TABLE OF CONTENTS

LIST OF TABLES

LIST OF EXHIBITS

LIST OF APPENDICES

Additional study documents can be accessed at: www.BrentSpenceBridgeCorridor.com

1.0 Introduction

1.1 Project Background

Interstate 75 (I-75) within the Greater Cincinnati/Northern Kentucky region is a major thoroughfare for local and regional mobility. Locally, it connects to I-71, I-74, and US Route 50. The Brent Spence Bridge provides an interstate connection over the Ohio River and carries both I-71 and I-75 traffic (Exhibit 1). The bridge also facilitates local travel by providing access to downtown Covington, Kentucky and Cincinnati, Ohio. Safety, congestion, and geometric problems exist on the structure and its approaches. The Brent Spence Bridge, which opened to traffic in 1963, was designed to carry 80,000 vehicles per day. Currently, approximately 160,000 vehicles per day use the Brent Spence Bridge and traffic volumes are projected to increase to approximately 200,000 vehicles per day in 2035.

The I-75 corridor within the Greater Cincinnati/Northern Kentucky region is experiencing problems which threaten the overall efficiency and flexibility of this vital trade corridor. Areas of concern include, but are not limited to, growing travel demand and congestion, land use pressures, environmental concerns, adequate safety margins, and maintaining linkage in key mobility, trade, and national defense highways.

The I-75 corridor has been the subject of numerous planning and engineering studies over the years and is a strategic link in the region's and the nation's highway network. As such, the Kentucky Transportation Cabinet (KYTC) and the Ohio Department of Transportation (ODOT) , in cooperation with the Federal Highway Administration (FHWA), are proposing to improve the operational characteristics of I-75 and the Brent Spence Bridge in the Greater Cincinnati/Northern Kentucky region through a major transportation project.

1.2 Project History

1.2.1 Federal Project Designations

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) identified High Priority Corridors on the National Highway System (NHS). This listing of high priority corridors included the Ohio sections of both I-75 and I-71 (Table 1-1).

Table 1-1. Interstates 75 and 71 as Listed Under Section 1105(c) ISTEA (P.L. 102-240), as amended through P.L. 109-59

Item Number	Corridor	Location
76	Interstate Route 75	Ohio
78	Interstate Route 71	Ohio

Source: FHWA, 2005

More recent federal surface transportation legislation (the 1998 Transportation Equity Act for the 21st Century [TEA] and the 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users [SAFETEA-LU), continued to identify projects along these high priority corridors to be eligible for federal funding. Table 1-2 identifies six of the high priority projects listed under SAFETEA-LU that are in the vicinity of the Brent Spence Bridge Replacement/Rehabilitation Project.

Table 1-2. High Priority Projects Listed Under SAFETEA-LU Located in or near the Brent Spence Bridge Replacement/Rehabilitation Project

Item Number	State	Project Description	Amount
685	OH	Study and design of modifications to I-75 interchanges at Martin Luther King, Jr. Boulevard, Hopple Street, I-74, and Mitchell Avenue in Cincinnati	$2.4 million
3385	KY	Replace Brent Spence Bridge, Kenton County	$1.6 million
4217	KY	Transportation improvements to Brent Spence Bridge	$34 million
4621	OH	On I-75 toward Brent Spence Bridge, Cincinnati	$10 million
4623	OH	Reconstruction, widening, and interchange upgrades to I-75 between Cincinnati and Dayton	$5 million
4624	OH	Replace the Edward N. Waldvogel Viaduct, Cincinnati (US Route 50)	$6 million

1.2.2 Kentucky Project Designations

In 1999, KYTC completed its current long-range multimodal transportation plan (Kentucky Transportation Cabinet, Statewide Transportation Plan FY 1999–2018, December 1999). The transportation plan is a 20-year plan for all modes of transportation. The plan consists of two phases – the short range element, which is the Six-Year Transportation Plan, and the long-range element, which is a 14-year plan beyond the six year plan. The long-range element is the principal source for new projects added to the Six-Year Transportation Plan. The statewide plan was updated in 2006 in the 2006 Kentucky Long-Range Statewide Transportation Plan. The 2006 plan is a 25-year multimodal plan for the Commonwealth of Kentucky. The current plan is a policy-only plan that identifies a vision and set of goals.

KYTC initiated an engineering feasibility study to investigate replacement options for the Brent Spence Bridge in 2003. The results of this study are documented in the *Feasibility and Constructability Study of the Replacement/Rehabilitation of the Brent Spence Bridge (May 2005).* The study area for this analysis began south of Kyles Lane in Kentucky and extended to the Western Hills Viaduct in Ohio. Concurrently, ODOT evaluated a number of alternatives for improving segments of I-75 in Ohio, from the area north of the Western Hills Viaduct, to a point north of I-275.

Kentucky's *Recommended Six-Year Transportation Plan FY 2007-2012* lists six "Mega-Projects" that are expected to cost in excess of $1 billion. The I-71/I-75 Brent Spence Bridge Replacement/Rehabilitation Project is one of the six "Mega-Projects". The plan notes that the I-71/I-75 Brent Spence Bridge "is the focal point for some of the heaviest traffic volumes in Kentucky", which not only provides a link between two major urban centers (Covington, Kentucky and Cincinnati, Ohio) but also connects the region to one of the nation's busiest airports, the Cincinnati/Northern Kentucky International Airport located in Boone County, Kentucky.

1.2.3 Ohio Project Designations

ODOT completed a statewide transportation study and strategic plan, *Access Ohio* in 1993. This plan was updated in 2004. *Access Ohio* identified "Transportation Efficiency and Economic Advancement Corridors" also known as "macro corridors" throughout the State of Ohio. These corridors are defined as "highways with statewide significance that provide connectivity to population and employment centers in Ohio and the nation by accommodating desired movements of persons and goods". The I-75 corridor is included in the list of macro corridors.

In 2000, the Ohio-Kentucky-Indiana Regional Council of Governments (OKI) and the Miami Valley Regional Planning Commission (MVRPC) formed a partnership with KYTC and ODOT to undertake a large scale analysis of the I-75 corridor. The limits of this analysis stretched from the I-71/I-75 Interchange in northern Kentucky to Piqua, Ohio. Known as the *North-South Transportation Initiative (February 2004)*, this traditional Major Investment Study (MIS) was conducted as part of the merged National Environmental Policy Act (NEPA) process. One goal of this study was to identify strategies to ensure that the I-75 corridor remains effective and efficient at moving people and goods through the region. The study addressed major improvements to all existing modes of transportation and identified appropriate transportation alternatives that need to be incorporated into the regional transportation plans. A preferred program of projects was defined based upon a thorough assessment of transportation needs and a consensus of the region's ambitions for the future.

The *North-South Transportation Initiative* recommended a number of capacity and safety improvements for the I-71 and I-75 corridor in Kentucky and I-75 in Ohio. A number of major replacements and rehabilitations were recommended for advancement into the NEPA process. One key recommendation was the Brent Spence Bridge Replacement/Rehabilitation Project (PID 75119) in order to provide for improved capacity, access, and safety in this portion of the corridor.

Two projects north of the Brent Spence Bridge were also recommended by the *North-South Transportation Initiative.* These recommendations resulted in ODOT's Thru-the-Valley project (PID 76256) and the Mill Creek Expressway (PID 76257). Both of these projects have incorporated ramp metering to maintain level of service. These two ODOT projects are being conducted as part of an overall program to improve I-75. The primary goals of this program are preserving right of way and assuring that short term improvements made to the corridor build on each other and provide improved capacity.

1.2.4 Metropolitan Planning Organization Project Designations

The Ohio Kentucky Indiana Regional Council of Governments (OKI) is the region's MPO and is responsible for planning and programming the region's transportation improvements. The Brent Spence Replacement/Rehabilitation Project is included in OKI's 2030 Regional Transportation Plan that serves as the region's federally mandated Long Range Transportation Plan update. It is also included in the FY 2008 to FY 2011 Transportation Improvement Program (TIP). This plan lists both fiscally constrained projects and those needed but not funded taking into account currently expected funding levels. Funding for the Brent Spence Bridge Replacement/Rehabilitation Project is included in the plan's fiscally-constrained list. Inclusion of the project in OKI's TIP indicates the project's eligibility for federal funding and that it is incorporated into the Statewide Transportation Improvement Programs (STIP) in both Kentucky and Ohio.

Due to the bi-state nature of the project, funding is divided between the two states in the TIP. The Ohio portion of the TIP includes a total of $38.83 million in Preliminary Engineering funds for Ohio bridge approaches; $13.83 million in FY08 and $25.0 million in FY10. The Kentucky portion of the TIP includes three separate project line items totaling $35.0 million. There is $10 million for design activities in fiscal years previous to 2008 and $25 million for right of way and utility coordination activities in FY2009. A total of $2.92 billion is listed as a funded line item for Kenton County, Kentucky. This line item is intended to cover construction costs for the entire project.

The OKI 2030 Regional Transportation Plan also indicates the results of its initial air quality analysis. The Brent Spence Bridge Replacement/Rehabilitation Project is included in the 2020 conformity analysis. In addition, several highway segments within the project study limits are identified in the OKI Congestion Management Process (CMP). The CMP assessed the region's transportation system performance through the collection of traffic data and an evaluation of congestion. The CMP also projected future travel conditions and developed a matrix of strategies to address future congestion levels.

Specific congestion "hot spot" segments in the project limits that were identified in the CMP are:

- I-71/I-75 in Northern Kentucky from Dixie Highway to Kyles Lane
- I-71/I-75 in Northern Kentucky from Kyles Lane to KY 12th Street in Covington
- I-71/I-75 in Northern Kentucky from KY 12th Street to KY 5th Street in Covington

The CMP identified other "hot spot" highway segments in both states, but these three specific segments were among the most congested in the region.

Planning for regional light rail was developed as part of OKI's *North-South Transportation Initiative* (February 2004). The planned regional light rail line would follow the I-75 corridor and provide service to Cincinnati and northern Kentucky. It is anticipated that light rail would use the Clay Wade Bailey Bridge corridor to cross the Ohio River and not the Brent Spence Bridge, however each of the feasible alternatives have been designed to not preclude light rail in the future as identified in the rail plan.

1.3 Study Area

The overall project corridor (Exhibit 2) is located along a 7.8-mile segment of I-75 within the Commonwealth of Kentucky (state line mile 186.7) and the State of Ohio (state line mile 2.7). The southern limit of the project is 5,000 feet south of the midpoint of the Dixie Highway Interchange on I-71/I-75 in Fort Wright, south of Covington, Kentucky. The northern limit of the project is 1,500 feet north of the midpoint of the Western Hills Viaduct Interchange on I-75 in Cincinnati, Ohio.

The eastern and western limits of the study area generally follow the existing alignment of I-75. From the south, the study area is a 1,500-foot wide corridor centered on I-75 northward towards the City of Covington. At Covington, the eastern and western study area boundaries widen and follow city streets as described below:

- Western project limits (from south to north):
  - At KY 5th Street in the City of Covington, the western boundary extends in the northwesterly direction across the Ohio River to US 50, approximately 1,000 feet west of the Freeman Avenue Interchange.
  - The western limit extends northerly parallel to Dalton Avenue to Hopkins Street.
  - The western limit extends westerly along Hopkins Street to the western limits of Union Terminal, where it then extends northerly along the western limits of Union Terminal to Kenner Street.
  - The western limit follows easterly along Kenner Street to the intersection with Dalton Avenue.
  - The western limit parallels Dalton Avenue to north of Findlay Street, where it follows in the northerly direction with a consistent 750-foot offset from the I-75 centerline.

- Eastern project limits (from south to north):
    - In the City of Covington, the eastern boundary follows Philadelphia Street to its intersection with KY 5th Street.
    - The eastern boundary follows KY 5th Street to its intersection with Main Street and then follows Main Street to the Ohio River.
    - The eastern boundary parallels the Clay Wade Bailey Bridge across the Ohio River to Pete Rose Way in the City of Cincinnati.
    - Through downtown Cincinnati, the eastern boundary follows OH 2nd Street and US 50 eastbound to approximately the I-71/US 50 Interchange over Broadway Avenue, north on Broadway Avenue then westerly along OH 4th Street to Plum Street, then northward until it reaches West Court Street.
    - From West Court Street, the eastern boundary extends west to Linn Street, where it follows Linn Street to Central Parkway.
    - The eastern boundary extends north paralleling Central Parkway to Linn Street.
    - From Linn Street, the eastern boundary extends westerly to Bank Street.
    - From Bank Street, the eastern limits extend in the northerly direction with a consistent 750-foot offset from the I-75 centerline.

1.4 Roadway Network

The existing roadway network within the study area consists of two interstates (I-71 and I-75), several US Routes (US 25, US 42, US 50, and US 127), two State Routes (KY 8 and OH 264), and numerous local streets. Major local streets and roads in Kentucky include Dixie Highway, Kyles Lane, KY 4th, 5th, 9th, and 12th streets, Pike Street, Crescent Avenue, Bullock Street, Jillians Way, and Philadelphia Street. In Ohio, major local streets include OH 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, and 9th streets, Central Avenue, Gest Street, Linn Street, Freeman Avenue, Western Avenue, Winchell Avenue, Ezzard Charles Drive, Bank Street, Spring Grove Avenue, and Harrison Avenue. This roadway network serves both regional and local traffic within the Greater Cincinnati/Northern Kentucky region.

I-71 and I-75 are major north-south transportation corridors through the Midwestern United States. I-75 was constructed in the 1950's and the Brent Spence Bridge was completed in 1963. Since the construction of I-75, the Brent Spence Bridge deck was reconfigured to add a fourth travel lane in each direction in 1985. In 1998, I-71/I-75 in Kentucky was realigned and widened between the southern limits of the Brent Spence Bridge and Dixie Highway. I-71, also known as Fort Washington Way through downtown Cincinnati, was reconstructed in 2000 which included the reconfiguration of connections to I-75 and the US 50 Interchange in Ohio. Even with the recent construction projects, the I-75 corridor is characterized by outdated design, vehicular safety problems, and poor levels of service which threaten the overall efficiency of people and goods movement within the region. Congestion in both directions on I-75 is a regular occurrence throughout the entire study area and is often present at various times during the day.

1.5 Purpose of Report

The Preferred Alternative Verification Report (PAVR) submittal is a design submission produced near the end of Step 7 of ODOT's Project Development Process (PDP), based upon engineering conducted after the identification of the recommended preferred alternative. The purpose of the PAVR is to provide documentation to facilitate review and approval of the basic design elements that will be used: (1) to determine the impact limits for the environmental assessment; (2) to scope Stage 1 design and beyond; and (3) to update costs for programming of various construction phases.

The design of the preferred alternative is based upon the guidelines in ODOT's Location and Design Manual, Volume 3, Section 1400. Section 1403.5 provides a description of Step 7 design activities along with a listing of elements that must be submitted for review as part of the PAVR. This report documents the status of each element and the timing and method of submission.

2.0 Purpose and Need

The purpose and need statement for the Brent Spence Bridge Replacement/Rehabilitation Project was completed in May 2006. The purpose and need was updated during Step 5 of the Ohio Department of Transportation's (ODOT's) Project Development Process (PDP) and reported in the Purpose and Need section of the *Conceptual Alternatives Study Report (April 2009)*.

The Brent Spence Bridge Replacement/Rehabilitation Project will improve the operational characteristics within the I-71/I-75 corridor for both local and through traffic. In the Greater Cincinnati/Northern Kentucky region, the I-71/I-75 corridor suffers from congestion and safety–related issues as a result of inadequate capacity to accommodate current traffic demand. The purpose of this project is to:

- Improve traffic flow and level of service,
- Improve safety,
- Correct geometric deficiencies, and
- Maintain connections to key regional and national transportation corridors.

Specific problems of I-71 and I-75 within the study area include, but are not limited to, growing demand, congestion, and design deficiencies.

2.1 Traffic Flow and Level of Service

Traffic analyses completed for the *Existing and Future Conditions Report (February 2006)* and conceptual alternatives determined that approximately 160,000 vehicles per day use the Brent Spence Bridge and traffic volumes are projected to increase to approximately 200,000 vehicles per day in 2035 for the No Build Alternative.

Level of service (LOS) is an assessment of roadway and intersection performance, expressed LOS A to F. The desired LOS on an interstate is LOS C. The current and future levels of service (LOS) in the I-71/I-75 corridor range from LOS B to F. More traffic details are provided in Section 5.0 Traffic Analysis.

In 2005, traffic data and the level of service on I-75 for the No Build Alternative were analyzed. During the AM Peak, 48 percent of the freeway segments analyzed operated at LOS D or worse. During the PM Peak, 63 percent of the I-75 freeway segments analyzed were at LOS D or worse. The 2035 traffic data and level of service for the No Build Alternative were also analyzed, for basic freeway segments on I-75. During the AM Peak, 64 percent of the freeway segments analyzed were estimated to be LOS D or worse. During the PM Peak, 95 percent of the freeway segments analyzed were estimated to be LOS D or worse. A comparison of I-75 traffic data shows significant problems for motorists, especially during the PM peak, when almost all of the freeway segments on I-75 will operate at LOS D or worse.

Freeway segments on I-71 and US 50 were operating under acceptable levels of service in 2005. However, many of the freeway segments will also experience conditions of poor levels of service in 2035.

2.2 Safety

A discussion of crash rates (2001-2003) and safety issues is detailed in the *Planning Study Report* (September 2006), *Purpose and Need Statement* (May 2006), and *Existing and Future Conditions Report* (February 2006). Crash rates for the I-71/I-75 corridor exceed the Kentucky and Ohio statewide averages. This is due in part to congested traffic conditions in addition to deficient and substandard roadway geometry.

Based on the most recently available crash reports (2001-2003), the I-71/I-75 corridor within Kenton County, Kentucky has a crash rate higher than the statewide average of 0.78 accidents per million vehicle miles traveled. The overall crash rate for this section is 1.30, which is nearly 1.67 times higher than Kentucky's statewide average crash rate for interstate highways.

Based on the most recently available crash reports (2001-2003),the overall crash rate for the Ohio section of I-71 in the study area is 3.22 accidents per million vehicle miles traveled, which is approximately 1.7 times higher than the Ohio statewide average rate of 1.887 accidents per million vehicle miles traveled. Overall, I-75 within the study area in Ohio has a crash rate of 2.91, which is approximately 1.5 times higher than the statewide average rate.

ODOT's safety management databases indicate that the I-75 corridor has been designated as a corridor with safety concerns. The 2009 Highway Safety Program (HSP) List for years 2007-2009 includes three highway segments within the study area, which are ranked in the top 100 least safe roadways in the state. The section of I-75 from mile post 0.91 to mile post 3.23 is ranked #7, the section of I-75 from mile post 0.47 to mile post 0.90 is ranked #22, and the section of I-71 from mile post 0.60 to mile post 1.10 is ranked #40. The 2009 Hot Spot Freeway List for years 2007-2009 ranks the section of I-75 from mile post 0.90 to mile post 2.90 as the #1 Hot Spot Location with 807 crashes in the three year period.

2.3 Geometric Deficiencies

The geometric design features of I-71 and I-75 within the study area do not meet current standards for an instate highway facility. Design deficiencies include:

- Substandard vertical alignments with limited stopping sight distances.
- Acceleration and deceleration lanes that are not of sufficient length for anticipated traffic volumes and movements.
- Narrow shoulders that present safety hazards, make maintenance of traffic difficult, and contribute to traffic delays when crashes, vehicle breakdowns, or scheduled roadwork result in lane restrictions.

A complete list of existing geometric deficiencies is provided in the *Existing and Future Conditions Report* (February 2006).

2.4 National, Regional, and Local System Linkage

The I-75 corridor in the Greater Cincinnati/Northern Kentucky area is a significant transportation corridor, not only for local access and mobility needs, but also for regional, statewide, and national access and mobility needs. However, transportation plans and recommendations at all levels (local, state, and national) recognize that these facilities now operate at or beyond capacity and therefore, need to be upgraded to modern standards to maintain these important transportation links.

3.0 Alternatives

Development of conceptual alternatives for the Brent Spence Bridge was initiated in 2003 by the Kentucky Transportation Cabinet (KYTC). These initial alternatives were documented in the *Feasibility and Constructability Study (*May 2005). This report recommended a series of potential feasible build alternatives for replacement and/or rehabilitation of the Brent Spence Bridge structure and improvement to its approaches and surrounding transportation system. Six conceptual alternatives were recommended for further study.

In 2006, 25 conceptual alternatives, including the No Build alternative, were developed in Step 4 of the Ohio Department of Transportation's (ODOT) Project Development Process (PDP). These 25 conceptual alternatives included the six alternatives from the *Feasibility and Constructability Study.* The 25 conceptual alternatives were evaluated using a two-phased screening process based on a comparative analysis. Phase one of the analysis was an evaluation of the conceptual alternatives based on the goals of the purpose and need and comments received from local governments. In phase two of the analysis, the conceptual alternatives that were not eliminated in phase one were evaluated using stakeholder goals and measures of success; design compatibility with the I-75 Mill Creek Expressway project (HAM-75-2.30) to the north; and concurrence among government agencies obtained through a series of meetings. Some alternatives were combined into hybrid alternates and then evaluated in phase two of the analysis.

The two-phased comparative analysis eliminated 19 of the 25 conceptual alternatives from further study and evaluation as these 19 conceptual alternatives failed to meet the purpose and need goals of the project and did not adequately address the stakeholder's goals and measures of success. Additionally, these eliminated alternatives would not have been compatible with the I-75 Mill Creek Expressway project (HAM-75-2.30) and the five travel lanes needed to provide a seamless connection between the two projects.

The *Planning Study Report* (September 2006) documents the 25 conceptual alternatives and the two-phased comparative analysis.

3.1 Conceptual Alternatives

At the end of Step 4 of the PDP, a total of six conceptual alternatives were recommended for further study, including the No Build and five mainline build alternatives. The No Build Alternative, which consists of minor and short-term safety and maintenance improvements to the Brent Spence Bridge and I-75 corridor, was retained as a baseline for evaluation of the build alternatives. From the five mainline alternatives, a variety of sub-alternatives were developed, resulting in eight conceptual alternatives to provide options for key intersection and traffic flow areas within the project corridor. These eight conceptual alternatives were identified as Alternatives A through H. Detailed descriptions of the mainline alternative and the various sub-alternatives are presented in the *Planning Study Report*. These eight alternatives were further developed and refined during Step 5 of the PDP. Evaluation efforts included environmental studies, traffic analysis, refinement of horizontal and vertical alignments, cost estimates, utilities coordination, and stakeholder coordination.

All of the conceptual alternatives were the same at the southern and northern ends of the project corridor. The differences among the conceptual alternatives were in the design configuration, access points, and number of lanes that occur between 12th Street in Kentucky to Ezzard Charles Drive in Ohio. In Kentucky, south of KY 12th Street, I-71/I-75 has six lanes northbound and southbound. North of Western Hills Viaduct in Ohio, I-75 has five lanes northbound and southbound. The configurations of the Dixie Highway, Kyles Lane, and Western Hills Viaduct interchanges were the same for all conceptual alternatives, except Alternative H which did not incorporate a collector-distributor (C-D) roadway system. For conceptual alternatives A through G, the Dixie Highway and Kyles Lane interchanges would be modified slightly to accommodate a C-D roadway system, which would be constructed along both sides of I-71/I-75 between the two interchanges.

Alternatives A through G also improved Western and Winchell avenues to facilitate traffic flow and increase capacity. For each of these alternatives, the Western Hills Viaduct Interchange would be reconfigured.

3.2 Feasible Alternatives

The *Conceptual Alternatives Study* (April 2009) report from Step 5 of the PDP recommended feasible alternatives for further study in Step 6 and Step 7 of the PDP. During Step 5, Alternatives A, B, F, G, and H were eliminated from further consideration.

A hybrid alternative consisting of a combination of Alternatives C and D, identified as Alternative I, along with Alternative E from the *Conceptual Alternatives Study* (April 2009), were recommended to be developed for further study in Step 6 and Step 7 as feasible alternatives.

Alternatives C and D were very similar in overall design. Based on the comparative analysis in Step 5, with respect to horizontal and vertical alignments, impacts, and the flow of traffic of Alternatives C and D, it was determined that a hybrid alternative that included the northbound portion of Alternative C and the southbound portion of Alternative D would be advanced for further consideration. It was recommended to increase the number of lanes for I-75 to three lanes in each direction to support the improved level of service this alternative would provide. The hybrid alternative consisting of a combination of Alternatives C and D was identified as Alternative I and was later determined to be the recommended preferred alternative.

The recommendation to further develop Alternative E was based on the access provided to the cities of Covington and Cincinnati and the minimal amount of community impacts it had in comparison to the other alternatives. It was recommended to maintain the number of lanes for I-75 at three lanes in each direction to support the improved level of service this alternative would provide.

While Alternative G was recommended to be eliminated from further consideration due to its high costs and residential and business displacements, many of the beneficial design features were carried forward. This decision was made based upon the analyses completed and feedback as part of community input. The following beneficial design features of Alternative G were carried forward for further analysis and incorporated into the feasible alternatives:

- Access to north end of Clay Wade Bailey Bridge from I-75 southbound using a C-D roadway and US 50 eastbound;
- Two access points into Covington;
- Access from a northbound C-D roadway from Kentucky to I-71 northbound in Ohio; and
- Access ramp just north of Ezzard Charles Drive for Freeman Avenue and local traffic to I-75 northbound.

3.3 Recommended Feasible Alternatives

The comparative analysis led to the recommendation of carrying forward two feasible alternatives. The two feasible alternatives consist of Alternative E and a combination of Alternatives C and D designated as Alternative I. Based on the analyses completed and feedback as part of community input, it was also recommended that certain design elements (as listed above) of Alternative G be incorporated into the two feasible alternatives in Step 6 of ODOT's PDP. Both feasible alternatives were designed to provide three lanes in each direction on I-75. A comparison between these two alternatives along with the No Build Alternative is provided in Table 3-1.

3.3.1 No Build Alternative

The No Build Alternative consists of minor, short-term safety and maintenance improvements to the Brent Spence Bridge and I-75 corridor, which would maintain continuing operations. All safety and maintenance improvements will be performed within existing right of way.

The No Build does not meet the purpose and need for this project. This alternative does not improve traffic flow and existing congestion will worsen. The No Build does not provide improvements for safety. Lane widths would remain and the lack of shoulders on the bridge would continue. Geometric deficiencies would not be corrected. The No Build would maintain existing connections to local, regional, and national transportation corridors but does not improve these connections.

The No Build Alternative is retained as a baseline alternative to compare with the feasible Build Alternatives.

3.3.2 Alternative E

Alternative E utilizes the existing I-71/I-75 alignment from the southern project limits at the Dixie Highway Interchange north to the Kyles Lane Interchange (Exhibit 3 and Appendix A). The Dixie Highway and Kyles Lane interchanges will be modified slightly to accommodate a C-D roadway, which will be constructed along both sides of I-71/I-75 between the two interchanges. North of the Kyles Lane Interchange, the alignment shifts to the west to accommodate additional I-71/I-75 travel lanes. Between Kyles Lane and KY 12th Street, six lanes will be provided in each direction for a total of 12 travel lanes.

Near KY 12th Street, the northbound alignment separates into two routes; one for interstate traffic and one for a local C-D roadway. Between Pike Street and KY 9th Street, the interstate separates into I-71 and I- 75 only routes. The C-D roadway will carry local traffic northbound and provide access to Covington at KY 12th and 5th streets and access from KY 9th and 4th streets. The southbound C-D roadway will carry traffic from Ohio, cross over I-71 and I-75, and provides access to both the interstate and into Covington at KY 9th Street.

A portion of Crescent Avenue will be closed with a new connection to Bullock Street. Access from Covington for southbound interstate traffic is located at KY 12th Street. Bullock Street will be extended north from Pike Street to KY 9th, 5th, and 4th streets and Jillians Way will be extended north from Pike Street to KY 9th, 5th, and 4th streets. Bullock Street and Jillians way will function as one-way pair local frontage roadways.

A new double deck bridge, the new Ohio River Bridge, will be built just west of the existing Brent Spence Bridge to carry northbound and southbound I-71 and I-75 traffic. On the upper deck, I-71 southbound will have three lanes and I-71 northbound will have two lanes. On the lower deck, I-75 will have three northbound and three southbound lanes. The existing Brent Spence Bridge will be rehabilitated to carry northbound and southbound local traffic with two lanes in the southbound direction and three lanes in the northbound direction and will meet the standards and requirements for maintaining interstate traffic.

In Ohio, Alternative E reconfigures I-75 through the I-71/I-75/US 50 Interchange and eliminates some of the existing access points along I-75. Existing ramps to I-71, US 50 and downtown Cincinnati will be reconfigured. The existing direct connections between I-75 to westbound and from eastbound US 50 will be maintained in Alternative E. US 50 will be reconfigured to eliminate left-hand entrances and exits. The OH 5th Street overpass will be eliminated and the OH 6th Street Expressway will be reconfigured as a two-way, six-lane elevated roadway with a new signalized intersection for US 50 access and egress. Access between southbound I-71 (Fort Washington Way) and northbound I-75 will be provided near OH 9th Street as a direct connection. Both I-75 southbound and US 50 (OH 6th Street Expressway) will have access to northbound I-71 (Fort Washington Way).

A local C-D roadway will carry local traffic northbound from the existing Brent Spence Bridge and provide access to OH 2nd, 5th, and 9th streets, Winchell Avenue and access from OH 4th before reconnecting to I-75 just south of the Linn Street overpass. The northbound ramps from OH 6th and 9th streets to I-75 will be removed requiring traffic from these points to utilize a new local roadway parallel to I-75 connecting to Winchell Avenue and access the interstate at Bank Street. Southbound I-75 traffic will separate from the local C-D roadway near Ezzard Charles Drive. The southbound C-D roadway will carry traffic over I-75 to OH 7th Street, allowing traffic to either; access downtown at 7th Street, travel south to OH 5th and 2nd streets, or travel across the existing Brent Spence Bridge into Covington. Access to the local southbound C-D roadway will be provided at Western Avenue and at OH 4th and 8th streets.

Alternative E also improves Western and Winchell avenues to facilitate traffic flow and increase capacity. The ramps to Western Avenue and from Winchell Avenue just north of Ezzard Charles Drive will be removed. The ramp from Freeman Avenue to I-75 northbound and the ramp from I-75 southbound to Freeman Avenue will remain. Between Ezzard Charles Drive and Western Hills Viaduct, southbound I-75 will have six lanes, northbound I-75 will have five lanes. The Western Hills Viaduct Interchange will be reconfigured to provide a full movement interchange. The improved interchange will be a single point urban interchange (SPUI) design.

3.3.3 Alternative I

Alternative I is a combination of Alternatives C and D with certain design elements of Alternative G (Exhibit 4 and Appendix A). Alternative I utilizes the existing I-71/I-75 alignment from the southern project limits at the Dixie Highway Interchange north to the Kyles Lane Interchange. The Dixie Highway and Kyles Lane interchanges will be modified slightly to accommodate a C-D roadway, which will be constructed along both sides of I-71/I-75 between the two interchanges. North of the Kyles Lane Interchange, the alignment shifts to the west to accommodate additional I-71/I-75 travel lanes. Between Kyles Lane and KY 12th Street, six lanes will be provided in each direction for a total of 12 travel lanes. Near KY 12th Street, the alignment northbound separates into three routes for I-71, I-75, and a local C-D roadway.

In Alternative I, access into Covington from the interstate will be provided by the local C-D roadway; at KY 12th Street for northbound traffic and at KY 5th and 9th streets for southbound traffic. Access from Covington for northbound traffic will be provided by a ramp located between Pike Street and KY 9th Street from Jillians Way. The ramp will provide direct access to I-71 from Covington and provide access to I-75 northbound using the C-D roadway through downtown Cincinnati and connecting at the merge near Ezzard Charles Drive. Access from Covington will also be provided at KY 4th Street to the northbound C-D roadway.

Access from Covington for southbound interstate traffic is located at KY 12th Street. Bullock Street will be extended north from Pike Street to KY 9th, and 4th streets and Jillians Way will be extended north from Pike Street to KY 9th and 5th streets. Bullock Street and Jillians way will function as one-way pair local frontage roadways.

A new double deck bridge will be built just west of the existing Brent Spence Bridge. This new bridge will carry three lanes of I-75 southbound and two lanes of I-71 northbound on the upper deck and three lanes local southbound and three lanes of I-75 northbound on the lower deck. The existing Brent Spence Bridge will be rehabilitated to carry two lanes of northbound I-71 traffic on the upper deck and three lanes for northbound local traffic on the lower deck as part of the C-D roadway system. The existing bridge plans indicate a 15' 0" minimum clearance. AASHTO's "Green Book", "A Policy on Geometric Design of Highways and Streets", (2004), as well as AASHTO's "A Policy on Design Standards Interstate System" (January 2005, 5th edition), both of which KYTC utilizes as their design standards, identify a minimum vertical clearance of 14' may be used where there is an alternative route, which in this case would be I-275. Therefore the existing Brent Spence Bridge will meet current standards and requirements for maintaining interstate traffic.

Alternative I reconfigures I-75 through the I-71/I-75/US 50 Interchange and eliminates all access to and from I-75 from KY 12th Street to the Freeman Avenue overpass in the northbound direction. Alternative I eliminates access to I-75 southbound between the Freeman Avenue exit and KY 9th Street. Alternative I also eliminates access from I-75 southbound between the US 50/6th Street overpass and Kyles Lane.

In Ohio, a local C-D roadway will be constructed along both sides of I-75. The local northbound C-D roadway will carry local traffic from the existing bridge and provide access ramps to OH 2nd Street, I-71 northbound, US 50 westbound, OH 5th Street, and Winchell Avenue before reconnecting to I-75 just south of Ezzard Charles Drive. The northbound ramps from OH 4th Street will utilize the new local northbound C-D roadway for access to I-75. The northbound ramps from OH 6th and 9th streets to I-75 will be removed requiring traffic from these two points to utilize a new local roadway parallel to I-75 connecting to Winchell Avenue and access the interstate at Bank Street. The southbound C-D roadway begins near the Ezzard Charles Drive overpass and carries both downtown Covington and Cincinnati traffic. The southbound C-D roadway will provide access to OH 7th, 5th, and 2nd streets, as well as connecting to access ramps from Western Avenue, OH 9th Street, and US 50 eastbound. The C-D roadway will continue south over the new bridge into Covington.

Between Ezzard Charles Drive and the Western Hills Viaduct, northbound I-75 will have five lanes and southbound I-75 will have six lanes, for a total of 11 travel lanes. The ramps to Western Avenue and from Winchell Avenue just north of Ezzard Charles Drive to the Interstate will be eliminated. The southbound ramp to Freeman Avenue and the northbound ramp from Freeman Avenue to I-75 will remain. Alternative I also improves Western and Winchell avenues to facilitate traffic flow and increase capacity. Ramps to Western Avenue and from Winchell Avenue will be provided around the Western Hills Viaduct Interchange, which will be reconfigured to be a Tight Urban Diamond design.

