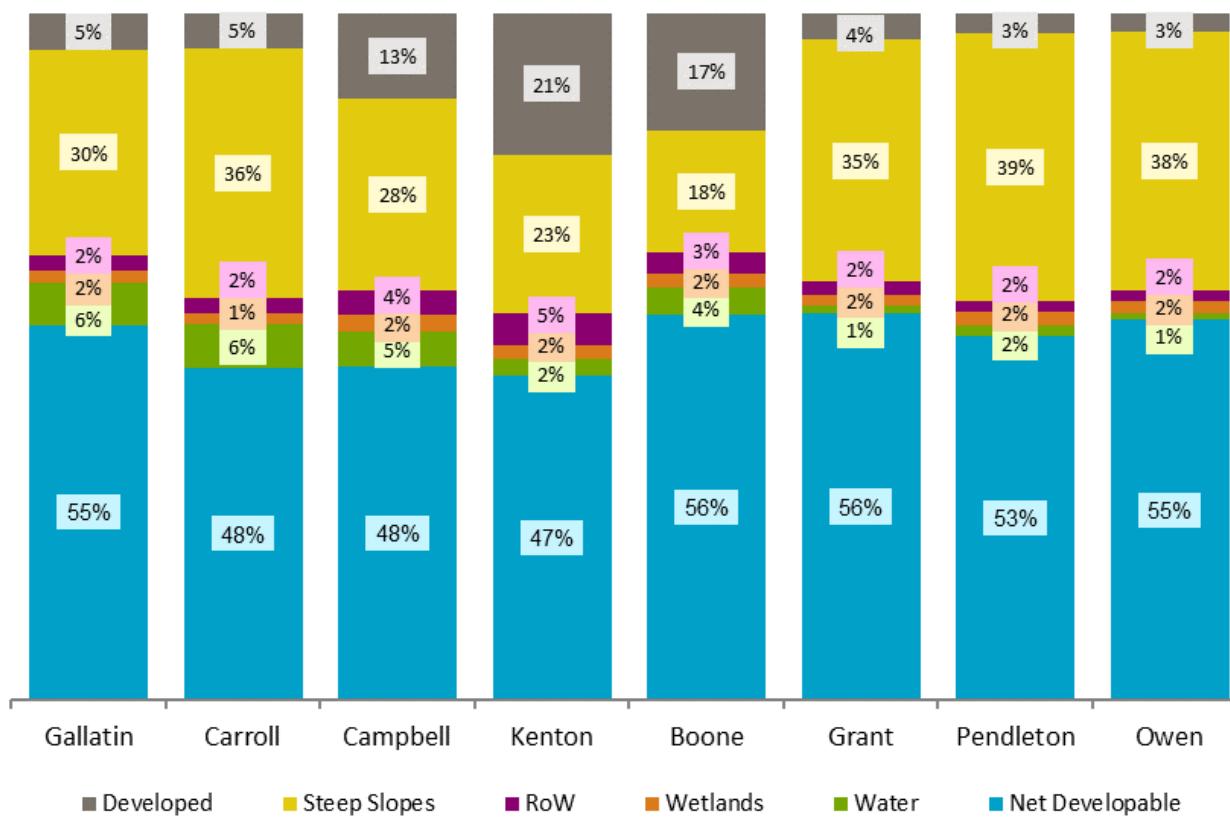


Figure 17. Net Developable Land by County

An analysis was then performed to determine the socioeconomic impact of each of the four alternatives. To assist with this effort, a national database was developed through a literature search for this study of interstate and freeway segments constructed between 1990 and 2015. County-level growth rates for population, households, and employment were then compared for the period pre- and post-interstate construction. Results from the analysis show that rural counties tend to see larger percentage gains over the short-term from development of a new interstate. This is logical as they would tend to start with lower populations and development density and provide more opportunities in terms of developable land. The complete economic analysis report is included in **Appendix F**.

Based on these results and an assumed opening year of 2030 for the purposes of developing traffic forecasts, the project team revised the KYSTM’s 2040 projections of population, households, and employment within each TAZ affected by each potential alignment scenario. **Table 4** presents the “no build” or baseline estimates and revised 2040 population, household, and employment growth for each alternative with and without the construction of a bridge at the eastern end of each corridor to connect to Ohio across the Ohio River.

Table 4. KYSTM Base and Revised 2040 Socioeconomic Summary

	Baseline	With Interstate	With Interstate & Bridge	Projected Growth with Interstate	Projected Growth with Interstate & Bridge
POPULATION					
Alternative A	46,852	47,868	49,396	1,016	2,544
Alternative B1	35,083	35,682	36,375	599	1,292
Alternative D1	30,985	31,548	32,207	563	1,222
Alternative D2	45,087	45,984	47,028	897	1,941
HOUSEHOLDS					
Alternative A	18,440	19,707	20,115	409	1,025
Alternative B1	13,463	13,693	13,823	229	493
Alternative D1	12,251	12,446	12,549	222	482
Alternative D2	17,385	17,730	17,917	345	748
EMPLOYMENT					
Alternative A	9,229	9,479	10,012	250	783
Alternative B1	11,816	13,201	13,553	1,385	1,737
Alternative D1	9,338	10,723	11,006	1,385	1,668
Alternative D2	14,758	16,697	17,163	1,939	2,405

Using the updated KYSTM from the Level One Evaluation and the revised socioeconomic data in **Table 4**, 2040 daily traffic volumes were estimated for each level two alternative for scenarios with and without the Ohio portion of the Cincinnati Eastern Bypass (CEB) which extends the Northern Kentucky Outer Loop alternatives across the Ohio River to I-75 just south of Lebanon, Ohio. These estimates are summarized on **Figure 18** through **Figure 20**. The process by which this was performed is summarized in a technical memorandum in **Appendix E**.

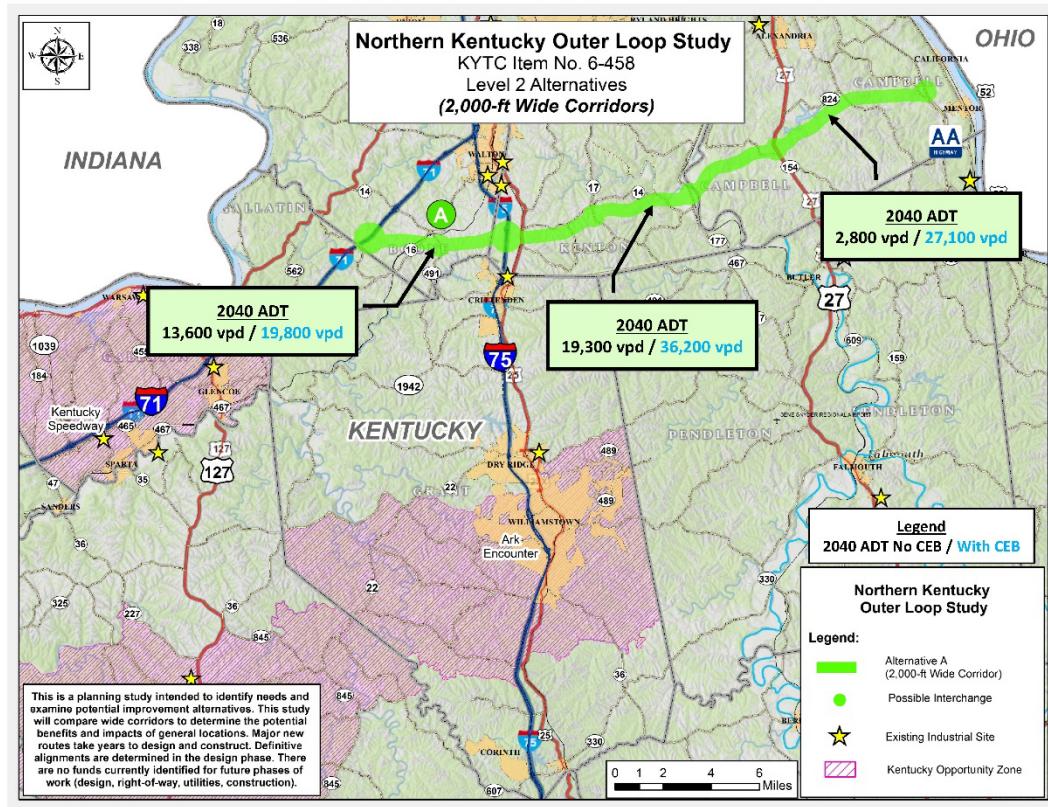


Figure 18. Alternative A – 2040 Daily Traffic Forecasts

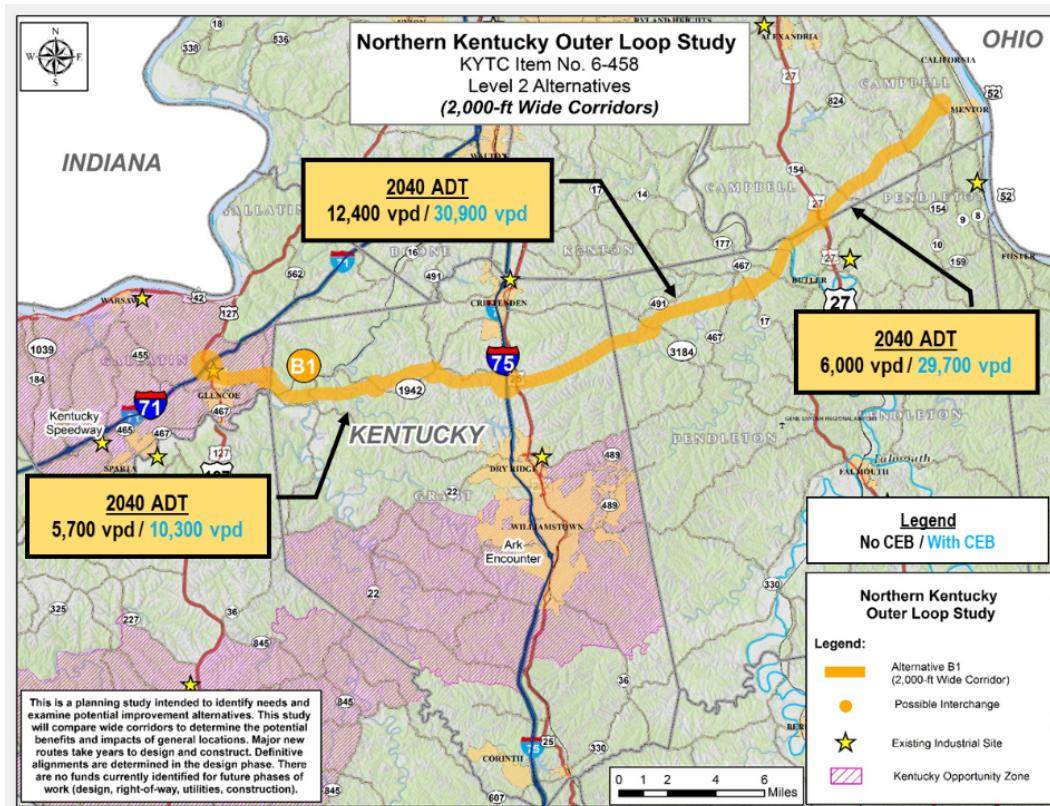


Figure 19. Alternative B1 – 2040 Daily Traffic Forecasts

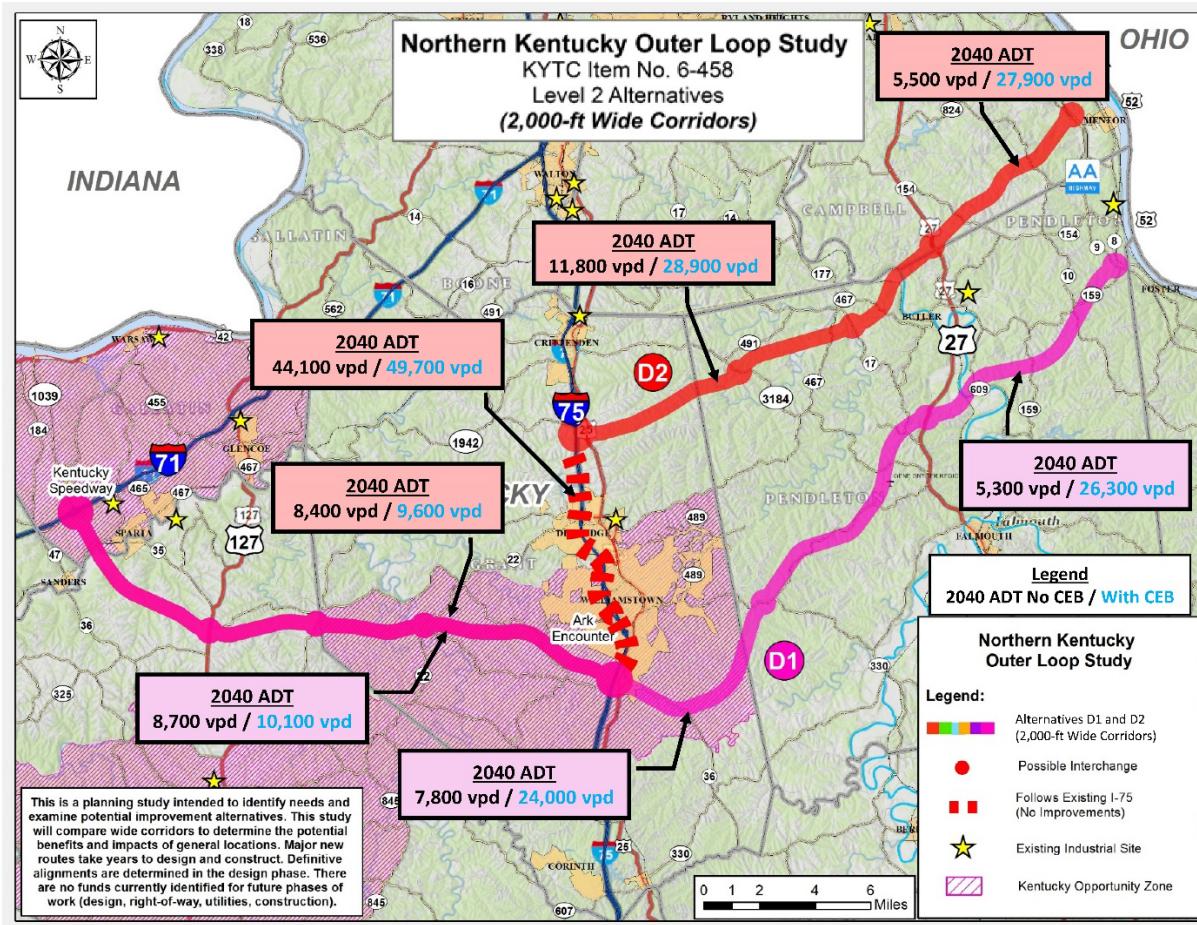


Figure 20. Alternative D1 & D2 – 2040 Daily Traffic Forecasts

As expected, an Ohio River crossing would increase the amount of traffic utilizing the level two alternatives. Without a new Ohio River bridge (i.e. “No CEB”), the eastern portion of Alternative A (Figure 18) would not be heavily utilized, with only 2,800 VPD in 2040. With a bridge, however, that same segment would carry over 27,000 VPD. The portions of Alternative A near the freeway would also be utilized more with an Ohio River crossing. Similarly, Alternative B1 (Figure 19) and Alternatives D1 and D2 (Figure 20) would also see a significant increase in traffic with a bridge to Ohio.