Table 3-1. Feasible Alternatives Evaluation Matrix

Evaluation Feature	No Build Alternative	Alternative E	Alternative I
Brief Description of Alternative	The No Build Alternative maintains the existing configuration of the I-75 corridor and consists of minor, short-term safety and maintenance improvements to the interstate which would maintain its continuing operation	Alternative E utilizes the existing I-71/I-75 alignment from the southern project limits at the Dixie Highway Interchange, north to the Kyles Lane Interchange. A collector distributor (C-D) roadway will be constructed along both sides of I-71/I-75 between the two interchanges. A new double deck bridge will be built just west of the existing Brent Spence Bridge. . The existing Brent Spence Bridge will be rehabilitated to carry three lanes for northbound local traffic and two lanes for southbound local traffic. In Ohio, a local C-D roadway will be constructed along both sides of I-75. In Ohio, I-75 will be reconfigured through the I-71/I-75/US 50 interchange and some access points along I-75 will be eliminated. A local C-D roadway will provide local access in Ohio.	Alternative I is a combination of Alternatives C and D with certain design elements of Alternative G. Alternative I utilizes the existing I-71/I-75 alignment from the southern project limits at the Dixie Highway Interchange north to the Kyles Lane Interchange. A C-D roadway will be constructed along both sides of I-71/I-75 between the two interchanges. A new double deck bridge will be built just west of the existing Brent Spence Bridge. The existing Brent Spence Bridge will be rehabilitated to carry two lanes for northbound I-71 and three lanes for northbound local traffic. In Ohio, a local C-D roadway will be constructed along both sides of I-75.
Local access to/from the interstate	No changes to existing access	Provides indirect access to interstate by way of local C-D road • I-75 access between KY 12th Street and Ezzard Charles Drive Provides direct access to interstate • 1 direct access point to I-71 NB at KY 9th Street • 1 direct access point to I-75 NB in KY 9th Street • Direct access to I-71/I-75 SB at KY 12th Street • 1 direct access point to/from I-75 NB and SB at Freeman Avenue	Provides indirect access to interstate by way of local C-D road • I-75 access between KY 12th Street and Ezzard Charles Drive Provides direct access to interstate • 1 direct access point to I-71 NB in KY at Pike Street • Direct access to I-71/I-75 SB at KY 12th Street • 1 direct access point to/from I-75 NB and SB at OH 3rd Street • 1 direct access point to/from I-75 NB and SB at Freeman Avenue
Access to Covington from I-75	No changes to existing access	Provides direct access to Covington • I-75 SB and I-71 SB access at KY 9th Street Provides indirect access to Covington by C-D road • NB access at KY 5th and 12th Street	Provides indirect access to Covington from I-75 by a C-D road • NB access at KY 12th Street SB access at KY 5th and 9th Street

Table 3-1. Feasible Alternatives Evaluation Matrix

Evaluation Feature	No Build Alternative	Alternative E	Alternative I
Existing access points to I-75 in Cincinnati	No changes to existing access	Alters existing access to I-75 • Existing I-75 NB and SB access eliminated or reconfigured between KY 9th Street to just north of Western Hills Viaduct • Existing direct access to/from I-75 will remain but reconfigured at US 50	Eliminates direct access to/from I-75; Access provided by C-D road • I-75 NB access eliminated between KY 12th Street to just south of Ezzard Charles Drive • I-75 SB access eliminated between KY 9th Street and the Western Hills Viaduct • Access provided by C-D road
Separates local and regional traffic	Does not separate local and regional traffic	• A new bridge just west of the existing Brent Spence Bridge will be constructed to carry I-75 and I-71 NB and SB traffic • The existing Brent Spence Bridge will be rehabilitated to carry local NB and SB traffic	• A new bridge just west of the existing Brent Spence Bridge will be constructed to carry I-75 NB and SB, I-71 SB, and local SB traffic • Existing Brent Spence Bridge will be rehabilitated to carry I-71 NB and local NB traffic
Design Exceptions	Not applicable	42 locations in total (5 in KY; 37 in OH)	43 locations in total (3 in KY; 40 in OH)
Existing (2005) levels of service and average daily traffic	Approximately 160,000 vehicles per day LOS C to F	Not applicable	Not applicable
Future (2035) levels of service along mainline segments	I-75: • 16 NB and 15 SB LOS E or worse I-71: • 3 NB and 6 SB LOS E or worse	I-75: • 9 NB and 10 SB LOS E or worse I-71: • 5 NB and 3 SB LOS E or worse	I-75: • 6 NB and 10 SB LOS E or worse I-71 • 6 NB and 2 SB LOS E or worse

Table 3-1. Feasible Alternatives Evaluation Matrix

Evaluation Feature	No Build Alternative	Alternative E	Alternative I
Future (2035) daily hourly volumes along mainline segments (NB = northbound; SB = southbound)	I-75: • NB ranges from 2,360 – 8,860 • SB ranges from 2,760 – 10,170 I-71/I-75: • NB ranges from 5,310-8,650 • SB ranges from 940-9,160 I-71: • NB ranges from 1,900 – 7,400 • SB ranges from 2,420 – 6,330	I-75: • NB ranges from 2,870 – 8,680 • SB ranges from 2,940 – 9,360 I-71/I-75: • NB ranges from 6,440 – 8,910 • SB ranges from 6,440 – 10,390 I-71: • NB ranges from 2,240 – 7,690 • SB ranges from 2,660 – 6,490	I-75: • NB ranges from 2,010 – 8,870 • SB ranges from 2,730 – 9,750 I-71/I-75: • NB ranges from 5,700 – 8,910 • SB ranges from 6,440 – 10,390 I-71: • NB ranges from 2,240 – 7,690 • SB ranges from 2,310 – 6,490
Right-of-way Impacts – (acres within construction limits)	No Impact	36.90 total acres KY – 24.45 acres OH – 12.45 acres	31.37 total acres KY – 21.76 acres OH – 9.61 acres
Parcels – (total estimated parcels impacted)	No Impact	KY – 162 parcels OH – 111 parcels	KY – 123 parcels OH – 68 parcels
Compatibility with existing community land use plans	• Not compatible with economic development plans • Does not preclude future light rail plans • No changes to existing land uses	Compatible with plans • Supports redevelopment and economic plans in Queensgate and Cincinnati • Keeps land uses conducive with Northern Kentucky comprehensive plans • Makes provisions for future light rail plans	Compatible with plans • Supports redevelopment and economic plans in Queensgate and Cincinnati • Keeps land uses conducive with Northern Kentucky comprehensive plans • Makes provisions for future light rail plans
Community Cohesion	No impact	Loss of residences in Lewisburg neighborhood and historic district and West McMicken Avenue neighborhood	Loss of residences in Lewisburg neighborhood and historic district

Table 3-1. Feasible Alternatives Evaluation Matrix

Evaluation Feature	No Build Alternative	Alternative E	Alternative I
Facilities and Services	No impacts	• Goebel Park (3.7 acres - parking lot, portion of walking trail, and basketball court) • Queensgate Playground and Ball Fields (strip take – 0.6 acres) • Notre Dame Academy School (1.34- portion of parking lot and ball field) • Beechwood Schools (strip take) • Central Church of the Nazarene (KY) (0.44 acres – portion of parking lot)	• Goebel Park (1.9 acres - basketball court, parking lot) • Queensgate Playground and Ball Fields (strip take – 0.9 acres) • Notre Dame Academy School (1.34 acres - portion of parking lot and ball field) • Beechwood Schools (strip take) • Central Church of the Nazarene (KY) (0.44 acres – portion of parking lot)
Residential – (total estimated structures and residences displaced)	No Impact	89 Total (89 – 356 persons) KY – 74 structures (74 – 296 persons) OH – 15 structures (15 - 60 persons)	43 Total (43-172 persons) KY – 43 structures (43-172 persons) OH – no residential displacements
Business – (total estimated businesses and employees displaced)	No Impact	17 Total (408 – 529 employees) KY – 8 businesses (100-130 employees) OH – 9 businesses (308 – 399 employees)	15 Total (341 – 382 employees) KY – 8 businesses (90-115 employees) OH – 7 business (251 – 267 employees)
Environmental Justice – (impacts to neighborhoods and Census tracts with high percentage of low income and minority populations)	No impact	• No minority population impacts in KY • Medium impact to low-income populations (residences displaced in Lewisburg) in KY • Impact to parking lot, basketball court, and portion of walking path in Goebel Park • Medium impact to low-income population in Ohio (residences displaced on McMicken Avenue) • Strip taken of land in Queensgate Playground and Ball Fields in EJ community • No disproportionate impacts	• No minority population impacts in KY • Low impact to low-income populations (residences displaced in Lewisburg) in KY • Impact to parking lot and basketball court in Goebel Park • Low impact to low-income population in Ohio (residences displaced on McMicken Avenue) • Strip taken of land in Queensgate Playground and Ball Fields in EJ area • No disproportionate impacts
Intermittent Streams	No impact	3,335 linear feet	3,340 linear feet
Ephemeral Streams	No impact	0 linear feet	0 linear feet
Wetlands	No impact	1.38 acres	1.38 acres
Indiana bat habitat (Potential /Marginal)	No impact	28/27 acres	28/28 acres
Potential Running Buffalo Clover habitat	No impact	2 acres	2 acres
Floodplains	No impact	Piers for new Ohio River Bridge	Piers for new Ohio River Bridge
Farmland	No impact	No impact	No impact
Number of sites recommended for Phase II Environmental Site Assessment	No Impact	10 in total	11 in total
Number of sites recommended for Phase I Environmental Site Assessment at Western Hills Viaduct	No Impact	0	1
Individual properties eligible for listing or listed in the National Register of Historic Places (NRHP)	No impact	Longworth Hall – 198 feet	Longworth Hall – 198 feet
Historic Districts (HD) directly impacted	No impact	• Lewisburg Historic District (53 contributing buildings) • West McMicken Avenue Historic District (8 contributing buildings)	• Lewisburg Historic District (33 contributing buildings)
Potential Archaeological Sites	No impact	1	0
Air Quality	Conforming	Conforming	Conforming
Number of receptor sites where 2035 noise levels will approach or exceed the NAC of 66 dBA for Category B land use (residential)	40	45	52

Table 3-1. Feasible Alternatives Evaluation Matrix

Evaluation Feature	No Build Alternative	Alternative E	Alternative I
Number of receptor sites where 2035 noise levels will approach or exceed the NAC of 71 dBA for Category C land use (industrial/commercial)	2	6	3
Section 4(f) Resources	No Impact	• Goebel Park (3.7 acres – basketball court and portion of walking trail) • Lewisburg Historic District (53 contributing buildings) • Queensgate Playground and Ball Fields (0.6 acres) • Longworth Hall (198 feet of building) • West McMicken Avenue Historic District (8 contributing buildings)	• Goebel Park (1.9 acres – basketball court) • Lewisburg Historic District (33 contributing buildings) • Queensgate Playground and Ball Fields (0.9 acres) • Longworth Hall (198 feet of building)
Section 6(f) Parks	No Impact	Goebel Park (3.7 acres)	Goebel Park (1.9 acres)
Maintenance of Traffic and Constructability	No impact	• The project will be constructed in five phases • Construction will last seven years. • I-71 will be re-shielded to I-471 • Access to the CBDs in Covington and Cincinnati will be maintained at all times	• The project will be constructed in five phases • Construction will last seven years. • I-71 will be re-shielded to I-471 • Access to the CBDs in Covington and Cincinnati will be maintained at all times
Utilities	No Impact	57	57
Cost Estimates (in millions)	Not applicable	Kentucky $699.7 Ohio $930.5 WHV $270.0 Existing Bridge $73.5 New Bridge $730.2 Total $2,703.9	Kentucky $642.4 Ohio $855.6 WHV $142.2 Existing Bridge $73.5 New Bridge $730.2 Total $2,443.7

3.4 Western Hills Viaduct Interchange

3.4.1 Interchange Alternative Development

The Western Hills Viaduct (WHV) is a multi level structure which spans across the Mill Creek Valley connecting I-75, Central Parkway, West McMillan Street, and Spring Grove Avenue on the east with Queen City Avenue, Harrison Avenue, and State Avenue on the west. The WHV carries local traffic between the west side of Cincinnati and downtown and provides connections to I-75 northbound and southbound from the west side of Cincinnati. Interstate and local traffic movements are intermixed between the upper deck, which consists of four travel lanes, and the lower deck, which consists of three travel lanes. The WHV provides pedestrian access with a sidewalk on the south side of the upper deck; however, does not have any shoulders or bike lanes along the travel lanes for bicycle access.

The existing interchange is a full movement interchange to the west only with a left-hand exit. Southbound I-75 traffic exits to the lower deck and enters from the lower deck while northbound I-75 traffic exits to the upper deck and enters from the upper deck.

Ramp metering was used at the WHV interchange in order to keep freeway lanes flowing at near capacity when the demand to enter the freeway, if left unchecked, would cause the freeway to exceed its capacity. Ramp meters, which are essentially traffic signals, would be placed on entrance ramps to restrict the flow of traffic entering the freeway. WHV is the northern most interchange within the Brent Spence Bridge Replacement/Rehabilitation Project and traffic demand is substantially higher than the carrying capacity of the lanes on I-75 in the vicinity of WHV. Because of this, the metering rate was set to the most restrictive level possible to avoid the level of service on I-75 dropping to an LOS F.

In Step 4 of the PDP, several sub-alternatives were evaluated for the WHV Interchange. Three of these sub-alternatives were recommended for further study in the *Planning Study Report*. These three sub-alternatives were studied in the *Conceptual Alternatives Study* (April 2009) during Step 5 of the PDP: an offset roundabout diamond, a single roundabout diamond, and a single-point urban interchange (SPUI) with an at-grade intersection with Central Parkway.

During Step 5, all three sub-alternatives were dismissed from further study because analyses showed each concept did not have the capacity to handle the projected future traffic. A fourth alternative was considered during Step 5 which connected Spring Grove to I-75 by adding a third level to the interchange under I-75. This full movement interchange was also dismissed after further investigation due to several fatal flaws both operationally and geometrically.

The primary conceptual design constraints of the WHV were:

- Incorporating the existing WHV multi-level configuration into the proposed design to avoid replacing the entire structure to the west.
- Number of existing travel lanes on both levels of the WHV.
- Limited storage capacity between the I-75/WHV Interchange and the intersection to the east with Central Parkway and West McMillan Street.
- Large traffic demand created when adding additional movements to make a full movement interchange
- Close proximity between the existing WHV and Hopple Street interchanges precluded designs which required two lane entrance ramps or ramp braiding from WHV to the north.

- Topography of the general area, particularly to the east of I-75 restricted possible realignment of side roads and intersection locations.

In Step 7 of the PDP, a full movement SPUI alternative and a tight urban diamond interchange (TUDI) alternative with restricted access to and from the west were developed for the WHV Interchange. The two interchange alternatives were developed independently from the rest of the Brent Spence Bridge Replacement/Rehabilitation Project. This was done to achieve the best configuration for the WHV Interchange. The geometric layout of either interchange will work with Alternative E or Alternative I. For analysis purposes, the SPUI design is shown with Alternative E and the TUDI design is shown with Alternative I, refer to Appendix A.

3.4.2 Single Point Urban Interchange (grade-separated with Central Parkway)

A SPUI has a single intersection for all ramps located in the center of the interchange, versus a traditional diamond interchange which has two ramp intersections located to the right and to the left of the mainline.

The SPUI alternative is a full movement interchange (Exhibit 5). Both northbound and southbound interstate traffic would have access to WHV eastbound and westbound. Local traffic from the east and from the west would also have access to both northbound and southbound I-75. Several of these movements are not provided by the existing interchange. There is one existing movement that would not be provided by the SPUI. Westbound traffic on West McMillan Street would no longer have access to northbound Central Parkway because the left turn movement onto the Connector Road would be prohibited. This movement accounts for a very small number of vehicles.

An earlier SPUI design was removed from consideration during Step 5 of the PDP. This original design did not provide the necessary storage at the Western Hills interchange with Central Parkway, and was therefore removed from consideration. The SPUI was later redesigned to its current configuration to bridge Central Parkway and loop back around, connecting to the east side of Central Parkway, thereby providing sufficient storage at the interchange of Western Hills and Central Parkway.

For the SPUI alternative, WHV was realigned to intersect West McMillan Street at the existing West McMillan Street/West McMicken Avenue intersection. This realignment also includes grade separating the intersection of WHV and Central Parkway. A new bridge would replace the existing WHV structure from approximately 900 feet west of Spring Grove Avenue to just east of I-75. An additional structure would be required to carry the WHV over Central Parkway. The WHV would be connected to Central Parkway by a new two-way Connector Road. The addition of this new road would provide storage between the WHV and Central Parkway necessary for acceptable traffic operations at this interchange. In several locations multi-lane turning movements would be required including one triple left turn movement from I-75 southbound to WHV eastbound.

On the upper deck of the WHV, traffic would be a mix of both local and interstate traffic. The lower deck connection to and from Spring Grove Avenue would remain; however, the existing access between I-75 and the lower deck would be removed. Pedestrian access on the south side of the upper deck would be maintained on the new structure with a connection to Central Parkway along the inside of the new Connector Road.

3.4.3 Tight Urban Diamond Interchange

A Tight Urban Diamond Interchange (TUDI) has two ramp intersections like a traditional diamond but they are located much closer to each other. This configuration creates a smaller footprint than a traditional diamond interchange.

The TUDI alternative is a full movement interchange to the west only. This alternative replaces the same movements provided in the existing condition but removes the undesirable left-hand exit and splits the existing function of the WHV by separating the local traffic movements from the interstate traffic movements between the upper and lower decks. The local traffic movement between the west side of Cincinnati and downtown would be located on the upper deck of the WHV, while interstate traffic movements would be located on the realigned lower deck (Exhibit 6 and Exhibit 7). Because the TUDI would tie into the existing double deck configuration of the WHV structure, the WHV structure would not require any changes beyond the immediate tie in with the TUDI. Should the WHV be modified from a double deck structure to a single deck structure, a traffic signal and interchange would be required on the east side to coordinate traffic flow from what was originally two decks down to a single deck.

This interchange alternative would provide a replacement structure in the existing structure location from just east of Spring Grove Avenue to the existing abutment location, east of I-75. This replacement structure would connect to the existing upper deck of the WHV at Spring Grove Avenue. The lower deck structure would be realigned beginning west of the current I-75 southbound ramp diverge location. It would follow a new alignment which crosses Spring Grove Avenue and I-75 south of the WHV upper deck location. This new lower deck structure would be constructed along a new alignment to accommodate two lanes in each direction to carry WHV interstate traffic over I-75 to the lower deck of the WHV.

This new lower deck structure would provide the basis for the interchange which would have the I-75 northbound and southbound ramps tying into it, and would accommodate two lanes of traffic in each direction. The two lanes of traffic in the westbound direction would taper down utilizing pavement markings to one lane west of the interchange and would tie into the outside lane on the north side of the lower deck. This tapering down from two lanes to one lane will be accomplished by pavement markings and not be actual structural narrowing. The remaining two lanes on the lower deck of the WHV would be used to move eastbound traffic to the new I-75 interchange. This configuration requires reversing the direction of traffic in the center lane on the lower deck from the existing condition (westbound) to eastbound.

Realigning the lower deck removes the existing connection to and from Spring Grove Avenue. In order to restore this connection, two one-way connections are proposed in the Tight Diamond Interchange Option 1 (Exhibit 6). One connection replaces the movement from Spring Grove Avenue to the west and the other replaces the movement from the west to Spring Grove Avenue. Both connections utilize the footprints of the existing loop ramps which would be removed as part of this interchange alternative. Pedestrian access to and from the upper deck would be provided along the inside of these two connections. The connection to carry traffic to the west is proposed north of the interchange. This connection would have an intersection at Spring Grove Avenue and pass under I-75 and form a merge with WHV to the east of I-75 closely following the alignment of the existing loop ramp. Similarly, in the eastbound direction, the connection would follow the alignment of the existing loop ramp for several hundred feet and then align to become the fourth leg of an intersection with Harrison Avenue and Winchell Avenue to the southeast of the new interchange.

The Spring Grove Avenue two one-way connections were removed in the Tight Diamond Interchange Option 2 (Exhibit 7). The connections were removed in this option to reduce construction and utility relocation costs. The connection from Spring Grove Avenue to westbound WHV pass under I-75 which requires bridges structures to be constructed. There are underground utilities in the vicinity where the bridge structures would need to be constructed which may need to be relocated. Table 3- provides a summary comparison of the interchange options for the Western Hills Viaduct Interchange.

Table 3-1a. Western Hills Viaduct Interchange Alternatives Evaluation Matrix

Evaluation Feature	No Build Alternative	Single Point Urban Interchange	Tight Urban Diamond
Summary Description of Interchange Alternative	The No Build Alternative maintains the existing configuration of the WHV and consists of minor, short-term safety and maintenance improvements to the interchange which would maintain its continuing operation	WHV is realigned to intersect West McMillan Street at the existing West McMillan Street/West McMicken Avenue intersection. This also includes grade separating the intersection of WHV and Central Parkway. A new bridge would replace the existing WHV structure from ~900 feet west of Spring Grove Avenue to just east of I-75. An additional structure would be required to carry WHV over Central Parkway. WHV would be connected to Central Parkway by a new two-way Connector Road.	This interchange alternative would provide a replacement structure in the existing structure location from just east of Spring Grove Avenue to the existing abutment location. This structure would connect to the existing upper deck of the WHV at Spring Grove Avenue. The lower deck would be realigned beginning west of the current I-75 southbound ramp diverge location and follow an alignment which crosses Spring Grove Avenue and I-75 south of the WHV upper deck location.
Future (2035) levels of service at ramp junctions	Intersections – B Ramps – A through F	Intersections – B through D Ramps – C through E	Intersections – A through C Ramps – B through D
Future (2035) daily hourly volumes at ramp junctions	Ranges from 293 – 1,010	Ranges from 520 – 1,410	Ranges from 320 – 1,070
Right-of-way Impacts – (acres within construction limits)	No Impact	3.9 total acres	1.9 total acres
Residential – (total estimated structures and residences displaced)	No Impact	14 Total (14-56 persons)	No residential displacements
Business – (total estimated businesses and employees displaced)	No Impact	3 businesses (15-30 employees)	2 businesses (10-20 employees)
Parcels – (total estimated parcels impacted)	No Impact	63 parcels	20 parcels

Table 3-1a. Western Hills Viaduct Interchange Alternatives Evaluation Matrix

Evaluation Feature	No Build Alternative	Single Point Urban Interchange	Tight Urban Diamond
Compatibility with existing community land use plans	• Not compatible with economic development plans • Does not preclude future light rail plans • No changes to existing land uses	• Supports redevelopment and economic plans • Makes provisions for future light rail plans • Impacts residential land uses	• Supports redevelopment and economic plans • Makes provisions for future light rail plans
Community Cohesion	No impact	Loss of residences in West McMicken Avenue neighborhood	No loss of residences or facilities in communities
Facilities and Services	No impacts	No impact	No impact
Environmental Justice – (impacts to neighborhoods and Census tracts with high percentage of low income and minority populations)	No impact	• Medium impact to low-income population • Medium impact to minority population • No impact to facilities and services within EJ area • No disproportionate impacts	• No impact to low-income population • No impact to minority population • No impact to facilities and services within EJ area • No disproportionate impacts
Wetlands – (wetland areas impacted)	No impact	No impact	No impact
Intermittent Streams	No impact	No impact	No impact
Ephemeral Streams	No impact	No impact	No impact
Indiana Bat Habitat (Potential /Marginal)	No impact	No impact	No impact
Potential Running Buffalo Clover Habitat	No impact	No impact	No impact
Floodplains	No impact	No impact	No impact
Farmland	No impact	No impact	No impact
Individual properties eligible for listing or listed in the National Register of Historic Places (NRHP)	No impact	Western Hills Viaduct	Western Hills Viaduct
Historic Districts (HD) directly impacted	No impact	West McMicken Avenue Historic District	No impact
Number of sites recommended for Phase II Environmental Site Assessment	No impact	1	1
Number of sites recommended for Phase I Environmental Site Assessment	No Impact	1	1
Section 6(f) Parks	No Impact	No impact	No impact

Table 3-1a. Western Hills Viaduct Interchange Alternatives Evaluation Matrix

Evaluation Feature	No Build Alternative	Single Point Urban Interchange	Tight Urban Diamond
Section 4(f) Resources	No Impact	Western Hills Viaduct and West McMicken Avenue Historic District	Western Hills Viaduct
Utilities	No Impact	5 total	5 total
Cost Estimates (in millions)	Not applicable	$273.4	$141.0

4.0 Design Issues

This section provides an update on design changes that have occurred since Step 6. It also includes the status of major findings of each of the required design components for the Preferred Alternative Verification Review Submission (PAVR) and where identified plans, documents, or calculations may be found. Those items indicated as submitted under separate cover are not provided for every PAVR reviewer.

4.1 Alternative I Design Options

This section discusses design options that can be incorporated into the final configuration of Alternative I.

4.1.1 Alternative I High Speed / Low Speed Exit Ramp

The Brent Spence Replacement/Rehabilitation Project is required to match into the current configuration of the recently reconstructed Fort Washington Way (FWW) which carries I-71 and US 50. The FWW was a metric project and therefore, the stated English dimensions may be nominal and not actual. The footprint of the FWW westbound consists of four 12-foot lanes, two12-foot shoulders, a concrete barrier on the left and a concrete barrier and/or a retaining wall on the right that separates FWW from OH 3rd street. The total width for the FWW barrier to barrier is about 72 feet.

Due to the existing FWW footprint and existing design constraints, two ramp options were considered to connect southbound I-71 with the southbound C-D roadway (Exhibit 8A and Exhibit 8B). A high speed exit ramp design and a low speed exit ramp design were considered at this location.

If a high speed exit ramp is used for motorists exiting I-71 to the southbound C-D roadway, the cross-section for FWW westbound would consists of a four-foot inside shoulder, four 12-foot lanes, a 12-foot ramp and an eight-foot outside shoulder. With this design, the lanes are shifted to the left by eight feet, requiring a design exception for a deficient inside shoulder that would extend 1,650 feet. The left two lanes of the FWW westbound are designated for US-50 traffic and I-75 north traffic, with US-50 traffic in the extreme left lane, and I-75 north traffic in the adjacent right lane. When the lane for US-50 ultimately diverges from the other lanes at the western end of the FWW, the US-50 ramp will have a four-foot left shoulder, 16-foot lane, and six-foot right shoulder. Using a high speed exit ramp on the right for southbound I-71 traffic exiting to the southbound C-D roadway permits the exiting traffic to decelerate from the interstate lanes without impeding the flow on the interstate.

If a low speed exit ramp is used, in lieu of the high speed exit ramp, the existing inside shoulder width for FWW would be maintained at 12-foot. Adjacent to the 12-foot left shoulder, there would be four 12-foot lanes, a 12-foot ramp, and a four-foot outside shoulder. The four-foot outside shoulder happens at a pinch point where an abutment wall terminates. Excluding the pinch point location and the tapers leading to it, the outside shoulder width would be eight-foot as required during the divergence of this exiting ramp from the Interstate. Using the low speed exit ramp will require the exiting traffic to decelerate on the interstate before exiting, which will impede the traffic flow on the interstate.

A low speed exit ramp design is not permitted on a high speed facility, since it is does not comply with the design speed, as a result, design exceptions are not mentioned in the Location and Design manual. With the use of the low speed ramp design, a design exception would be needed for inadequate shoulder width. Whether a high speed or a low speed exit ramp is used, a design exception for inadequate shoulder width would be required. It is recommended to use the high speed exit ramp design which is reflected in the current design as it provides a deceleration lane that would improve the ability of traffic to decrease speed prior to diverging into the exit ramp curve without impeding the flow of traffic on the interstate.

4.1.2 Alternative I OH 3rd Street / Clay Wade Bailey Bridge Connection

As discussed in Section 3.2, based on the analyses completed and community feedback received, certain beneficial design features of Alternative G from Step 5 were carried forward for further analysis and incorporated into the two feasible alternatives studied during Step 6. One of the design features was to provide access to north end of Clay Wade Bailey Bridge from I-75 southbound using a C-D roadway and US 50 eastbound. This design feature was also recommended during the Value Engineering Study conducted on August 24-26, 2009.

Alternative I was modified during Step 6 to include access to the north end of the Clay Wade Bailey Bridge. The final configuration of this design feature provided ramp connections, from the southbound C-D roadway and directly to northbound I-75, from the north end of the OH 3rd Street and Clay Wade Bailey Bridge intersection (Exhibit 9A). The ramp connections provide the following benefits with respect to connections to I-75 northbound and from I-75 southbound:

- Provides an additional access route to and from Covington CBD by way of the Clay Wade Bailey Bridge;
- Provides an additional access route to and from the Cincinnati riverfront;
- Provides a second access route from Cincinnati CBD without utilizing Winchell Avenue;
- Provides an improved access route to existing and future businesses located west of I-75 and south of US 50; and
- Provides critical maintenance of traffic access routes to and from Covington and Cincinnati.

During Step 6 stakeholder coordination, the City of Cincinnati requested that the ramp connections to OH 3rd Street and Clay Wade Bailey Bridge intersection (Exhibit 9B) be removed from further consideration for the following reasons:

- The existing signalized intersections at both ends of the bridge do to not function well;
- The ramp connections would require widening OH 3rd Street; and
- The regional rail plan utilizes the Clay Wade Bailey Bridge for future rail transit.

Based on City of Cincinnati objection and the reasons listed above, the ramp connections to the OH 3rd Street and Clay Wade Bailey Bridge intersection were not recommended for advancement.

4.2 Value Engineering

A Value Engineering (VE) Study was conducted August 24-26, 2009 and the results were incorporated into the feasible alternatives during Step 6 of ODOT's PDP. The VE team was led by Lewis and Zimmerman Associates, Inc. and was comprised of a multidisciplinary team of professionals from KYTC and ODOT. The team included professionals in the disciplines of highway design, geometrics, structural engineering, traffic control, construction, transportation engineering, and geotechnical engineering, along with a working knowledge of VE procedures. The *Value Engineering Study Report* (August 2009) documents the events and results of the VE Study. The VE report is included in Appendix B.

The VE team developed 11 VE alternatives and 10 design suggestions. On November 9, 2009, a meeting was held by KYTC and ODOT with participants from FHWA KY, FHWA OH, and the design team. The purpose of the meeting was to review the recommendations of the VE Study and to determine which recommendations should be evaluated/incorporated into the Step 6 design analysis of the two feasible alternatives. As a result of the meeting, 14 of the 21 recommendations were accepted, one was on-hold, and six were rejected. The Disposition of Recommendations from this meeting is included in Appendix B.

Table 4-1 provides a status update on the 14 accepted recommendations that were documented in the VE report.

Table 4-1. VE Recommendation Status

Alt. No.	Description	Current Status
MOT-1A	For all options in Kentucky, replace the outside shoulders on I-471 southbound with full depth pavement support rerouting of traffic during construction.	Recommended as part of Conceptual MOT Plan for the corridor. Improvements to I-471 are being evaluated by KYTC.
MOT-2	For all options in Ohio, add alternative Newport Exit Signing from I-71 via US 27 to reroute traffic during construction.	Recommended as part of Conceptual MOT Plan for the corridor. Coordination with the cities of Cincinnati, Covington, and Newport on final signage and routes will need to be performed as part of final MOT design.
MO-4A	For all options, use Ohio Option 1 as a contractor lay down area for use during construction of the main river crossing.	Requirements (size, location, etc) for the contractor lay down area will be dependent on the bridge type selected (Tied Arch, Two Tower Cable Stayed, Single Tower Cable Stayed) for the new Ohio River Bridge. Each bridge would have different needs. Recommendation for lay down area will be made after selection of new bridge. Impacts to property will be included in the environmental documentation.
MOT-4B	For all options, use Ohio Option 2 as a contractor lay down area for use during construction of the main river crossing.	Requirements (size, location, etc) for the contractor lay down area will be dependent on the bridge type selected (Tied Arch, Two Tower Cable Stayed, Single Tower Cable Stayed) for the new Ohio River Bridge. Each bridge would have different needs. Recommendation for lay down area will be made after selection of new bridge. Impacts to property will be included in the environmental documentation.
MOT-4C	For all options, use Kentucky Option 1 as a contractor lay-down area for use during construction of the main river crossing.	Requirements (size, location, etc) for the contractor lay down area will be dependent on the bridge type selected (Tied Arch, Two Tower Cable Stayed, Single Tower Cable Stayed) for the new Ohio River Bridge. Each bridge would have different needs. Recommendation for lay down area will be made after selection of new bridge. Impacts to property will be included in the environmental documentation.

Table 4-1. VE Recommendation Status

Alt. No.	Description	Current Status
P-3	An Alternative E, replace the 5th Street northbound ramp to I-71 in Kentucky with an indirect ramp connection from the collector-distributor roadway to I-71 in Ohio.	KY 5th Street loop ramp replaced with with ramp from Cresent Avenue near KY 9th Street.
P-5	Eliminate the KY 9th Street intersection with the collector-distributor roadway from all options.	Based on meetings with stakeholders and KYTC during Step 6, it was recommended to keep the KY 9th Street intersection in both alternatives.
P-8	For the Hybrid Alternative CD, provide a direct connection from southbound collector-distributor roadway to 2nd Street in Ohio and additional connection to the US 42/3rd Street intersection to improve access and increase the use of the Clay Wade Bailey Bridge.	Direct connection from southbound C-D roadway to OH 2nd Street was incorporated into Alternative I. Direct connection from southbound C-D roadway to US 42/ OH 3rd Street intersection was incorporated into Alternative I, but was later removed due to feedback received from a stakeholder.
P-11	For the Hybrid Alternative CD, update the cost estimate to reflect the additional lane on the I-75 mainline.	Cost estimate was updated to reflect current design.
P-13	For Alternative E, shift the collector-distributor roadway to minimize impacts to Goebel Park and avoid relocating the radio station tower.	Alterantive E was designed to minimize the impacts to Goebel Park and any impact to the radio station tower. Alternative E design refects request from the City of Covington which has a larger impact area than Alternative I. Radio station tower is impacted in both alternatives.
S-1	For Hybrid Alternative CD, provide an exit from the northbound collector-distributor roadway to Ezzard Charles Drive similar to that shown in the Alternative E design.	This recommendation was included in Alterantive I.
S-4	With all options, provide a means to mitigate potential structural impacts to Willow Run Sewer during construction.	This recommendation needs to be adressed as part of the final design efforts as part of the structures type analysis efforts.
R-1	For all options, realign Section 1 near the cut in the hill to the east to reduce right-of-way and excavation requirements.	The segment of I-71/I-75 in Section 1 from approximately 2,000 feet south of KY 12th Street to 4,000 feet south of KY 12 Street was realigned to minimize excavation requirements. Alignment to the west was maintained where slope stability issues along the Highland Avenue section were located.
R-2	Specify that recycled concrete pavement is acceptable for use as sub-grade stabilization in Kentucky.	This recommendation needs to be addressed as part of final design efforts. This will be adopted and included as a contractor option, not a requirement.

Additional value engineering reviews are not anticipated until after Stage 1 design.

4.3 Right of Way

Existing right of way in prior steps was based upon information from the Hamilton County Auditor and the Kenton County Property Value Administrator. Property maps identifying right of way are included in Appendix C. The total new right of way required is 36.90 acres for Alternative E and 31.37 acres for Alternative I. The following is a summary of the anticipated property impacts of the project. Real estate costs by construction phases are summarized in Section 9.2.1.

4.3.1 Existing Conditions – Land Use

The study area is both urban and suburban in nature. The primary land uses within the study area are commercial, industrial, residential, institutional, and existing roadway rights of way. No farmland is present within the study area. A detailed description of land use in the study area is presented in the *Conceptual Alternatives Study* (April 2009).

4.3.2 Land Use Impacts

Land use is directly affected where land is converted to right of way and indirectly affected by changes to land use. Land use impacts for Alternatives E and I are presented in Table 4-2. The total acres impacted in Kentucky are: Alternative E – 24.45 acres and Alternative I – 21.76 acres. The total acres impacted in Ohio are: Alternative E – 12.45 acres and Alternative I – 9.61 acres. The No Build Alternative would not affect land uses within the study area because any minor, short-term safety and maintenance improvements to the existing Brent Spence Bridge and I-75 corridor would be within the existing right of way.

Table 4-2. Land Use Impacts (acres)

	Alternative E	Alternative I
Kentucky		
Residential	4.93	3.60
Industrial	0.70	0.41
Commercial	2.89	3.97
Undeveloped	11.98	7.89
Institutional	2.57	1.40
Other	1.38	4.49
Subtotal KY	*24.45*	*21.76*
Ohio		
Residential	1.41	0.10
Industrial	1.39	1.76
Commercial	2.00	1.03
Undeveloped	1.74	1.03
Institutional	3.16	3.85
Undefined[1]	2.75	1.84
Subtotal OH	*12.45*	*9.61*
Total	**36.9**	**31.37**

Source: Cincinnati Area Geographic Information System (CAGIS) (2006)
[1]Undefined land uses are those that do not have a specified land use as noted by the source of the data.

Alternatives E and I would convert mostly residential, commercial, and undeveloped land uses. Residential land use would be impacted through loss of homes along Crescent Avenue and in Lewisburg Historic District. Commercial land would be lost through displacements north of KY 4th Street, adjacent to existing I-

75, and near Pike Street. Alternatives E and I would also require land from recreational uses and activities utilized at Goebel Park.

Within Kentucky, impacts to land use would be the same for both feasible alternatives south of KY 12th Street. Mostly open space would be converted in areas south of KY 12th Street with select residences displaced. South of KY 12th Street, institutional uses would be converted to right of way by both feasible alternatives at Notre Dame Academy, Central Nazarene Church, and Saint Elizabeth Hospital Development. However, this impact would not change the land use activities at the properties or result in displacements. Commercial uses between Kyles Lane and Dixie Highway would require the same amount of land use acreage by both alternatives. This is a loss of property but not a loss in the function of the land use. A parking lot would be impacted at the Central Nazarene Church near the Dixie Highway Interchange.

In Ohio, Alternative I would have the most impact on institutional and commercial land uses to the east of I-75. Alternative E, like Alternative I, would convert institutional and commercial land uses east of I-75 adjacent to existing right of way, however, Alternative E would also impact residential uses in the area of the Western Hills Viaduct due to the SPUI option currently paired with Alternative E. The TUDI option, currently paired with Alternative I, would not impact residential uses in the area however the TUDI would impact more commercial uses than the SPUI. The SPUI and the TUDI are interchangeable and can be paired with either Alternative. The SPUI however would require more right of way than the TUDI alternative, requiring 3.9 acres and 1.9 acres respectively, and the SPUI would impact two Section 4(f) resources, while the TUDI would only impact one Section 4(f) resource. While both alternatives would require a Phase II Environmental Site Assessment and both would have the same impacts on utilities, the SPUI would have a construction cost of nearly double that of the TUDI alternative, with the cost for the SPUI being $273.4 million and the cost of the TUDI being $141.0 million.

In Ohio, Alternatives E and I would both require conversion of utility to right of way at the Duke Energy power station. Both Alternatives E and I would encroach on recreational land use at the Queensgate playground and Ball Fields.

North of Ezzard Charles Drive in Ohio some residential, commercial, and industrial uses adjacent to the existing right of way would be impacted by Alternative E, however the uses would not be precluded due to the amount of acreage required. Some impacts are also only property takes that impact land and not a building or use that serves as the function to the property. To accommodate the improvements of the Western Hills Viaduct Interchange, residential land uses would be required for right of way.

The No Build Alternative would not affect land uses within the study area because any minor, short-term safety and maintenance improvements to the Brent Spence Bridge and I-75 corridor would be within the existing right of way.

4.4 Drainage

The following is a summary of the drainage analyses conducted for Kentucky and Ohio. The completed Drainage Criteria Form (LD-35) is included in Appendix D.

4.4.1 Kentucky

The preliminary layouts for the proposed drainage systems are similar for both Alternative E and Alternative I. Inlets were placed approximately every 300 feet with manholes placed as necessary at junction points. High and low points of the road profiles were taken into consideration and low points received flanking inlets. The following information is valid regardless of which alternative is selected as the preferred alternative.

The Willow Run Sewer is a combined system that carries both stormwater and sanitary flows in the watershed that I-75 is currently constructed. All I-71/I-75 generated stormwater from approximately the Kyle's Lane Interchange to the Ohio River flows into this sewer. The combined Willow Run Sewer between KY 5th Street and the Ohio River is approximately a 120-inch culvert. During times of wet weather, it overflows and discharges untreated sewerage into the Ohio River and into neighborhood parks, streams and creeks. The US Environmental Protection Agency (EPA), through a consent decree, has mandated that the overflows be reduced or eliminated in the watershed.

The Kentucky Transportation Cabinet (KYTC), with the new Ohio River Bridge and major widening of I-71/I-75 in Kentucky, will increase the flows in the sewer if left unabated. The Brent Spence Design Team has been directed to study removing the amount of increased runoff associated with the new impervious areas by containing a portion of direct highway runoff into a separate storm sewer system. This system would bypass the Willow Run Combined Sewers and be discharged directly into the Ohio River.

According to Sanitary District 1 (SD1), there are seven sewer diversions in the Willow Run Combined Sewer. These diversions divert the low flow or "dry" weather flow into the parallel sanitary interceptor sewer. Flows are then carried, via gravity, to the treatment plant. During wet weather, when the flow exceeds the capacity of the diversions, a portion of the flow overtops the diversions and overflows directly into the Ohio River. Generally it takes about a one half inch of rain in the Willow Run watershed to trigger an overflow event. During high Ohio River levels (exceeding 38 feet) the following occurs:

1. The Ohio River water backs up into the combined system, flows over the diversions and gets into the interceptor sewer.
2. At 43.5 feet above normal river flow elevations, the flow backs out of the Willow Run combined sewer and into Goebel Park.
3. At 45.9 feet, the pumps are turned on to pump the combined system over the levee and back into the Ohio River. A 12-foot by 12-foot sluice gate is lowered at this point.

These events occur approximately 10 to 15 times per year. Reducing the stormwater runoff to the combined sewers should assist SD1 in the mandated reduction in the combined sewer overflows.

As part of the Brent Spence Bridge Replacement/Rehabilitation Project, a plan for reducing flow into the Willow Run Sewer has been developed. The plan includes "green" solutions and a new stormwater pump station at the Ohio River. The pump station will be utilized to pump the storm flow over the levee during high river levels. At this time, due to the uncertainty of the design and limitations of the existing storm pump station, a new one will be estimated and included in the project.

Additionally, this plan studies a system which would capture an amount of runoff equal to or slightly greater than the amount of excess flow generated by widening I-71/I-75 in Kentucky. It runs from approximately the Ohio River to KY 12th Street. This plan would also intercept flows from the new KY 12th Street project. Exact flowrates are not known at this time from the KY 12th Street system, but for study purposes, it was assumed that the runoff area would be six acres. The main storm pipe would be located on the western side of I-75, in between the ramps and the mainline. A few "Stormceptor" units could be used at strategic locations to incorporate environmentally friendly processes into the design to aid in the removal of grit, sediment, oils and grease. This plan mitigates the increased flowrate caused by widening I-71/I-75 in Kentucky by 120 percent.

4.4.2 Ohio

The preliminary layouts for the proposed drainage systems are similar for both Alternative E and Alternative I. Inlets were placed approximately every 300 feet with manholes placed as necessary at junction points. High and low points of the road profiles were taken into consideration and low points received flanking inlets. The proposed storm system in its entirety is to be gravity fed and no pump stations will be required for either alternative. The following information is valid regardless of which alternative is selected as the preferred alternative.