6.3. Level Two Cost Estimates

The project team performed detailed preliminary engineering on the level two alternatives to better determine probable cost, right-of-way needs, and potential utility impacts. The team developed a digital model using the same software tools KYTC requires for all design projects (MicroStation and InRoads). Design guidelines from AASHTO’s *A Policy on Design Standards – Interstate System* dated May 2016 were followed. Specific design guidelines utilized for this study are summarized as follows:

- Design Speed (Mainline) = 70 mph
- Design Speed (System Interchange Ramps and Exit Curves for Service Interchanges) = 50 mph*
- Design Speed (Approaches) = Match existing roadway characteristics
- Superelevation = 8% (maximum)

- Connectivity to all public roads will be maintained. Access to private roads/driveways and landlocked parcels will not be addressed at this time.
- Drainage Thresholds:
 - Less than 500 cubic feet per second (CFS) will be included in minor drainage percentage
 - 500 to 660 CFS = 8-ft x 8-ft reinforced concrete box culvert (RCBC)
 - 660 to 900 CFS = 12-ft x 8-ft RCBC
 - 900 to 1,600 CFS = 14-ft x 10-ft RCBC
 - 1,600 to 2,400 CFS = 16-ft x 12-ft RCBC
 - Greater than 2,400 CFS = Bridge

* Lower design speeds can be utilized for service interchanges if adequate acceleration and deceleration is provided.

Each alternative assumes the construction of a rural, multi-lane, divided, fully controlled-access freeway facility on new alignment. The typical section is shown in **Figure 21**, which includes four driving lanes and a 60-ft depressed median. This matches the rural typical section assumed in the Brent Spence Strategic Corridor Study.

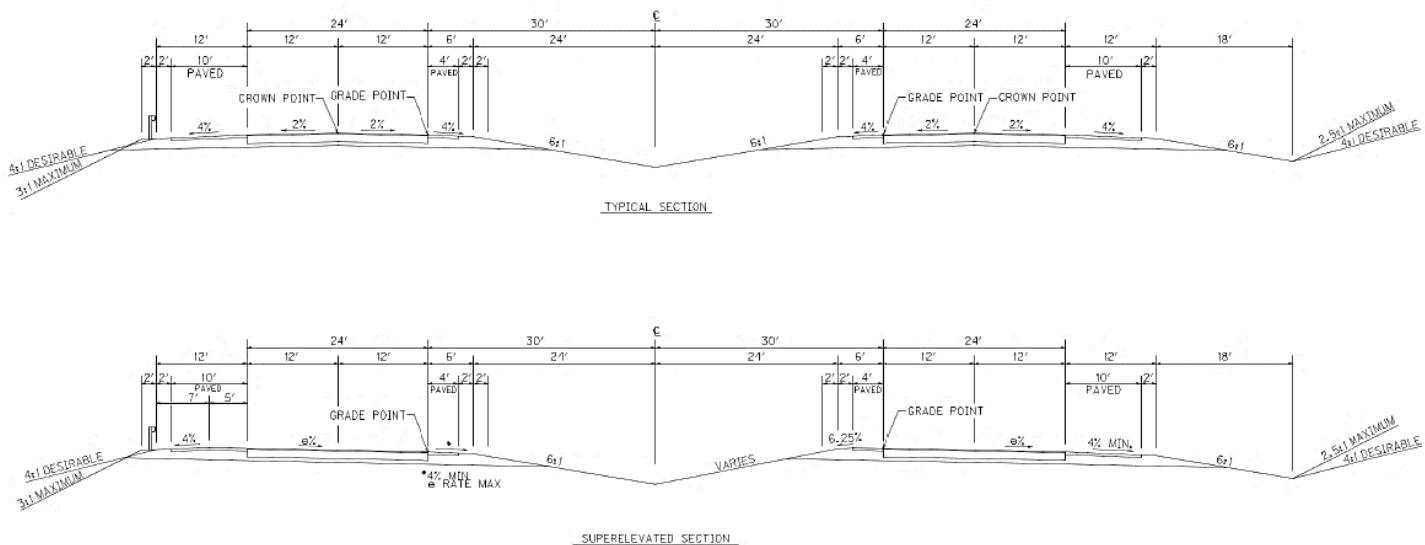


Figure 21. Typical Section

The cost estimates were broken into the five phases of project development: 1) design/environmental, 2) right-of-way acquisition, 3) utility relocations, 4) construction, and 5) construction engineering and inspection (CEI). For the construction cost estimates, the digital terrain model for each alternative was used to produce earthwork and other construction material quantities. Once all major quantities for over 60 of the most significant typical construction bid items were identified, the project team used the KYTC Estimator Program to assign unit costs for each item. The KYTC Estimator Program is used by KYTC and its agents to develop cost estimates for roadway construction projects. This program assigns unit bid prices for each construction item based on historical prices specific to the region of the state where the project is located.