Existing sewers located north of OH 3rd Street in Ohio are mostly combined sanitary/storm sewers. Ideally storm and sanitary lines should be separate. Unfortunately this is economically unfeasible at this time. As such the proposed system was designed as a separate entity and joins the existing combined sanitary/storm systems at point locations. This will enable the drainage from this redevelopment to easily be redirected to lines solely dedicated to storm drainage if the opportunity ever exists in the future.

The redevelopment of the existing highway system approaching the Brent Spence Bridge will follow existing drainage patterns. Minor changes in drainage area and C values (coefficient of runoff, determined by how impervious the surface is) are expected at connection points to the existing combined sanitary system. These minor changes reflect the proposed reconfiguration of the highway as well as profile grade alterations. Specific analysis will need to be completed on the proposed storm sewer system including tie-in points to existing systems to determine if pipe capacity of the existing lines will be adequate to accommodate the proposed flow. Since existing drainage patterns were used as a guideline to developing the proposed system, it is generally assumed that the existing systems will be able to handle the proposed stormwater flow.

Located just south of Ezzard Charles Drive on I-75 mainline, there is an 84-inch combined sewer crossing the interstate. The profile of I-75 mainline at this location has been lowered in elevation. The existing 84-inch combined sewer will need to be extended to the east and an existing junction chamber and two adjoining pipes will need to be reconfigured. This should affect approximately 200 linear feet of existing pipe.

There are two additional existing mainline combined sanitary sewer pipes crossing I-75 that will remain. The first is a 66-inch combined sewer located just north of the Linn Street Bridge on I-75. The second is a 36-inch combined sewer located between Linn Street Bridge and OH 9th Street. The 66-inch combined sewer crossing is located extremely close to the proposed abutment of the new Linn Street Bridge. After review of the area it is expected that the 66-inch combined sewer will miss the proposed abutment of the Linn Street Bridge. The 36-inch combined sewer crossing averages nine feet of cover from the finished surface to the top of pipe. Although adequate cover is provided, care should be taken not to damage or crush this or any other existing sewer that will remain intact throughout construction and completion of the project. Further investigation of these areas and exact locations of existing underground utilities will be required during the next phase of the project. It is recommended to perform SUE Quality Level A survey for the 84-inch, 66-inch, and 36-inch combined sewers.

The applications of stormwater runoff treatment Best Management Practices (BMPs) to be used on this project will be selected based on the available right of way, soil types, and impacts to utilities found in an area. The BMP selections will be chosen to treat water quality and water quantity while restricting the impacts to the existing project right of way, utilities, and other project design features. Further investigations will be made to determine the best method of treatment in the most favorable locations to meet the requirements for stormwater runoff treatment for the project.

4.5 Structures

The new Ohio River Bridge Main River Bridge Structure Type Study will be submitted under separate cover. Structure type studies for the preferred alternative structures will be performed during the next step of the PDP.

The KYTC Bridge Type Selection Process was conducted for the new Ohio River Bridge to select the best design for the new Ohio River crossing. The Bridge Type Selection Process is a three step process, which involves developing and analyzing numerous bridge concepts leading to a recommendation of three final bridge type alternatives. Steps 1 and 2 have been completed to date for the project and resulted in the recommendation of three final three bridge alternatives selected to proceed to preliminary design during Step 3. The three alternatives include an arch bridge and two cable-stayed bridges. All three bridges will work with Alternative E or Alternative I.

4.6 Retaining Wall Justifications

Retaining wall justifications will be submitted under separate cover.

4.7 Noise Wall Justifications

ODOT and KYTC require that noise abatement measures be considered at locations where traffic related noise impacts are identified. Noise walls can be constructed along the I-71/75 corridor to mitigate noise impacts. Based on the noise analysis, noise walls are recommended at six locations, one in Kentucky and five in Ohio. The final locations of the noise walls will be determined through a public involvement process.

To abate or minimize expected construction noise impacts, mitigation measures could be noted directly in contract plans and specifications. Project specific construction noise abatement that could be utilized to minimize, to the greatest extent possible, the noise impact zone in areas outside the construction site boundary, include the following:

- Informing the public when work is going to be performed,
- Limit the number and duration of idling equipment on site,
- Install mufflers on equipment and maintain all construction equipment in good repair,
- Reduce noise from all stationary equipment by utilizing suitable enclosures,
- Minimize the use of back-up alarms,
- Schedule and space truck loading and unloading operations to minimize noise impacts,
- Limit operation of heavy equipment and other noisy procedures to daylight hours whenever possible, and
- Locate equipment and vehicle staging areas as far from noise sensitive areas as possible.

Noise wall impacts and justifications will be submitted under separate cover.

4.8 Pedestrian Overpass

Two pedestrian overpasses were identified within the study area in Ohio. The first overpass connects Freeman Avenue to West Court Street, crossing over an exit ramp from northbound C-D to Winchell Avenue. This pedestrian overpass will be reconstructed to comply with the standards set forth in the Americans with Disabilities Act (ADA). The second pedestrian overpass is located on the NB ramp to KY 5th Street. This pedestrian overpass will no longer be needed in the build condition under either alternative.

4.9 Geotechnical Investigation

A geotechnical investigation will be submitted under separate cover as part of the Main River Bridge Structure Type Study. A geotechnical investigation will be submitted under separate cover as part of the Retaining Wall Justification.

Geotechnical Investigations for pavement design request were not part of the scoped services for steps 6 and 7.

4.10 Cut/Fill Quantity Report

Earthwork calculations have been completed for the entire project using InRoads and Geopak. The quantities have been separated into totals for each of Kentucky's and Ohio's project contract numbers in Table 4-3 and Table 4-4. Refer to Exhibit 11 and Exhibit 12.

Table 4-3. Cut/Fill Quantities – Kentucky

Segment Description	Contract #	Alternative E		Alternative I	
		Cut Total (CY)	Fill Total (CY)	Cut Total (CY)	Fill Total (CY)
I-471 Widening and Ramp Modifications	KY-1	0	0	0	0
Kyles Lane Bridge Replacement	KY-2	11,040	0	11,040	0
Dixie Highway Bridge Replacement	KY-3	19,600	0	19,600	0
New Ohio River Bridge	KY-4	0	0	0	0
I-75 Reconstruction from Mile Point 187.2 to Mile Point 189.5	KY-5	489,560	82,400	489,560	82,400
I-75 Reconstruction from Mile Point 189.5 to the South Termini of the KY 12th Street Interchange	KY-6	662,700	51,300	662,700	51,300
I-75 Reconstruction from the South Termini of 12th Street Interchange to the new Ohio River Bridge	KY-7	200,900	268,200	284,500	209,000
Rehabilitation of the Existing Brent Spence Bridge	KY-8	0	0	0	0
TOTAL		**1,383,800**	**401,900**	**1,467,400**	**342,700**

Table 4-4. Cut/Fill Quantities – Ohio

Segment Description	Contract #	Alternative E		Alternative I	
		Cut Total (CY)	Fill Total (CY)	Cut Total (CY)	Fill Total (CY)
I-71/I-471 Ramp Modifications	OH-1	0	0	0	0
Linn Street Bridge Replacement and Gest Street Reconstruction	OH-2	9,087	1,051	12,592	816
Ezzard Charles Drive Bridge Replacement; Western Avenue Reconstruction; Freeman Avenue Interchange Reconstruction; Winchell Street Reconstruction; and the Court Street Cul-de-sac Construction	OH-3	74,822	2,345	40,911	155
OH 7th/8th/9th Street Interchange Reconstruction	OH-4	11,864	3,782	45,208	2,269
I-75 Reconstruction from Findlay Street to the Northern Terminus of the Corridor Western Hills Viaduct Interchange Reconstruction	OH-5	142,088	273,627	77,557	117,928
I-75 Reconstruction from North of the US 50 Interchange to Findlay Street	OH-6	121,755	34,515	171,483	41,277
I-75 Reconstruction from the new Ohio River Bridge to North of the US 50 Interchange	OH-7	193,736	197,488	710,462	185,082
TOTAL		**553,352**	**512,808**	**1,058,213**	**347,527**

4.11 Utilities

A wide range of underground and aboveground utilities are present within the study area in both Kentucky and Ohio. These utilities include electric transmission lines, high pressure gas mains, electric substations, sanitary and combined sewer lines, water mains, fiber optic lines, and transmission towers. A total of 14 public utility companies have been identified as having facilities within the study area:

- AT&T Fiber Optics
- Cincinnati Bell (telephone)
- Cincinnati Water Works
- Duke Electric
- Duke Transmission Group
- Insight Communications
- Level 3 Communications, LLC
- Metropolitan Sewer District (Greater Cincinnati)
- MCI/Verizon Fiber Optic
- Northern Kentucky Water District
- Sanitation District Number 1 (Northern Kentucky)
- Sprint Fiber Optic
- Time Warner Cable

- Qwest National Network Services

A utility coordination meeting was held on March 16, 2006 to provide preliminary project information and to begin coordination between the Project Team and utility providers. From the meeting, a utility coordination team was formed. This team will work together to ensure that no loss of service occurs during construction or operation of the project.

4.11.1 Utility Impacts

The potential utility conflicts and possible relocations are described in Table 4-5 for Kentucky and Table 4-6 for Ohio and are presented in Exhibit 10. The impacts are the same for both feasible alternatives. Alternatives E and I would impact a total of 57 individual utilities (46 below ground and 11 above ground).

Table 4-5. Utility Impacts in Kentucky

Item Number[1]	Utility	Description
Cincinnati Bell and Other Telecommunications Providers		
1-3	Telephone Feeder Lines	Cincinnati Bell Telephone overhead feeder lines drop and run underground along Rivard Drive at the existing Rivard Drive structure. I-71/I-75 mainline widening will require these lines to be relocated.
2-2	Fiber Optic Lines	AT&T aerial fiber optics and Cincinnati Bell Telephone feeder lines are located on the Duke Energy poles along the west side of Crescent Avenue. I-71/I-75 mainline widening will require these lines to be relocated.
Duke Energy		
1-1	Electric Lines	Overhead transmission lines serving the Fort Mitchell Substation (approximately 120 feet south of Dixie Highway) and overhead electric lines approximately 890 feet north of Dixie Highway. I-71/I-75 mainline widening and ramp and structure construction may impact these lines.
1-4	Gas Main	An 8-inch gas main is located under the I-71/I-75 mainline and ramps just south of the existing Kyles Lane Bridge. I-71/I-75 mainline widening may require relocation of this main.
1-8	Electric Line	A 138 kilovolt (KV) overhead transmission line crosses I-71/I-75 1,500 feet south of KY 12th Street. West side grading and potential wall construction may impact the electric lines.
1-10	Electric Lines	Two overhead electric lines crosses I-71/I-75, one crossing at KY 12th Street and one crossing approximately 225 feet south of KY 12th Street. I-71/I-75 mainline widening may require these lines to be relocated.
1-12	Electric Line	A 69 KV overhead transmission line crosses I-71/I-75 approximately 120 feet north of KY 12th Street and runs parallel to the west side of I-75 to near Pike Street. I-71/I-75 mainline and ramp widening may require this line to be relocated.
2-1	Electric Line	A 69 KV overhead electric transmission line runs along the west side of Crescent Avenue in Covington. New Ohio River Bridge will require these lines to be relocated from approximately 1,400 feet north of Pike Street to the Ohio River.
2-3	Gas Main	A 12-inch high pressure gas transmission main runs along Crescent Avenue in Covington. New Ohio River Bridge will require these lines to be relocated from approximately 1,400 feet north of Pike Street to the Ohio River.

Table 4-5. Utility Impacts in Kentucky

Item Number[1]	Utility	Description
Northern Kentucky Water District		
1-5	Water Main	A 10-inch water main crosses the I-71/I-75 mainline under the Kyles Lane Bridge. Structure construction will require relocation of this water main.
1-11	Water Main	A 20-inch water main exists under KY 12th Street in Covington at the I-71/I-75 crossing. This main may require relocation due to mainline structure construction.
Sanitation District Number 1		
1-2	Sanitary Sewer	Sanitary sewer crossing approximately 1,025 feet north of Dixie Highway. I-71/I-75 mainline widening may require the manhole to be relocated.
1-6	Combined Sewer	A four-foot x four-foot box culvert serves as a combined sewer located approximately 5,000 feet north of Kyles Lane. I-71/I-75 mainline widening may require this culvert to be lengthened.
1-7	Storm Water Detention Basin	A regional storm water detention basin is located on the west side of I-75 approximately 1,900 feet south of KY 12th Street in Covington. I-71/I-75 mainline widening may require modifications due to proposed grading and drainage construction. The existing Sanitation District No 1 combined sewer running north from the detention basin along the west side of I-75 will require relocation/modification due to mainline widening.
1-9	Combined Sewer	The Willow Run 108-inch diameter combined sewer. I-71/I-75 mainline widening and ramp construction will require relocation/ modifications of the sewer line from approximately 1,500 feet south of KY 12th Street in Covington to approximately 375 feet north of Pike Street.
1-13	Combined Sewer	A 96-inch diameter combined sewer crosses I-71/I-75 at KY 9th Street in Covington. I-71/I-75 mainline, ramp and structure widening will require relocation/modifications to the sewer line.
1-14	Sanitary Sewer	A 27-inch diameter sanitary sewer by-pass runs along the east side of I-71/I-75 from just north of Pike Street in Covington to approximately 200 feet north of KY 9th Street. I-71/I-75 mainline, ramp and structure widening will require relocation/modifications to the sewer line.
1-15	Combined Sewer	A combined sewer line ranges in diameter from 36 to 60 inches. I-71/I-75 mainline widening will require relocation/modifications to the sewer line.
2-13	Sanitary Sewer	A 33-inch sanitary sewer bypass crosses I-71/I-75 at a skew from Goebel Park in Covington on the east side to approximately 480 feet south of KY 5th Street on the west side of I-71/I-75 where it widens to 36 inches. I-71/I-75 mainline widening will require relocation/modifications to this sewer line.
2-14	Combined Sewer	The 12-foot x 14-foot Willow Run interceptor is located on the east side I-71/I-75 and crosses the interstate at a skew south of KY 5th Street. I-71/I-75 mainline widening will require relocation/modifications to this sewer line from approximately 900 feet north of KY 9th Street to KY 5th Street.

Table 4-5. Utility Impacts in Kentucky

Item Number[1]	Utility	Description
2-15	Storm Water Ponding Outlet	Two storm water ponding outlets (combined sewer overflows) are located in Goebel Park. I-71/I-75 mainline widening will require relocation/modifications to these ponding areas.
2-16	Combined Sewer	A 48-inch diameter combined sewer runs west to east from Western Avenue toward I-71/I-75 between KY 3rd and KY 4th streets. I-71/I-75 mainline, ramp and structure widening will require relocation/modifications to the sewer line.

[1] Item numbers represent utility identification numbers shown on Exhibit 10.

Table 4-6. Utility Impacts in Ohio

Item Number[1]	Utility	Description
Cincinnati Bell and Other Telecommunications Providers		
2-20	Fiber Optic Line	Verizon and AT&T underground fiber optic lines; and Cincinnati Bell Telephone and Level 3 Communications underground duct banks in and along OH 3rd Street. Interstate improvements may impact these lines.
2-21	Fiber Optic Line	Verizon and MCI underground fiber optic lines run west from OH 4th and Plum streets then south to OH 3rd Street. Interstate improvements may impact these lines.
2-24	Telephone Line	Duke Energy, Level 3 Communications and Cincinnati Bell Telephone conduits are hung on the Linn Street bridge over I-75. These lines will require relocation due to new structure construction.
2-26	Fiber Optic Line	AT&T fiber optics in Duke Energy conduits cross at a skew under I-75 approximately 360 feet north of Linn Street. Interstate improvements may require relocation of these lines.
2-27	Trunk Line	Cincinnati Bell Telephone and Level 3 Communications trunk lines cross under I-75 approximately 620 feet north of Linn Street. Interstate improvements may require relocation of these lines.
2-28	Cell Tower	A multi-use cell tower is located on the east side of I-75 just north of Linn Street. Interstate improvements may require relocation of the cell tower.
2-33	Fiber Optic Line	A Level 3 Communications trunk line is located along OH 3rd Street. Interstate improvements may require relocation of this fiber optic line.
2-35	Fiber Optic Line	An AT&T underground fiber optics line runs approximately 410 feet north along the west side of I-75 from 3rd Street then runs west to Gest Street. Interstate improvements may require relocation of these lines.
3-2	Duct Bank	A Cincinnati Bell Telephone duct bank crosses I-75 approximately 425 feet south of Liberty Street, then runs north along the west side of I-75 to Dalton and Bank streets. Interstate improvements may require relocation of the duct bank.
3-5	Duct Bank	A Cincinnati Bell Telephone duct bank crosses I-75 just north of Poplar Street, then runs north along the west side of I-75 to approximately 500 feet north of York Street. Interstate improvements may require relocation of the duct bank.

Table 4-6. Utility Impacts in Ohio

Item Number[1]	Utility	Description
3-12	Duct Bank	A Cincinnati Bell Telephone duct bank crosses I-75 approximately 500 feet north of the Western Hills Viaduct. I-75 mainline and ramp widening will require relocation of the duct bank.
Duke Energy		
2-18	Electric Line	A 138 KV underground oil filled transmission line runs east, parallel to and 240 feet south of Pete Rose Way, then north along Central Avenue. Interstate improvements may require relocation of this line.
2-19	Electric Line	A 69 KV underground oil filled transmission line runs north from Pete Rose Way under existing I-75 structures then east along OH 3rd Street. Interstate improvements may require relocation of this line.
2-21	Oil Transmission Line	Verizon and MCI underground fiber optics running west from 4th and Plum streets in Cincinnati then south to 3rd Street may be impacted.
2-26	Fiber Optic Line	The AT&T fiber optics in Duke Energy conduits crossing at a skew under I-75 approximately 360' north of Linn Street in Cincinnati may require relocations depending on potential mainline profile revisions.
3-7	Electric Line	Primary underground electric lines cross I-75 approximately 90 feet south of York Street. Interstate improvements will require relocation of these lines.
2-31	Substation	West End substation located on the north bank of the Ohio River. Interstate improvements will require relocation of this substation.
2-32	Electric Line	A 138 KV underground oil filled transmission line is located just east of the West End substation. Interstate improvements may require relocation of this line where it crosses Rose Street.
3-9	Gas Main Line	A 24-inch gas main runs north along the east side of Spring Grove Avenue/west side of I-75 from Bank Street to north of the Western Hills Viaduct. Improvements to the Western Hills Viaduct connection may impact this line.
3-11	Electric Line	Primary underground electric line crosses I-75 approximately 500 feet north of the Western Hills Viaduct. I-75 mainline and ramp widening may require relocation of this line.
3-14	Electric Line	Overhead electric lines located west of the Western Hills Viaduct Interchange. Improvements to the Western Hills Viaduct connection may impact these lines.
3-15	Substation & Electric Line	Substation and overhead transmission lines located south of the Western Hills Viaduct. Improvements to the Western Hills Viaduct connection may impact these lines.
Metropolitan Sewer District (MSD)		
2-17	Combined Sewer	A 48-inch and two 60-inch combined sewers located in the area of Central Avenue, OH 2nd and OH 3rd streets. Interstate improvements may impact these lines.
2-22	Combined Sewer	A 36-inch combined sewer is located under I-75 approximately 400 feet north of OH 8th Street. I-75 mainline and ramp widening may require relocation of this line.
2-25	Combined Sewer	A 66-inch combined sewer under I-75 runs northwest from the Linn Street overpass on the east side of I-75. I-75 mainline widening may require relocation of this line.

Table 4-6. Utility Impacts in Ohio

Item Number[1]	Utility	Description
2-30	Combined Sewer	60-inch and 72-inch combined sewers cross I-75 approximately 300 feet south of Ezzard Charles Drive and parallel the east side of I-75 south to Clark Street. I-75 mainline widening may require relocation of these lines.
3-1	Combined Sewer	A 30-inch combined sewer crosses I-75 approximately 425 feet south of Liberty Street. I-75 mainline widening may require relocation or modification of this line.
3-8	Combined Sewer	A 30-inch combined sewer crosses I-75 just north of York Street. I-75 mainline widening may require relocation of this line.
Cincinnati Water Works		
2-23	Water Main	A 36-inch water main crosses I-75 approximately 545 feet north of OH 8th Street and then runs north along the west side of I-75/Gest Street. I-75 mainline widening may require relocation of this main.
2-34	Water Main	A 24-inch water main runs along OH 3rd Street. I-75 improvements may impact this main.
3-3	Water Main	A 42-inch water main crosses under I-75 at Liberty Street. I-75 mainline widening may require relocation of this main.
3-4	Water Main	A 36-inch water main runes north from Liberty Street to approximately 270 feet north of York Street along the west side of I-75. I-75 mainline widening and retaining wall construction may impact this main.
3-6	Water Main	A 24-inch water main crosses under I-75 at Findlay Street. I-75 mainline widening may require relocation of this main on the west side of I-75.
3-10	Water Main	A 48-inch water main is located in Central Parkway at the east end of the Western Hills Viaduct. Improvements to the Western Hills Viaduct connection may impact this main.
3-13	Water Main	A 48-inch water main crosses I-75 approximately 1,100 feet north of the Western Hills Viaduct. I-75 mainline widening may require relocation of this main.

[1] Item numbers represent utility identification numbers shown on Exhibit 10.

The building that houses the Advanced Regional Traffic Interactive Management and Information System (ARTIMIS) operation will be affected by both feasible alternatives. Relocation of the services provided by this building will need to occur. It is recommended that the service relocations be completed prior to the corridor reconstruction. This building is located north of OH 3rd Street between northbound I-75 and southbound I-75.

Utility impacts in Kentucky include two gravity fed sewer lines and high voltage electric lines. There is a 33-inch sanitary sewer bypass which crosses I-71/I-75 at a skew from Goebel Park in Covington to approximately 480 feet south of KY 5th Street on the west side of I-71/I-75 where it widens to 36-inches. I-71/I-75 mainline widening may require relocation/modifications to this sewer line. The 12-foot by 14-foot Willow Run interceptor is located on the east side of I-71/I-75 and crosses the interstate at a skew south of KY 5th Street. I-71/I-75 mainline widening may also require relocation/modifications to this sewer line from approximately 900 feet north of KY 9th Street to KY 5th Street. The high voltage electric lines parallel Western and Crescent avenues and could be impacted by Alternatives E and I.

Notable utility impacts in Ohio include the Duke Energy West End substation and oil filled transmission lines; and two combined sewer lines that cross under I-75 north of OH 9th Street.

KYTC and ODOT have been coordinating with the utility companies throughout the project development process. A summary of this coordination is provided in Section 10.2.4.

4.12 Aesthetics

From the outset of the project, KYTC and ODOT instituted an aesthetics committee to provide guidance to the Project Team. The Aesthetics Committee, a sub-committee of the Advisory Committee, provides local input on the design and aesthetic appearance of the corridor and the main span of the new Ohio River Bridge. As the project moves forward, more detail will be provided to and from this committee in order to give input on community values with respect to the aesthetics of the bridge and along the project corridor.

Two Project Aesthetic Committee (PAC) meetings were held during Steps 1 through 5 of the PDP. The first meeting was held on December 16, 2005 and the second on August 29, 2006. Agendas and meeting minutes for each PAC meeting are posted to the project website.

Four PAC meetings were held during Steps 6 and 7 of the PDP to select the design for the new Ohio River crossing. These meetings focused on KYTC's Bridge Type Selection Process conducted for the new Ohio River Bridge to select the best design for the new Ohio River crossing. The Bridge Type Selection Process is a three step process, which involves developing and analyzing numerous bridge concepts leading to a recommendation of three final bridge type alternatives. The meetings were held on September 25, 2009, January 29, 2010, April 15, 2010, and September 20, 2010. Summaries of these four PAC meetings are presented in Table 4-7.

Table 4-7. Project Aesthetic Committee Meetings

Meeting Date	Meeting Summary
September 25, 2009	• Context of aesthetics in the project study area was presented • Key design criteria for the project was developed • Bridge types feasible for this location were shown, including cable-stayed, arch, and truss • Suspension bridge type is not feasible
January 29, 2010	• Twelve bridge concepts were presented • Committee members completed a criteria matrix for the 12 bridge concepts • Preference stated for cable-stayed bridges is a harp arrangement paired with a Pratt truss with stays parallel to the truss diagonals • Double-deck truss style bridge was not preferred • Two-legged cable-stayed towers are generally preferred over a three-legged tower option
April 15, 2010	• Receive feedback on six bridge type alternatives to select three final bridge alternatives • Committee presented more details of the six bridge type alternatives • Key visual and aesthetic criteria were provided to committee which was then used to evaluate the six bridge type alternatives • Cable-stayed bridges were more favorably received than the arch bridges • Aesthetics not related to the actual bridge structure were noted as just as important as the bridge aesthetics • Costs of bridges were noted as a concern

Table 4-7. Project Aesthetic Committee Meetings

Meeting Date	Meeting Summary
September 20, 2010	• Discuss aesthetic treatment of the I-75 corridor • Receive feedback for possible themes that could be applied to the project • Provide examples of project design themes, elements and treatments • Brainstorm potential aesthetic ideas

In addition, a survey was sent from the PAC on November 9, 2010. The purpose of the survey was:

- To identify the one unifying theme for the entire corridor as well as themes for each state; and
- To develop preferences for aesthetic design elements of the project.

4.13 Special Bid Items

No Special Bid items have been identified. It is anticipated that the City of Cincinnati and the City of Covington will request a specific type of signal controller to be used on streets within their jurisdiction.

4.14 Interchange Modifications

The Access Point Request Document for the Brent Spence Bridge Replacement/Rehabilitation Project will include changes to the 14 intersections in Kentucky and the 14 intersections in Ohio. These intersections are discussed in Section 5.5.5 and are identified in Table 5-11 and Table 5-12. The Access Point Request Document is being prepared separately and is currently scheduled for submital on August 27, 2010.

4.15 Design Criteria

The feasible alternatives were developed in accordance with the geometric design criteria requirements of both KYTC and ODOT. The Kentucky section of the conceptual alternatives was designed in accordance with the most current version of KYTC's *Highway Design Manual* and the Ohio section of the conceptual alternatives was designed in accordance with the most current version of ODOT's *Location and Design Manual*.

In Kentucky, three categories of design requirements were applied to the feasible alternatives; mainline, service ramps, and local streets. In Ohio, four categories of design requirements were applied to the feasible alternatives; mainline, directional ramps, service ramps, and local streets. Each of these categories has a roadway classification and design speed. The functional classification of the mainline roadway is "Principal Arterial – Interstate (Urban)" with a design speed of 60 miles per hour (mph). The directional ramps and service ramps for both Kentucky and Ohio are classified as "Collector (Urban)" with design speeds varying from 30 to 60 mph; and the local streets are classified as "Local (Urban)" with a design speed of 30 mph in Kentucky and 25 to 40 mph in Ohio. The required criteria for the nine categories of design features, with detailed subcategories, and the location of reference information in the respective design manuals, are detailed in Table 4-8. Engineering line diagrams and geometric plans and profiles of each conceptual alternative are provided in Appendix A.

A central part of the project is the rehabilitation/replacement of the existing Brent Spence Bridge. New structures would include an open span to preserve the navigation channel of the Ohio River. Coordination with the US Coast Guard (USCG) was initiated to determine locations of bridge piers in the Ohio River.

Alternatives E and I would cross the Ohio River on a new bridge with a centerline located approximately 140 feet west of the existing Brent Spence Bridge centerline. In accordance with USCG requirements, the piers for this bridge must be placed "outside" of the existing Brent Spence Bridge piers. The piers would be placed in the Ohio River approximately 85 feet closer to the banks of the Ohio River than the current Brent Spence Bridge piers. The existing Brent Spence Bridge has a middle span length of 830.5 feet between existing piers. The new bridge would have a middle span length of approximately 1,000 feet from center to center of the proposed piers.

Table 4-8. Geometric Design Criteria

Design Feature	Design Criteria – Ohio								Design Criteria - Kentucky						Notes
	Mainline (60 mph)		Directional Ramp[1] (60/45 mph)		Service Ramp[2] (50/40/30 mph)		Local Street (25 - 40 mph)		Mainline (60 mph)		Service Ramp[2] (50/40/30 mph)		Local Street (30 mph)		
Horizontal Alignment															
Max Centerline Deflection w/o Horizontal Curve	1°00'	Fig. 202-1E	1°00' 1°45'	Fig. 202-1E	1°15' 2°15' 3°45'	Fig. 202-1E	2°15'	Fig. 202-1E	n/a		n/a		n/a		
Maximum Degree of Curve	4°15'	Fig 202-2E	4°15' 9°00'	Fig 202-2E Fig 202-10E	6°45' 11°45' 24°45'	Fig 202-2E Fig 202-10E Fig 202-10E	10°45'	Fig 202-9E	1205'	Exhibit 3-23 161	835' 510' 275'	Exhibit 3-22 159	300'	Exhibit 3-21 157	
Max Curve without Super	0°33'	Fig 202-3E	0°33' 0°57'	Fig 202-3E Fig 202-10E	0°47' 1°10' 1°58'	Fig 202-3E Fig 202-10E Fig 202-10E	7°42'	Fig 202-9E	12000'	Exhibit 3-23 161	8000' 6000' 3500'	Exhibit 3-22 159	3500'	Exhibit 3-21 157	
Maximum Superelevation (e_{max})	6.00%	Fig 202-8E	6.00%	Fig 202-8E Fig 202-10E	6.00%	Fig 202-8E Fig 202-10E	4.00%	Fig 202-9E	8.00%		6.00%		4.00%		
Spiral Length	≥ Length of Runoff		---	---	---	---	---	---	Length of Runoff		---	---	---	---	
Vertical Alignment															
Maximum Grade[3]	4%	Fig 203-1E	6%	Fig 203-1E	6%	Fig 203-1E	10%	Fig 203-1E	4%	Exhibit 8-1 510	5%	pg. 833	11%		1% steeper may be used in extreme cases or for one-way downgrades.
Max Vertical Deflection without a Vertical Curve	0.30%	Fig 203-2E	0.30% 0.55%	Fig 203-2E	0.45% 0.75% 1.30%	Fig 203-2E	0.75%	Fig 203-2E	n/a		n/a		n/a		Min. distance between deflections is 100' for speed ≥ 50 MPH, 50' for speed < 50 MPH.
Pavement Cross Slopes (normal)	0.016	301.1.5	---	---	---	---	---	---	2.00%		---	---	---	---	
Use of Spirals	D > 3°	202-11 202-5	---	---	---	---	---	---	e > 3.0%		---	---	---	---	
Transition Length / Rate (drop line)	L= 60 x Lane Width	301.1.4	---	---	---	---	---	---	L = 50:1 to 70:1		---	---	---	---	
Pavement Slope Transition	222:1 max	Fig 202-4E	222:1 max 185:1 max	202-4E	200:1 max 172:1 max 152:1 max	202-4E	172:1	202-4E	222:1 max	Exhibit 3-27 170	200:1 max 172:1 max 152:1 max	Exhibit 3-27 170	152:1	Exhibit 3-27 170	For methods of transition see 202-5, 202-5a, 202-5b, 202-5c, 202-5d, 202-6.

Table 4-8. Geometric Design Criteria

Design Feature	Design Criteria – Ohio								Design Criteria - Kentucky						Notes
	Mainline (60 mph)		Directional Ramp[1] (60/45 mph)		Service Ramp[2] (50/40/30 mph)		Local Street (25 - 40 mph)		Mainline (60 mph)		Service Ramp[2] (50/40/30 mph)		Local Street (30 mph)		
Grade Point Position	Inside Edge		Inside/ Outside Edge		Inside/ Outside Edge		Outside Edge		Inside Edge		Inside/ Outside Edge		Outside Edge		
K-Values															
Crest Vertical Curve	151	Fig 203-3E	151 61	Fig 203-3E	84 44 19	Fig 203-3E	44	Fig 203-3E	151	Exhibit 3-76 274	84 44 19	Exhibit 3-76 274	19	Exhibit 3-76 274	
Sag Vertical Curve[4]	136	Fig 203-6E	136 79	Fig 203-6E	96 64 37	Fig 203-6E	64	Fig 203-6E	136	Exhibit 3-79 280	96 64 37	Exhibit 3-79 280	37	Exhibit 3-79 280	
Sight Distance															
Stopping Sight Distance (vertical curves)	570' min.	Fig 201-1E	570' 360'	Fig 201-1E	425' 305' 200'	Fig 201-1E	305'	Fig 201-1E	570' min.	Exhibit 3-1 112	425' 305' 200'	Exhibit 3-1 112	200'	Exhibit 3-1 112	
Min. Passing Sight Distance	---	---	---	---	---	---	1470'	Fig 201-3E	---	---	---	---	1090'	Exhibit 3-7 124	
Intersection Sight Distance	---	---	---	---	---	---	445' LT 385' RT	Fig 201-5E	---	---	---	---	335' LT 290' RT	Exhibit 9-55, 665 Exhibit 9-58, 668	See Fig. 201-4 also.
Decision Sight Distance	1150' (B) 1280' (E)	Fig 201-6E	1150' (B) 1280'(E) 800'(B) 930' (E)	Fig 201-6E	910' (B) 1030' (E) 690' (B) 825' (E) 490' (B) 620' (E)	Fig 201-6E	690' (B) 825' (E)	Fig 201-6E	1150' (B) 1280' (E)	Exhibit 3-3 116	910' (B) 1030' (E) 690' (B) 825' (E) 490' (B) 620' (E)	Exhibit 3-3 116	490' (B) 620' (E)	Exhibit 3-3 116	
Clearances (New & Reconstructed)															
Lateral On Bridge (≥ 200' long)	12' Rt. 12' Med. ≤ 2 lanes 12'RT, 4'LT	Fig 302-1E	**1-Lane / 2-Lane** 8' Rt. / 12' Rt. 6' Lt. / 6' Lt.	Fig 303-1E	8' Rt. 6' Lt.	Fig 303-1E	**Uncurbed / Curbed** 4'-10' / 1'-2'	Fig 301-4E	12' Rt. 12' Med.	pg. 765	8' Rt. 6' Lt.	pg. 765	**Uncurbed / Curbed** 4'-10' / 1'-2'		12' accommodates future MOT. 4' lateral on median allowed on four-lane alternative.
Lateral On Bridge (≤ 200' long)	12' Rt. 12' Med. ≤ 2 lanes 12'RT, 4'LT	Fig 302-1E	**1-Lane / 2-Lane** 8' Rt. / 12' Rt. 6' Lt. / 6' Lt.	Fig 303-1E	8' Rt. 6' Lt.	Fig 303-1E	**Uncurbed / Curbed** 4'-10' / 1'-2'	Fig 301-4E	12' Rt. 12' Med.	pg. 765	8' Rt. 6' Lt.	pg. 765	**Uncurbed / Curbed** 4'-10' / 1'-2'		12' accommodates future MOT. 4' lateral on median allowed on four-lane alternative.

Table 4-8. Geometric Design Criteria

Design Feature	Design Criteria – Ohio								Design Criteria - Kentucky						Notes
	Mainline (60 mph)		Directional Ramp[1] (60/45 mph)		Service Ramp[2] (50/40/30 mph)		Local Street (25 - 40 mph)		Mainline (60 mph)		Service Ramp[2] (50/40/30 mph)		Local Street (30 mph)		
Vertical	17.0' Pref. 15.5' Min.	Fig 302-1E	17.0' Pref. 15.5' Min.	Fig 302-1E	17.0' Pref 15.5' Min.	Fig 302-1E	15.0' Pref 14.5' Min.	Fig 302-1E	17.5' Pref.. 16.0' Min.	pg. 511	17.5' Pref.. 16.0' Min.	pg. 511	17' Pref.. 14.5' Min.	pg. 511	
Clear Zone	(>6000 ADT)		(>6000 ADT)		(>6000 ADT)		(>6000 ADT)		(>6000 ADT)		(>6000 ADT)		(>6000 ADT)		
Foreslope 6:1 or Flatter	30'	Fig 600-1E	30' 19'	Fig 600-1E	19' 15' 15'	Fig 600-1E	15'	Fig 600-1E	30'	Table 3.1 3-6[a]	22' 15' 15'	Table 3.1 3-6[a]	15'	Table 3.1 3-6[a]	
Foreslope Steeper than 6:1 to 4:1	30'	Fig 600-1E	30' 26'	Fig 600-1E	26' 17' 17'	Fig 600-1E	17'	Fig 600-1E	40'	Table 3.1 3-6[a]	26' 17' 17'	Table 3.1 3-6[a]	17'	Table 3.1 3-6[a]	
Backslope 6:1 or Flatter	27'	Fig 600-1E	27' 21'	Fig 600-1E	21' 15' 15'	Fig 600-1E	15'	Fig 600-1E	27'	Table 3.1 3-6[a]	22' 15' 15'	Table 3.1 3-6[a]	15'	Table 3.1 3-6[a]	
Backslope Steeper than 6:1 to 4:1	25'	Fig 600-1E	25' 19'	Fig 600-1E	19' 15' 15'	Fig 600-1E	15'	Fig 600-1E	25'	Table 3.1 3-6[a]	20' 15' 15'	Table 3.1 3-6[a]	15'	Table 3.1 3-6[a]	
Backslope Steeper than 4:1	21'	Fig 600-1E	21' 15'	Fig 600-1E	15' 15' 15'	Fig 600-1E	15'	Fig 600-1E	21'	Table 3.1 3-6[a]	15' 15' 15'	Table 3.1 3-6[a]	15'	Table 3.1 3-6[a]	
Lanes															
Number of Thru Lanes	>3 (by alt)		2 or 1		2 or 1		Varies		>3 (by alt)		2 or 1		Varies		
Lane Width	12'	Fig 301-4E	12' (2-lane) 16' (1-lane)	Fig 303-1E	12' (2-lane) 16' (1-lane)	Fig 303-1E	12' 11' (Min.)	Fig 301-4E	12'		12' (2-lane) 15' (1-lane)		12'		
Shoulders															
Treated Width	12' Rt. 12' Med ≤ 2lanes 12' Rt 4' Med	Fig 301-3E	10'Rt. / 4'Lt. 6'Rt. / 4'Lt.	Fig 303-1E[5]	6'Rt. / 3'Lt.	Fig 303-1E	2' Curb & Gutter	Fig 301-4E	12' Rt. 12' Med.		6'Rt. / 4'Lt.		2' Curb & Gutter		12' accommodates future MOT. 4' median shoulder allowed on four-lane alternative.
Graded Width with Barrier or Foreslopes Steeper Than 6:1	17' Rt. 17' Med.	Fig 301-3E	15'Rt. / 9'Lt. 11'Rt. / 9'Lt.	Fig303-1E	15'Rt. / 9'Lt. 11'Rt. / 9'Lt.	Fig 303-1E	---	---	See Clear Zone Criteria		See Clear Zone Criteria		---	---	Two lane (top) One lane (bottom)
Graded Width without Barrier and Foreslopes 6:1 or Flatter	12' Rt. 12' Med.	Fig 301-3E	10'Rt. / 6'Lt. 8'Rt. / 6'Lt.	Fig 303-1E	10'Rt. / 6'Lt. 8'Rt. / 6'Lt.	Fig 303-1E	---	---	See Clear Zone Criteria		See Clear Zone Criteria		---	---	Two lane (top) One lane (bottom)

Table 4-8. Geometric Design Criteria

Design Feature	Design Criteria – Ohio								Design Criteria - Kentucky						Notes
	Mainline (60 mph)		Directional Ramp[1] (60/45 mph)		Service Ramp[2] (50/40/30 mph)		Local Street (25 - 40 mph)		Mainline (60 mph)		Service Ramp[2] (50/40/30 mph)		Local Street (30 mph)		
Normal Barrier Offset[7]	14' Rt. 14' Med. 12' RT & Med if Conc Barr	Fig 301-3E Or 10' RT 4' LT for ≤ 2 lanes w/ Conc Barr	12'Rt. / 6'Lt. 8'Rt. / 6'Lt.	Fig 303-1E	12'Rt. / 6'Lt. 8'Rt. / 6'Lt.	Fig 303-1E	4' Min.	602.1.5.1	14' Rt. 14' Med.	pg. 319	8'Rt. / 6'Lt.		4' min.		Two lane (top) One lane (bottom)
Assumed Median Width	30'	---	---	---	---	---	---	---	30'	---	---	---	---	---	
Shoulder Pavement Cross Slopes (normal)	4%	Fig 301-8	4%	Fig 301-8	4%	Fig 301-8	4%	Fig 301-8	4%	pg. 320	4%	pg. 320	4%	pg. 320	
Terminal Classification															
Freeway Terminal	---	---	Highspeed	Fig 503-2aE Fig 503-3aE	Highspeed	Fig 503-2aE Fig 503-3aE	---	---	---	---			---	---	
	---	---	Low Speed	Fig 503-4aE Fig 503-4bE	Low Speed	Fig 503-4aE Fig 503-4bE	---	---	---	---			---	---	
	---	---	C-D	Fig 504-1E Fig 504-2E	C-D	Fig 504-1E Fig 504-2E	---	---	---	---			---	---	
	---	---	Multi- Entrance	Fig 505-1aE Fig 504-2E	Multi- Entrance	Fig 505-1aE Fig 504-2E	---	---	---	---			---	---	
	---	---	Mulit-Exit	Fig 505-2aE Fig 505-2bE	Mulit-Exit	Fig 505-2aE Fig 505-2bE	---	---	---	---			---	---	

Ohio geometric design criteria provided in the current ODOT Location and Design Manual, Volume 1.
Kentucky geometric design criteria provided in the American Association of State Highway and Transportation Officials (AASHTO) Roadside Design Guide[a] and the AASHTO “Green Book” (A Policy on Geometric Design of Highways and Streets, Fifth Edition).