The level two construction costs included a 25 percent contingency for miscellaneous construction items. This encompasses items that cannot be accurately quantified at this stage but are traditionally

included in the final construction estimate. Given the extremely large scale of the corridors under consideration, the design and environmental cost estimates were assumed to be only nine percent of the construction cost estimate. Similarly, the CEI cost estimates were assumed to be eight percent of the construction cost estimate.

Right-of-way acquisition costs were derived using the Property Value Administration (PVA) estimated values multiplied by the percentage of the area of the parcel to be acquired. Parcels where 40 percent or more of the area would be acquired or where direct impacts or proximity to dwellings or commercial buildings occurred were assumed to be total takings. This cost was then added to the projected relocation and labor costs for acquiring each parcel to formulate to the total cost for right-of-way acquisition. The full right-of-way acquisition report is included in **Appendix G**.

For utility transmission mains or those with potentially major impacts, the individual system and company has been identified and, to the extent possible, unit costs for relocations have been utilized based on information provided by the utility company. Most utility companies were not able to provide unit costs for relocation, so other sources such as KYTC historical expenditures, United States Department of Transportation (US DOT) and research studies on utility relocation costs have been utilized. For non-major utility distribution lines or collector systems which may be impacted along the proposed alignments, an estimated unit cost was utilized to determine the general impact of these systems on the project. The full utility relocation report is included in **Appendix H**.

A summary of the opinion of probable costs for each phase is shown in **Table 5** in current year (2019) dollars. **Table 6** shows the cost in anticipated year of expenditure, which escalated the 2019 cost estimates to the assumed year of expenditure using the ODOT Business Plan Calculator¹¹. The ODOT Business Plan Calculator was used to develop the Brent Spence Bridge Replacement/Rehabilitation (KYTC Item No. 6-17) year of expenditure cost estimates and was used here to maintain consistency between estimates. As shown, total project costs range from \$1.6 billion to \$2.6 billion in YOE dollars.

Table 5. Level Two Current Year (2019) Cost Estimates by Phase

Phase	Alternative A	Alternative B1	Alternative D1	Alternative D2
Design/Environmental	\$91,600,000	\$129,200,000	\$152,800,000	\$158,100,000
Right-of-Way	\$43,800,000	\$31,600,000	\$48,300,000	\$40,300,000
Utilities	\$23,100,000	\$31,500,000	\$33,300,000	\$33,000,000
Construction	\$995,900,000	\$1,403,800,000	\$1,659,600,000	\$1,701,200,000
CEI	\$80,400,000	\$117,500,000	\$138,800,000	\$143,700,000
Total	\$1,234,800,000	\$1,713,600,000	\$2,032,800,000	\$2,076,300,000
Length (miles)	25.0	35.5	48.4	43.9

¹¹ <http://www.dot.state.oh.us/Divisions/ConstructionMgt/Estimating/Pages/BART.aspx>

Table 6. Level Two Year of Expenditure Cost Estimates by Phase

Phase	Assumed Year of Completion	Concept A	Concept B1	Concept D1	Concept D2
Design/Environmental	2020-2022	\$91,600,000	\$129,200,000	\$152,800,000	\$158,100,000
Right-of-Way	2023-2024	\$43,800,000	\$31,600,000	\$48,300,000	\$40,300,000
Utilities	2025-2026	\$27,400,000	\$37,400,000	\$39,600,000	\$39,200,000
Construction	2027-2030	\$1,292,900,000	\$1,822,400,000	\$2,154,500,000	\$2,208,500,000
CEI	2027-2030	\$104,400,000	\$152,500,000	\$180,200,000	\$186,600,000
Total		\$1,560,100,000	\$2,173,100,000	\$2,575,400,000	\$2,632,700,000
Length (miles)		25.0	35.5	48.4	43.9

6.4. Level Two Screening Criteria

The level two evaluation matrix is shown below in **Table 7**, summarizing each alternative's ability to satisfy the Draft Purpose & Need Statement and Project Goals detailed in **Section 3**. To help quantify the economic impacts, KYTC ran each alternative through the TREDIS. This tool estimates employment growth over a ten-year period (2030 to 2040) as well as the value added. This is the same program that is used in KYTC's SHIFT statewide prioritization process.¹²

Table 7. Level Two Evaluation Matrix

Concept	Alternative A	Alternative B1	Alternative D1	Alternative D2
Economic Development				
Additional 2030-2040 Employment Growth with New Freeway (number of new jobs) ¹	443	163	221	182
Additional 2030-2040 Value Added with New Freeway (2019 \$Millions) ¹	\$32	\$17	\$16	\$13
Industrial Sites (within a 6-mile-wide corridor representing each alternative)				
Existing Sites	18	15	18	17
Shovel-Ready (total site acreage)	617	1,403	1,711	1,951