Table notes:
1. For Directional Ramps, top line indicates upper range speed (60 MPH), second line indicated middle range speed (45 MPH).
2. For Service Ramps, top line indicates upper range speed (50 MPH), middle line indicates middle range speed (40 MPH), and bottom line indicates lower range speed (30 MPH).
3. Grades may be increased by 1percent for freeways in developed areas where a flatter grade is precluded.
4. Where street lighting is present, the minimum length of sag vertical curve is three times the speed.
5. For three lanes or more use: 10-foot right/ 10-foot left
6. Local streets may have different criteria as required by the City of Cincinnati.
7. For the Interstate inside shoulder widths use an offset of 15’ to the inside E/P.

4.16 Design Exceptions

Due to the constraints of the urban study area and required connections to existing roadways, some design exceptions were incorporated into the feasible alternatives. These design exceptions include the following categories:

- Increased grade: The degree of rise or descent of a vertical profile.
- Reduced shoulder width for the inside shoulders of the interstate mainline.
- Restrictions for horizontal stopping sight distance: When stopping sight distance is restricted horizontally. This occurs where the roadway ahead curves to the left and the median barrier on the left restricts stopping sight distance from the driver's eye to the object.
- Restrictions for vertical stopping sight distance: When stopping sight distance is restricted vertically, it occurs at either a crest or sag vertical curve within the roadway.
- Degree of curve.

Most of the anticipated design exceptions within Ohio were requested by the City of Cincinnati and are due to tying this project into existing conditions while minimizing any major impacts to adjacent properties including environmental and/or business impacts. In nearly every case, the design exceptions improve upon the existing conditions, however, eliminating all design exceptions would require significant impacts to adjacent properties due to the tight urban corridor.

4.16.1 Alternative E

The following is a summary of the anticipated design exceptions that would be required for Alternative E in Kentucky and Ohio. A total of 42 design exceptions would be required for Alternative E with five in Kentucky and 37 in Ohio. For additional detailed information regarding design exceptions, refer to Appendix J.

4.16.1.1 Kentucky

In Kentucky, five design exceptions are anticipated for Alternative E involving grade, shoulder width, and lane width.

Grade

The only location where the grade criterion is violated in Kentucky is the I-75 southbound exit ramp to Kyles Lane. The maximum grade criterion is 6.0 percent in Kentucky. The existing grade for this ramp is 6.5 percent, and under Alternative E, the proposed ramp grade is 8.1 percent. This increase in grade is due to wide right of way limits required for the connection to the existing elevation at the ramp terminal. This steep slope is less than 500 feet long and provides an exit ramp to Kyles Lane on which traffic has to decelerate. The elimination of this design exception would require extending the beginning of the ramp south and thus widening the right of way limits.

Shoulder Width

There are a total of three locations where shoulder width would be less than the criterion of 14 feet. Two of these design exceptions are located at station 571+00 on the I-75 mainline both northbound and southbound. At this location, the southbound structure of the C-D road over I-75 would have a long span and require a pier located at the center of I-75. The proposed pier diameter would be nine feet. This pier would reduce the inside shoulder widths on both sides of I-75 to nine feet around the pier and tapers. Eliminating this design exception would require widening the overall footprint of the roadway to accommodate the diameter of the pier.

The third shoulder width design exception location would be located on the lower deck of the existing bridge which would carry northbound C-D roadway traffic. The lower deck would require a minimum four foot left shoulder and an eight foot right shoulder to maintain three through lanes utilizing the existing bridge width. Eliminating this design exception would require replacing the existing bridge by building a new structure that would accommodate a wider section.

Lane Width

There is only one location in Kentucky where the lane width criterion is violated. On the lower deck of the existing bridge, carrying northbound C-D roadway traffic, two of the three lanes would need to be reduced from the criterion of 12 feet to 11 feet in order to accommodate all three lanes. Eliminating this design exception would require replacing the existing bridge by building a new structure that would accommodate a wider shoulder.

4.16.1.2 Ohio

In Ohio, 37 design exceptions are anticipated for Alternative E, involving degree of curve, horizontal stopping sight distance, vertical stopping sight distance, and length of spiral.

Horizontal Alignment, Degree of Curve

Alternative E would require 10 design exceptions for horizontal alignment, degree of curve at the locations identified in Table 4-9. While the design speeds vary depending on the specific roadway (interstate, ramp, or local street), the interstate is designed for 60 miles per hour (mph). The design exceptions are proposed on I-71 northbound and southbound, just north of the Brent Spence bridge towards the east (Fort Washington Way [FWW]) and also in the connections between the C-D roadway and I-75 northbound, OH 8th Street, and OH 7th Street. For I-71, the degree of curve for the northbound mainline travel lanes was reduced by over three degrees, but the southbound mainline travel lanes were improved by almost one degree. Additionally, both directional ramps between I-75 and I-71 are improved with this alternative. Flattening the degree of curve for the majority of these design exceptions would require significantly widening the width of the shoulders, and/or would result in impacts to nearby buildings or impacts to the storage capacity of local roads.

Table 4-9. Alternative E Design Exceptions for Horizontal Alignment, Degree of Curve - Ohio

Roadway	Location
I-71 NB	PI Sta. 31+39.32 PI Sta. 39+54.57
I-71 SB	PI Sta. 3+96.80 PI Sta. 6+62.17 PI Sta. 17+34.68
C-D NB to I-75 NB	PI Sta. 48+86.24
8th St. to C-D SB	PI Sta. 21+58.20 PI Sta. 32+03.55 PI Sta. 35+29.53
C-D SB to 7th	PI Sta. 37+80.71

Horizontal Stopping Sight Distance

Alternative E would require 22 design exceptions for horizontal stopping sight distance at the locations identified in Table 4-10. While the design speeds vary depending on the specific roadway (mainline interstate, ramp, or city street), none of the design exceptions on the interstate or its ramp differ by more than 29 mph between the stopping sight distance required, impacting properties in the vicinity of the design exception or impacting the storage capacity of local streets. Potential mitigation measures for these design exceptions include additional signage and lighting in the areas of the design exceptions to alert drivers.

Table 4-10. Alternative E Design Exceptions for Horizontal Stopping Sight Distance - Ohio

Roadway	Location
I-75	PI Sta. 48+69.80 PI Sta. 76+47.01
I-71 NB	PI Sta. 23+95.64 PI Sta. 31+39.20 PI Sta. 39+54.57
I-71 SB	PI Sta. 3+96.80 PI Sta. 6+62.17 PI Sta. 17+34.68 PI Sta. 29+35.43
C-D NB to I-75 NB	PI Sta. 48+86.24
8th St to C-D SB	PI Sta. 21+58.20 PI Sta. 32+03.55 PI Sta. 35+29.53 PI Sta. 40+62.31 PI Sta. 45+70.78
C-D SB to 7th	PI Sta. 37+80.71
I-75 SB to I-71 NB	PI Sta. 33+07.04
C-D SB to 2nd	PI Sta. 5+57.82
US 50 to I-71 NB/US 50	PI Sta. 15+55.27
I-71 SB to I-75 NB	PI Sta. 13+69.55 PI Sta. 27+36.92
I-75 SB to Freeman Ave.	PI Sta. 6+39.26

Vertical Stopping Sight Distance

Alternative E would require 2 design exceptions for vertical stopping sight distance at the locations identified in Table 4-11. The design exception for vertical stopping sight distance on the Interstate mainline occurs in one location on I-71 and it is 15 mph less than the required 60 mph design speed. Eliminating this design exception would require increasing the grade of I-71 NB which is already at six percent. Additional signage and lighting are suggested as mitigation measures. The other design exception for vertical stopping sight distance is located on the OH 8th Street ramp to the southbound C-D roadway and is within five mph of the required 50 mph design speed. This design exception is needed for clearance over the northbound C-D roadway and under I-71 southbound. Suggested mitigation measures for this location include additional signage and traffic control devices. The possibility of changing grades to allow for more room to increase vertical curve lengths will also be examined.

Table 4-11. Alternative E Design Exceptions for Vertical Stopping Distance - Ohio

Roadway	Location
I-71 NB	VPI Sta. 30+98.00
8th St to C-D SB	VPI Sta. 43+25.09

Other Design Exceptions

Alternative E would require three additional design exceptions for reasons identified in Table 4-12. Additional signage, lighting, and traffic control devices are all recommended as mitigation measures.

Table 4-12. Alternative E Other Design Exceptions – Ohio

Roadway	Location	Design Exception
8th St to C-D SB	PI Sta. 32+03.55 PI Sta. 35+29.53	Length of Spiral Length of Spiral
C-D SB to 7th	37+80.71	Length of Spiral

4.16.2 Alternative I

In Alternative I, there are 42 design exceptions anticipated. The following is a summary of the anticipated design exceptions that would be required for Alternative I in Kentucky and Ohio. For additional detailed information regarding design exceptions, refer to Appendix J.

4.16.2.1 Kentucky

In Kentucky, three design exceptions are anticipated for Alternative I, involving grade, lane width, and shoulder width. The design exception occurring at the ramp from I-75 southbound to Kyles Lane requires an 8.1 percent grade due to wide right of way limits required for the connection to the existing elevation at the ramp terminal. This steep slope is less than 500 feet long and provides an exit ramp to Kyles Lane on which traffic has to decelerate. This design exception could be eliminated by extending the ramp further south and thereby requiring additional right of way. To eliminate the two design exceptions that occur on the lower deck of the existing bridge, the existing bridge would need to be replaced with a new structure that could accommodate the wider lane and shoulder widths. Table 4-13 identifies the design exception and location

Table 4-13. Alternative I Other Design Exceptions - Kentucky

Roadway	Location	Design Exception
I-75 SB to Kyles Lane	Sta. 445+00	Grade
C-D NB	Existing Bridge Lower Deck Existing Bridge Lower Deck	Lane Width Shoulder Width

4.16.2.2 Ohio

In Ohio, 39 design exceptions are anticipated for Alternative I. These design exceptions are classified as horizontal alignment degree of curve, horizontal stopping sight distance, vertical stopping sight distance, grade, shoulder width, and taper rate.

Horizontal Alignment, Degree of Curve.

Alternative I would require 11 design exceptions for horizontal alignment, degree of curve at the locations identified in Table 4-14. While the design speeds vary depending on the specific roadway (interstate, ramp, or local street), the interstate is designed for 60 mph. For interstate alignments, the only degree of curve deficiencies that occur on I-71 northbound and southbound occur just north of Brent Spence Bridge towards the east (FWW). This is still an improvement over the existing condition at these locations. The curve is needed to tie into the existing bridge abutment and still tie in with US 50 eastbound before entering FWW.

The majority of the remaining design exceptions for degree of curve in Ohio are needed to achieve clearance both over and under the surrounding roadways without causing additional impacts, particularly to the Dunhumby building in the vicinity of the US 50 tie in with the C-D roadway and at the connection of I-75 southbound and I-71 northbound. For all degree of curve design exceptions a combination of additional signage, lighting, and traffic signals will be incorporated as mitigation measures.

Table 4-14. Alternative I Design Exceptions for Horizontal Alignment, Degree of Curve - Ohio

Roadway	Location
I-75 SB to I-71 NB	PI Sta. 125+75.61
I-71 SB	PI Sta. 16+31.45
I-71 NB	PI Sta. 14+44.56
US 50 EB	PI Sta. 109+73.97
US 50 WB	PI Sta. 114+02.58 PI Sta. 128+38.49
I-71 SB to C-D SB	PI Sta. 31+16.63 PI Sta. 34+50.75
FWW to C-D NB	PI Sta. 17+51.02
C-D NB to US 50 WB	PI Sta. 33+69.33
US 50 EB to C-D SB	PI Sta. 108+02.34

Horizontal Stopping Sight Distance

Alternative I would require 18 design exceptions for horizontal stopping sight distance at the locations identified in Table 4-15. Additional signage, lighting, and traffic control devices will be used as mitigation measures for all horizontal stopping sight distance design exceptions in Ohio, except for one of the two locations on the I- 71 southbound connection to the southbound C-D roadway. At this location, the line of sight for the inside lane is impeded by the bridge parapet and the proposed shoulder would need to be widened to meet the needed sight distance, therefore requiring an increase in structural width.

Table 4-15. Alternative I Design Exceptions for Horizontal Stopping Sight Distance - Ohio

Roadway	Location
I-75	PI Sta. 24+98.87 PI Sta. 33+88.15 PI Sta. 65+12.82
I-75 SB to I-71 NB	PI Sta. 120+59.21 PI Sta. 125+75.61
I-71SB	PI Sta. 16+31.45
I-75 SB Baseline at Ezzard Charles	PI Sta. 65+22.36

Table 4-15. Alternative I Design Exceptions for Horizontal Stopping Sight Distance - Ohio

Roadway	Location
I-71 NB	PI Sta. 14+44.56
US 50 EB	PI Sta. 109+73.97
US 50 WB	PI Sta. 114+02.58
I-71 SB to C-D SB	PI Sta. 31+16.63 PI Sta. 34+50.75
I-71 SB/US 50 WB to C-D NB	PI Sta. 17+51.02
C-D NB to US 50 WB	PI Sta. 22+70.83 PI Sta. 33+69.33
C-D NB to I-75 NB	PI Sta. 33+41.55
US 50 EB to C-D SB	PI Sta. 108+02.34
Gest Street	PI Sta. 14+34.53

Vertical Stopping Sight Distance

Alternative I would require two design exceptions for vertical stopping sight distance both located along the northbound C-D roadway connection to Winchell Avenue, identified in Table 4-16. These two design exceptions for vertical stopping sight distance on the C-D roadway are within nine mph of the required 40 mph design speed. Correcting these design exceptions would impact up to eight total structures. Additional signage and lighting are proposed as mitigation measures.

Table 4-16. Alternative I Design Exceptions for Vertical Stopping Sight Distance - Ohio

Roadway	Location
C-D NB to Winchell	PI Sta. 65+75.00 PI Sta. 69+20.00

Other Design Exceptions

Alternative I would require eight additional design exceptions at eight other locations for reasons identified in Table 4-17. Eliminating the shoulder width design exception at the northbound C-D roadway connection to I-71 northbound would require a widening of the I-71 trench. The remaining design exceptions are all related to grade. Eliminating these remaining design deficiencies would generally cause a violation of clearance requirements either for railroads or surrounding road structures.

Table 4-17. Alternative I Other Design Exceptions - Ohio

Roadway	Location	Design Exception
C-D NB to I-71 NB	Sta. 27+80 Sta. 9+50	Shoulder Width Grade
I-75	Sta. 23+00 to Sta. 27+00 (southbound only)	Grade
I-75 SB to C-D SB	Sta. 26+00 to Sta. 30+50	Grade
I-71 SB	Sta. 20+00 to Sta 32+00 Sta. 25+00 to 35+00	Grade Shoulder Width
I-71 NB	Sta. 25+00 to Sta. 29+00	Grade
C-D SB to OH 5th St.	Sta. 26+10 to Sta. 32+60	Grade

5.0 Traffic Operations

This section discusses the traffic operations analysis that was performed on the No Build Alternative, Alternative E, and Alternative I and compares the findings.

When Interstates are reconstructed, it is the Federal Highway Administration's (FHWA's), the Kentucky Transportation Cabinet's (KYTC's), and the Ohio Department of Transportation's (ODOT's) policy that current design standards are used. The American Association of State Highway and Transportation Officials (AASHTO) Greenbook requires interstate interchanges to have full-movement with entrance and exit ramps and bi-directional access to crossroads from both directions. In addition there is a one mile minimum spacing requirement between interchanges measured from the bridge of one crossroad to the bridge of the second crossroad. FHWA's Manual on Uniform Traffic Control Devices (MUTCD) requires one-mile advance signing for all service interchanges and suggests that signing for one interchange should not overlap with signing for an adjacent interchange. The existing interstate system has entrance and exit ramps directly merging and diverging into and from the general purpose lanes of I-71 and I-75.

Within the Kentucky portion of the Brent Spence Bridge Replacement/Rehabilitation Project there are two independent, full movement interchanges: Dixie Highway and Kyles Lane. These two interchanges are less than a mile apart and utilize an auxiliary lane in each direction between the two interchanges. In Covington's Central Business District (CBD), there are currently two, full movement interchanges which serve Covington: the split diamond interchange with KY 4th and KY 5th streets; and the split diamond interchange with KY 12th and Pike streets. The distance between Pike Street to KY 5th Street is only 0.57 miles. Using the same guidelines stated above, Covington could have only one interchange on I-71/I-75 along its CBD. This would be inadequate to meet the traffic demands.

Within the Ohio portion of the Brent Spence Bridge Replacement/Rehabilitation Project there are two independent, full movement interchanges: Western Hills Viaduct and Ezzard Charles Drive. The remaining entrance and exit ramps are partial interchanges that connect to Cincinnati's one-way street system in Cincinnati's CBD. From OH 2nd Street to OH 9th Street, every street has an entrance or an exit ramp from either northbound or southbound I-75. Cincinnati's CBD, which stretches from the Ohio River to OH 9th Street, is less than one mile in distance along I-75. A design concept that relies on its entrance and exit ramps directly connecting into the general purpose lanes would only provide one interchange on I-75 along Cincinnati's CBD. One interchange would be inadequate to meet the traffic demands for Cincinnati.

To rectify the capacity issues, a design concept was created that would provide more access to the CBDs of both Covington and Cincinnati. This concept would create a giant diamond interchange, stretching from south of KY 12th Street in Covington to north of Linn Avenue in Cincinnati. The exit and entrance ramps in each direction of I-75 will be connected by a collector-distributor (C-D) roadway. This C-D system will have numerous connections to the local street system before reconnecting to mainline I-75. This design concept will not violate any of the requirements contained in the AASHTO's Greenbook or FHWA's Manual on Uniform Traffic Control Devices. As a result, both Alternative E and Alternative I, while fundamentally different, use the single interchange concept with a C-D roadway connecting their exit ramp to their entrance ramp along I-75 in each direction.

While the single interchange system would improve access, it would also improve safety. Safety is always a major concern in any highway design. Conflict points, which occur when one traffic stream crosses, separates, or combines with another traffic stream, are a primary source of accidents. Researchers have found a linear relationship between the number of conflict points and the number of accidents, with accident rates increasing as more conflict points are introduced. As an added benefit of the single interchange concept, the number of conflict points are substantially reduced. Between KY 12th Street in Covington and Linn Street in Cincinnati, motorists on I-75 are free from any interstate conflict points. Motorists desiring to exit or enter I-75 from either the Cincinnati or Covington street system would first enter the C-D system, which will have several thousand fewer vehicles than I-75. This will make movements safer and easier. While both Alternatives E and I include design exceptions, both alternatives reduce the number of conflict points and the number of vehicles traveling through conflict points. Both alternatives would significantly improve safety over the existing No Build Alternative.

In analyzing each of the alternatives, including the No Build Alternative, demand traffic volumes were constrained in the analysis when the roadway reached capacity. "Demand traffic" is the traffic volume that would like to use the roadway, usually mentioned in terms of the design year. The roadway becomes "constrained" when the demand traffic exceeds the capacity of the roadway. As a result, the constrained traffic is that portion of the demand traffic that is "held back or constrained" due to the capacity limitations of the roadway. Appendix F shows the results of the capacity analysis. An asterisk was placed next to the traffic volumes used downstream to show that not all of the demand traffic was able to reach this point, and that traffic is constricted somewhere upstream of this point. In order to determine the amount of constrained traffic, the traffic volume can be subtracted from demand traffic.

5.1 Traffic Volumes

Traffic counts were performed on an average weekday within the Brent Spence Bridge study area in September, October, and November of 2005 in order to obtain existing weekday traffic volumes. Additional traffic counts were conducted in January 2008 to collect additional traffic data at the Dixie Highway Interchange, along McMillan Avenue, and on I-71 near the I-471 Interchange area. Traffic volumes for at-grade intersections were collected using turning movement counts, while ramp and mainline volumes on I-71, I-75, and US 50 were collected using portable machine counters. The AM and PM peak hours were identified from the traffic counts and were used in the 2005 analyses for the study area. The AM and PM peak hours are 7:30 to 8:30 AM and 4:30 to 5:30 PM, respectively.

Design year (2035) traffic volumes were determined using the Ohio Kentucky Indiana Regional Council of Governments (OKI) regional travel demand model. In order to coordinate the traffic projections within the I-75 corridor and the region, traffic projections for all three adjoining I-75 projects (HAM-71/75-0.00/0.22 Brent Spence Bridge, HAM-75-2.30 Mill Creek Expressway, and HAM-75-10.10 Thru the Valley) were incorporated into the OKI regional travel demand model. The 2005 volumes were used to project the peak hour volumes for design year 2035. In addition to the No Build condition, the OKI demand model was utilized to compute 2035 design hour traffic volumes for the five conceptual alternatives. The demand model was re-run for each of the conceptual alternatives because differences in freeway access points could affect local street and freeway traffic patterns. Truck percentages for the study area were calculated based on existing traffic counts and growth rates generated from the travel demand model.

5.2 Traffic Capacity

The mainline segments of I-75, I-71, and US 50 were divided into 54 segments for the 2005 existing conditions capacity analyses. The results of the analyses indicate that most segments operate at a Level of Service (LOS) of C or D for the I-75 mainline. Of the 54 segments analyzed, 41 segments have a LOS of either C or D. Comparing the 2005 data to the 2035 No Build conditions, locations with a current LOS D will degrade to a LOS of E or F in the design year (2035).

5.3 Freeway Segments

Basic freeway segments include the portions of freeway where flow is not influenced by the diverging, merging, or weaving associated with ramp/freeway connections. The common methodology used for analyzing basic freeway segment operations is from Chapter 23 of the Highway Capacity Manual (*HCM)*. The primary factors that affect operations on basic freeway segments include: lane widths, lateral clearance, the number of lanes, interchange density, heavy vehicles, grades, and driver familiarity.

Where the demand traffic flowing from one section of the freeway to another or from an entrance ramp to the mainline exceeds the maximum capacity of the freeway, the demand traffic will be constrained to reflect the actual traffic volumes which can be accommodated on the freeway (v/c=1.0). The portion of the demand traffic that exceeded the capacity of the freeway will be constrained and not used in downstream calculations.

Freeway capacity is the maximum volume of traffic that a freeway can accommodate without resulting in a state of failure. As the volume traveling on a freeway segment increases, the density of vehicles traveling on the freeway also increases, resulting in reduced speed on the freeway. This will continue until the volume driving on the freeway reaches capacity; once the volume attempting to utilize the freeway exceeds its capacity, the freeway reaches a stop and go operating condition. The capacity of a freeway segment is dependent on several parameters: number of vehicles, free flow speed, truck traffic, number of lanes, and the peak hour factor.

5.4 Ramp Junctions

The analysis associated with operations at ramp junctions with the freeway mainline typically involves the effects of vehicles either merging onto or diverging from the mainline. The common methodologies used for analyzing these movements are those from Chapter 25 of the *HCM*. These methodologies focus on an influence area of 1,500 feet (downstream from ramp if merging and upstream from ramp if diverging). It should be noted that while the *HCM* methodology defines the influence area of merging or diverging traffic to be within 1,500 feet, the effects can extend outside of this area. The analysis for merging and diverging areas is discussed further below.

5.5 Intersections

The analysis of local street at-grade intersections included a review of operations at both unsignalized and signalized intersections. All intersections were analyzed using HCS+. At urban intersections, the level of service at signalized and stop-controlled intersections is the critical measure of how a roadway is functioning. Intersection level of service provides a measure of the impact of traffic from cross streets, as well as turning traffic. level of service ranges from LOS A to LOS F, with A being very good (short signal cycles, almost no waiting to go through a signalized intersection); and F representing very poor (very long wait or wait through multiple signal cycles) or failure (gridlock). Historically, LOS C has been considered good and acceptable for an urban area. More recently, with the tremendous growth in travel, LOS D has become acceptable because limited financial resources could preclude otherwise worthy projects if they were constructed to LOS C. Volume/Capacity (V/C) Ratio is defined as the ratio of traffic flow rate to capacity of the road to handle that traffic flow. The V/C may be the actual or projected rate of flow on a designated lane group during a specific time period. A V/C ratio over 1.0 indicates that traffic volume has exceeded the road or intersection's capacity.

5.6 No Build Alternative

In the northbound direction, beginning just south of the Dixie Highway Interchange in Kentucky, the I-71/I-75 mainline consists of three lanes which continue north until the KY 4th Street entrance ramp adds a fourth mainline lane. The four lane mainline of I-71/I-75 continues across the Ohio River where I-75 and I-71 have a major diverge with the right two lanes diverging to I-71 and the left two lanes to I-75. Near OH 8th Street, two additional lanes join I-75 to make a four lane mainline for I-75, continuing as such to the project limits. The two additional lanes that joined I-75 are a combination of entrance ramps from partial interchanges to I-75 northbound from I-71 southbound/US 50 WB; Oh 4th Street; and OH 6th Street. Other partial interchange ramps which connect with I-75 northbound include: OH 2nd Street (exit ramp); OH 5th Street (exit ramp); Freeman Ave (entrance ramp); and Winchell Avenue (entrance ramp). In Kentucky, full movement interchanges exist at Dixie Highway, Kyles Lane, KY 12th and Pike streets, KY 5th and KY 4th streets. In Ohio, full movement interchanges are located at the Western Hills Viaduct Interchange and the Ezzard Charles Drive Interchange.

In the southbound direction, beginning just north of the Western Hills Viaduct Interchange with I-75 in Ohio, I-75 consists of four mainline lanes. The four mainline lanes of I-75 continue southbound to approximately OH 8th Street, where the two left lanes separate from the mainline, to provide access to OH 5th Street; I-71 northbound/US 50 eastbound; and OH 2nd Street. The remaining two mainline lanes of southbound I-75 continue to the approach of the existing Brent Spence Bridge where the two mainline lanes of southbound I-71 join the two mainline lanes of southbound I-75 to produce a four lane mainline throughout the remainder of the project. In Ohio's southbound direction, there are full I-75 movements for the interchanges at Western Hills Viaduct (westbound direction only), and Ezzard Charles Drive. In addition, there are partial interchanges consisting of a single ramp lane from: Western Ave (entrance ramp); OH 8th Street (entrance ramp); OH 7th Street (exit ramp) and US 50 EB (entrance ramp).

5.6.1 No Build Traffic Capacity

Capacity analyses were run for all movements on the freeway, which included freeway segments, diverges, merges and weaves, and for the ramp intersections. Since the design criteria for level of service for all roadways and intersections is LOS D for this project, a table was created to categorize the percentage of instances where the No Build Alternative will not meet the level of service criteria for freeway segments, diverges, merges, weaves and intersections on a system basis for the entire alternative. This will be compared with the same criteria for Alternatives E and I to help select a preferred alternative.

The 2035 No Build Exhibits in Appendix F presents analysis that I-75 would be overcapacity in the design year unless additional capacity is created. This overcapacity on southbound I-75 near the Western Hills Viaduct Interchange would form a queue in each lane of 435 passenger cars (pc). At 25 feet per vehicle, the backup would extend for 2.06 miles in each lane. Using the constrained freeway volume of 7,887, capacity analyses were performed throughout the project southbound. The results show that no additional locations would be overcapacity downstream of the gridlocked section throughout the project during the AM peak Hour. However, I-75 southbound from Western Hills Viaduct Interchange to the Ohio River would have LOS E (near capacity), even with the constrained volume reduction noted above.

5.6.1.1 2035 No Build Northbound

Beginning at the Dixie Highway Interchange during the AM peak hour, the three lanes of northbound I-75 would be overcapacity at LOS F. The maximum traffic which can be accommodated by the three lanes is 5,710 pc. Using this constrained traffic, the 270 pc which exit to Dixie Highway will produce a LOS E. This would continue until the merge with the entrance ramp for Kyles Lane, where a LOS F results. Again, the traffic volumes would have to be constrained. With the constrained traffic volumes, LOS E would be provided until the merge with the entrance ramp from Jillians Way, where the flow would degrade to LOS F. Again, the traffic volumes would have to be constrained, producing LOS E, which would continue northward until the major diverge with I-71 and I-75. LOS E would exist on I-71 from the diverge with I-75 to the east until the OH 2nd Street exit, where it would increase to LOS D. On I-75 just to the north of the major diverge with I-71; a LOS C or better would exist throughout the project.

Northbound I-75 just to the south of the Dixie Highway Interchange would have a PM peak hour LOS F and the traffic volumes must be constrained to produce LOS E. With these reduced traffic volumes, LOS E would be maintained to the exit ramp for KY 5th Street, where the I-75 mainline would rise to LOS D and would stay at LOS D until the exit to OH 5th Street in Ohio, where a lane drops to OH 5th Street leaving two lanes for the I-75 mainline at LOS E. At the adjacent upstream diverge to Winchell Avenue, the LOS on I-75 increase to LOS D where it will be maintained at LOS D or higher throughout the Western Hills Viaduct Interchange.

Since the Brent Spence Bridge Replacement/Rehabilitation Project is approximately eight miles in length and the alternatives differ substantially with regard to length of roadways, number of lanes, number of diverges and merges, etc., comparing the percentage of major roadway elements at various levels of service may provide insight into how well each alternative would function. Since LOS D and higher meets the design criteria, the percentage of locations which are below LOS D will be emphasized. Traveling southbound in the AM peak hour during the design year, 10 percent of the freeway segments would be at LOS E and three percent would be at LOS F. All of the merge and diverge locations would be at LOS D or better, but 50 percent of the weave sections would be at LOS E. Similarly, during the PM peak hours in the design year for the southbound direction, 23 percent of the freeway segment would be at LOS E and 10 percent would be at LOS F. For the merges, 14 percent would be at LOS E and 45 percent would be at LOS F. For the exits (diverges), 22 percent of the locations would be at LOS E and 11 percent at LOS F. The weaves would have 25 percent of their locations at LOS E and 25 percent at LOS F.

In the northbound direction during the AM peak hour in the design year 2035, 23 percent of the freeway segments would be at LOS E and six percent at LOS F. The merge areas would have 22 percent of their locations at LOS F and the diverge areas would have 28 percent of their locations at LOS E and 28 percent of their locations at LOS F. The single weave section in the northbound direction would be at LOS E. Similarly, during the PM peak hour in the design year, 23 percent of the freeway segments would be at LOS E and 11 percent at LOS F. The merge areas would have 22 percent of their locations at LOS F and the diverge locations would have 43 percent of their locations at LOS E and 14 percent at LOS F. The single weave section would be at LOS E.

The preceding sections have described the conditions which would exist on northbound I-75 in the design year and the overlapped portion of I-71 for the mainline lanes of the Interstate System. In addition, capacity analyses were also performed for all ramp intersections and those adjacent to the ramps. Based on the analysis for 56 intersections, only nine percent (five intersections) would be at either LOS E or F during the AM peak hour, and nine percent (five intersections) at LOS F during the PM peak hour.

5.6.1.2 2035 No Build Southbound

From the Western Hills Viaduct Interchange to OH 8th Street, the southbound I-75 peak hour traffic demand volumes would not exceed the capacity of the four lanes on I-75, resulting in a LOS D. After the OH 8th Street ramp merges into I-75, the flow would drop to LOS E. At the next adjacent merge with traffic from US 50 eastbound, the traffic flow would drop to LOS F, and would require the constraining of 830 pc. The two lane section of I-75 would have a 415 pc queue in each lane and would produce a queue length of 1.96 miles in each lane. Even if the 830 pc that exceeded the capacity of the two lane section of I-75 were diverted to another roadway, I-75 southbound would again become overcapacity (LOS F) with the merging of I-71 southbound. This would continue into Kentucky to the exit with KY 5th Street. From the KY 5th Street exit to the Pike Street exit the flow would rise to LOS D. At the merge with the Pike Street entrance ramp the flow would drop to LOS E and would continue as such until the merge with the Bullock Street entrance ramp where LOS F would result. I-75 would remain at LOS F until the exit ramp to Kyles Lane, where LOS E would exist throughout the remainder of the project. The No Build Alternative freeway analysis is presented below in Table 5-1 for Kentucky and in Table 5-2 for Ohio.