¹² <https://transportation.ky.gov/SHIFT/Pages/default.aspx>

Concept		Alternative A	Alternative B1	Alternative D1	Alternative D2
Enhance Regional Mobility					
Travel Time Savings (minutes)		26	24	21	14
2040 Average Daily Traffic (No Ohio River Connection to Cincinnati Eastern Bypass)	I-71 to I-75	13,600	5,700	8,700	8,400
	I-75 to US 27	19,300	12,400	7,800	11,800
	US 27 to AA	2,800	6,000	5,300	5,500
2040 Average Daily Traffic (Includes New Ohio River Connection to Cincinnati Eastern Bypass)	I-71 to I-75	19,800	10,300	10,100	9,600
	I-75 to US 27	36,200	30,900	24,000	28,900
	US 27 to AA	27,100	29,700	26,300	27,900
Cost-Effective Constructible Solution					
Total Cost (2019 \$Millions)		\$1,235	\$1,713	\$2,033	\$2,076
2030-2040 Benefit Related to Crash Reduction (2019 \$Millions)		\$7	\$2	\$7	\$4
2030-2040 Benefit Related to Travel Time Savings (2019 \$Millions)		\$475	\$309	\$233	\$184
Performs High in How Many Categories? (Cells Highlighted in Green)		11	3	5	4
Performs Medium in How Many Categories? (Cells Highlighted in Blue)		1	9	5	5
Performs Low in How Many Categories? (Cells Highlighted in Orange)		2	2	4	5

¹ Source: Transportation Economic Development Impact System (TREDIS)

6.5. Level Two Evaluation Summary

Alternative A and B1 scored high or medium in 12 categories, Alternative D1 scored high or medium in 10 categories, and Alternative D2 scored high or medium in nine categories. The following summarizes the results of the level two evaluation:

Alternative A: Performed high in 11 categories and had:

- Largest increase in employment
- Access to 18 existing industrial sites
- Largest travel time savings
- Highest traffic volumes between I-71 and US 27
- Lowest total cost (\$1.2 Billion)
- One of the highest right-of-way costs (\$43.8 Million)

Alternative B1: Performed high in three categories and had:

- One of the largest travel time savings
- Access to 15 existing industrial sites
- One Opportunity Zone and One Enhanced Incentive County
- Highest traffic volumes between US 27 and AA Highway
- Second lowest total cost (\$1.7 Billion)
- Lowest right-of-way cost (\$31.6 Million)

Alternative D1: Performed high in five categories and had:

- One of the largest increases in employment
- Access to 18 existing industrial sites and 1,700 acres of shovel-ready sites
- Two Opportunity Zones and One Enhanced Incentive County
- Second highest traffic volumes between I-71 and I-75
- One of the highest total costs (\$2.0 Billion)

Alternative D2: Performed high in four categories and had:

- Access to 17 existing industrial sites and 2,000 acres of shovel-ready sites
- Two Opportunity Zones and One Enhanced Incentive County
- Second highest traffic volumes between US 27 and AA Highway
- Highest total cost (\$2.1 Billion)

7.0. Stakeholder Meeting No. 3

A final stakeholder meeting was held on February 24, 2020 at the Northern Kentucky Area Development District in Florence, Kentucky. There were 29 stakeholders in attendance who provided feedback on the level two evaluation of alternatives. In general, stakeholders concurred with the level two evaluation. Some additional comments included:

- Even though this project will take more than 10 years to complete, the process behind it is setting Northern Kentucky up for less congestion and better traffic flow for the next 50 years.
- This project will keep people in Northern Kentucky and help job growth.

- The Ohio connection is critical. KYTC should continue to work with ODOT to pursue the Ohio portion of the CEB.

A complete summary of the third stakeholder meeting is included in **Appendix B**.

8.0. Conclusions

The Northern Kentucky Outer Loop Study (KYTC Item No. 6-458) examined conceptual new freeway corridors that would connect I-71, I-75, and the AA Highway, enhancing regional mobility, improving safety, and fostering economic development opportunities in this region of the state. The project is in the planning phase and was conducted to examine the benefits of building the Kentucky portion of a future Cincinnati Eastern Bypass (CEB) as segments of independent utility. This study was not intended to select a preferred corridor but rather focus its resources to examine four potential options. Therefore, additional variations could be considered in future project phases.

Longer term, the selected corridor could provide the Kentucky portion of a future CEB. An ODOT report¹³ on the proposed CEB was submitted to Ohio lawmakers on December 31, 2019. It concluded that “when the costs and time associated delivery of the CEB are evaluated with the known benefits identified in the KYTC [Brent Spence Strategic Corridor Spence] study, it is ODOT’s opinion that no further expenditures of funding and staff time be put toward the CEB.” The report stated that “completion of the Brent Spence Bridge Corridor project [KYTC Item No. 6-17] should be the priority.”

Given ODOT’s current position on the CEB, the effect the Ohio connection has on the projected traffic volumes, the stakeholder feedback noting how critical the Ohio connection is to the project, and that there are no future phases of this project funded in *Kentucky’s FY 2020 – FY 2026 Highway Plan* or included in the *Ohio-Kentucky-Indiana Regional Council of Governments (OKI) 2040 Regional Transportation Plan* – any future development of this project could shift to the priority sections of independent utility. More discussion of these priority sections is detailed in the sections that follow.