Table 5-1. No Build Alternative Freeway Analysis - Kentucky

Ref	Facility	Location	No Build LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-1	SB I-71/I-75	South of Ohio River	D	6,520	6,048	F	8,870	7,905
F-2	SB I-71/I-75	South of 5th St. off-ramp	D	5,660	5,250	E	8,020	6,880
F-3	SB I-71/I-75	South of Pike St./12th St. off-ramp	D	5,390	5,000	D	7,430	6,370
F-4	SB I-71/I-75	North of 12th St. on-ramp	D	5,870	5,470	E	8,580	7,470
F-5	SB I-71/I-75	South of 12th St. on-ramp	D	6,220	5,820	F	9,160	8,050
F-6	SB I-71/I-75	South of Kyles Lane off-ramp	D	5,620	5,260	E	8,140	6,740
F-7	SB I-71/I-75	North of Dixie Hwy off-ramp	D	6,060	5,700	E	8,780	7,380
F-8	SB I-71/I-75	South of Dixie Hwy off-ramp	D	5,870	5,520	E	8,070	6,780
F-9	SB I-71/I-75	South of Dixie Hwy on-ramp	D	6,200	5,850	E	8,650	7,360
F-10	NB I-71/I-75	South of Dixie Hwy off-ramp	F	5,760	5,710	F	6,570	5,730
F-11	NB I-71/I-75	North of Dixie Hwy off-ramp	E	5,490	5,440	E	6,210	5,420
F-12	NB I-71/I-75	North of Dixie Hwy on-ramp	D	6,430	6,380	D	6,600	5,810
F-13	NB I-71/I-75	North of Kyles Lane off-ramp	E	5,930	5,680	E	5,790	5,100
F-14	NB I-71/I-75	North of Kyles Lane on-ramp	E	7,250	5,760	E	6,410	5,720
F-15	NB I-71/I-75	North of 12th St. off-ramp	E	7,010	5,540	E	5,860	5,230
F-16	NB I-71/I-75	North of 5th St. off-ramp	E	6,370	5,040	D	5,310	4,740

Table 5-1. No Build Alternative Freeway Analysis - Kentucky

Ref	Facility	Location	No Build LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-17	NB I-71/I-75	North of Pike St. on-ramp	F	7,490	5,810	E	5,710	5,140
F-18	NB I-71/I-75	North of 4th St. on-ramp	D	8,650	6,970	D	6,690	6,120

Table 5-2. No Build Alternative Freeway Analysis - Ohio

Ref	Facility	Location	No Build LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-1	I-75 SB	North of Western Hills Viaduct	F	9,630	-	D	6,530	-
F-2	I-75 SB	Between Western Hills Viaduct Ramps	E	9,370	7,674	D	6,030	-
F-3	I-75 SB	Between Western Ave. Ramps	E	9,430	7,857	D	5,960	-
F-4	I-75 SB	Between Ezzard Charles Dr. & Freeman Ave. Ramp	E	8,810	7,340	D	5,720	-
F-5	I-75 SB	Between Freeman Ave. & Western Ave. Ramps	D	8,140	6,782	C	5,260	-
F-6	I-75 SB	Between 7th St. & 2nd Ave./I-71 Ramps	D	7,080	5,962	D	5,550	-
F-7	I-75 SB	Between 9th St. & 7th St.	C	3,000	2,528	D	2,760	-
F-8	I-75 SB	Between 7th St. & 5th St.	D	3,160	2,688	E	3,700	-
F-9	I-75 SB	Between 5th St. & 3rd St.	D	3,840	3,368	F	4,530	3,967
F-10	I-71 SB	North of Liberty St.	E	5,350	-	F	6,330	-
F-11	I-71 SB	Between Liberty St. & Eggleston Ave.	D	4,700	-	D	4,820	4,568
F-12	I-71 SB	Between Eggleston Ave. & 5th St.	D	3,030	-	F	4,290	4,066
F-13	I-71 SB	Ramp to 3rd St.	D	1,670	-	A	530	502
F-14	US 50 WB	East of I-71	C	2,240	-	B	1,900	-
F-15	I-71 SB	Between US 50 & I-75 NB Off-Ramp	C	5,270	-	D	6,190	5,881
F-16	I-71 SB	Between I-75 NB Off-Ramp & 3rd St. Ramp	C	2,420	-	D	3,140	2,983

Table 5-2. No Build Alternative Freeway Analysis - Ohio

Ref	Facility	Location	No Build LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-17	I-71 SB	Between 3rd St On-Ramp & I-75 SB	D	2,680	-	F	4,340	3,966
F-18	I-71 SB	Crossing Ohio River SB	D	6,520	6,048	F	8,870	7,905
F-19	I-75 SB	I-75 SB Ramp between I-71 & 5th St. Ramp	D	4,080	3,434	D	2,790	-
F-20	I-75 SB	I-75 SB Ramp between 5th St. Ramp & 2nd St. Ramp	D	3,370	2,836	C	2,540	-
F-21	I-75 SB	I-75 SB Ramp between 2nd St. Ramp & 6th St. Ramp	D	1,860	1,565	D	1,730	-
F-22	I-75 SB	I-75 SB Ramp to 2nd St.	C	1,510	1,271	B	810	-
F-23	6th St. EB	Ramp to I-71 NB	D	1,750	-	C	1,190	-
F-24	I-75 SB	Ramp to I-71 NB	D	3,610	3,315	D	2,920	-
F-25	6th St. EB	West of 5th St. Ramp	B	3,330	-	A	2,290	-
F-26	6th St. EB	Ramp to 5th St.	A	560	-	A	150	-
F-27	6th St. EB	East of 5th St. Ramp	D	2,770	-	C	2,140	-
F-28	6th St. EB	Ramp to I-71/I-75 SB & 2nd St.	C	1,020	-	C	950	-
F-29	6th St. EB	Ramp to I-71/I-75 SB	B	680	-	B	830	-
F-30	6th St. EB	Ramp to 2nd St.	A	340	-	A	120	-
F-31	I-75 SB	I-75 SB Ramp/6th St. Ramp to 2nd St.	B	1,850	1,611	A	930	-
F-32	2nd St. EB	East of I-75 SB Ramp	B	2,070	1,831	A	1,340	-
F-33	I-71 NB	Crossing Ohio River NB	D	8,650	6,970	D	6,690	6,120
F-34	I-71 NB	East of I-75 NB	E	4,800	3,868	C	2,330	2,131
F-35	I-71 NB	Between 2nd St. Ramp & I-75 SB Ramp	D	3,600	2,901	B	1,900	1,738
F-36	I-71 NB	East of I-75 SB Ramp	D	7,210	6,216	C	4,820	4,658
F-37	2nd St. EB	East of I-71 NB Ramp	A	3,270	2,798	A	1,770	1,733
F-38	I-71 NB	Between US 50 & 2nd St. Ramp	F	5,120	4,414	C	2,390	2,310

Table 5-2. No Build Alternative Freeway Analysis - Ohio

Ref	Facility	Location	No Build LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-39	US 50 EB	West of I-71 NB	B	2,090	1,802	C	2,430	2,348
F-40	I-71 NB	Between 2nd St. Ramp & 5th St. Ramp	C	5,210	4,033	B	2,820	2,740
F-41	I-71 NB	Between 5th St. Ramp & I-471 Ramp	D	5,430	4,253	C	3,440	3,360
F-42	I-71 NB	Between I-471 Ramp & Gilbert Ave. Ramp	F	7,400	6,004	D	4,560	4,480
F-43	I-71 NB	North of Gilbert Ave. Ramp	D	7,550	6,151	D	5,700	5,620
F-44	I-471 SB	East of I-71	A	970	-	D	2,920	-
F-45	I-471 NB	East of I-71	D	3,430	-	B	1,370	-
F-46	I-75 NB	Between I-71 & 5th St. Ramp	C	3,850	3,102	C	4,360	3,989
F-47	I-75 NB	Between 5th St. Ramp & 6th St. Ramp	C	3,090	2,490	E	3,990	3,650
F-48	I-75 NB	Ramp to 5th St.	B	760	612	A	370	339
F-49	I-75 NB	Between 6th St. & 9th St.	C	2,360	1,902	D	3,290	3,010
F-50	I-75 NB	Ramp to 6th St.	B	730	588	B	700	640
F-51	I-71 SB	Ramp to I-75 NB/6th St.	D	2,850	-	D	3,050	2,898
F-52	I-71 SB	Ramp to 6th St.	C	940	-	D	1,450	1,378
F-53	I-71 SB	I-71 SB/I-75 NB Ramp to 6th St.	B	1,670	1,528	C	2,150	2,018
F-54	US 50 WB	West of I-71/I-75	A	1,860	1,718	B	3,110	2,978
F-55	I-71 SB	Ramp to I-75 NB	E	1,910	-	D	1,600	1,520
F-56	I-71 SB	Ramp to I-75 NB	C	2,200	-	D	3,200	3,120
F-57	I-71 SB	Ramp to I-75 NB (North of 6th St.)	B	2,390	-	B	3,720	3,640
F-58	I-71 SB	Ramp to I-75 NB (North of Winchell Off-Ramp)	B	2,220	-	C	3,400	3,327
F-59	I-75 NB	Between I-75 Ramp & 9th St. Ramp	C	4,580	4,122	D	6,690	6,337
F-60	I-75 NB	Between 9th St. Ramp & Freeman Ave. Ramp	C	4,730	4,272	E	7,520	7,167
F-61	I-75 NB	Between Freeman Ave. Ramp & Ezzard Charles Dr.	C	5,220	4,762	E	8,080	7,727

Table 5-2. No Build Alternative Freeway Analysis - Ohio

Ref	Facility	Location	No Build LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-62	I-75 NB	Between Winchell Ave. Ramp & Western Hills Viaduct	C	5,350	4,892	F	8,480	7,893
F-63	I-75 NB	Bank St./Western Hills Viaduct On-Ramp	C	1,010	-	B	910	-
F-64	I-75 NB	Between Western Hills Viaduct Ramps	C	5,030	4,599	E	7,950	7,400
F-65	I-75 NB	North of Western Hills Viaduct	D	6,040	5,609	F	8,860	7,888
F-66	I-75 SB	Between I-74 Merge & Hopple St. Diverge	F		9,452	D		6,863
F-67	I-75 NB	Between Hopple St. Merge & Bates Ave. Merge	C		5,340	E		7,591
F-67A	I-75 NB	Between Hopple St. Diverge & Hopple St. Merge	C		5,081	E		7,329
F-68	I-75 SB	Between Hopple St. Diverge & Hopple St. Merge	F		8,636	D		6,079

5.7 Alternative E

5.7.1 Freeway Segments

Twenty-three freeway segments were analyzed along Alternative E in Kentucky.

5.7.1.1 Kentucky

AM Peak
During the AM peak period, 35 percent operated at LOS C, 35 percent of the freeway segments operated at LOS D, 18 percent of the freeway segments operated at LOS E, and 12 percent of the freeway segments operated at LOS F.

PM Peak
During the PM peak period, 13 percent operated at LOS C, 39 percent of the freeway segments operated at LOS D, 26 percent of the freeway segments operated at LOS E and 22 percent of the freeway segments operated at LOS F. The poor levels of services do not occur in one concentrated area, but throughout the project limits on I-75 in Kentucky.

The freeway segment analysis for Alternative E in Kentucky is presented in Table 5-3.

Table 5-3. Alternative E Freeway Segment Analysis - Kentucky

Ref	Facility	Location	Alternative E LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-1	SB I-71	South of Ohio River	C	2,780	-	D	4,940	4,670
F-2	SB I-75	South of Ohio River	D	4,530	-	D	4,250	-
F-3	SB I-71	South of Bullock off-ramp	C	2,660	-	D	4,810	4,550
F-4	SB I-75	South of Bullock off-ramp	C	3,600	-	C	2,940	-
F-5	SB I-71	South of Local C-D merge	C	2,960	-	F	5,990	5,710
F-6	SB I-71/I-75	South of I-71/I-75 merge	C	6,560	-	D	8,930	8,650
F-7	SB I-71/I-75	South of 12th St. on-ramp	D	7,340	-	E	10,390	10,110
F-8	SB I-71/I-75	6-lane section south of Kyles Lane off-ramp	C	6,460	-	D	8,570	7,540
F-9	SB I-71/I-75	5-lane section south of Kyles Lane off-ramp	D	6,460	-	E	8,570	7,540
F-10	SB I-71/I-75	4-lane section south of Kyles Lane off-ramp	E	6,460	-	F	8,570	7,540
F-11	SB I-71/I-75	South of Kyles Lane on-ramp	D	6,810	-	E	9,130	8,100
F-12	SB I-71/I-75	South of Dixie Hwy on-ramp	D	7,150	-	E	9,760	8,730
F-13	SB I-71/I-75	South of Buttermilk Pk off-ramp	E	6,440	-	F	8,540	7,640
F-14	NB I-71/I-75	South of Dixie Hwy off-ramp	F	7,160	-	F	8,280	-
F-15	NB I-71/I-75	3-lane section north of Dixie Hwy off-ramp	F	6,440	-	F	7,180	-
F-16	NB I-71/I-75	4-lane section north of Dixie Hwy off-ramp	D	6,440	-	E	7,180	-
F-17	NB I-71/I-75	South of Kyles Lane on-ramp	D	7,440	-	D	7,560	-
F-18	NB I-71/I-75	South of 12th St. off-ramp	D	8,910	-	D	8,270	-
F-19	NB I-71/I-75	North of 12th St. off-ramp	E	6,740	-	E	6,730	-
F-20	NB I-71	North of I-71/I-75 split	E	3,670	-	C	2,240	-
F-21	NB I-75	North of I-71/I-75 split	C	3,070	-	D	4,490	-
F-22	NB I-71	North of Bullock St. loop ramp entrance	F	4,470	3,880	C	2,660	-
F-23	NB I-75	North of 9th St. on-ramp	C	3,620	-	D	4,830	-

5.7.1.2 Ohio

Forty-two freeway segments were analyzed along Alternative E in Ohio.

AM Peak

During the AM peak period, 7 percent of the freeway segments operated at LOS A, 3 percent of the freeway segments operated at LOS B, 38 percent operated at LOS C, 38 percent of the freeway segments operated at LOS D, 7 percent of the freeway segments operated at LOS E and 7 percent of the freeway segments operated at LOS F.

PM Peak

During the PM peak period, 14 percent of the freeway segments operated at LOS A, 5 percent of the freeway segments operated at LOS B, 33 percent operated at LOS C, 38 percent of the freeway segments operated at LOS D, 5 percent of the freeway segments operated at LOS E and 5 percent of the freeway segments operated at LOS F. Segments with a LOS of E or F included I-71 southbound north of Liberty Street ramps; I-75 southbound connector from 6^{th} Street; I-75 northbound between the Western Hills Viaduct and Hopple Street; and the Western Ave C-D road near the Western Hill Viaduct.

The freeway segment analysis for Alternative E in Ohio is presented in Table 5-4.

Table 5-4. Alternative E Freeway Segment Analysis - Ohio

Ref	Facility	Location	Alternative E LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-1	I-75 SB	North of Western Hills Viaduct	D	9,360	-	C	6,850	-
F-1A	I-75 SB	Off-Ramp to Western Hills Viaduct & Western Ave.	E	1,870	-	E	1,320	-
F-1B	I-75 SB	Off-Ramp to Western Hills Viaduct	C	1,220	-	A	520	-
F-1C	I-75 SB	On-Ramp from Western Hills Viaduct	D	1,410	-	A	800	-

Table 5-4. Alternative E Freeway Segment Analysis - Ohio

Ref	Facility	Location	Alternative E LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-1D	I-75 SB	Off-Ramp to Western Ave.	B	650	-	A	800	-
F-2	I-75 SB	Between Western Hills Viaduct Ramps	D	7,490	-	C	5,530	-
F-3	I-75 SB	NOT USED						
F-4	I-75 SB	South of Western Hills Viaduct	D	6,780	-	C	5,530	-
F-5	I-75 SB	Between C-D Road SB & 9th St.	C	4,960	-	C	4,440	-
F-5A	I-75 SB to I-71 NB	Between 9th St & 6th St	A	1,070	-	A	980	-
F-5B	I-75 SB to I-71 NB	Between 6th St & I-71 NB	D	3,010	-	C	2,360	-
F-5C	6th St to I-71 NB	From 6th St Ramp to I-71 NB	E	1,940	-	D	1,380	-
F-6	I-75 SB	9th St to 6th St	C	3,890	-	C	3,460	-
F-7	I-75 SB	South of 6th St	D	4,530	-	D	4,250	-
F-8	I-71 SB	North of Liberty St.	D	5,230	-	F	6,490	-
F-9	I-71 SB	Between Liberty St. & Eggleston Ave.	D	4,580	-	D	4,960	4,586
F-9A	I-71 SB	Ramp to 3rd St.	D	1,460	-	A	470	435
F-10	I-71 SB	Between Eggleston Ave. & 5th St.	D	3,120	-	F	4,490	4,151
F-10A	US 50 WB	E of I-71	C	2,320		C	1,970	-
F-11	I-71 SB	Between US 50 & I-75 NB Off-Ramp	D	5,440	-	D	6,460	5,951
F-11A	I-71 SB to I-75 NB	From FWW Trench to 6th St/I-75 NB	D	2,940	-	D	2,970	2,736
F-11B	I-71 SB to I-75 NB	From FWW Trench/6th St to I-75 NB	E	1,900	-	C	1,400	1,290
F-12	I-71 SB	FWW to 3rd St On-Ramp	C	2,500	-	D	3,490	3,215
F-13	I-71 SB	South of 3rd St On-Ramp	C	2,780	-	D	4,940	4,665
F-14	I-71 NB	South of FWW	F	4,470	3,880	C	2,660	-
F-15	I-71 NB	In FWW Trench	D	7,480	6,879	C	5,020	-

Table 5-4. Alternative E Freeway Segment Analysis - Ohio

Ref	Facility	Location	Alternative E LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-15A	US 50 EB	West of I-71 NB	C	2,160	1,986	C	2,510	-
F-16	I-71 NB	Between US 50 & 2nd St Ramps	F	5,320	4,893	C	2,510	-
F-17	I-71 NB	Between 2nd St & 5th St Ramps	C	5,380	4,003	B	2,800	-
F-18	I-71 NB	Between 5th St & I-471 Ramps	D	5,570	4,193	C	3,330	-
F-19	I-71 NB	Between I-471 & Gilbert Ramps	F	7,530	6,153	D	4,440	-
F-20	I-71 NB	North of Gilbert On-Ramp	D	7,690	6,161	D	5,680	-
F-21	I-75 NB	South of C-D NB Off-Ramp	C	3,620	-	D	4,830	-
F-22	I-75 NB	After C-D NB Off-Ramp	C	2,870	-	D	4,100	-
F-23	I-75 NB	Between FWW and C-D NB On	C	4,770	-	D	5,500	5,390
F-24	I-75 NB	Between C-DNB On & Freeman	C	5,470	-	C	7,930	7,820
F-25	I-75 NB	North of Freeman Ave	C	5,980	-	D	8,680	8,570
F-26	I-75 NB	Between Western Hills On & Off Ramps	C	4,850	-	D	7,290	7,540
F-27	I-75 NB	Between Western Hills On-Ramps	C	5,160	-	D	8,400	7,974
F-28	I-75 NB	N of Western Hills Ramps	C	6,460	-	E	8,630	8,784
F-31A	NB I-75 Ramp	Ramp to 9th St WB	A	80	-	A	100	-
F-35	I-471 SB	East of I-71	A	1,000	-	D	2,970	-
F-36	I-471 NB	East of I-71	D	3,050	-	B	1,340	-

5.7.2 Ramp Junctions

5.7.2.1 Kentucky

Twenty-seven ramp junctions were analyzed along Alternative E in Kentucky. 13 of these were merges and 14 were diverges.

AM Peak

During the AM peak period, 31 percent of the merges operated at LOS A, 31 percent of the merges operated at LOS B, 22 percent of the merges operated at LOS C, 8 percent of the merges operated at LOS

D, and 8 percent of the merges operated at LOS F. Fourteen of the ramp junctions analyzed along Alternative E in Kentucky were diverges. During the AM peak period, 14 percent of diverges operated at LOS A, 50 percent of diverges operated at LOS B, 15 percent of diverges operated at LOS C, 14 percent of diverges operated at LOS D and 7 percent of diverges operated at LOS F.

PM Peak

During the PM peak period, 15 percent of the merges operated at LOS A, 46 percent of the merges operated at LOS B, 23 percent of the merges operated at LOS C, 8 percent of the merges operated at LOS D, and 8 percent of the merges operated at LOS E. During the PM peak period, 14 percent of diverges operated at LOS A, 14 percent of diverges operated at LOS B, 50 percent of diverges operated at LOS C, 8 percent of diverges operated at LOS D, and 14 percent of the diverges operated at LOS F.

The ramp junction analysis for Alternative E in Kentucky is presented in Table 5-5.

Table 5-5. Alternative E Ramp Junction Analysis - Kentucky

Ref	Facility	Location	Alternative E LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
R-1	SB I-71	Bullock St. off-ramp	B	120	-	C	130	120
R-2	SB I-75	Bullock St. off-ramp	D	930	-	C	1,310	-
R-3	SB Local C-D	Off-ramp to I-71 SB	DROP A	300	-	DROP C	1,180	-
R-4	SB I-71	SB Local C-D on-ramp	C	300	-	E	1,180	-
R-5	SB Local C-D	Crescent Ave. on-ramp	ADD C	1,170	-	ADD C	1,210	-
R-6	SB Local C-D	Off-ramp to I-71 NB	DROP B	800	-	DROP A	420	-
R-7	SB I-71/I-75	12th St. on-ramp	B	780	-	D	1,460	-
R-8	SB I-71/I-75	Kyles-Dixie C-D off-ramp	C	880	-	F	1,820	1,770
R-9	SB Kyles-Dixie C-D	Kyles Lane off-ramp	B	690	-	D	1,140	1,110
R-10	SB Kyles-Dixie C-D	Kyles Lane on-ramp	A	350	-	B	560	-
R-11	SB Kyles-Dixie C-D	Dixie Hwy off-ramp	A	190	-	C	680	660
R-12	SB I-71/I-75	Kyles-Dixie C-D on-ramp	ADD A	350	-	ADD B	560	-
R-13	SB I-71/I-75	Dixie Hwy on-ramp	B	340	-	C	630	-
R-14	SB I-71/I-75	Buttermilk Pk on-ramp	DROP A	710	-	DROP B	1,220	1,090
R-15	NB I-71/I-75	Kyles-Dixie C-D off-ramp	F	720	-	F	1,100	-
R-16	NB Kyles-Dixie C-D	Dixie Hwy off-ramp	B	280	-	C	380	-
R-17	NB Kyles-Dixie C-D	Dixie Hwy on-ramp	B	1,000	-	B	380	-
R-18	NB I-71/I-75	Kyles-Dixie C-D on-ramp	ADD C	1,000	-	ADD A	380	-
R-19	NB Kyles-Dixie C-D	Kyles Lane off-ramp	D	440	-	C	720	-
R-20	NB I-71/I-75	Kyles Lane on-ramp	ADD D	1,470	-	ADD B	710	-
R-21	NB I-71/I-75	Off-ramp to NB Local C-D Road	DROP C	2,170	-	DROP B	1,540	-
R-22	NB Local C-D	12th St. off-ramp	B	250	-	B	550	-
R-23	NB I-71	SB Local C-D on-ramp	F	800	-	C	420	-
R-24	NB I-75	9th St. on-ramp	B	550	-	C	340	-
R-25	NB Local C-D	5th St. off-ramp	B	890	-	A	650	-
R-26	NB Local C-D	9th St. on-ramp	A	10	-	A	80	-
R-27	NB Local C-D	4th St. on-ramp	B	1,230	-	B	760	-

Table 5-5. Alternative E Ramp Junction Analysis - Kentucky

5.7.2.2 Ohio

Fifteen ramp junctions were analyzed along Alternative E in Ohio. Of these, 11 were merges and four were diverges.

AM Peak

During the AM peak period, 9 percent of the merges operated at LOS A, 64 percent of the merges operated at LOS C, 18 percent of the merges operated at LOS D, and 9 percent of the merges operated at LOS F. During the AM peak period, 25 percent of diverges operated at LOS B, 25 percent of diverges operated at LOS C, 25 percent of diverges operated at LOS D, 25 percent of diverges operated at LOS E.

PM Peak
During the PM peak period, 18 percent of the merges operated at LOS A, 27 percent of the merges operated at LOS B, 27 percent of the merges operated at LOS C, 18 percent of the merges operated at LOS D, and 9 percent of the merges operated at LOS F. During the PM peak period, 25 percent of diverges operated at LOS B, 50 percent of the diverges operated at LOS D, and 25 percent of the diverges operated at LOS F.

The ramp junction analysis for Alternative E in Ohio is presented in Table 5-6.

Table 5-6. Alternative E Ramp Junction Analysis - Ohio

Ref	Facility	Location	Alternative E LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
R-1	I-75 SB	Freeman Ave. Off-Ramp	B	380	-	B	450	-
R-2	I-75 SB	Western Ave. On-Ramp	C	50	-	B	160	-
	I-75 SB	R-3 & R-4 NOT USED						
R-5	I-75 SB	US 50 On-Ramp	D	640	-	C	790	-
	I-75 SB	R-6 - R-8 NOT USED						
R-9	I-71 SB	3rd St. On-Ramp	C	280	-	F	1,450	-
	I-71 SB	R-10 & R-11 NOT USED						
R-12	2nd St.	C-D Road NB On-Ramp	C	1,200	-	B	430	-
R-13	2nd St.	C-D Road SB On-Ramp	C	1,250	-	A	640	-
	2nd St.	R-14 - R-22 NOT USED						
R-23	Winchell Ave.	Freeman Ave. On-Ramp	A	370	-	A	120	-
R-24	I-75 NB	Freeman Ave. On-Ramp	C	510	-	D	750	-
R-25	I-71 NB	5th St. On-Ramp	C	190	-	B	530	-
R-26	I-71 SB	I-471 Off-Ramp	D	650	-	F	1,530	1,415
R-27	I-71 NB	I-471 On-Ramp	F	1,960	-	C	1,110	-
	I-71 NB	R-28 & R-29 NOT USED						
R-30	I-75 NB	Western Hills Viaduct Off-Ramp	C	1,130	-	D	1,140	-
R-31	I-75 NB	Western Hills Viaduct On-Ramp	C	1,300	-	D	810	-
R-32	I-75 SB	Western Hills Viaduct On-Ramp	D	1,410	-	C	800	-
R-33	I-75 SB	Findlay St. Off-Ramp	E	1,220	-	D	520	-

5.7.3 Intersections

5.7.3.1 Kentucky

Alternative E includes the intersections which are formed by freeway ramps and their crossroads, but also include the intersections on the crossroads adjacent to those at the freeway ramps. Other area intersections were analyzed if work was to be done at those intersections because of this alternative or if traffic operations were affected. A total of 21 intersections were analyzed in Kentucky for Alternative E. Two of the intersections were unsignalized and the other 19 were analyzed as signalized intersections (Table 5-11).

AM Peak
One unsignalized intersection in Alternative E operated at LOS B and one operated at LOS F. At the signalized intersections during the AM peak period, approximately 63 percent of the intersections were at LOS B, 21 percent of the intersections were at LOS C, and 16 percent operated at LOS F.

PM Peak
During the PM Peak period, one unsignalized intersections had approaches that were LOS B and one LOS D. At the signalized intersections during the PM peak period, approximately 47 percent of the intersections were at LOS B, 26 percent of the intersections were at LOS C, 11 percent of the intersections were at LOS D, 5 percent of the intersections were at LOS E, and 11 percent operated at LOS F.

5.7.3.2 Ohio

A total of 47 intersections were analyzed in Alternative E. Three of the intersections were unsignalized and the other forty-four were analyzed as signalized intersections. New signals will be required at the C-D roadway and 4th Street; the C-D roadway and 5th Street; the C-D Road and 7th Street; I-75 northbound and southbound Ramps at 6th Street; and Western Hills Viaduct Interchange at the I-75 northbound and southbound ramps (Table 5-12).

AM Peak
During the AM Peak period, one of the unsignalized intersections or 33 percent, had approaches that were LOS A and two of the unsignalized intersections or 33 percent had approaches with LOS B. At the signalized intersections during the AM peak period, approximately two percent operated at LOS A, 80 percent of the intersections were at LOS B, seven percent of the intersections were at LOS C, and 11 percent of the intersections were at LOS D.

PM Peak
During the PM Peak period, one of the unsignalized intersections or 33 percent had approaches that were LOS B; one of the unsignalized intersections or 33 percent had approaches that were LOS C; and one of the unsignalized intersections or 33 percent had approaches that were LOS D. At the signalized intersections during the PM peak period, approximately 5 percent of the intersections were at LOS A; 70

percent of the intersections were at LOS B; 18 percent of the intersections were at LOS C; 4 percent of the intersections were at LOS D; and 3 percent of the intersections were at LOS E.

In Alternative E, even though many of the signalized intersections have acceptable levels of service, five intersections operate at conditions that are worse than the applicable ODOT standard when v/c ratios are considered. The intersection of 4th Street and Central Avenue (I-34) has LOS E for the PM peak hour. Two of its movements have v/c ratios of 1.02. The intersection of 5th Street and Central Avenue (I-33) has LOS D for the AM peak hour and a v/c ratio of 0.95. The intersection of the C-D Road and 4th Street (I-60) has movements with v/c ratios of 1.10 and 0.99 for the PM peak hour. The intersection of I-71 Southbound Ramp/I-75 Northbound ramp and US 50 (I-62) has a movement with a v/c ratio of 0.94 for the PM peak hour. The intersection of the C-D roadway and 7th Street (I-63) has two movements with v/c ratios of 1.02 for the AM peak hour.

The additional traffic due to the full movement interchange at I-75 & Western Hills Viaduct Interchange causes Central Parkway and Mohawk Place (I-3) to need a westbound left turn lane. This turn lane is not needed in the No Build or in Alternative I.

5.8 Alternative I

5.8.1 Freeway Segments

5.8.1.1 Kentucky

Twenty-one freeway segments were analyzed along Alternative I in Kentucky.

AM Peak
During the AM peak period, 5 percent operated at LOS B, 24 percent of the freeway segments operated at LOS C, 48 percent of the freeway segments operated at LOS D, 14 percent of the freeway segments operated at LOS E, and 9 percent operated at LOS F.

PM Peak
During the PM peak period, 5 percent operated at LOS B, 19 percent of the freeway segments operated at LOS C, 33 percent of the freeway segments operated at LOS D, 24 percent of the freeway segments operated at LOS E, and 19 percent operated at LOS F.

The freeway segment analysis for Alternative I in Kentucky is presented below in Table 5-7.

Table 5-7. Alternative I Freeway Segment Analysis - Kentucky

Ref	Facility	Location	Alternative I LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-1	SB I-75	South of Ohio River	D	3,920	-	B	2,730	-
F-2	SB I-71	South of Ohio River	C	2,310	-	D	3,170	2,920
F-3	SB I-75	North merge with I-71	C	4,250	-	C	5,760	5,740
F-4	SB I-71/I-75	7-lane section south of merge	C	6,560	-	D	8,930	8,660
F-5	SB I-71/I-75	6-lane section south of merge	C	6,560	-	D	8,930	8,660
F-6	SB I-71/I-75	South of 12th St. on-ramp	D	7,340	-	E	10,390	10,120
F-7	SB I-71/I-75	6-lane section south of Kyles off-ramp	C	6,460	-	D	8,570	8,350
F-8	SB I-71/I-75	5-lane section south of Kyles off-ramp	D	6,460	-	E	8,570	8,350
F-9	SB I-71/I-75	4-lane section south of Kyles off-ramp	E	6,460	-	F	8,570	7,540
F-10	SB I-71/I-75	South of Kyles on-ramp	D	6,810	-	E	9,130	8,100
F-11	SB I-71/I-75	South of Dixie Hwy on-ramp	D	7,150	-	E	9,760	8,730
F-12	SB I-71/I-75	South of Buttermilk Pk off-ramp	E	6,440	-	F	8,540	7,640
F-13	NB I-71/I-75	South of Dixie Hwy on-ramp	F	7,160	-	F	8,280	-
F-14	NB I-71/I-75	3-lane section north of Dixie Hwy off-ramp	F	6,440	-	F	7,180	-
F-15	NB I-71/I-75	4-lane section north of Dixie Hwy off-ramp	D	6,440	-	E	7,180	-
F-16	NB I-71/I-75	South of Kyles on-ramp	D	7,440	-	D	7,560	-
F-17	NB I-71/I-75	South of 12th St. off-ramp	D	8,910	-	D	8,270	-
F-18	NB I-71/I-75	South of I-71 and I-75 split	D	5,700	-	D	6,240	-
F-19	NB I-71	South of Pike St. on-ramp	D	3,250	-	C	2,240	-
F-20	NB I-75	South of Ohio River	B	2,450	-	C	4,000	-
F-21	NB I-71	South of Ohio River	E	3,690	-	C	2,380	-

5.8.1.2 Ohio

Fifty-four freeway segments were analyzed along Alternative I in Ohio

AM Peak
During the AM peak period, 24 percent operated at LOS A, 15 percent of the freeway segments operated at LOS B, 19 percent of the freeway segments operated at LOS C, 28 percent of the freeway segments operated at LOS D, 11 percent of the freeway segments operated at LOS E, and 3 percent operated at LOS F.

PM Peak
During the PM peak period, 31 percent operated at LOS A, 9 percent operated at LOS B, 30 percent of the freeway segments operated at LOS C, 24 percent of the freeway segments operated at LOS D, 2 percent of the freeway segments operated at LOS E, and 4 percent operated at LOS F.

The freeway segment analysis for Alternative I in Ohio is presented in Table 5-8.

Table 5-8. Alterantive I Freeway Segment Analysis - Ohio

Ref	Facility	Location	Alternative I LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-1	I-75 SB	North of Western Hills Viaduct	D	9,750	-	C	7,690	-
F-2		Between Western Hills Viaduct Ramps	E	8,750	-	D	6,720	-
F-3		Ramp to Western Hills Viaduct/Findlay St.	C	1,000	-	C	970	-
F-4		Between Western Hills Viaduct & C-D Road SB Ramps	D	9,550	-	C	7,120	-
F-5		Between C-D Road SB & I-71 NB Ramp	E	5,240	-	C	3,950	-
F-6		Between I-71 NB Ramp & Ohio River	D	3,920	-	C	2,730	-
F-7	9th St. WB	East of Winchell Ave. Ramp	A	400	-	A	1,540	-
F-8		Between Winchell Ave. & C-D Road SB Ramps	A	330	-	A	1,190	-
F-9		Ramp to Winchell Ave.	A	70	-	A	350	-
F-10		West of C-D Road SB Ramp	A	240	-	A	690	-
F-11		Ramp to C-D Road SB	A	90	-	A	500	-
F-12	7th St. EB	West of C-D Road SB Ramp to 7th St.	A	850	-	A	570	-
F-13		East of C-D Road SB Ramp to 7th St.	B	2,220	-	A	750	-
F-14	6th St. WB	Between Winchell Ave. & C-D Road NB Ramps	A	130	-	A	800	-
F-15		Between C-D Road NB & I-71 SB Ramps	A	980	-	A	1,630	-
F-16		West of I-71 SB Ramp	A	1,910	-	B	3,090	2,975
F-17	6th St. EB	West of C-D Road SB Ramp	B	3,210	-	A	2,250	-

Table 5-8. Alterantive I Freeway Segment Analysis - Ohio

Ref	Facility	Location	Alternative I LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-18		Between C-D Road SB & 2nd St. Ramps	C	2,270	-	B	1,340	-
F-19		Between 2nd St. & 5th St. Ramps	A	940	-	A	910	-
F-20		Ramp to 5th St.	A	270	-	A	90	-
F-21		Ramp to C-D Road SB	B	670	-	B	820	-
F-22		Ramp to 2nd St.	B	580	-	A	200	-
F-24	I-71 SB	North of Liberty St.	D	5,230	-	F	6,490	-
F-25		Between Liberty St. & Eggleston Ave.	D	4,580	-	D	4,960	4,586
F-26		Between Eggleston Ave. & US 50	D	3,120	-	F	4,490	4,151
F-27		Ramp to 3rd St.	D	1,460	-	A	470	435
F-28	US 50 WB	East of I-71 SB	C	2,320	-	C	1,970	-
F-29	I-71 SB	Between US 50 & I-75 NB Off-Ramp	D	5,440	-	D	6,460	5,951
F-30		West of C-D Road NB Ramp	C	2,310	-	D	2,920	2,670
F-31	I-75 NB	Between Ohio River & 3rd St. On-Ramp	B	2,450	-	C	4,000	-
F-32		Between 3rd St. On-Ramp & NB C-D Road	C	2,780	-	D	4,490	-
F-33		Between I-71 SB & US 50 WB Ramp	D	2,940	-	D	2,970	2,736
F-34		Between US 50 WB & 4th St. Ramps	E	2,010	-	D	1,510	1,391
F-35		Ramp to US 50 WB	B	930	-	C	1,345	1,230
F-36		Between NB C-D Road & Freeman Ave.	C	5,490	-	D	7,740	7,629
F-37		Between Freeman Ave. Ramp & Western Hills Viaduct	C	6,160	-	D	8,490	8,379
F-38		Between Western Hills Viaduct Ramps	C	5,840	-	D	7,856	7,752
F-39		North of Western Hills Viaduct	D	6,910	-	E	8,870	8,766
F-40	2nd St. EB	Between C-D Road SB & C-D Road NB Ramps	B	1,970	-	A	1,550	-

Table 5-8. Alterantive I Freeway Segment Analysis - Ohio

Ref	Facility	Location	Alternative I LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
F-41		East of C-D Road NB Ramps	B	3,170	-	A	1,980	-
F-42	US 50 EB	Ramp to I-71 NB	D	1,690	-	C	1,140	-
F-43	I-75 SB	Ramp to I-71 NB	D	3,010	-	C	2,360	-
F-44	I-71 NB	Between Ohio River & C-D Road NB Ramp	E	3,690	-	C	2,380	-
F-45		Between C-D Road NB & I-75 SB Ramp	E	4,470	3,943	C	2,660	-
F-46		Between I-75 SB Ramp & US 50 EB	E	7,480	6,953	C	5,020	-
F-47		Between US 50 EB & 2nd St. Ramps	F	5,320	4,945	C	2,510	-
F-48	US 50 EB	East of I-71 NB	C	2,160	2,008	C	2,510	-
F-49	I-71 NB	Between 2nd St. & 5th St. Ramps	C	5,380	4,041	B	2,800	-
F-50		Between 5th St. & I-471 NB Ramps	D	5,570	4,231	C	3,330	-
F-51		Between I-471 Ramp & Gilbert Ave. Ramp	F	7,530	6,005	D	4,440	-
F-52		North of Gilbert Ave. Ramp	D	7,690	6,161	D	5,680	-
F-53	I-471 NB	East of I-71 NB	D	3,280	-	B	1,340	-
F-54	I-471 SB	East of I-71 SB	A	1,000	-	D	3,050	-
F-56	I-75 SB	Between Hopple St. Merge & Hopple St. Merge	E	8,950	-	D	7,450	-
F-57	I-75 NB	Between Hopple St. Diverge & I-75 Diverge	C	6,440	-	D		8,410

5.8.2 Ramp Junctions

5.8.2.1 Kentucky

Twenty-three ramp junctions were analyzed along Alternative I in Kentucky. Of these, 11 were merges and 12 were diverges.

AM Peak

During the AM peak period, 27 percent of the merges operated at LOS A, 27 percent of the merges operated at LOS B, 27 percent of the merges operated at LOS C, and 19 percent of the merges operated at LOS D. Twelve of the ramp junctions analyzed along Alternative I in Kentucky were diverges. During the AM peak period, 33 percent of diverges operated at LOS A, 25 percent of diverges operated at LOS B, 17 percent of diverges operated at LOS C, 17 percent of diverges operated at LOS D and 8 percent of diverges operated at LOS F.

PM Peak

During the PM peak period, 18 percent of the merges operated at LOS A, 46 percent of the merges operated at LOS B, 18 percent of the merges operated at LOS C, and 18 percent of the merges operated at LOS D. During the PM peak period, 8 percent of diverges operated at LOS A, 25 percent of diverges operated at LOS B, 34 percent of diverges operated at LOS C, 17 percent of diverges operated at LOS D, 8 percent of diverges operated at LOS E, and 8 percent of the diverges operated at LOS F.

The ramp junction analysis for Alternative I in Kentucky is presented in Table 5-9.

Table 5-9. Alternative I Ramp Junction Analysis - Kentucky

Ref	Facility	Location	Alternative I LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
R-1	SB Local C-D	5th St. off-ramp	A	800	-	D	850	-
R-2	SB Local C-D	9th St. off-ramp	A	280	-	B	780	-
R-3	SB Local C-D	Merge with I-75 SB	ADD A	330	-	ADD D	3,030	3,010
R-4	SB I-71/I-75	12th St. on-ramp	B	780	-	D	1,460	-
R-5	SB I-71/I-75	Kyles-Dixie C-D off-ramp	C	880	-	E	1,820	1,770
R-6	SB Kyles-Dixie C-D	Kyles Lane off-ramp	B	690	-	D	1,140	1,110
R-7	SB Kyles-Dixie C-D	Kyles Lane on-ramp	A	350	-	B	560	-
R-8	SB Kyles-Dixie C-D	Dixie Hwy off-ramp	A	190	-	C	680	660
R-9	SB I-71/I-75	Kyles-Dixie C-D on-ramp	ADD A	350	-	ADD B	560	-
R-10	SB I-71/I-75	Dixie Hwy on-ramp	B	340	-	C	630	-
R-11	SB I-71/I-75	Buttermilk Pk off-ramp	DROP A	710	-	DROP B	1,220	1,090
R-12	NB I-71/I-75	Kyles-Dixie C-D off-ramp	F	720	-	F	1,100	-
R-13	NB Kyles-Dixie C-D	Dixie Hwy off-ramp	B	280	-	C	380	-
R-14	NB Kyles-Dixie C-D	Dixie Hwy on-ramp	B	1,000	-	B	380	-
R-15	NB I-71/I-75	Kyles-Dixie C-D on-ramp	ADD C	1,000	-	ADD A	380	-

Table 5-9. Alternative I Ramp Junction Analysis - Kentucky

Ref	Facility	Location	Alternative I LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
R-16	NB Kyles-Dixie C-D	Kyles Lane off-ramp	D	440	-	C	720	-
R-17	NB I-71/I-75	Kyles Lane on-ramp	ADD D	1,470	-	ADD B	710	-
R-18	NB I-71/I-75	Off-ramp to NB Local C-D Road	DROP D	3,210	-	DROP C	2,030	-
R-19	NB Local C-D	12th St. off-ramp	C	1,140	-	B	1,200	-
R-20	Pike St. Off-Ramp	Split to NB Local C-D and NB I-71	DROP B	1,430	-	DROP A	550	-
R-21	NB I-71	Pike St. on-ramp	D	440	-	B	140	-
R-22	NB Local C-D	Pike St. on-ramp	C	990	-	A	410	-
R-23	NB Local C-D	4th St. on-ramp	ADD C	1,160	-	ADD C	1,050	-

5.8.2.2 Ohio

Twenty ramp junctions were analyzed along Alternative I in Ohio. Of these, eight were merges and ten were diverges.

AM Peak
During the AM peak period, 12 percent of the merges operated at LOS A, 38 percent of the merges operated at LOS B, 25 percent of the merges operated at LOS C, and 25 percent of the merges operated at LOS F. During the AM peak period, 10 percent of the diverges operate at LOS A, 20 percent of diverges operated at LOS B, 40 percent of diverges operated at LOS C, and 30 percent of diverges operated at LOS D.

PM Peak
During the PM peak period, 12 percent of the merges operated at LOS A, 25 percent of the merges operated at LOS B, and 63 percent of the merges operated at LOS C. During the PM peak period, 10 percent of the diverges operate at LOS A, 30 percent of diverges operated at LOS B, 40 percent of diverges operated at LOS C, 10 percent of the diverges operated at LOS D, 20 percent of the diverges operated at LOS F.

The ramp junction analysis for Alternative I in Ohio is presented in Table 5-10.