8.1. Priority Sections

The overall cost of the level two alternatives ranges between \$1.2 billion and \$2.1 billion. Under an optimistic implementation scenario, construction could take place between 2027 and 2030 with an open to traffic year of 2031. Escalating the current estimated costs to the year of expenditure (YOE), capital costs range between \$1.6 billion and \$2.6 billion for the entire project. **Table 8** summarizes the cost estimates for the level two alternatives as well as the projected traffic and costs for the segment of the corridor with the highest traffic volume.

Table 8. Priority Section Cost Estimates

Alternative	Total Project Cost (YOE)	Total Project Cost (\$2019)	Priority Section with Highest Traffic Volume	Priority Section 2040 VPD (No CEB)	Priority Section Cost Estimate (\$2019)
A	\$1.5 billion	\$1.2 billion	I-75 to US 27	19,300	\$599 million
B1	\$2.1 billion	\$1.7 billion	I-75 to US 27	12,400	\$793 million
D1	\$2.4 billion	\$2.0 billion	I-71 to I-75	8,700	\$1.1 billion
D2	\$2.5 billion	\$2.1 billion	I-75 to US 27	11,800	\$791 million

¹³ https://2050.oki.org/wp-content/uploads/2020/04/ODOT-2019-Report-to-Legislature_w_attach-Final.pdf

By utilizing the strategy of usable construction sections, this project could be built over time while improving east-west connectivity where traffic volumes justify the improvement without the Ohio portion of the CEB. Should economic growth occur, the time frame for completion of the entire project could be accelerated, but in the meantime, enough traffic will utilize these priority sections to provide independent utility.

8.2. Preliminary Financial Overview

The project faces several funding challenges, including:

- COVID-19 has had severe impacts to the state's Road Fund, with the long-term impacts unknown at this time.
- Available state funding is fully committed to other projects and the state has a maintenance deficit; future phases of the project are not included in Kentucky's FY 2020 – FY 2026 Highway Plan. As outlined within the 2020 Highway Plan, state funding is committed to other scheduled projects and committed for required state matching funds for federal-aid highway funding.
- The state has limited bonding capacity for transportation investment and currently cannot support this project. The availability of bonding capacity was not part of this study and would require an in-depth financial analysis with the ultimate approval by the Kentucky General Assembly.
- There are at least two major unfunded projects (Brent Spence Bridge and the I-69 Ohio River Crossing between Henderson and Evansville, Indiana) that would likely be a higher priority than the Northern Kentucky Outer Loop currently in the development pipeline that will absorb available funds. There are other KYTC unfunded Mega Projects, including the Brent Spence Ohio River Bridge Project, the I-69 Ohio River Bridge Project, and the widening of the Mountain Parkway projects that are already currently identified as major unfunded needs.
- The expiration of toll credits in FY 2020 will limit the state's available match funds for federal aid and grants. Kentucky's remaining available toll credits to use as matching funds for federal-aid highway funding were fully utilized in September 2019. Thus, resulting in required \$125M of state funds each year to provide required matching funds for the federal-aid highway funding program.

No single funding source can cover the full amount of this project and a comprehensive financial package will require a combination of federal, state, local, and private funds. The Northern Kentucky Outer Loop will need to be designated as part of the National Highway System (NHS) by KYTC in coordination with the Federal Highway Administration and adjoining states to make it eligible for federal formula funds and federal discretionary funding.

Longer term, advancing the project would require a patient and focused approach that completes sufficient planning work early so that the project can be nimble and opportunistic when unexpected funds become available to advance the priority sections.

Corridor coalitions can aid in sustaining this long-term focus on a single corridor. A multi-state example includes the Ports-to-Plains Alliance which over the past decade has seen almost \$3.61 billion in federal and state funding for road improvements in the nine-state region¹⁴. The US 70 Coalition¹⁵ in North Carolina provides an example of a single state corridor. What these examples all have in common is that they are economic development highways—high cost projects with low initial projections of travel—

¹⁴ <https://www.portstoplains.com/>

¹⁵ <https://www.ncdot.gov/projects/us-70-corridor/Pages/default.aspx>

advanced to foster economic growth in areas that have lagged economically. Such coalitions serve as advocates for the project, helping to ensure that their project is “first in line” for new funding sources that become available over time.

Some possible future funding and borrowing options include:

- State Road Funds: For the past two Kentucky General Assembly sessions, there have been discussions about raising Kentucky’s motor vehicle user fees, but there has been no approval action by the General Assembly.
- Federal Aid Funds: The current authorization, the Fixing America’s Surface Transportation (FAST) Act of 2015, expired September 30, 2020. The continuation of the federal-aid highway funding will require Congressional approval of either a new Transportation Act, or additional continuing resolutions of the current FAST Act of 2015.
- Federal Financing: Transportation Infrastructure Finance and Innovation Act (TIFIA) Loans: These loans have a 35-year payback period. This loan would be secured against toll revenue or state funds. TIFIA loans are capped at 33 percent of the total project cost.
- Federal grants such as the US Department of Transportation (DOT) Infrastructure for Rebuilding America (INFRA) discretionary grant program.
- Local Contributions.

To better understand the potential revenue from tolling, a planning level analysis was conducted. Diversion percentages were developed based on a time impedance equal to the toll value of time placed in the Kentucky Statewide Traffic Model. These routines account for the burden of tolls that would potentially reduce the number of trips on the new route. The route choice model requires costs to be provided as dollar values. The toll rate structure for the Louisville-Southern Indiana Ohio River Bridges (LSIORB) project was used in the analysis for this project, as it is the most recent example of toll implementation in Kentucky. The LSIORB project was completed in late 2016, and tolls were implemented in December of that year. The base toll rates in place when the project opened in December 2016 were \$2.00 for cars, \$5.00 for medium trucks, and \$10.00 for large trucks, as shown in the graphic to the right.

CLASSIFICATION	VEHICLE DESCRIPTION	TOLL WITH TRANSPONDER
Passenger Vehicle	2-axle up to 7 ½ feet in height	\$2
		
	2-axle more than 7 ½ feet in height	
Medium Vehicle	All 3-axle	\$5
	All 4-axle	
Large Vehicle	5-axle or more	\$10

Based on this cursory analysis, approximately 30 percent diversion (i.e. reduction in traffic demand) was found for the Alternative A scenario that does not include a new Ohio River crossing and connection to Ohio. For the scenario that does include a new Ohio River connection to the CEB, there was approximately 20 percent diversion. **Table 9** summarizes the estimated gross revenue from tolling for each scenario for the 35-year period between 2030 and 2065. The 2019 dollars were estimated based on an assumed inflation rate of 2.5 percent per year. These numbers represent gross revenues and do not account for the cost of toll infrastructure or operation and maintenance costs.

Table 9. Planning Level Tolling Gross Revenue Analysis for Alternative A

Alternative A Tolling Scenario	Description	2030 - 2065	
		Year of Collection (in \$M)	2019 \$ (in \$M)
Without Ohio River Bridge	Includes tolls on segment east of I-75 (\$2/\$5/\$10)	\$ 1,317	\$605
With Ohio River Bridge	Includes tolls on segment east of I-75 (\$2/\$5/\$10)	\$ 1,767	\$826

Understanding these current constraints and future opportunities, a summary of the funding opportunities for two potential alternatives are shown in **Table 10**. The complete Preliminary Financial Overview for the Northern Kentucky Outer Loop Study is included in **Appendix I**.

Table 10. Potential Funding Opportunities

Alternative	Full A	Full D2	Priority Section A	Priority Section D2
Total Cost (\$2019)	\$1.2 billion	\$2.1 billion	\$599 million	\$1.1 billion
Funding Sources (existing and new)				
TIFIA Loan (25% of Toll Revenues)	\$72 to \$82 million	\$72 to \$82 million	\$72 to \$82 million	\$72 to \$82 million
Discretionary Grant (INFRA)	\$120 million	\$120 million	\$80 million	\$80 million
Local Contributions	\$10 million	\$10 million	\$10 million	\$10 million
New Federal Bill, Potential 27% increase yields \$183.5M / year	Can close any gap depending on the share and length of time committed to the project provided highway is eligible for federal funds.			
Portion of Potential State Gas Tax Increase, \$32M / penny	Can close any gap depending on the share and length of time committed. Provides state the greatest flexibility. Last proposal to increase the gas tax (did not pass) proposed a 10-cent increase plus increases in registration fees.			
Reprogrammed Bridge Funds	\$50 M	\$50 M	\$50 M	\$50 M

8.3. Performance Based Flexible Solutions

Given the effect the Ohio connection has on the projected traffic volumes, future phases of the project should consider a two-lane initial/four-lane ultimate typical section. The initial two-lane roadway would provide one direction of travel for the ultimate four-lane freeway facility.

Even if the initial two-lane typical section is considered, it would be prudent to purchase right-of-way and relocate utilities needed to accommodate a future four-lane ultimate typical section in case large industries locate along the new connector and/or ODOT advances the Ohio portion of the CEB. For that reason, it is assumed that this approach would not reduce the upfront right-of-way or utility cost estimates. However, the two-lane initial typical section is estimated to reduce the initial construction cost estimate by approximately 35 percent, saving KYTC millions of dollars in the near-term.

8.4. Next Steps

If a build alternative or priority section advances for future consideration, the next step would be Preliminary Engineering and Environmental Analysis. Further funding will be necessary to advance an improvement concept to the design phase. No future phases of this project were funded in *Kentucky's FY 2020 – FY 2026 Highway Plan*.

8.5. Contacts/Additional Information

Written requests for additional information should be sent to Mikael Pelfrey, Director, KYTC Division of Planning, 200 Mero Street, Frankfort, KY 40622. Additional information regarding this study can also be obtained from Lindsay Carter, KYTC Division of Program Management, (email at Lindsay.Carter@ky.gov).