Table 5-10. Alternative I Ramp Junction Analysis - Ohio

Ref	Facility	Location	Alternative I LOS					
			AM Peak	Certified Traffic	Volume Constrained	PM Peak	Certified Traffic	Volume Constrained
R-1	I-75 SB	Findlay St. Off-Ramp	B	740	-	B	470	-
R-2		Freeman Ave. Off-Ramp	D	810	-	C	610	-
R-3		I-71 NB Off-Ramp	D	1,320	-	C	1,220	-
R-4	C-D Road SB	Western Ave. On-Ramp	B	160	-	A	350	-
R-5		US 50 On-Ramp	A	670	-	C	820	-
R-6		Clay Wade Bailey Off-Ramp	C	200	-	B	260	-
R-7	I-71 SB	I-471 SB Off-Ramp	D	650	-	F	1,530	1,415
R-8		C-D Road SB Off-Ramp	C	190	-	C	320	295
R-9	C-D Road SB	3rd St. On-Ramp	A	280	-	B	1,450	-
R-10	I-75 NB	3rd St. On-Ramp	B	330	-	C	490	-
R-11	C-D Road NB	5th St. Off-Ramp	B	580	-	B	280	-
R-12	I-75 NB	Freeman Ave. On-Ramp	B	670	-	C	750	-
R-13		Western Hills Viaduct Off-Ramp	C	320	-	D	530	523
R-14		Western Hills Viaduct On-Ramp	C	1,070	-	C	910	-
R-15	C-D Road NB	2nd St. Off-Ramp	C	1,200	-	A	430	-
R-16	I-71 NB	C-D Road NB On-Ramp	F	780	-	C	280	-
R-17		5th St. On Ramp	C	190	-	B	530	-
R-18		I-471 NB On-Ramp	F	1,960	-	C	1,110	-
R-20	I-75 SB	Hopple St. Entrance Ramp	D	230	-	C	240	-
R-21	I-75 NB	Hopple St. Exit Ramp	C	470	-	D		356

5.8.3 Intersections

5.8.3.1 Kentucky

Alternative I includes the intersections which are formed by freeway ramps and their crossroads, but also include the intersections on the crossroads adjacent to those at the freeway ramps. Other area intersections were analyzed if work was to be done at those intersections because of this alternative or if traffic operations were affected. A total of 21 intersections were analyzed in Kentucky for Alternative I. Three of the intersections were unsignalized and the other 18 were analyzed as signalized intersections.

AM Peak
At the unsignalized intersections in Alternative I, 33 percent operated at LOS B, 33 percent operated at LOS C, and 33 percent operated at LOS F. At the signalized intersections during the AM peak period, 61 percent of the intersections were at LOS B, 28 percent of the intersections were at LOS C, and 11 percent operated at LOS F.

PM Peak
At the unsignalized intersections in Alternative I, 67 percent operated at LOS C, and 33 percent operated at LOS D. At the signalized intersections during the PM peak period, approximately 56 percent of the intersections were at LOS B, 28 percent of the intersections were at LOS C, 6 percent of the intersections were at LOS D and 10 percent of the intersections were at LOS F.

The intersection analysis for Alternative I in Kentucky is presented in Table 5-11.

Table 5-11. Intersection Analysis - Kentucky

Ref	Intersection	LOS					
		No Build		Alternative E		Alternative I	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
I-1	W. 4th Street and Crescent Avenue	C	F	B	B	C	C
I-2	W. 4th Street and Philadelphia Street	D	E	F	B	C	B
I-3	W. 4th Street and Bakewell Street	B	B	B	B	B	B
I-4	W. 4th Street and Clay Wade Bailey Bridge	B	C	B	D	B	D
I-5	-	-	-	-	-	-	-
I-6	W. 5th Street and Crescent Avenue	B	C	-	-	B	C
I-7	W. 5th Street and Philadelphia Street	B	B	B	B	B	B
I-8	W. 5th Street and Bakewell Street	E	C	F	D	F	D
I-9	W. 5th Street and Main Street	B	B	B	D	B	D
I-10	Pike Street and Bullock Street	C	C	B	B	C	C
I-11	Pike Street and Jillians Way	D	B	B	B	B	B
I-12	W. 12th Street and Bullock Street	C	C	B	B	B	B
I-13	W. 12th Street and Jillians Way	F	F	B	B	C	B
I-14	Kyles Lane and Dixie Highway	F	F	F	F	F	F
I-15	Kyles Lane and I-75 SB Ramps	C	D	B	C	B	C
I-16	Kyles Lane and I-75 NB Ramps	F	C	C	C	C	C
I-17	W. Kyles Lane and Highlands Avenue	F	F	F	F	F	F
I-18	Dixie Highway and I-75 SB Ramps	B	C	B	C	B	C
I-19	Dixie Highway and I-75 NB Ramps	C	B	C	B	C	B
I-A	9th Street and Jillians Way	-	-	C	C	B	B
I-B	9th Street and Bullock Street	-	-	B	C	B	B
I-C	W. 5th Street and Jillians Way	-	-	B	B	B	B
I-D	-	-	-	-	-	-	-
I-E	W. 4th Street and Jillians Way	-	-	C	E	-	-

X	LOS OK, Movement V/C > 1.0
X	LOS E or F
X	Non-Project Intersection

5.8.3.2 Ohio

A total of 43 intersections were analyzed in Alternative I. Three of the intersections were unsignalized and the other 40 were analyzed as signalized intersections.

AM Peak
During the AM Peak period, one of the unsignalized intersections or 33 percent, had approaches that were LOS A and two or 67 percent had approaches with LOS B. At the signalized intersections during the AM peak period, 3 percent operated at LOS A, approximately 79 percent of the intersections were at LOS B, 15 percent of the intersections were at LOS C, and 3 percent of the intersections were at LOS D.

PM Peak
During the PM Peak period, two of the unsignalized intersections or 67 percent had approaches that were LOS B and one of the unsignalized intersections or 33 percent had approaches that were LOS C. At the signalized intersections during the PM peak period, approximately 3 percent of the intersections operated at LOS A; 80 percent of the intersections operated at LOS B; 10 percent of the intersections operated at LOS C; and 7 percent of the intersections operated at LOS D.

In Alternative I, all intersections operate at a LOS D or better. Because all intersections have v/c ratios less than 0.92, there are no concerns. The intersection analysis for Alternative I in Ohio is presented in Table 5-12.

Table 5-12. Intersection Analysis - Ohio

Ref	Intersection	LOS					
		No Build		Alternative E		Alternative I	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
1	Bank Street & Dalton Avenue	B	B	B	B	B	B
2	Bank Street & Winchell Avenue	B	B	B	B	B	B
3	Central Parkway & Linn Street	B	B	B	C	B	B
4	Bank Street & Linn Street	B	B	B	B	B	B
5	Dalton Avenue & Findlay Street	B	B	B	B	B	B
6	Findlay Street & Western Avenue	B	B	B	B	B	B
7	Findlay Street & Winchell Avenue	B	B	B	B	B	B
8	Dalton Avenue & Liberty Street	B	B	B	B	B	B
9	Western Avenue & Liberty Street	C	B	B	B	C	C
10	Liberty Street & Winchell Avenue	B	B	B	B	B	B
11	Liberty Avenue & Linn Street	B	B	B	B	B	B
12	Ezzard Charles Drive (WB) & Western Avenue	B	B	B	B	B	B
13	Ezzard Charles Drive (WB) & Winchell Avenue	B	B	B	B	B	B
14	Ezzard Charles Drive (EB) & Western Avenue	B	B	B	B	B	B
15	Ezzard Charles Drive (EB) & Winchell Avenue	B	B	B	B	B	B
16	Ezzard Charles Drive & Linn Street	B	B	B	B	B	B
17	Gest Street & Dalton Avenue	B	B	B	B	B	B
18	Gest Street & Western Avenue	B	B	B	B	B	B
*18**	Gest Street & Western Avenue	*A*	*A*	*A*	*B*	*A*	*B*
19	Gest Street & Freeman Avenue	C	C	C	C	C	C
*19**	*Gest Street & Western Avenue*	*D*	*D*	*D*	*D*	*D*	*D*
20	Linn Street & Gest Street	B	B	B	B	B	B
21	Court Street & Linn Street	C	C	B	C	B	B
23	8th Street & Dalton Avenue	B	B	B	B	B	B
24	8th Street & Freeman Avenue	B	B	B	B	B	B
25	8th Street & Linn Street	B	C	B	B	B	B

Table 5-12. Intersection Analysis - Ohio

Ref	Intersection	LOS					
		No Build		Alternative E		Alternative I	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
26	Western Hills Viaduct & Spring Grove Avenue	B	B	B	C	B	B
27	Dalton Avenue & Linn Street	B	B	B	B	B	B
28	6th Street & Linn Street	A	B	A	D	A	C
29	Court Street & Central Avenue	B	B	B	B	B	B
30	9th Street & Central Avenue	B	D	B	B	B	C
31	7th Street & Central Avenue	B	B	C	B	B	B
32	6th Street & Central Avenue	B	C	D	D	B	B
33	5th Street & Central Avenue	C	B	D	C	C	B
34	4th Street & Central Avenue	B	D	B	E	B	D
35	3rd Street & Central Avenue	D	E	D	C	D	D
36	4th Street & Plum Street	B	B	B	B	B	B
37	3rd Street & Plum Street	B	B	B	B	B	B
38	4th Street & Elm Street	B	B	B	B	B	B
39	3rd Street & Elm Street	B	B	B	B	B	B
40	2nd Street & Elm Street	B	B	B	B	B	B
41	3rd Street & Clay Wade Bailey Bridge	C	D	B	C	C	D
43	Central Parkway & McMillan Street	C	D	A	B	C	D
43b	Central Parkway & McMillan Street	-	-	B	A	-	-
50	Western Hills Viaduct & I-75 SB Ramp	-	-	D	C	A	A
51	Western Hills Viaduct & I-75 NB Ramp	-	-	-	-	C	B
60	C-D Road & 4th Street	-	-	B	D	-	-
61	C-D Road & 5th Street	-	-	B	A	-	-
62	I-71 SB/I-75 NB & 6th Street	-	-	C	C	-	-
63	C-D Road & 7th Street	-	-	D	B	-	-

*	*Synchro Results for I-18 and I-19*
X	LOS OK, Movement v/c > 1.00
X	LOS E or F
X	Non-Project Intersection

5.9 Highway Lighting Warrants

This section has been prepared in accordance with the ODOT Traffic Engineering Manual, Section 1100 Highway Lighting.

5.9.1 Existing Conditions

Interstate Route 75 (I-75) within the project limits is located in an urban corridor which currently has continuous freeway lighting and interchange lighting at all interchanges. The land use surrounding the project consists of commercial, industrial and residential.

5.9.2 Lighting Warrants

As part of the highway lighting warrant review, traffic crash data and traffic 2035 Annual Average Daily Traffic (AADT) volumes were reviewed. Traffic volumes show that lighting will be warranted within the project limits, but traffic crash data did not show any indications that it was a factor in lighting being warranted.

5.9.3 Accident History Review

There were 1,101 total crashes on I-75 mainline southbound over the three-year period. Of these, 272 lighting listed as dark. The years utilized in determining the number of crashes were 2001 – 2003. Details of the lighting levels related to I-75 mainline southbound were as follows:

- Daylight – 760 crashes
- Dark – 272 crashes
- Dawn/Dusk – 56 crashes
- Other Lighting – 13 crashes

There were 1,711 total crashes on I-75 mainline northbound over the three-year period. Of these 403 had lighting listed as dark. Details of the lighting levels related to I-75 mainline northbound were as follows:

- Light – 1228 crashes
- Dark – 403 crashes
- Dawn/Dusk – 80 crashes

5.9.4 Traffic Volumes Review

The 2035 AADT traffic volumes for Alternatives E and I were reviewed and show the need for continuous freeway lighting (CFL) and complete interchange lighting (CIL) based on the Warrants for Freeway and Interchange Lighting located in Table 1197-3 of ODOT's Traffic Engineering Manual. Per Table 1197-3, Continuous Freeway Lighting, only one condition needed to be met to warrant lighting. Based on the review, three conditions were met, Case CFL-1, Case CFL-2, and Case CFL-3. Case CFL-1 requires 30,000 or more ADT (Anticipated opening data volumes). Mainline I-75 2035 AADT traffic volumes ranged from 104,990 to 224,620 for Alternative E and ranged from 76,400 to 212,640 for Alternative I. The traffic volumes differ so much between the two alternatives due to the amount of traffic that uses the C-D roadway, and the traffic that selects alternative routes based on destinations. Case CFL-2 requires that three or more interchanges be located with an average spacing of 1.5 miles or less. This was met at the Buttermilk Pike, Dixie Highway and Kyles Lane Interchanges. Case CFL-3 requires urban development along the freeway for a length of two miles or more. Urban development was located along the I-75 corridor. Table 5-13 identifies Highway Lighting Warrants for Alternative E and Table 5-14 identifies Highway Lighting Warrants for Alternative I.

Per Table 1197-3, where CFL is warranted and complete interchange lighting (CIL) is also warranted.

Table 5-13. Highway Lighting Warrants Alternative E

Location	2035 AADT Refined Alternative E Ramp	2035 AADT Refined Alternative E Mainline
I-75 Southbound		
Mainline I-75 North of Western Hills Viaduct		92900
I-75 SB Exit Ramp to Western Hills Viaduct WB	7340	
Mainline between Western Hills Viaduct ramps		85560
I-75 SB On Ramp from Western Hills Viaduct EB	7590	
Mainline between Western Ave. ramp & Freeman Ave. ramp		82290
I-75 SB Exit Ramp to Western Ave.	10860	
Mainline between Freeman Ave. ramp & 7th St. Viaduct ramp		49270
I-75 SB On Ramp from Western Ave.	2680	
I-75 SB Ramp to I-71 EB	12590	
Mainline I-75 SB from 2nd St. Ramp to Kentucky		45890
Mainline I-75 SB from Ohio to 5th St. ramp in Kentucky		45890
I-75 SB On Ramp from 5th St.	6510	
Mainline between 5th St. Ramp & Bullock St. Ramp		101490
I-75 SB On Ramp from Bullock St.	8030	
Mainline between Bullock St. Ramp & Kyles Ln. Ramp		109500
I-75 SB Exit Ramp to Kyles Ln.	15270	
Mainline between Kyles Ln. Ramps		94230
I-75 SB On Ramp from Kyles Ln.	5970	
I-75 SB On Ramp from Dixie Hwy	5890	
Mainline between Dixie Hwy Ramp & Buttermilk Pike Ramp		106090
I-75 SB Exit Ramp to Buttermilk Pike	12850	
Mainline between Buttermilk Pike Ramps		93240
I-75 SB On Ramp from Buttermilk Pike	16380	
Mainline I-75 South of Buttermilk Pike Ramp		109620
I-75 Northbound		
Mainline I-75 NB South of Buttermilk Pike		115000
I-75 NB Exit Ramp to Buttermilk Pike	18140	
Mainline between Buttermilk Pike Ramps		96860
I-75 NB On Ramp from Buttermilk Pike	9690	
Mainline between Buttermilk Pike Ramp & Dixie Hwy Ramp		106550
I-75 NB Exit Ramp to Dixie Hwy	10780	
Mainline between Dixie Hwy Ramps		95190
I-75 NB On Ramp from Dixie Hwy	5910	
Mainline between Dixie Hwy Ramp & Kyles Ln. Ramp		101100
I-75 NB On Ramp from Kyles Ln.	11180	
Mainline between Kyles Ln. Ramp & 12th St. Ramp		112280
I-75 NB Exit Ramp to 12th St.	35240	
Mainline between 12th St. Ramp & 5th St. Ramp		77040
I-75 NB Exit Ramp to 5th St.	36140	

Table 5-13. Highway Lighting Warrants Alternative E

Location	2035 AADT Refined Alternative E Ramp	2035 AADT Refined Alternative E Mainline
Mainline I-75 NB from Kentucky		59100
I-75 NB On Ramp from Freeman Ave.	6840	
Mainline between Freeman Ave. ramp & Winchell Ave. Ramp		82240
I-75 NB On Ramp from Winchell Ave.	5250	
Mainline between Winchell Ave. Ramp and Western Hills Viaduct		91620
I-75 NB Exit Ramp to Western Hills Viaduct	17060	
Mainline between Bank St. and Western Hills Viaduct Ramp		74560
I-75 NB On Ramp from Western Hills Viaduct	15040	
Mainline I-75 North of Western Hills Viaduct Ramp		93640

Table 5-14. Highway Lighting Warrants Alternative I

Location	2035 AADT Refined Alternative I Ramp	2035 AADT Refined Alternative I Mainline
I-75 Southbound		
Mainline I-75 North of Western Hills Viaduct		92000
I-75 SB Exit Ramp to Western Hills Viaduct WB	11790	
Mainline between Western Hills Viaduct ramps		80210
I-75 SB On Ramp from Western Hills Viaduct EB	10000	
Mainline between Western Ave. ramp & Freeman Ave. ramp		90210
I-75 SB Exit Ramp to Western Ave.	5010	
I-75 SB Exit Ramp to Freeman Ave.	40940	
Mainline between Freeman Ave. ramp & 7th St. Viaduct ramp		49270
I-75 SB On Ramp from Western Ave.	3470	
I-75 SB On Ramp from 8th St. Viaduct	2500	
I-75 SB Exit Ramp to 7th St. Viaduct	6170	
I-75 SB Exit Ramp to 5th St.	4820	
I-75 SB Ramp to I-71 EB	11690	
I-75 SB Exit Ramp to 2nd St.	2410	
Mainline I-75 SB from 2nd St. Ramp to Kentucky		35500
Mainline I-75 SB from Ohio to 5th St. ramp in Kentucky		35500
I-75 SB On Ramp from 5th St.	59340	
Mainline between 5th St. Ramp & Bullock St. Ramp		94840
I-75 SB On Ramp from Bullock St.	14660	
Mainline between Bullock St. Ramp & Kyles Ln. Ramp		109500
I-75 SB Exit Ramp to Kyles Ln.	15270	
Mainline between Kyles Ln. Ramps		94230
I-75 SB On Ramp from Kyles Ln.	5970	
I-75 SB On Ramp from Dixie Hwy	5890	
Mainline between Dixie Hwy Ramp & Buttermilk Pike Ramp		106090

Table 5-14. Highway Lighting Warrants Alternative I

Location	2035 AADT Refined Alternative I Ramp	2035 AADT Refined Alternative I Mainline
I-75 SB Exit Ramp to Buttermilk Pike	12850	
Mainline between Buttermilk Pike Ramps		93240
I-75 SB On Ramp from Buttermilk Pike	16380	
Mainline I-75 South of Buttermilk Pike Ramp		109620
I-75 Northbound		
Mainline I-75 NB South of Buttermilk Pike		115000
I-75 NB Exit Ramp to Buttermilk Pike	18140	
Mainline between Buttermilk Pike Ramps		96860
I-75 NB On Ramp from Buttermilk Pike	9690	
Mainline between Buttermilk Pike Ramp & Dixie Hwy Ramp		106550
I-75 NB Exit Ramp to Dixie Hwy	11360	
Mainline between Dixie Hwy Ramps		95190
I-75 NB On Ramp from Dixie Hwy	5910	
Mainline between Dixie Hwy Ramp & Kyles Ln. Ramp		101100
I-75 NB On Ramp from Kyles Ln.	11180	
Mainline between Kyles Ln. Ramp & 12th St. Ramp		112280
I-75 NB Exit Ramp to 12th St.	35240	
Mainline between 12th St. Ramp & 5th St. Ramp		77040
I-75 NB Exit Ramp to 5th St.	36140	
Mainline I-75 NB from 5th St. Ramp to Ohio		40900
Mainline I-75 NB from Kentucky		40900
I-75 NB On Ramp from Clay Wade Bailey	3900	
Mainline between 6th St. ramp & Freeman Ave. Ramp		44800
I-75 NB On Ramp from Freeman Ave.	37440	
Mainline between Freeman Ave. ramp & Winchell Ave. Ramp		82240
I-75 NB On Ramp from Winchell Ave.	9010	
Mainline between Winchell Ave. Ramp and Western Hills Viaduct		91250
I-75 NB Exit Ramp to Western Hills Viaduct	10570	
Mainline between Western Hills Viaduct ramp and Bank St. Ramp		80680
I-75 NB On Ramp from Bank St.	7460	
Mainline between Bank St. Ramp and Western Hills Viaduct Ramp		88140
I-75 NB On Ramp from Western Hills Viaduct	12000	
Mainline I-75 North of Western Hills Viaduct Ramp		100140

5.10 Signal Warrants

Traffic signal warrant analyses were performed for the interchange area intersections within the project limits where work is being proposed. The focus of these analyses was to determine which proposed intersections or currently unsignalized intersections will require a traffic signal on opening day.

Opening day certified traffic (2020) is required to evaluate signal warrants for the Brent Spence Bridge Replacement/Rehabilitation Project. Since opening day certified traffic was not available, signal warrant analyses were completed using the available certified traffic volumes for the 2005 No Build Alternative and the 2035 Build Alternative for both Alternative E and Alternative I. Using the available certified traffic data, if the signals were warranted using the 2005 No Build certified traffic data, and if the signals were also warranted using the 2035 Build certified traffic data for the respective alternative, then the signal was considered warranted on opening day. This was done in lieu of reducing the 2035 traffic volumes by a projected growth factor of 2 percent per year to reduce traffic volumes to 2020. Since Cincinnati already has capacity problems on its city street system, it may be false to assume the city street system can absorb future growth at 2 percent per year indefinitely. Following the procedure outlined in the MUTCD, intersections were evaluated using Warrant 1 (Eight-Hour Vehicular Volume) and Warrant 3B (Peak Hour Volume). For Warrant 1, ADT's were adjusted using a factor of 0.054, as provided by KYTC, to estimate the eighth highest hour for each scenario. Table 5-17 summarizes the results of the fourteen intersections in Kentucky where signal warrants were analyzed, and Table 5-18 summarizes the results of the fourteen intersections in Ohio where signal warrants were analyzed. According to the data, all of the signals meet the requirements for warrants in 2005 and 2035 with the single exception of the intersection of Findlay Street at Western Avenue. Because this intersection currently meets the requirements for having a traffic signal, it has been determined that a signal will remain at this intersection until actual traffic volumes drop below the threshold for warranting a traffic signal. The detailed design will accommodate for both a signalized intersection and a non-signalized intersection. All signal warrant analysis worksheets are included in Appendix G.

5.11 Turn Lane Storage Lengths

Required turn lane storage lengths were calculated based on KYTC methodology for the Kentucky intersections and based on ODOT methodology for the Ohio intersections. The current turn lane storage length is compared to the required turn lane storage length and is summarized in Table 5-19 through Table 5-22 for both Alternatives E and I for both Kentucky and Ohio. Turn lane storage length calculations are provided in Tables 5-19 and 5-20. Intersections shaded in red have insufficient storage lengths. In Table 5-21, the intersection reference I-62 is listed as having inadequate storage. Providing adequate storage at this intersection would back traffic onto US 50 which, at this location, is free flow.

5.12 Traffic Operations Summary and Conclusions

The No Build Alternative has numerous freeway segments at LOS F in both the AM and PM peak hours in the years leading up to and including the design year in both Kentucky and Ohio. Motorists travelling within these freeway segments will experience frequent stops, long queues and substantial delays. The problem will be magnified when the I-75 projects north of the Brent Spence Bridge Replacement/Rehabilitation, Through the Valley Project and the Mill Creek Expressway Project, are completed with an additional mainline freeway lane in each direction. The additional freeway lanes will allow more vehicles to reach the project limits of this project during the peak hours causing greater gridlock for the No Build Alternative than currently exists. In those freeway sections, where the LOS would be LOS F and the freeway is at capacity, it will prevent motorists from having the opportunity to enter the freeway. For practical purposes many of the entrance ramps will function as if they are closed, causing further traffic operational problems not only on the ramps, but also on the city streets to which they connect with their backups. From strictly a capacity viewpoint, the No Build Alternative would not support the traffic flows required for Cincinnati and Covington leading up to and including the design year.

Both Alternative E and Alternative I provide vast improvements operationally over the No Build Alternative due to the operations provided by their design and the capacity expansion of the additional lanes for the freeway mainline. While Both Alternatives E and I are superior operationally to the No Build Alternative, their design, their connection points and how they operate are different.

A comparison between Alternatives E and I for travel times through the corridor was developed utilizing VISSIM modeling. The output gives the number of cars that make the trip through the entire corridor (I-75 NB, I-71 NB, I-75 SB, and I-71 SB) and the average time (in minutes) that it took those vehicles to make that trip Table 5-15 and Table 5-16 presents the travel times comparison.

Table 5-15. AM Travel Times

Segment	I-75 NB		I-71 NB		I-75 SB		I-71 SB	
Output	# Vehicles	Time (min)	# Vehicles	Time (min)	# Vehicles	Time (min)	# Vehicles	Time (min)
Alt E	918	12.62	1094	15.31	2042	9.75	1536	7.39
Alt I	1332	10.28	1203	15.34	2504	9.51	1666	7.07

Table 5-16. PM Travel Times

Segment	I-75 NB		I-71 NB		I-75 SB		I-71 SB	
Output	# Vehicles	Time (min)	# Vehicles	Time (min)	# Vehicles	Time (min)	# Vehicles	Time (min)
Alt E	1888	8.81	633	6.90	1758	13.88	1924	11.37
Alt I	2235	8.75	716	6.65	2196	9.54	2194	7.24

After reviewing all the advantages and disadvantage of each alternative, Alternative I would be the preferred alternative. This is based on the knowledge that Alternative I's LOS throughout the freeway system is superior to Alternative E. This will provide greater mobility and safety throughout the corridor. Queue lengths and travel times will be reduced. Alternative I's design is based on a collector–distributor system which provides free-flow movements, while Alternative E's design is based on a service road system which provides interrupted flow due to its four signalized intersections.

Table 5-17. Signal Warrant Analysis Summary - Kentucky

Location			2005 ADT	2035 Alt. E ADT	2035 Alt. I ADT	2005		2035 Alternative E		2035 Alternative I	
						Is Warrant 1 Met?	Is Warrant 3B Met?	Is Warrant 1 Met?	Is Warrant 3B Met?	Is Warrant 1 Met?	Is Warrant 3B Met?
Ref	Intersection	Approach				8-hour Vehicular Volume	Peak Hour Volume	8-hour Vehicular Volume	Peak Hour Volume	8-hour Vehicular Volume	Peak Hour Volume
1	W. 4th Street and Crescent Avenue	Eastbound	0	0	0	No	No	No	Yes	No	No
		Westbound	1160	21,460	1,120						
		Northbound	4640	0	4,690						
		Southbound	3300	5,130	2,750						
6	W. 5th Street and Crescent Avenue	Eastbound	0	0	0	No	No	-	-	No	No
		Westbound	4310	0	4,430						
		Northbound	810	0	1,470						
		Southbound	1890	16,130	2,730						
10	Pike Street and Bullock Street	Eastbound	4540	1,160	3,920	No	Yes	No	Yes	Yes	Yes
		Westbound	5510	7,470	9,970						
		Northbound	0	0	0						
		Southbound	6710	18,450	12,660						
11	Pike Street and Jillians Way	Eastbound	5270	2,550	4,950	No	Yes	No	Yes	Yes	Yes
		Westbound	5220	6,180	8,870						
		Northbound	5440	6,670	16,360						
		Southbound	0	0	0						
12	W. 12th Street and Bullock Street	Eastbound	1890	2,140	2,330	No	No	No	Yes	No	Yes
		Westbound	3320	3,860	4,730						
		Northbound	0	0	0						
		Southbound	5790	17,100	13,270						
13	W. 12th Street and Jillians Way	Eastbound	4990	7,360	4,490	Yes	Yes	Yes	Yes	Yes	Yes
		Westbound	6030	7,130	7,790						
		Northbound	5600	5,600	16,090						
		Southbound	0	0	0						
15	Kyles Lane and I-71/I-75 SB Ramps	Eastbound	9660	10,530	10,530	Yes	Yes	Yes	Yes	Yes	Yes
		Westbound	11750	12,220	12,220						
		Northbound	0	0	0						
		Southbound	8020	10,460	10,460						
16	Kyles Lane and I-71/I-75 NB Ramps	Eastbound	12940	15,280	15,280	Yes	Yes	Yes	Yes	Yes	Yes
		Westbound	14880	16,970	16,970						
		Northbound	6390	6,970	6,970						
		Southbound	0	0	0						
18	Dixie Highway and	Eastbound	8270	10,630	10,630	Yes	Yes	Yes	Yes	Yes	Yes

Table 5-17. Signal Warrant Analysis Summary - Kentucky

Location			2005 ADT	2035 Alt. E ADT	2035 Alt. I ADT	2005		2035 Alternative E		2035 Alternative I	
						Is Warrant 1 Met?	Is Warrant 3B Met?	Is Warrant 1 Met?	Is Warrant 3B Met?	Is Warrant 1 Met?	Is Warrant 3B Met?
Ref	Intersection	Approach				8-hour Vehicular Volume	Peak Hour Volume	8-hour Vehicular Volume	Peak Hour Volume	8-hour Vehicular Volume	Peak Hour Volume
	I-71/I-75 SB Ramps	Westbound	12220	15,280	15,280						
		Northbound	0	0	0						
		Southbound	4370	4,810	4,810						
19	Dixie Highway and I-71/I-75 NB Ramps	Eastbound	8940	9,730	9,730	No	Yes	Yes	Yes	Yes	Yes
		Westbound	15970	17,290	17,290						
		Northbound	2750	4,390	4,390						
		Southbound	0	0	0						
A	W. 9th Street and Jillians Way	Eastbound	0	13,160	1,080	-	-	Yes	Yes	No	No
		Westbound	0	4,550	3,010						
		Northbound	0	3,500	5,080						
		Southbound	0	0	0						
B	W. 9th Street and Bullock Street	Eastbound	0	3,630	2,020	-	-	No	Yes	No	Yes
		Westbound	0	4,370	2,750						
		Northbound	0	0	0						
		Southbound	0	25,360	9,480						
C	W. 5th Street and Jillians Way	Eastbound	0	2,520	10,350	-	-	No	Yes	No	Yes
		Westbound	0	0	0						
		Northbound	0	20,860	6,020						
		Southbound	0	0	0						
E	W. 4th Street and Jillians Way	Eastbound	0	0	0	-	-	No	No	-	-
		Westbound	0	9,770	0						
		Northbound	0	6,460	0						
		Southbound	0	0	0						

Table 5-18. Signal Warrant Analysis Summary - Ohio

<table>
<tr><th colspan="3">Location</th><th rowspan="3">2005 ADT</th><th rowspan="3">2035 Alt. E ADT</th><th rowspan="3">2035 Alt. I ADT</th><th colspan="2">2005</th><th colspan="2">2035 Alternative E</th><th colspan="2">2035 Alternative I</th></tr>
<tr><th rowspan="2">Ref</th><th rowspan="2">Intersection</th><th rowspan="2">Approach</th><th>Is Warrant 1 Met?</th><th>Is Warrant 3B Met?</th><th>Is Warrant 1 Met?</th><th>Is Warrant 3B Met?</th><th>Is Warrant 1 Met?</th><th>Is Warrant 3B Met?</th></tr>
<tr><th>8-hour Vehicular Volume</th><th>Peak Hour Volume</th><th>8-hour Vehicular Volume</th><th>Peak Hour Volume</th><th>8-hour Vehicular Volume</th><th>Peak Hour Volume</th></tr>
<tr><td>5</td><td>Dalton Avenue & Findlay Street</td><td>Southbound</td><td></td><td>8,420</td><td>5,894</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Findlay Street & Western Avenue</td><td>Eastbound</td><td>1,990</td><td>2,020</td><td>2,800</td><td rowspan="4">No</td><td rowspan="4">Yes</td><td rowspan="4">No</td><td rowspan="4">No</td><td rowspan="4">No</td><td rowspan="4">No</td></tr>
<tr><td>Westbound</td><td>1,230</td><td>930</td><td>1,490</td></tr>
<tr><td>Northbound</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Southbound</td><td>7,330</td><td>10,860</td><td>5,010</td></tr>
<tr><td rowspan="4">19</td><td rowspan="4">Gest Street & Freeman Avenue</td><td>Eastbound</td><td>4,590</td><td>9,400</td><td>4,440</td><td rowspan="4">No</td><td rowspan="4">Yes</td><td rowspan="4">Yes</td><td rowspan="4">Yes</td><td rowspan="4">No</td><td rowspan="4">Yes</td></tr>
<tr><td>Westbound</td><td>4,100</td><td>4,660</td><td>4,780</td></tr>
<tr><td>Northbound</td><td>6,330</td><td>5,760</td><td>5,880</td></tr>
<tr><td>Southbound</td><td>6,190</td><td>0</td><td>7,310</td></tr>
<tr><td rowspan="4">26</td><td rowspan="4">Western Hills Viaduct LOWER DECK & Spring Grove</td><td>Eastbound</td><td>4880</td><td>5730</td><td>4030</td><td rowspan="4">Yes</td><td rowspan="4">Yes</td><td rowspan="4">Yes</td><td rowspan="4">Yes</td><td rowspan="4">Yes</td><td rowspan="4">Yes</td></tr>
<tr><td>Westbound</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Northbound</td><td>11500</td><td>16160</td><td>12440</td></tr>
<tr><td>Southbound</td><td>9340</td><td>12640</td><td>10700</td></tr>
<tr><td rowspan="4">30</td><td rowspan="4">9th Street & Central Avenue</td><td>Eastbound</td><td>0</td><td>0</td><td>0</td><td rowspan="4">No</td><td rowspan="4">Yes</td><td rowspan="4">No</td><td rowspan="4">Yes</td><td rowspan="4">No</td><td rowspan="4">Yes</td></tr>
<tr><td>Westbound</td><td>11,390</td><td>8,600</td><td>9,670</td></tr>
<tr><td>Northbound</td><td>6,940</td><td>5,550</td><td>5,130</td></tr>
<tr><td>Southbound</td><td>810</td><td>790</td><td>640</td></tr>
<tr><td rowspan="4">31</td><td rowspan="4">7th Street & Central Avenue</td><td>Eastbound</td><td>15,750</td><td>15,500</td><td>16,600</td><td rowspan="4">No</td><td rowspan="4">Yes</td><td rowspan="4">No</td><td rowspan="4">Yes</td><td rowspan="4">No</td><td rowspan="4">Yes</td></tr>
<tr><td>Westbound</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Northbound</td><td>4,490</td><td>5,660</td><td>4,150</td></tr>
<tr><td>Southbound</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td rowspan="4">32</td><td rowspan="4">6th Street & Central Avenue</td><td>Eastbound</td><td>0</td><td>7,000</td><td>0</td><td rowspan="4">No</td><td rowspan="4">Yes</td><td rowspan="4">No</td><td rowspan="4">Yes</td><td rowspan="4">No</td><td rowspan="4">Yes</td></tr>
<tr><td>Westbound</td><td>10,220</td><td>11,660</td><td>8,190</td></tr>
<tr><td>Northbound</td><td>3,460</td><td>4,640</td><td>3,260</td></tr>
<tr><td>Southbound</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td rowspan="4">33</td><td rowspan="4">5th Street & Central Avenue</td><td>Eastbound</td><td>11,180</td><td>12,590</td><td>10,840</td><td rowspan="4">No</td><td rowspan="4">Yes</td><td rowspan="4">Yes</td><td rowspan="4">Yes</td><td rowspan="4">No</td><td rowspan="4">Yes</td></tr>
<tr><td>Westbound</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Northbound</td><td>4,410</td><td>8,530</td><td>5,860</td></tr>
<tr><td>Southbound</td><td>1,570</td><td>4,800</td><td>1,480</td></tr>
<tr><td rowspan="4">34</td><td rowspan="4">4th Street & Central Avenue</td><td>Eastbound</td><td>0</td><td>0</td><td>0</td><td rowspan="4">No</td><td rowspan="4">Yes</td><td rowspan="4">Yes</td><td rowspan="4">Yes</td><td rowspan="4">No</td><td rowspan="4">Yes</td></tr>
<tr><td>Westbound</td><td>7,450</td><td>13,480</td><td>11,290</td></tr>
<tr><td>Northbound</td><td>7,920</td><td>9,290</td><td>6,090</td></tr>
<tr><td>Southbound</td><td>1,410</td><td>3,330</td><td>1,910</td></tr>
</table>

Table 5-18. Signal Warrant Analysis Summary - Ohio

Location			2005 ADT	2035 Alt. E ADT	2035 Alt. I ADT	2005		2035 Alternative E		2035 Alternative I	
						Is Warrant 1 Met?	Is Warrant 3B Met?	Is Warrant 1 Met?	Is Warrant 3B Met?	Is Warrant 1 Met?	Is Warrant 3B Met?
Ref	Intersection	Approach				8-hour Vehicular Volume	Peak Hour Volume	8-hour Vehicular Volume	Peak Hour Volume	8-hour Vehicular Volume	Peak Hour Volume
41	3rd Street & Clay Wade Bailey Bridge	Eastbound	4,680	4,640	5,030	No	Yes	Yes	Yes	Yes	Yes
		Westbound	5,680	9,980	10,930						
		Northbound	4,740	8,120	9,520						
		Southbound	0	0	920						
43	McMillian Street & Central Parkway	Eastbound	10630	17490	11530	Yes	Yes	Yes	Yes	Yes	Yes
		Westbound	5800	8060	5420						
		Northbound	9540	9350	11710						
		Southbound	6990	0	8110						
43b	McMillian Street & Central Parkway	Eastbound	-	0	-	-	-	Yes	Yes	-	-
		Westbound	-	10170	-						
		Northbound	-	15440	-						
		Southbound	-	7120	-						
50	Western Hills Viaduct UPPER DECK & I-75 SB Off-Ramp	Eastbound	-	22980	11790	-	-	Yes	Yes	Yes	Yes
		Westbound	-	16660	4840						
		Northbound	-	10570	0						
		Southbound	-	6780	6270						
51	Western Hills Viaduct UPPER DECK & I-75 NB Off-Ramp	Eastbound	-	-	6700	-	-	-	-	Yes	Yes
		Westbound	-	-	0						
		Northbound	-	-	10920						
		Southbound	-	-	0						

Table 5-19. Alternative E Turn Lane Lenghts - Kentucky

Reference	Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Total Turn Storage Length (Incl. Taper)	Storage per Turn Lane	Thru Vehicles per Cycle per Lane	Queue per Thru Lane	Final Turn Lane Length	Storage Length Provided	Adequate Storage Provided?
1	W. 4th St. and Crescent Ave.	WB	Left	2	0	920	0	60	15.3	625	312.5	N/A	N/A	313	798, 808	YES
			Right	1	0	490	0	60	8.2	325	325	N/A	N/A	325	192	NO
2	W. 4th St. and Philadelphia St.	NB	Left	1	1	170	160	60	2.8	150	150	2.7	91	150	175	YES
		SB	Right	1	1	800	110	60	13.3	550	550	1.8	62	550	305	NO
		WB	Left	1	2	140	1140	60	2.3	150	150	9.5	323	323	290	NO
4	W. 4th St. and Clay Wade Bailey Bridge	NB	Left	1	1	160	510	60	2.7	150	150	8.5	289	289	340	YES
		SB	Right	1	1	420	990	60	7.0	325	325	16.5	561	561	695	YES
		WB	Left	1	2	190	770	60	3.2	175	175	6.4	218	218	380	YES
			Right	1	2	250	1040	60	4.2	200	200	8.7	295	295	300	YES
6	W. 5th St. and Crescent Ave.	SB	Left	1	1	240	1170	0	N/A	125	125	N/A	N/A	-	219	YES
7	W. 5th St. and Philadelphia St.	SB	Left	1	1	250	80	60	4.2	-	-	1.3	45	45	160	YES
8	W. 5th St. and Bakewell St.	EB	Right	1	2	20	1220	0	N/A	-	-	N/A	N/A	-	100	YES
9	W. 5th St. and Main St.	NB	Right	1	1	60	400	60	1.0	-	-	6.7	227	227	110	NO
		SB	Left	1	1	350	830	60	5.8	275	275	13.8	470	470	230	NO
10	Pike St. and Bullock St.	SB	Left	1	3	230	1280	60	3.8	200	200	7.1	242	242	525	YES
12	W. 12th St. and Bullock St.	SB	Left	1	2	430	1180	60	7.2	325	325	9.8	334	334	373	YES
			Right	1	2	60	1180	60	1.0	125	125	9.8	334	334	427	YES
		WB	Left	1	1	270	60	60	4.5	-	-	1.0	34	34	213	YES
14	Kyles Lane and Dixie Hwy	WB	Left	1	1	380	30	100	10.6	450	450	0.8	28	450	562	YES
			Right	1	1	830	30	100	23.1	925	925	0.8	28	925	577	NO
15	Kyles Lane and I-75 SB Ramps	SB	Left	2	0	760	0	100	21.1	850	425	N/A	N/A	425	465,465	YES
			Right	1	0	380	0	100	10.6	450	450	N/A	N/A	450	479	YES
		EB	Right	1	2	270	700	100	7.5	325	325	9.7	331	331	418	YES
		WB	Left	1	2	290	860	100	8.1	350	350	11.9	406	406	622	YES
16	Kyles Lane and I-75 NB Ramps	NB	Left	1	0	340	0	100	9.4	400	400	N/A	N/A	400	278	NO
			Right	1	0	380	0	100	10.6	450	450	N/A	N/A	450	286	NO
		EB	Left	1	2	370	750	90	9.3	250	250	9.4	319	319	623	YES
		WB	Right	1	2	1100	560	90	27.5	1075	1075	7.0	238	1075	296	NO
17	Kyles Lane and Highlands Ave	NB	Left	1	1	10	1320	90	0.3	125	125	33.0	1122	1122	125	NO
			Right	1	1	260	1320	90	6.5	300	300	33.0	1122	1122	550	NO

Table 5-19. Alternative E Turn Lane Lenghts - Kentucky

Reference	Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Total Turn Storage Length (Incl. Taper)	Storage per Turn Lane	Thru Vehicles per Cycle per Lane	Queue per Thru Lane	Final Turn Lane Length	Storage Length Provided	Adequate Storage Provided?
		SB	Left	1	1	180	1450	100	5.0	250	250	40.3	1369	1369	255	NO
		WB	Right	1	1	330	10	90	8.3	300	300	0.3	9	300	210	NO
18	Dixie Hwy and I-75 SB Ramps	SB	Left	2	0	580	0	70	11.3	475	237.5	N/A	N/A	238	303, 295	YES
			Right	1	0	100	0	70	1.9	-	-	N/A	N/A	-	414	YES
		EB	Right	1	2	540	630	70	10.5	450	450	6.1	208	450	294	NO
		WB	Left	1	2	90	650	70	1.8	125	125	6.3	215	215	325	YES
19	Dixie Hwy and I-75 NB Ramps	NB	Left	1	0	250	0	70	4.9	225	225	N/A	N/A	225	307	YES
			Right	1	0	130	0	70	2.5	-	-	N/A	N/A	-	315	YES
		EB	Left	1	2	60	1150	70	1.2	125	125	11.2	380	380	350	NO
		WB	Right	1	2	870	1240	70	16.9	125	125	12.1	410	410	524	NO
A	W. 9th St. and Jillians Way	EB	Left	2	1	850	70	60	14.2	575	287.5	1.2	40	288	212, 212	NO
B	W. 9th St. and Bullock St.	SB	Left	2	3	770	1500	60	12.8	525	262.5	8.3	283	283	570, 570	YES
		EB	Right	1	1	160	150	60	2.7	-	-	2.5	85	85	182	YES
		WB	Left	1	1	380	70	60	6.3	300	300	1.2	40	300	212	NO
C	W. 5th St. and Jillians Way	NB	Right	2	1	1130	300	60	18.8	750	375	5.0	170	375	314, 1365	YES
E	W. 4th St. and Jillians Way	NB	Left	1	0	540	0	60	9.0	-	-	N/A	N/A	-	332	YES

No proposed work shown
Meets turn lane length requirement
Fails to meet turn lane length requirement
Meets storage requirement, but fails to meet queue length

Table 5-20. Alternative I Turn Lane Lengths - Kentucky

Reference	Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Total Turn Storage Length (Incl. Taper)	Storage per Turn Lane	Thru Vehicles per Cycle per Lane	Queue per Thru Lane	Final Turn Lane Length	Storage Length Provided	Adequate Storage Provided?
1	W. 4th St. and Crescent Ave.	NB	Right	1	1	30	390	N/A	N/A	-	-	N/A	N/A	-	245	YES
		SB	Left	1	1	200	210	N/A	N/A	-	-	N/A	N/A	-	-	-
2	W. 4th St. and Philadelphia St.	NB	Left	1	1	130	340	60	2.2	125	125	5.7	193	193	175	YES
		SB	Right	1	1	730	80	60	12.2	500	500	1.3	45	500	305	NO
		WB	Left	1	2	70	710	60	1.2	125	125	5.9	201	201	290	YES
4	W. 4th St. and Clay Wade Bailey Bridge	NB	Left	1	1	120	520	60	2.0	125	125	8.7	295	295	340	YES
		SB	Right	1	1	300	1110	60	5.0	250	250	18.5	629	629	695	YES
		WB	Left	1	2	280	650	60	4.7	225	225	5.4	184	225	380	YES
			Right	1	2	280	580	60	4.7	125	125	4.8	164	164	300	YES
6	W. 5th St. and Crescent Ave.	SB	Left	1	1	200	50	0	N/A	-	-	N/A	N/A	-	210	YES
7	W. 5th St. and Philadelphia St.	SB	Left	1	1	120	60	60	2.0	-	-	1.0	34	34	160	YES
8	W. 5th St. and Bakewell St.	EB	Right	1	2	30	860	0	N/A	-	-	N/A	N/A	-	100	YES
9	W. 5th St. and Main St.	NB	Right	1	1	160	500	60	2.7	150	150	8.3	283	283	110	NO
		SB	Left	1	1	390	1000	60	6.5	300	300	16.7	567	567	230	NO
10	Pike St. and Bullock St.	WB	Left	2	1	530	590	60	8.8	375	187.5	9.8	334	334	245, 245	NO
11	Pike St. and Jillians Way	NB	Left	1	3	200	1170	60	3.3	175	175	6.5	221	221	424	YES
			Right	1	3	360	1170	60	6.0	275	275	6.5	221	275	424	YES
		EB	Left	2	1	410	470	60	6.8	300	150	7.8	266	266	245, 245	YES
12	W. 12th St. and Bullock St.	SB	Left	1	2	370	540	60	6.2	275	275	4.5	153	275	460	YES
			Right	1	2	80	540	60	1.3	125	125	4.5	153	153	465	YES
		WB	Left	1	1	370	90	60	6.2	275	275	1.5	51	275	230	NO
13	W. 12th St. and Jillians Way	NB	Right	1	3	460	670	60	7.7	350	350	3.7	127	350	471	YES
		EB	Left	1	1	230	400	60	3.8	200	200	6.7	227	227	230	YES
14	Kyles Lane and Dixie Hwy	WB	Left	1	1	380	30	100	10.6	450	450	0.8	28	450	563	YES
			Right	1	1	830	30	100	23.1	925	925	0.8	28	925	577	NO
15	Kyles Lane and I-75 SB Ramps	SB	Left	2	0	760	0	100	21.1	850	425	N/A	-	425	478, 478	YES
			Right	1	0	380	0	100	10.6	450	450	N/A	-	450	485	YES
		EB	Right	1	2	270	700	100	7.5	325	325	9.7	331	331	418	YES
		WB	Left	1	2	290	860	100	8.1	350	350	11.9	406	406	622	YES
16	Kyles Lane and I-75 NB Ramps	NB	Left	1	0	340	0	100	9.4	400	400	N/A	-	400	400	YES
			Right	1	0	380	0	100	10.6	450	450	N/A	-	450	450	YES
		EB	Left	1	2	370	750	90	9.3	250	250	9.4	319	319	630	YES
		WB	Right	1	2	1100	560	90	27.5	1075	1075	7.0	238	1075	304	NO
17	Kyles Lane and Highlands Ave	NB	Left	1	1	10	1320	90	0.3	125	125	33.0	1122	1122	125	NO

Table 5-20. Alternative I Turn Lane Lengths - Kentucky

Reference	Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Total Turn Storage Length (Incl. Taper)	Storage per Turn Lane	Thru Vehicles per Cycle per Lane	Queue per Thru Lane	Final Turn Lane Length	Storage Length Provided	Adequate Storage Provided?
			Right	1	1	260	1320	90	6.5	300	300	33.0	1122	1122	550	NO
		SB	Left	1	1	180	1450	100	5.0	250	250	40.3	1369	1369	255	NO
		WB	Right	1	1	330	10	90	8.3	300	300	0.3	9	300	210	NO
18	Dixie Hwy and I-75 SB Ramps	SB	Left	2	0	580	0	100	16.1	475	237.5	N/A	-	238	303, 295	YES
			Right	1	0	100	0	100	2.8	-	-	N/A	-	0	414	YES
		EB	Right	1	2	540	630	100	15.0	450	450	8.8	298	450	294	NO
		WB	Left	1	2	90	650	100	2.5	125	125	9.0	307	307	325	YES
19	Dixie Hwy and I-75 NB Ramps	NB	Left	1	0	250	0	100	6.9	225	225	N/A	-	225	307	YES
			Right	1	0	130	0	100	3.6	-	-	N/A	-	0	315	YES
		EB	Left	1	2	60	1150	90	1.5	125	125	14.4	489	489	350	YES
		WB	Right	1	2	870	1240	90	21.8	125	125	15.5	527	527	524	NO
A	W. 9th St. and Jillians Way	NB	Left	1	2	20	300	60	0.3	-	-	2.5	85	85	569	YES
C	W. 5th St. and Jillians Way	NB	Right	2	0	560	0	60	9.3	-	-	N/A	-	0	2164, 2162	YES

No proposed work shown
Meets turn lane length requirement
Fails to meet turn lane length requirement
Meets storage requirement, but fails to meet queue length

Table 5-21. Alternative E Turn Lane Lengths - Ohio

Ref	Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Total Turn Storage Length	Storage per Turn Lane	Thru Vehicles per Cycle per Lane	Queue per Thru Lane	Final Turn Lane Length	Storage Length Provided	Adequate Additional Storage Provided?
I-1	Bank St & Dalton Ave	Westbound	Right	1	2	310	20	60	6	250	250	1	50	361	280	Yes
I-1	Bank St & Dalton Ave	Northbound	Left	1	2	20	710	60	1	50	50	6	250	250	230	Yes
I-1	Bank St & Dalton Ave	Southbound	Left	1	2	150	910	60	3	150	150	8	325	325	180	No
I-2	Bank St & Winchell Ave	Westbound	Right	1	2	70	120	60	2	100	100	1	50	211	Continuous	Yes
I-2	Bank St & Winchell Ave	Northbound	Left	1	2	210	310	60	4	175	175	3	150	286	Continuous	Yes
I-3	Central Pkwy & Linn St	Northbound	Left	1	1	220	100	65	4	175	175	2	100	286	Continuous	Yes
I-3	Central Pkwy & Linn St	Northbound	Right	1	1	90	100	65	2	100	100	2	100	211	200	Yes
I-3	Central Pkwy & Linn St	Westbound	Left	1	3	130	2100	65	3	150	150	13	475	475	-	No
I-4	Bank St & Linn St	Southbound	Right	1	2	40	280	60	1	50	50	---	---	161	Free-flow	Yes
I-4	Bank St & Linn St	Eastbound	Left	1	1	30	80	60	1	50	50	2	100	100	Continuous	Yes
I-4	Bank St & Linn St	Eastbound	Right	1	1	80	30	60	2	100	100	1	50	150	Continuous	Yes
I-5	Dalton Ave & Findlay St	Eastbound	Left	1	1	40	70	60	1	50	50	2	100	100	90	Yes
I-5	Dalton Ave & Findlay St	Westbound	Left	1	1	90	10	60	2	100	100	1	50	150	80	No
I-5	Dalton Ave & Findlay St	Westbound	Right	1	1	70	10	60	2	100	100	1	50	150	Continuous	Yes
I-5	Dalton Ave & Findlay St	Northbound	Left	1	2	10	780	60	1	50	50	7	275	275	70	No
I-5	Dalton Ave & Findlay St	Southbound	Left	1	2	140	540	60	3	150	150	5	200	261	200	Yes
I-6	Findlay St & Western Ave	Eastbound	Right	1	2	67	133	60	2	100	100	2	100	150	Continuous	Yes
I-6	Findlay St & Western Ave	Southbound	Left	1	2	60	170	60	1	50	50	2	100	100	Continuous	Yes
I-8	Dalton Ave & Liberty St	Westbound	Left	1	1	110	190	60	2	100	100	4	175	211	Continuous	Yes
I-8	Dalton Ave & Liberty St	Westbound	Right	1	1	190	110	60	4	175	175	2	100	286	Continuous	Yes
I-8	Dalton Ave & Liberty St	Southbound	Left	1	2	110	980	60	2	100	100	9	350	350	60	No
I-9	Western Ave & Liberty St	Westbound	Left	1	2	67	133	60	2	100	100	2	100	150	125	Yes
I-9	Western Ave & Liberty St	Southbound	Left	1	3	78	232	60	2	100	100	2	100	211	100	Yes
I-11	Linn St & Liberty St	Eastbound	Left	1	2	10	280	60	1	50	50	3	150	150	75	No
I-11	Linn St & Liberty St	Westbound	Left	1	2	170	320	60	3	150	150	3	150	200	75	No
I-11	Linn St & Liberty St	Northbound	Left	1	2	60	380	60	1	50	50	4	175	175	80	No
I-11	Linn St & Liberty St	Southbound	Left	1	2	50	330	60	1	50	50	3	150	150	75	No
I-11	Linn St & Liberty St	Northbound	Right	1	2	150	380	60	3	150	150	4	175	200	Continuous	Yes
I-11	Linn St & Liberty St	Southbound	Right	1	2	30	330	60	1	50	50	3	150	150	Continuous	Yes
I-12	Ezz Charles Dr & Western	Westbound	Left	1	2	50	20	60	1	50	50	1	50	100	Continuous	Yes
I-13	Ezz Charles Dr & Winchell	Westbound	Right	1	2	147	293	60	3	150	150	3	150	200	240	Yes
I-13	Ezz Charles Dr & Winchell	Northbound	Left	1	3	10	450	60	1	50	50	3	150	161	211	Yes
I-14	Ezz Charles Dr & Western	Southbound	Left	1	3	150	420	60	3	150	150	3	150	261	Continuous	Yes
I-15	Ezz Charles Dr & Winchell	Eastbound	Left	1	2	20	320	60	1	50	50	3	150	150	176	Yes
I-16	Ezz Charles Dr & Linn St	Eastbound	Left	1	2	40	490	60	1	50	50	5	200	200	130	No

Table 5-21. Alternative E Turn Lane Lengths - Ohio

Ref	Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Total Turn Storage Length	Storage per Turn Lane	Thru Vehicles per Cycle per Lane	Queue per Thru Lane	Final Turn Lane Length	Storage Length Provided	Adequate Additional Storage Provided?
I-16	Ezz Charles Dr & Linn St	Westbound	Left	1	2	60	360	60	1	50	50	3	150	150	90	No
I-16	Ezz Charles Dr & Linn St	Northbound	Left	1	2	70	450	60	2	100	100	4	175	175	125	Yes
I-16	Ezz Charles Dr & Linn St	Northbound	Right	1	2	50	450	60	1	50	50	4	175	175	75	No
I-16	Ezz Charles Dr & Linn St	Southbound	Left	1	2	50	430	60	1	50	50	4	175	175	125	Yes
I-16	Ezz Charles Dr & Linn St	Southbound	Right	1	2	70	430	60	2	100	100	4	175	175	50	No
I-17	Gest St & Dalton Ave	Eastbound	Left	1	2	80	170	60	2	100	100	2	100	150	140	Yes
I-17	Gest St & Dalton Ave	Westbound	Left	1	2	40	190	60	1	50	50	2	100	161	120	Yes
I-17	Gest St & Dalton Ave	Northbound	Left	1	2	20	300	60	1	50	50	3	150	161	140	Yes
I-17	Gest St & Dalton Ave	Southbound	Left	1	2	100	820	60	2	100	100	7	275	275	80	No
I-18	Gest St & Western Ave	Southbound	Left	2	1	300	40	60	5	200	100	1	50	225	Continuous	Yes
I-18	Gest St & Western Ave	Southbound	Right	1	2	40	300	60	1	50	50	3	150	161	Continuous	Yes
I-19	Gest St & Freeman Ave	Eastbound	Left	1	2	200	400	60	4	175	175	4	175	286	90	No
I-19	Gest St & Freeman Ave	Westbound	Left	1	2	10	140	60	1	50	50	2	100	161	165	Yes
I-19	Gest St & Freeman Ave	Westbound	Right	1	2	140	280	60	3	150	150	3	150	261	Continuous	Yes
I-19	Gest St & Freeman Ave	Northbound	Left	1	2	30	520	60	1	50	50	5	200	200	250	Yes
I-19	Gest St & Freeman Ave	Northbound	Right	2	2	20	520	60	1	50	25	5	200	200	Continuous	Yes
I-19	Gest St & Freeman Ave	Southbound	Left	1	2	140	310	60	3	150	150	3	150	200	300	Yes
I-20	Gest St & Linn Street	Westbound	Right	1	1	200	250	60	4	175	175	5	200	286	Continuous	Yes
I-20	Gest St & Linn Street	Southbound	Left	1	1	95	95	60	2	100	100	2	100	211	180	Yes
I-21	Court St & Linn Street	Westbound	Right	1	1	10	50	60	1	50	50	1	50	100	Continuous	Yes
I-21	Court St & Linn Street	Northbound	Left	1	2	30	430	60	1	50	50	---	---	125	140	Yes
I-21	Court St & Linn Street	Northbound	Right	1	2	80	310	60	2	100	100	---	---	211	120	Yes
I-21	Court St & Linn Street	Southbound	Left	1	2	10	480	60	1	50	50	---	---	100	80	Yes
I-23	8th St and Dalton Avenue	Eastbound	Left	1	3	80	590	60	2	100	100	4	175	175	210	Yes
I-23	8th St and Dalton Avenue	Eastbound	Right	1	3	30	590	60	1	50	50	4	175	175	140	Yes
I-23	8th St and Dalton Avenue	Westbound	Left	1	3	30	580	60	1	50	50	4	175	175	165	Yes
I-23	8th St and Dalton Avenue	Westbound	Right	1	3	140	220	60	3	150	150	2	100	200	680	Yes
I-23	8th St and Dalton Avenue	Northbound	Left	1	2	50	200	60	1	50	50	2	100	161	90	Yes
I-23	8th St and Dalton Avenue	Southbound	Left	1	2	250	410	60	5	200	200	4	175	311	120	No
I-24	8th St and Freeman Ave	Eastbound	Left	1	3	70	690	60	2	100	100	4	175	175	180	Yes
I-24	8th St and Freeman Ave	Eastbound	Right	1	3	250	360	60	5	200	200	2	100	250	700	Yes
I-24	8th St and Freeman Ave	Westbound	Left	1	3	210	620	60	4	175	175	4	175	225	180	Yes
I-24	8th St and Freeman Ave	Westbound	Right	1	3	100	620	60	2	100	100	4	175	175	780	Yes
I-24	8th St and Freeman Ave	Northbound	Left	1	3	60	680	60	1	50	50	4	175	175	175	Yes
I-24	8th St and Freeman Ave	Southbound	Left	1	3	140	410	60	3	150	150	3	150	261	180	Yes

Table 5-21. Alternative E Turn Lane Lengths - Ohio

Ref	Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Total Turn Storage Length	Storage per Turn Lane	Thru Vehicles per Cycle per Lane	Queue per Thru Lane	Final Turn Lane Length	Storage Length Provided	Adequate Additional Storage Provided?
I-24	8th St and Freeman Ave	Southbound	Right	1	3	120	410	60	2	100	100	3	150	211	710	Yes
I-25	8th St and Linn Street	Eastbound	Left	1	3	180	740	60	3	150	150	5	200	200	120	No
I-25	8th St and Linn Street	Eastbound	Right	1	3	140	740	60	3	150	150	5	200	200	760	Yes
I-25	8th St and Linn Street	Westbound	Left	1	3	200	680	60	4	175	175	4	175	225	120	No
I-25	8th St and Linn Street	Northbound	Left	1	3	230	230	60	4	175	175	2	100	286	190	Yes
I-25	8th St and Linn Street	Northbound	Right	1	3	400	230	60	7	275	275	2	100	386	Continuous	Yes
I-25	8th St and Linn Street	Southbound	Left	1	3	180	380	60	3	150	150	3	150	261	120	No
I-27	Dalton and Linn Street	Eastbound	Left	1	1	10	490	60	1	50	50	9	350	350	Continuous	Yes
I-27	Dalton and Linn Street	Eastbound	Right	1	1	490	10	60	9	350	350	1	50	461	Continuous	Yes
I-27	Dalton and Linn Street	Westbound	Left	1	2	10	510	60	1	50	50	5	200	200	260	Yes
I-27	Dalton and Linn Street	Northbound	Left	1	2	100	460	60	2	100	100	4	175	211	110	No
I-27	Dalton and Linn Street	Southbound	Right	1	3	40	540	60	1	50	50	3	150	161	530	Yes
I-28	6th St and Linn Street	Southbound	Left	1	2	590	470	60	10	375	375	---	---	486	100	No
I-29	Court St and Central Ave	Eastbound	Left	1	1	70	340	60	2	100	100	6	250	250	75	No
I-29	Court St and Central Ave	Westbound	Left	1	1	60	170	60	1	50	50	3	150	150	80	No
I-29	Court St and Central Ave	Westbound	Right	1	1	70	170	60	2	100	100	3	150	150	80	No
I-29	Court St and Central Ave	Northbound	Left	1	2	20	230	60	1	50	50	2	100	100	Continuous	Yes
I-29	Court St and Central Ave	Northbound	Right	1	2	410	240	60	7	275	275	2	100	325	Continuous	Yes
I-30	W. 9th St and Central Ave	Northbound	Left	1	4	115	165	60	2	100	100	1	50	150	Continuous	Yes
I-31	7th St W and Central Ave	Northbound	Right	1	2	400	230	70	8	325	325	3	150	375	Continuous	Yes
I-32	6th St W and Central Ave	Northbound	Left	2	2	270	90	105	8	326	163	2	100	263	140	No
I-33	W 5th St and Central Ave	Eastbound	Left	1	3	90	1600	120	3	150	150	18	625	600	Continuous	Yes
I-33	W 5th St and Central Ave	Eastbound	Right	1	3	100	1600	120	4	175	175	18	625	625	Continuous	Yes
I-33	W 5th St and Central Ave	Southbound	Left	2	2	200	310	120	7	276	138	6	250	250	150	No
I-34	4th St and Central Ave	Westbound	Right	1	2	410	1250	120	14	500	500	21	725	725	Continuous	Yes
I-34	4th St and Central Ave	Northbound	Left	2	2	770	540	120	26	856	428	9	350	528	210	No
I-35	3rd St and Central Ave	Eastbound	Left	2	1	130	30	60	3	150	75	1	50	175	140	Yes
I-35	3rd St and Central Ave	Eastbound	Right	1	2	80	160	60	2	100	100	2	100	150	Continuous	Yes
I-35	3rd St and Central Ave	Westbound	Left	1	2	540	370	60	9	350	350	4	175	400	Continuous	Yes
I-35	3rd St and Central Ave	Northbound	Left	2	2	100	670	60	2	100	50	6	250	250	130	No
I-36	4th St and Plum Street	Westbound	Left	1	3	70	1610	60	2	100	100	9	350	350	Continuous	Yes
I-36	4th St and Plum Street	Southbound	Right	1	2	33	67	60	1	50	50	1	50	100	50	Yes
I-38	4th St and Elm Street	Northbound	Left	1	3	148	442	60	3	150	150	3	150	200	Continuous	Yes
I-38	4th St and Elm Street	Westbound	Right	1	3	455	1365	60	8	325	325	8	325	375	130	No
I-39	3rd St and Elm Street	Northbound	Left	1	3	143	427	60	3	150	150	3	150	200	Continuous	Yes

Table 5-21. Alternative E Turn Lane Lengths - Ohio

Ref	Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Total Turn Storage Length	Storage per Turn Lane	Thru Vehicles per Cycle per Lane	Queue per Thru Lane	Final Turn Lane Length	Storage Length Provided	Adequate Additional Storage Provided?
I-39	3rd St and Elm Street	Westbound	Right	1	4	280	1870	60	5	200	200	8	325	325	Continuous	Yes
I-40	2nd St and Elm Street	Eastbound	Left	1	5	480	2970	60	8	325	325	10	375	375	230	No
I-41	3rd St and Bailey Bridge	Eastbound	Right	1	1	560	40	85	14	500	500	1	50	550	85	No
I-41	3rd St and Bailey Bridge	Westbound	Left	1	1	450	530	85	11	400	400	13	475	475	154	No
I-41	3rd St and Bailey Bridge	Northbound	Left	2	2	260	140	85	7	276	138	2	100	238	170	No
I-41	3rd St and Bailey Bridge	Northbound	Right	2	2	140	260	85	5	200	100	3	150	200	170	Yes
I-61	5th St and C-D Road	Northbound	Right	1	3	330	990	110	10	375	375	10	375	518	210	No
I-61	5th St and C-D Road	Southbound	Left	2	2	1190	1470	110	37	1176	588	23	775	600	230	No
I-62	US 50 and I-71 SB/I-75 NB	Northbound	Right	1	1	520	520	105	16	550	550	16	550	693	800	Yes
I-62	US 50 and I-71 SB/I-75 NB	Eastbound	Right	2	2	1790	610	105	53	1640	820	9	350	800	400	No

No proposed work shown
Meets turn lane length requirement
Fails to meet turn lane length requirement
Meets storage requirement, but fails to meet queue length

Table 5-22. Alternative I Turn Lane Lengths - Ohio

Ref	Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Total Turn Storage Length	Storage per Turn Lane	Thru Vehicles per Cycle per Lane	Queue per Thru Lane	Final Turn Lane Length	Storage Length Provided	Adequate Additional Storage Provided?
I-1	Bank St & Dalton Ave	Westbound	Right	1	2	450	50	60	8	325	325	1	50	436	280	No
I-1	Bank St & Dalton Ave	Northbound	Left	1	2	30	630	60	1	50	50	6	250	250	230	Yes
I-1	Bank St & Dalton Ave	Southbound	Left	1	2	190	850	60	4	175	175	8	325	325	180	No
I-2	Bank St & Winchell Ave	Westbound	Right	1	2	70	160	60	2	100	100	2	100	211	Continuous	Yes
I-2	Bank St & Winchell Ave	Northbound	Left	1	2	340	350	60	6	250	250	3	150	361	Continuous	Yes
I-3	Central Pkwy & Linn St	Northbound	Left	1	1	160	90	60	3	150	150	2	100	261	Continuous	Yes
I-3	Central Pkwy & Linn St	Northbound	Right	1	1	30	90	60	1	50	50	2	100	161	200	Yes
I-3	Central Pkwy & Linn St	Eastbound	Right	1	2	80	1240	60	2	100	100	11	400	400	300	No
I-4	Bank St & Linn St	Southbound	Right	1	2	50	270	60	1	50	50	---	---	161	Free-flow	Yes
I-4	Bank St & Linn St	Westbound	Left	1	1	40	80	60	1	50	50	2	100	100	Continuous	Yes
I-4	Bank St & Linn St	Westbound	Right	1	1	80	40	60	2	100	100	1	50	150	Continuous	Yes
I-5	Dalton Ave & Findlay St	Eastbound	Left	1	1	40	60	60	1	50	50	1	50	100	90	Yes
I-5	Dalton Ave & Findlay St	Westbound	Left	1	1	130	10	60	3	150	150	1	50	200	80	No
I-5	Dalton Ave & Findlay St	Westbound	Right	1	1	100	10	60	2	100	100	1	50	150	Continuous	Yes
I-5	Dalton Ave & Findlay St	Northbound	Left	1	2	10	700	60	1	50	50	6	250	250	70	No
I-5	Dalton Ave & Findlay St	Southbound	Left	1	2	170	580	60	3	150	150	5	200	261	200	Yes
I-6	Findlay St & Western Ave	Eastbound	Right	1	2	90	180	60	2	100	100	2	100	150	Continuous	Yes
I-6	Findlay St & Western Ave	Southbound	Left	1	2	80	220	60	2	100	100	2	100	150	Continuous	Yes
I-8	Dalton Ave & Liberty St	Westbound	Left	1	1	130	260	60	3	150	150	5	200	261	Continuous	Yes
I-8	Dalton Ave & Liberty St	Westbound	Right	1	1	260	130	60	5	200	200	3	150	311	Continuous	Yes
I-8	Dalton Ave & Liberty St	Southbound	Left	1	2	190	470	60	4	175	175	4	175	286	60	No
I-9	Western Ave & Liberty St	Westbound	Left	1	2	70	260	60	2	100	100	3	150	150	125	Yes
I-9	Western Ave & Liberty St	Southbound	Left	1	3	70	210	60	2	100	100	2	100	211	100	Yes
I-11	Linn St & Liberty St	Eastbound	Left	1	2	10	270	60	1	50	50	3	150	150	75	No
I-11	Linn St & Liberty St	Westbound	Left	1	2	190	300	60	4	175	175	3	150	225	75	No
I-11	Linn St & Liberty St	Northbound	Left	1	2	60	380	60	1	50	50	4	175	175	80	No
I-11	Linn St & Liberty St	Southbound	Left	1	2	50	320	60	1	50	50	3	150	150	75	No
I-11	Linn St & Liberty St	Northbound	Right	1	2	160	380	60	3	150	150	4	175	200	Continuous	Yes
I-11	Linn St & Liberty St	Southbound	Right	1	2	30	320	60	1	50	50	3	150	150	Continuous	Yes
I-12	Ezz Charles Dr & Western	Westbound	Left	1	2	30	30	60	1	50	50	1	50	100	Continuous	Yes
I-13	Ezz Charles Dr & Winchell	Westbound	Right	1	2	205	245	60	4	175	175	3	150	225	240	Yes
I-13	Ezz Charles Dr & Winchell	Northbound	Left	1	3	20	880	60	1	50	50	5	200	200	211	Yes
I-14	Ezz Charles Dr & Western	Southbound	Left	1	3	160	250	60	3	150	150	2	100	261	Continuous	Yes
I-15	Ezz Charles Dr & Winchell	Eastbound	Left	1	2	10	320	60	1	50	50	3	150	150	176	Yes

Table 5-22. Alternative I Turn Lane Lengths - Ohio

Ref	Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Total Turn Storage Length	Storage per Turn Lane	Thru Vehicles per Cycle per Lane	Queue per Thru Lane	Final Turn Lane Length	Storage Length Provided	Adequate Additional Storage Provided?
I-16	Ezz Charles Dr & Linn St	Eastbound	Left	1	2	50	470	60	1	50	50	4	175	175	130	Yes
I-16	Ezz Charles Dr & Linn St	Westbound	Left	1	2	30	400	60	1	50	50	4	175	175	90	No
I-16	Ezz Charles Dr & Linn St	Northbound	Left	1	2	40	410	60	1	50	50	4	175	175	125	Yes
I-16	Ezz Charles Dr & Linn St	Northbound	Right	1	2	30	410	60	1	50	50	4	175	175	75	No
I-16	Ezz Charles Dr & Linn St	Southbound	Left	1	2	80	380	60	2	100	100	4	175	175	125	No
I-16	Ezz Charles Dr & Linn St	Southbound	Right	1	2	110	380	60	2	100	100	4	175	175	50	No
I-17	Gest St & Dalton Ave	Eastbound	Left	1	2	90	180	60	2	100	100	2	100	150	140	Yes
I-17	Gest St & Dalton Ave	Westbound	Left	1	2	70	180	60	2	100	100	2	100	211	120	Yes
I-17	Gest St & Dalton Ave	Northbound	Left	1	2	70	330	60	2	100	100	3	150	211	140	Yes
I-17	Gest St & Dalton Ave	Southbound	Left	1	2	70	820	60	2	100	100	7	275	275	80	No
I-18	Gest St & Western Ave	Southbound	Left	2	1	130	100	60	3	150	75	2	100	200	Continuous	Yes
I-18	Gest St & Western Ave	Southbound	Right	1	2	100	130	60	2	100	100	2	100	211	Continuous	Yes
I-19	Gest St & Freeman Ave	Eastbound	Left	1	2	110	210	60	2	100	100	2	100	211	90	No
I-19	Gest St & Freeman Ave	Westbound	Left	1	2	10	90	60	1	50	50	1	50	161	200	Yes
I-19	Gest St & Freeman Ave	Westbound	Right	1	2	127	253	60	3	150	150	3	150	261	286	Yes
I-19	Gest St & Freeman Ave	Northbound	Left	1	2	10	520	80	1	50	50	6	250	250	250	No
I-19	Gest St & Freeman Ave	Northbound	Right	2	2	10	520	80	1	50	25	6	250	250	Continuous	Yes
I-19	Gest St & Freeman Ave	Southbound	Left	1	2	300	510	80	7	275	275	6	250	325	425	Yes
I-20	Gest St & Linn Street	Westbound	Right	1	1	200	240	60	4	175	175	4	175	286	Continuous	Yes
I-20	Gest St & Linn Street	Southbound	Left	1	1	95	95	60	2	100	100	2	100	211	180	Yes
I-21	Court St & Linn Street	Westbound	Right	1	1	10	60	60	1	50	50	1	50	100	Continuous	Yes
I-21	Court St & Linn Street	Northbound	Left	1	2	20	260	60	1	50	50	---	---	125	140	Yes
I-21	Court St & Linn Street	Northbound	Right	1	2	80	180	60	2	100	100	---	---	211	120	Yes
I-21	Court St & Linn Street	Southbound	Left	1	2	10	290	60	1	50	50	---	---	100	80	Yes
I-23	8th St and Dalton Avenue	Eastbound	Left	1	3	120	620	60	2	100	100	4	175	175	210	Yes
I-23	8th St and Dalton Avenue	Eastbound	Right	1	3	40	620	60	1	50	50	4	175	175	140	Yes
I-23	8th St and Dalton Avenue	Westbound	Left	1	3	20	620	60	1	50	50	4	175	175	165	Yes
I-23	8th St and Dalton Avenue	Westbound	Right	1	3	130	240	60	3	150	150	2	100	200	680	Yes
I-23	8th St and Dalton Avenue	Northbound	Left	1	2	70	200	60	2	100	100	2	100	211	90	No
I-23	8th St and Dalton Avenue	Southbound	Left	1	2	230	520	60	4	175	175	5	200	286	120	No
I-24	8th St and Freeman Ave	Eastbound	Left	1	3	50	670	60	1	50	50	4	175	175	180	Yes
I-24	8th St and Freeman Ave	Eastbound	Right	1	3	270	350	60	5	200	200	2	100	250	700	Yes
I-24	8th St and Freeman Ave	Westbound	Left	1	3	220	610	60	4	175	175	4	175	225	180	Yes
I-24	8th St and Freeman Ave	Westbound	Right	1	3	110	610	60	2	100	100	4	175	175	780	Yes

Table 5-22. Alternative I Turn Lane Lengths - Ohio

Ref	Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Total Turn Storage Length	Storage per Turn Lane	Thru Vehicles per Cycle per Lane	Queue per Thru Lane	Final Turn Lane Length	Storage Length Provided	Adequate Additional Storage Provided?
I-24	8th St and Freeman Ave	Northbound	Left	1	3	70	660	60	2	100	100	4	175	211	175	Yes
I-24	8th St and Freeman Ave	Southbound	Left	1	3	90	460	60	2	100	100	3	150	211	180	Yes
I-24	8th St and Freeman Ave	Southbound	Right	1	3	90	280	60	2	100	100	2	100	211	710	Yes
I-25	8th St and Linn Street	Eastbound	Left	1	3	230	570	60	4	175	175	4	175	225	120	No
I-25	8th St and Linn Street	Eastbound	Right	1	3	160	230	65	3	150	150	2	100	200	760	Yes
I-25	8th St and Linn Street	Westbound	Left	1	3	150	540	65	3	150	150	4	175	200	120	No
I-25	8th St and Linn Street	Northbound	Left	1	3	300	270	65	6	250	250	2	100	361	190	No
I-25	8th St and Linn Street	Northbound	Right	1	3	50	270	65	1	50	50	2	100	161	Continuous	Yes
I-25	8th St and Linn Street	Southbound	Left	1	3	140	510	65	3	150	150	4	175	261	120	No
I-27	Dalton and Linn Street	Eastbound	Left	1	1	10	500	60	1	50	50	9	350	350	Continuous	Yes
I-27	Dalton and Linn Street	Eastbound	Right	1	1	500	10	60	9	350	350	1	50	461	Continuous	Yes
I-27	Dalton and Linn Street	Westbound	Left	1	2	10	540	60	1	50	50	5	200	200	260	Yes
I-27	Dalton and Linn Street	Northbound	Left	1	2	100	160	60	2	100	100	2	100	211	110	Yes
I-27	Dalton and Linn Street	Southbound	Right	1	3	30	630	60	1	50	50	4	175	175	530	Yes
I-28	6th St and Linn Street	Southbound	Left	1	2	680	500	60	12	450	450	---	---	561	100	No
I-29	Court St and Central Ave	Eastbound	Left	1	1	40	340	60	1	50	50	6	250	250	75	No
I-29	Court St and Central Ave	Westbound	Left	1	1	130	160	60	3	150	150	3	150	200	80	No
I-29	Court St and Central Ave	Westbound	Right	1	1	30	160	60	1	50	50	3	150	150	80	No
I-29	Court St and Central Ave	Northbound	Left	1	2	30	170	60	1	50	50	2	100	100	Continuous	Yes
I-29	Court St and Central Ave	Northbound	Right	1	2	190	160	60	4	175	175	2	100	225	Continuous	Yes
I-30	W. 9th St and Central Ave	Northbound	Left	1	4	115	385	60	2	100	100	2	100	150	Continuous	Yes
I-31	7th St W and Central Ave	Northbound	Right	1	2	200	190	60	4	175	175	2	100	225	Continuous	Yes
I-32	6th St W and Central Ave	Northbound	Left	2	2	90	200	60	2	100	50	2	100	150	140	Yes
I-33	W 5th St and Central Ave	Eastbound	Left	1	3	110	1330	60	2	100	100	8	325	325	330	Yes
I-33	W 5th St and Central Ave	Eastbound	Right	1	3	80	1330	60	2	100	100	8	325	325	475	Yes
I-33	W 5th St and Central Ave	Southbound	Left	2	2	30	160	60	1	50	25	2	100	150	150	Yes
I-34	4th St and Central Ave	Westbound	Right	1	2	140	1180	70	2	150	150	12	450	450	Continuous	Yes
I-34	4th St and Central Ave	Northbound	Left	2	2	330	480	70	7	276	138	5	200	238	210	No
I-35	3rd St and Central Ave	Eastbound	Left	2	1	170	300	100	5	200	100	9	350	350	140	No
I-35	3rd St and Central Ave	Eastbound	Right	1	2	300	170	100	9	350	350	3	150	400	Continuous	Yes
I-35	3rd St and Central Ave	Westbound	Left	1	2	420	480	100	12	450	450	7	275	500	Continuous	Yes
I-35	3rd St and Central Ave	Northbound	Left	2	2	350	360	70	7	276	138	4	175	238	130	No
I-36	4th St and Plum Street	Westbound	Left	1	3	70	1270	60	2	100	100	8	325	325	Continuous	Yes
I-36	4th St and Plum Street	Southbound	Right	1	2	60	30	60	1	50	50	1	50	100	50	Yes
I-38	4th St and Elm Street	Northbound	Left	1	3	148	442	60	3	150	150	3	150	200	Continuous	Yes

Table 5-22. Alternative I Turn Lane Lengths - Ohio

Ref	Intersection	Approach	Turn Movement	# Turn Lanes	# Thru Lanes	Turn Volume	Thru Volume	Cycle Length	Turn Vehicles per Cycle	Total Turn Storage Length	Storage per Turn Lane	Thru Vehicles per Cycle per Lane	Queue per Thru Lane	Final Turn Lane Length	Storage Length Provided	Adequate Additional Storage Provided?
I-38	4th St and Elm Street	Westbound	Right	1	3	388	1162	60	7	275	275	7	275	325	130	No
I-39	3rd St and Elm Street	Northbound	Left	1	3	130	220	60	3	150	150	2	100	200	Continuous	Yes
I-39	3rd St and Elm Street	Westbound	Right	1	4	290	1970	60	5	200	200	9	350	350	Continuous	Yes
I-40	2nd St and Elm Street	Eastbound	Left	1	5	510	2660	60	9	350	350	9	350	400	230	No
I-41	3rd St and Bailey Bridge	Eastbound	Right	2	1	450	100	70	9	350	175	2	100	275	85	No
I-41	3rd St and Bailey Bridge	Westbound	Left	1	1	245	245	70	5	200	200	5	200	250	154	No
I-41	3rd St and Bailey Bridge	Westbound	Right	1	1	410	20	70	9	350	350	1	50	400	150	No
I-41	3rd St and Bailey Bridge	Northbound	Left	2	1	310	160	70	7	276	138	4	175	238	170	No
I-41	3rd St and Bailey Bridge	Northbound	Right	1	1	210	160	70	5	200	200	4	175	250	170	No
I-41	3rd St and Bailey Bridge	Southbound	Right	1	1	60	200	70	2	100	100	4	175	175	200	Yes

No proposed work shown
Meets turn lane length requirement
Fails to meet turn lane length requirement
Meets storage requirement, but fails to meet queue length

6.0 Affected Environment and Environmental Consequences

This section of the report summarizes the project's status towards achieving environmental clearance under the National Environmental Policy Act (NEPA) and related regulations. Evaluation of impacts is based upon studies identified in the Ohio Department of Transportation's (ODOT's) Project Development Process (PDP) manual and technical guidance documents.

6.1 Environmental Studies Summary

For this project, the following studies have been completed to date through ODOT's PDP:

- *Existing and Future Conditions Report* (February 2006),
- *Phase I History/Architecture Survey – Kenton County, Kentucky* (April 2010),
- *Phase I History/Architecture Survey – Hamilton County, Ohio* (June 2007),
- *Phase II History/Architecture Survey – Hamilton County, Ohio* (October 2008),
- *Phase II History/Architecture Survey – Hamilton County, Ohio* (September 2009),
- *Phase I History/Architecture Survey Addendum Report for the Western Hills Viaduct Interchange – Hamilton County, Ohio* (June 2010),
- *Determination of Effects Report (Draft, February 2011),*
- *Archaeological Existing Conditions and Disturbance Assessment – Hamilton County, Ohio (September 2010),*
- *Ecological Survey Report – Kentucky* (December 2009),
- *Level One Ecological Survey Report – Ohio* (March 2010),
- *Environmental Site Assessment Screening* (April 2007),
- *Environmental Site Assessment Screening- Western Hills Viaduct* (May 2010),*Phase I Environmental Site Assessments* (April 2010),
- *Draft Environmental Assessment* (November 2010),
- *Air Quality Technical Report: Mobile Source Air Toxics* (November 2010),
- *Air Quality Technical Report: Carbon Monoxide* (November 2010), and
- *Draft Qualitative $PM_{2.5}$ Hot-Spot Analysis (April 2011).*

Additionally, social and economic information has been gathered, noise analysis and air quality analyses have been conducted, and public as well as stakeholder involvement has been conducted including work with both an advisory and aesthetics committee that were instituted at the outset of the project by KYTC and ODOT. An Environmental Assessment has also been prepared and will be submitted under separate cover.

6.2 Environmental Impacts Summary

Alternatives E and I have similar impacts to ecological resources, community resources, land uses, hazardous material sites, and utilities. Both feasible alternatives would be compatible with existing land use plans, would support the Queensgate redevelopment plans, and help Cincinnati facilitate its economic renewal goals. Alternatives E and I differ in their impacts to Section 4(f) resources. Alternative E impacts more Section 4(f) resources than Alternative I. Overall, the impacts to these resources caused by Alternative E are more extensive than Alternative I. The impacts of the feasible alternative are summarized below:

- The total new right of way required is 36.90 acres for Alternative E and 31.37 acres for Alternative I.
- Alternative E would potentially have 106 displacements (89 residential and 17 commercial). Alternative I would potentially have 58 displacements (43 residential and 15 commercial).
- Goebel Park and Queensgate Playground and Ball Fields would be impacted by both feasible alternatives.
- Other community facilities will also have property only impacts from both feasible alternatives. These include the Notre Dame Academy property, the Beechwood Elementary and High schools, and Central Church of the Nazarene property.
- While displacements could occur in low-income populations by either feasible alternative, no disproportionately high and adverse impacts are expected to environmental justice (EJ) communities. Impacts to minority populations may occur as a result of the Western Hills Viaduct SPUI alternative. Impacts to parks within EJ communities would be mitigated.
- Neither feasible alternative provides a significantly greater ecological impact over the other. Both feasible alternatives would impact approximately 3,340 linear feet of intermittent streams, 1.38 acres of wetlands, and habitat for the Indiana bat and running buffalo clover. No impacts to significant ecological resources are anticipated from this project.
- One site in Ohio is recommended for a Phase I Environmental Site Assessment with Alternative I. Seventeen sites are recommended for Phase II ESA investigations, including two sites in Kentucky and 15 sites in Ohio. There are 10 sites within the right of way limits of Alternative E and 11 sites of Alternative I.
- National Register of Historic Places listed and eligible properties would be impacted by both feasible alternatives. Alternative E would have an adverse effect on three historic properties and Alternative I would have an adverse effect on two historic properties.
- The greatest amount of potential visual impact would be in the residential land uses to west of the Brent Spence Bridge on the south bank of the Ohio River. The area with the least amount of potential impact would be in the suburban residential areas south of Covington.
- Section 4(f) resources (parks and historic properties) would be impacted by both feasible alternatives. Alternative E would impact five Section 4(f) resources and Alternative I would impact four Section 4(f) resources.
- One Section 6(f) resource, Goebel Park will be impacted by both feasible alternatives. Alternative E will impact approximately 3.7 acres of the park while Alternative I will impact 1.9 acres.
- Both feasible alternatives will potentially impact 57 utilities, 46 below ground and 11 aboveground.

6.3 Air Quality

The Brent Spence Bridge Replacement/Rehabilitation project is a conforming project in the both Kentucky's and Ohio's Transportation Improvement Plans (TIP), and will have air quality impacts consistent with those identified in the State Implementation Plans for achieving the National Ambient Air Quality Standards (NAAQS). The technical studies completed for the project included a Mobile Source Air Toxics (MSAT) analysis, $PM_{2.5}$ Hot Spot Analysis, and a Carbon Monoxide (CO) analysis. The results of these analyses are documented in the following technical reports and will be incorporated into the Environmental Assessment for the project:

- *Air Quality Technical Report: Mobile Source Air Toxics* (November 2010),

- *Air Quality Technical Report: Carbon Monoxide* (November 2010), and
- *Draft Qualitative $PM_{2.5}$ Hot-Spot Analysis (April 2011)*

The air quality analyses conducted for the proposed project determined that neither feasible alternative would cause or exacerbate an exceedance of the carbon monoxide NAAQS or increase regional emission burdens or mobile source air toxin levels. Interagency consultation has been initiated (May 2011) to determine if the project is a project of air quality concern in regard to particulate matter ($PM_{2.5}$). Based upon the projected VMT estimates for the No Build Alternative, the project would slightly reduce MSATs in the overall study area.

6.4 Noise

The principal sources of noise in the study area are motor vehicles traveling on the I-75 and I-71 mainlines, adjoining service roads and connecting roadways. Residential areas and community facilities adjacent to these roadways are exposed to moderate to high levels of existing road traffic noise. Existing peak-hour noise levels approached or exceeded the Kentucky Transportation Cabinet (KYTC) and ODOT Category B impact threshold l of 66 dBA at 35 of the 48 monitoring locations. Noise measurements ranged from a low reading of 54 dBA at Site M-34 during the peak AM time period to a high reading of nearly 78 dBA at Site M-3 during the peak PM time period. Additional details on the noise study are available in Appendix F of the *Environmental Assessment* (November 2010).

In general, noise levels for the recommended preferred alternative are higher than for the No Build Alternative because of the higher travel speed and reduced congestion predicted for 2035.

Under the recommended preferred alternative, 55 properties would be expected to experience noise levels at or above the noise abatement criteria (NAC) as compared to 42 properties identified under the No Build Alternative in 2035. Predicted noise levels for the recommended preferred alternative would be between one and five decibels higher than those reported for the No Build Alternative. The noise levels would range from a maximum of 74 dBA at Sites M-3 and R-7 to a minimum of 56 dBA at Site M-47. No locations would be expected to experience a noise level increase of 10 or more dBA above the corresponding existing noise level.

In Kentucky, the highest concentration of properties with noise levels above the NAC would occur between Kyles Lane and Dixie Highway and in the southbound direction between KY 5th and Hermes Streets. In Ohio, the highest concentration of properties with noise levels above the NAC would be projected to occur from Bank Street to just south of Ezzard Charles Drive.

6.5 Water Way Permits and Mitigation

A Level One Ecological Survey Report was completed for both Ohio and Kentucky and submitted to ODOT's Office of Environmental Services (OES). OES coordinated the report with the U.S. Army Corps of Engineers (USACE), the Ohio Department of Natural Resources (ODNR), the U.S. Fish and Wildlife Service (USFWS), the Ohio Environmental Protection Agency (OEPA), and the U.S. Environmental Protection Agency (USEPA). A list of agency coordination letters received pertaining to this project are listed in Table 6-1.

This project was not scoped to complete the Waterway Permit Determination Package at this Stage. This will be completed during the next task of this project.

Table 6-1. Agency Coordination

Agency	Date	Coordination
Kentucky Department of Fish and Wildlife Resources	May 10, 2010	• Provided comments regarding the presence of breeding pairs of Peregrine Falcons within the study area. • Concerned that bridge construction may have negative effects on the falcons due to the proximity of the nest locations to the bridge. • The nongame branch of KDFWR can confirm if falcons are nesting on the bridge, prior to construction.
US Fish and Wildlife Service	May 11, 2010	• The USFWS concurs with KYTC's may affect but is not likely to adversely affect determination for the running buffalo clover. • KYTC should coordinate with the USFWS regarding the appropriate actions if trees will be cleared in areas of summer bat habitat. • The USFWS recommends that a mussel habitat reconnaissance survey be conducted under the proposed alignment site and under the existing bridge if any in-water work is required for rehabilitation of the structure. • Impacts to Trust Resources resulting from the development of staging, borrow, or waste areas or from the relocation of utilities should be coordinated with the USFWS as these are considered part of the action.
Ohio Environmental Protection Agency	May 20, 2010	• OEPA has no substantive issues with the project.
KY Department for Environmental Protection – Division of Water	May 21, 2010	• The Division recommends Alternative E as the Preferred Alternative. • Any water or monitoring wells, either drilled or dug in the construction corridor should be properly abandoned by a Kentucky Certified Water Well Driller to prevent the introduction of surface water directly into groundwater during construction. • A Groundwater Protection Plan may be required for construction.
KY Department for Environmental Protection – Division of Enforcement	May 21, 2010	• Prior to construction, all applicable permits and registrations must be in place and that KYTC remains in compliance during construction, demolition or repair activities.
Ohio Department of Natural Resources	May 24, 2010	• Since 2005, two more records for rare species within the study are have been added. These species are the Channel Darter, threatened in the Ohio River and the Peregrine Falcon, threatened, in downtown Cincinnati. • The agency recommends no in-water work between March 15 and June 30 to reduce impacts to the Channel Darter and other aquatic species and their habitat. • A detailed mussel survey should be conducted within the area of the new bridge. • The agency believes that the project will not likely impact the Peregrine Falcon.

6.6 Cultural Resources

Feasible Alternatives E and I will impact the Lewisburg Historic District, Longworth Hall, former Harriet Beecher Stowe Elementary School site, Western Hills Viaduct, and the West McMicken Avenue Historic District. The preliminary determination of effect for each resource is presented in Table 6-2. The No Build Alternative would not impact historic resources within the study area because any minor, short-term safety and maintenance improvements to the existing Brent Spence Bridge and I-75 corridor would be within the existing right of way.

Table 6-2. Cultural Resources Impacts

Resource Number	Name	National Register Status	Alternative Impacts	Preliminary Determination of Effect
NRHP No. 93001165	Lewisburg Historic District	NRHP 1993	Alternative E – 5.1 acres (44 contributing properties; 18 non-contributing properties); Change in access to the district on Crescent Avenue Alternative I – 2.8 acres (34 contributing properties; 11 non-contributing properties); Change in access to the district on Crescent Avenue and Lewis Street	Adverse Effect
HAM-1342-43	Harriet Beecher Stowe Elementary School (Fox 19 Television Station)	Eligible 2008	No impacts to the historic building Alternative E – 1,330 square feet of floor area from the parking garage Alternative I – 2,400 square feet of floor area from the parking garage	No Effect
HAM-1656-43 NRHP No. 86003521	Longworth Hall (Baltimore Ohio RR – Freight)	NRHP 1986	Alternative E – 20,500 square feet of floor area and 198 feet of the eastern end of the building Alternative I – 20,000 square feet of floor area and 198 feet of the eastern end of the building	Adverse Effect
	Western Hills Viaduct		Alternative E – Reconstruction of 1,604 feet Alternative I – Reconstruction of 1,108 feet	No Adverse Effect
	West McMicken Avenue Historic District		Alternative E – Demolition of eight contributing buildings Alternative I – None	Adverse Effect No Effect

6.7 Environmental Site Assessments

An inventory of hazardous materials sites in the study area was completed through ESA Screenings and Phase I ESAs. The results are documented in the following reports: *Environmental Site Assessment Screening* (April 2007); *Environmental Site Assessment Screening- Western Hills Viaduct* (May 2010); and *Phase I Environmental Site Assessments* (April 2010).

Seventeen sites are recommended for Phase II ESA investigations. Two sites are located in Kentucky and 15 sites are located in Ohio. Table 6-3 lists the sites warranted for Phase II ESA investigations and alternative impacts. The existing Brent Spence Bridge is not a listed site since it is right of way property and a condition exist associated with the structure.

Table 6-3. Sites Warranted for Phase II ESA

Site ID	State	Name	Facility Address	Issue	Alternative Impacts
1	OH	Parkway Market Food Mart	2310 Central Parkway	Historic Filling Station	E, I
3	OH	Sunset Janitorial Supply	1151 Harrison Avenue	OH LUST	E, I
4	OH	George E. Fern Company	2145 Winchell Avenue	OH SPILLS, Historic UST Location	None
9	OH	Wegman Company	1101 York Street	Multiple Manufacturing Facilities	E, I
14	OH	Center for Chemical Addiction Treatment	830 Ezzard Charles Drive	Historic Furniture Finishing	None
17	OH	Large Apartment Complex	845 Ezzard Charles Drive	Historic Filling Station	None
29	OH	city of Cincinnati Right of way	Formerly 817 Mound Street	Historic Filling Station	E, I
49	OH	ARTIMIS (ODOT)/ Former Gas Station	508 West 3rd Street	Historic Filling Station	E, I
51	OH	Vacant Site Owned by city of Cincinnati	4th Street and Central Avenue	Historic Filling Station	E, I
53	OH	Speedway Super America	605 West 3rd Street	Historic Filling Station	E, I
55	OH	Dunhumby USA	444 West 3rd Street	LUST, RCRA-SQG, Historic Land Use	None
58	OH	Parking Lot Owned by the city of Cincinnati	205 Central Avenue	Historic Filling Station, OH UST, OH LUST	E, I
60	OH	Parking Lot Owned by Duke Energy	646 Mehring Way	Historic MGP	E, I
65	OH	Valley Asphalt	612 West Mehring Way	RCRA-NonGen, OH SPILLS	None
66	OH	Hilltop Basic Resources	511 West Water Street	OH SPILLS, Historic Coal Tar Refinery	None
71	KY	Rusk Heating and Air Conditioning	666 West 3rd Street	Historic Junkyard Location, KY UST	E, I
78	KY	Kerry Toyota	550 Pike Street	Historic Filling Station, KY UST	I

LUST - Leaking Underground Storage Tank
UST - Underground Storage Tank
MPG – Maufactured Gas Plant
RCRA-NonGen – Resource Conservation and Recovery Act Non Generator
RCRA-SQG - Resource Conservation and Recovery Act Small Quantity Generator

Plan notes for petroleum contaminated soil (PCS) and contaminated groundwater, if dewatering is necessary for construction purposes, should be developed and placed into plans for the following sites:

- Site 52 – city of Cincinnati, 351 John Street,
- Site 54 – city of Cincinnati, 514 West Third Street, and
- Site 57 – city of Cincinnati, 302-304 Central Avenue.

The No Build Alternative would not impact hazardous materials resources within the study area because any minor, short-term safety and maintenance improvements to the existing Brent Spence Bridge and I-75 corridor would be within the existing right of way.

6.8 Environmental Commitments and Mitigation

Throughout development of the Brent Spence Bridge Replacement/Rehabilitation Project, KYTC, ODOT, and FHWA coordinated with federal, state, and local agencies; stakeholders; consulting parties, and the public to minimize project impacts. Where avoidance of impacts is not possible, KYTC and ODOT minimized impacts to the extent possible. The following sections provide an overview of the mitigation measures proposed for the Brent Spence Bridge Replacement/Rehabilitation Project.

6.8.1 Social and Economic Resources

6.8.1.1 Displacements

The acquisition of property for right of way would be in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646). This Act was enacted by congress in 1971 to assist residents, organizations, and businesses displaced by public agencies in relocating without suffering a disproportionate loss. Whenever federal funds are utilized in a project and residential or business displacement occurs, then relocation advisory and financial assistance must be offered to those occupants being displaced as a direct result of the project.

Reimbursement benefits include just compensation at fair market value for displaced property. Displaced property owners are due compensation for real property to be acquired, fees incidental to the transfer of the property, mortgage prepayment penalties, and appraisal expenses. In addition, a person displaced from his or her dwelling is eligible to receive compensation for the relocation of their personal property. Affected owners and tenants are eligible to receive residential relocation assistance. Every person or business being displaced by the project is eligible to receive advisory assistance in relocating to a replacement dwelling.

When certain eligibility requirements are met, displaced persons are entitled to financial assistance in relocating their personal property and the increased costs of buying or renting a comparable replacement dwelling. These services and benefits would be in addition to the compensation received by the property owner for the acquisition of real property. The Uniform Relocation Act provides that adequate replacement housing is available before requiring an individual to vacate the dwelling being acquired.

Each business displaced by the project is eligible to receive advisory assistance in relocating personal property. These services and benefits would be in addition to the compensation received by the property owner for the acquisition of real property. Displaced businesses are also entitled to compensation for the relocation of their personal property, based on actual and reasonable cost. A displaced business may also be entitled to reimbursement for miscellaneous expenses incurred for such items as storage or searching for a replacement site. The Uniform Relocation Act also provides an option to businesses to receive a payment in lieu of actual moving costs. This payment is based on average annual net income of the operation for the two taxable years prior to displacement.

As project development continues, efforts will be made to continue minimization and avoidance of impacts to business properties. A Relocation Assistance Program would be established to help property owners displaced by construction of the Preferred Alternative. The program will follow the procedures set forth in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended and the Uniform Relocation Assistance and Real Property Acquisition Regulations for Federal and Federally Assisted Programs dated March 2, 1998. The Relocation Assistance Program will be administered by KYTC and ODOT. KYTC and ODOT representatives will contact individual property owners well in advance of construction activities to begin negotiations for the purchase of the property.

6.8.1.2 Access

During construction access to all neighborhoods and community facilities would be maintained to the extent practical through controlled construction scheduling and/or provisions of alternate routes of entry. Any access changes would be mitigated by providing adequate signage for the access changes and, where necessary, by working with the facility throughout the construction period to provide advanced notification to the community regarding the changes.

To reduce temporary impacts to the economy with the feasible alternatives, KYTC and ODOT will ensure that access to businesses is maintained at all times. Maintenance of Traffic during construction is discussed in Section 6.8.7.

6.8.1.3 Outreach

A regional outreach program would be established to inform the public about major traffic delays associated with the construction phases. In addition postings on the project website, the local news media would be notified in advance of road closures, diversions, and other construction activities. The program's objective would be to create awareness of the potential problems and provide alternate travel routes for drivers, including transit options. The outreach program could include a transit voucher program to encourage drivers to use public transportation, thereby reducing congestion. The combination of identifying alternative routes with the regional outreach program should ensure that effective traffic operations could be maintained throughout all phase of construction.

6.8.2 Ecological Resources

Potential stream mitigation measures could include payment into the Kentucky Department of Fish and Wildlife Resources (KDFWR) In-lieu Fee Program or a stream restoration project within the watershed using natural channel design.

The US Army Corps of Engineers requires mitigation for impacts greater than 0.1 acres of jurisdictional wetland. Potential wetland mitigation measures for small impacts could be accomplished through purchase of wetland mitigation bank credits (if applicable) or creation of wetland within similar dry detention basins along the proposed corridor.

An effect determination on the Indiana bat will be made once a Preferred Alternative is selected. This determination will be based on impacts to the potential summer roosting and foraging habitats and through coordination with the USFWS. Creating or enhancing potential habitat for Indiana bat or payment to the Indiana Bat Conservation Fund could be used as mitigation for any impacts to potential Indiana bat habitat areas.

Since a new bridge will be constructed adjacent to the existing bridge in either alternative, best management practices would be used during placement of bridge piers to minimize impacts to aquatic life. In addition, in-stream work within the Ohio River would be restricted between March 15 and June 30.

During construction, best management practices would be used to ensure minimization of silt entering nearby headwater streams. Best management practices could include use of silt fences, staked straw bales, brush barriers, sediment basins, diversion ditches, and timing of construction to dry periods of the year.

A detailed mussel survey will be completed after a Preferred Alternative has been selected. An effects determination on these mussel species will be based on the results of the survey and the proposed level of disturbance.

Habitat areas within the right of way limits of the feasible alternatives would be disrupted due to construction activities. At the completion of construction, disturbed areas will be re-vegetated to provide some level of restoration.

Coordination with the non-game brand of Kentucky Department of Fish and Wildlife Resources would occur in the spring prior to demolition of the bridge approaches to address nesting of Peregrine Falcons.

Construction activities will disturb soils and possibly cause erosion and sedimentation. KYTC's and ODOT's standard specifications for sediment and erosion control would be implemented during all phases of construction. An amendment to the Clean Water Act broadened the definition of point source pollutants to include stormwater discharge from industrial activities and construction sites. A Stormwater Management Plan, which includes erosion and sediment control measures would be developed and implemented.

6.8.3 Hazardous Materials

Seventeen sites are recommended for Phase II ESA investigations. Two sites are located in Kentucky and 15 sites are located in Ohio. The Phase II ESAs will be conducted on sites impacted by the Preferred Alternative.

Plan notes for petroleum contaminated soil (PCS) and contaminated groundwater, if dewatering is necessary for construction purposes, would be developed and placed into plans for the following sites:

- Site 52 – City of Cincinnati, 351 John Street
- Site 54 – City of Cincinnati, 514 West Third Street
- Site 57 – City of Cincinnati, 302-304 Central Avenue

6.8.4 Section 4(f)/6(f) Resources

Minimization of impacts to Section 4(f)/6(f) resources was included as a design objective in the development of alternatives. Alternative I is the minimization alternative. The minimization of impacts for each resource is described in the following sections.

6.8.4.1 Goebel Park

Minimization of impacts to the Goebel Park resource includes reduction of stormwater impacts on the area also used by Sanitation District 1 for the Willow Street stormwater overflow. The KYTC is working with Sanitation District 1 to develop a management plan that fully eliminates stormwater runoff from I-71/75 onto Goebel Park property. In addition, land could be vacated by KYTC in the vicinity of the KY 5th Street ramps to exchange with city of Covington for relocation of affected park facilities. Approximately 2.4 acres of land would be available for transfer to the City of Covington for use as replacement parkland.

6.8.4.2 Lewisburg Historic District

Potential mitigation and minimization measures for the Lewisburg Historic could include:

- Relocation of buildings to be demolished to vacant lots within the historic district,
- Completion of photographic documentation of buildings to be demolished,
- Completion of Kentucky Individual Buildings Survey Forms for contributing resources within the Lewisburg Historic District (430 contributing buildings are listed in the National Register of Historic Places (NRHP) nomination),
- Revision of the 1993 NRHP nomination form to include contributing buildings that were not yet 50 years old at the date of nomination and to note which buildings are no longer extant due to recent residential development in the area, and
- Creation of a Historic Preservation Plan for Lewisburg to preserve the history of the district.
- Construction of a noise wall adjacent to I-71/I-75.

Additional coordination will be undertaken with the Kentucky Heritage Council and Section 106 consulting parties to further develop and define actual mitigation and minimization measures for the Lewisburg Historic District. These measures will be specified in a Section 106 Memorandum of Agreement (MOA) to be developed for this project.

6.8.4.3 Queensgate Playground and Ball Fields

A Memorandum of Agreement (MOA) was developed between ODOT and the City of Cincinnati Recreation Commission (CRC) to document commitments of ODOT required as a result of impacts to the Queensgate Playground and Ball Fields.

ODOT proposes to compensate the CRC for land and property acquired and the following:

- Compensation for the relocation of the two existing ball fields.
- Compensation for the relocation of the 435 feet of the walking path.
- Compensation for the loss of trees due to the relocation of ball fields.
- Compensation for the need to relocate field lighting due to the relocation of ball fields.
- Compensation for the need to prepare final mitigation plans and monitor construction of the mitigation project.

The total mitigation compensation to be provided in addition to land and property acquisition is $198,050.

During construction at the Queensgate Playground and Ball Fields, three recreational areas within 1.5 miles will be available for use by the public:

- Dyer Park located at 2110 Freeman Avenue is 1.3 miles from the Queensgate Playground and Ball Fields. Park facilities include a water sprayground, playground, basketball court, football and baseball fields, and picnic area,

- Lincoln Community Center located at 1027 Linn Street is 0.14 miles from the Queensgate Playground and Ball Fields. The community center has a playground, basketball and tennis courts, picnic area, swimming pools, computer center, game room, fitness center and meeting rooms, and
- Washington Park located at 1225 Elm Street is 0.65 miles from the Queensgate Playground and Ball Fields. Currently this park is being renovated. In the future, it will have a playground, performance stage, event plaza, dog park and green space.

6.8.4.4 Longworth Hall

Potential measures to minimize impacts on Longworth Hall could include:

- Preparation of Historic American Building Survey (HABS) Documentation on Longworth Hall,
- Reconstruction of the portion of the fourth floor of the building that was demolished by fire, which would allow the building to regain historic integrity and floor space that will otherwise be lost during the construction of the bridge.,
- Installation of appropriate storm windows throughout the building to reduce traffic and ambient noise, reduce dust and debris from the roadway, and to protect the historic windows,
- Rehabilitation of the associated scale house, located on the property north of Longworth Hall, for interpretative use, and
- Completion of a contextual study of extant large scale railroad freight houses in Ohio.

Additional coordination will be undertaken with the Ohio State Historic Preservation Office (OHPO) and Section 106 consulting parties to further develop and define actual mitigation and minimization measures for Longworth Hall. These measures will be specified in a Section 106 MOA to be developed for this project.

6.8.5 Air Quality

State and local regulations regarding dust control and other air quality emission reduction controls would be followed to minimize air impacts during construction. In order to minimize the amount of construction dust generated, the following mitigation measures below could be implemented:

- Minimize land disturbance,
- Use watering trucks to minimize dust,
- Cover trucks when hauling dirt,
- Stabilize the surface of dirt piles if they are not removed immediately,
- Use windbreaks to prevent accidental dust pollution,
- Limit vehicular paths and stabilize these temporary roads,
- Pave all unpaved construction roads and parking areas to road grade for a length no less than 50 feet from where such roads and parking areas exit the construction site. This prevents dirt from washing onto paved roadways,
- Cover trucks when transferring materials,
- Use dust suppressants on unpaved traveled paths,
- Minimize unnecessary vehicular and machinery activities,
- Minimize dirt track-out by washing or cleaning trucks before leaving the construction site. An alternative to this strategy is to pave a few hundred feet of the exit road just before entering the public road,
- Re-vegetate any disturbed land not used,
- Remove unused material,
- Remove dirt piles, and
- Re-vegetate all vehicular paths created during construction to avoid future off-road vehicular activities.

6.8.6 Noise

ODOT and KYTC require that noise abatement measures be considered at locations where traffic related noise impacts are identified. Noise walls will be constructed along the I-71/75 corridor to mitigate noise impacts. Based on the noise analysis, noise walls are recommended at six locations, one in Kentucky and five in Ohio. The final locations of the noise walls will be determined through a public involvement process.

To abate or minimize expected construction noise impacts, mitigation measures could be noted directly in contract plans and specifications. Project specific construction noise abatement that could be utilized to minimize, to the greatest extent possible, the noise impact zone in areas outside the construction site boundary, include the following:

- Informing the public when work is going to be performed,
- Limit the number and duration of idling equipment on site,
- Install mufflers on equipment and maintain all construction equipment in good repair,
- Reduce noise from all stationary equipment by utilizing suitable enclosures,
- Minimize the use of back-up alarms,
- Schedule and space truck loading and unloading operations to minimize noise impacts,
- Limit operation of heavy equipment and other noisy procedures to daylight hours whenever possible, and
- Locate equipment and vehicle staging areas as far from noise sensitive areas as possible.

6.8.7 Maintenance of Traffic Plan

A Maintenance of Traffic (MOT) plan would be developed and implemented to maintain traffic operations throughout the corridor and minimize disruption to the surrounding communities. KYTC and ODOT would work together to implement a seamless MOT plan through all phases of construction. The first phase of construction would involve modifications to interstates east of the study area to support detour and lane shifts. The construction of the I-75 corridor would be initiated in the western portion of the corridor, including the new Ohio River Bridge.

In order to reduce the volume of traffic using the I-75 corridor, I-71 traffic would be diverted to I-471 utilizing I-275 in Kentucky. To support this detour, the ramp from southbound I-71 to southbound I-471 and the ramp from southbound I-471 to westbound I-275 would be reconfigured to provide two travel lanes. Similarly, the ramp from eastbound I-275 to northbound I-471 and the ramp from northbound I-471 to northbound I-71 would be widened to two lanes. I-471 would be widened to four lanes in each direction to enhance capacity on this interstate.

The third and fourth phases of construction would include the new Ohio River Bridge and the approaches in Kentucky and Ohio. Access to Covington would be modified to provide only one entrance and one exit in the southbound and northbound directions. Access from southbound I-71/I-75 will be maintained via the Pike Street exit and access to southbound I-71/I-75 from Covington will be maintained via the KY 12th Street entrance ramp. In Cincinnati, I-75 would be reduced to two travel lanes in each direction where possible. Three travel lanes would be provided in the northbound direction on I-75 north of Freeman Avenue and in the southbound direction north of OH 9th Street in Cincinnati.

Once the southbound C-D roadway system in Ohio, new Ohio River Bridge and the approaches in Kentucky and Ohio are completed, southbound I-75 traffic would be diverted to the new, widened interstate, crossing the new bridge on the bottom deck, and utilizing the widened portion of the interstate in Kentucky. The new southbound I-71/I-75 connections to Covington would open. Northbound I-75 traffic would remain in its current location, leaving a large work area available to the contractor to construct new I-75 pavement and available ramp areas.

The final phase involves shifting northbound I-75 to its final location on the new Ohio River Bridge, which would allow the connections to Fort Washington Way and OH 2nd Street to be constructed. The rehabilitation of the existing Brent Spence Bridge would also occur during this phase. During this phase, most of the existing northbound I-75 ramps in Ohio and Kentucky would be accessible; however, all Ohio southbound I-75 exit ramps south of OH 7th Street would be closed. These include the ramps to OH 5th Street, Fort Washington Way, and OH 2nd Street. Ramps would be re-opened to traffic whenever possible as the work progresses.

6.8.8 Utilities

To mitigate temporary utility impacts, KYTC and ODOT will coordinate closely with the various utility owners in the study area throughout the design and construction phases of the project. Early coordination will decrease the chance of surprises during construction and will enable efficient phasing of the roadway, bridges, and utility work.

7.0 Construction Impact Analysis

Construction of the Brent Spence Bridge Replacement/Rehabilitation Project is anticipated to begin in 2014 and be complete by 2022. This section describes the potential conceptual construction phasing of the feasible alternatives as well as the anticipated temporary construction impacts on environmental resources. If an environmental resource is not specifically discussed in this section, it is anticipated to have minor impacts from construction activities. There would be no construction impacts with the No Build Alternative. Construction limits are identified in the plan set located in Appendix A.

7.1 Construction Phasing Plan

A conceptual construction phasing plan and maintenance of traffic plan were developed for the feasible alternatives to maintain traffic operations throughout the corridor and minimize disruption to the surrounding communities. Due to the complexity of the work and the large volume of traffic that utilizes the I-75 corridor, it was imperative to create a construction sequencing plan that minimizes disruption to interstate traffic. The needs for road closures, detours, temporary widening, and temporary roadways to maintain traffic flow were determined. The phasing plan presented in this section is one possible scenario based on many assumptions, which are the same for both Alternatives E and I. These assumptions included the creation of several contract packages for each state as listed below.

Kentucky:

- I-471 Widening and Ramp Modifications,
- Kyles Lane Bridge Replacement,
- Dixie Highway Bridge Replacement,
- New Bridge over the Ohio River,
- I-75 Reconstruction from MP 187.2 to MP 189.5,
- I-75 Reconstruction from MP 189.5 to the Southern Termini of the KY 12th Street Interchange,
- I-75 Reconstruction from the South Termini of the KY 12th Street Interchange to the New Bridge over the Ohio River and Existing Brent Spence Bridge, and
- Rehabilitation of the Existing Brent Spence Bridge.

Ohio:

- I-71/ I-471 Ramp Modifications,
- Linn Street Bridge Replacement and Gest Street Reconstruction,
- Ezzard Charles Drive Bridge Replacement; Western Avenue Reconstruction; Freeman Avenue Interchange Reconstruction; Winchell Street Reconstruction; OH 9th Street Northbound Entrance Ramp; and the Court Street Cul-de-sac Construction,
- 7th/8th/9th Street Interchange Reconstruction and the OH 6th Street Northbound Entrance Ramp,
- I-75 Reconstruction from Findlay Street to the Northern Terminus of the Corridor and the Western Hills Viaduct Interchange Reconstruction,
- I-75 Reconstruction from North of Linn Street to Findlay Street, and
- I-75 Reconstruction from the New Bridge Over the Ohio River and the Existing Brent Spence Bridge to North of Linn Street.

The first phase of construction involves the modification of the ramps to I-71 and I-471, as well as the widening of I-471, to support detours and lane shifts in later phases. As part of the detour for the I-75 corridor reconstruction, I-71 traffic would be diverted to I-471 utilizing I-275 in Kentucky.

The second phase of construction includes replacement of overpass bridges (i.e., Kyles Lane Bridge, Dixie Highway Bridge, and Linn Street Bridge) to accommodate the widening of I-75 corridor. The overpass bridges can be designed and constructed quickly, with minimal disruption to existing I-75 corridor traffic. The second phase also includes reconstruction of the Western Hills Viaduct and of local routes such as Gest Street; Winchell Street; and the Court Street cul-de-sac.

The third and fourth phases of construction include the new Ohio River Bridge and the approaches in Kentucky and Ohio. Once these elements are completed, southbound I-75 traffic would be diverted to the new, widened interstate, crossing the new bridge on the bottom deck, and utilizing the widened portion of the interstate in Kentucky. Northbound I-75 traffic would remain in its current location, leaving a large work area available to the contractor to construct new I-75 pavement and available ramp areas.

The fifth and final phase involves shifting northbound I-75 to its final location on the new Ohio River Bridge, which would allow the connections to Fort Washington Way and OH 2^{nd} Street to be constructed. The rehabilitation of the existing Brent Spence Bridge would also occur during this phase. Exhibit 11 and Exhibit 12 map the recommended Kentucky and Ohio contracts respectively.

8.0 Maintenance of Traffic Analysis

The Maintenance of Traffic Analysis (MOTA) report will be submitted under a separate cover during the next phase of the project. A general MOT phasing plan is included in Appendix H. A brief summary of what is anticipated as part of the MOTAA is provided below.

Once work begins in mainline I-75, it is critical to manage the maintenance of traffic (MOT) operations between other projects that are taking place along I-75 and between the two states of Kentucky and Ohio. The maintenance of traffic developed for this corridor reconstruction necessitates the coordination along the entire eight mile corridor length.

The general MOT plan involves constructing the western portion of the corridor first, including the new bridge over the Ohio River. The new bridge is on the project's critical path, as its construction may exceed three years. This work on the western portion of the corridor also includes replacing and lengthening the overpasses if they were not constructed in an earlier package. Once the western portion has been constructed, southbound I-75 traffic will be diverted to the widened area, crossing the new bridge on the bottom deck, and utilizing the widened portion in Kentucky. Northbound I-75 traffic will remain in its current location, leaving a large work area available to the contractor to construct new I-75 pavement and available ramp areas. The final phase involves shifting northbound I-75 to its final location on the new Ohio River Bridge, allowing the construction of the connections to Fort Washington Way (FWW) and OH 2^{nd} Street, in addition to the rehabilitation of the existing Brent Spence Bridge.

Due to the complexity of the above mentioned operations, it was necessary to explore delivery options for each state. Components of the recommended delivery options for each state are listed as follows:

<u>Ohio</u>

1. Procure a Project Management Support Consultant for coordination, scheduling, cost estimating, and risk management, among other duties
2. Procure Design Section Consultants to design each contract package
3. Procure Construction Inspection Consultants
4. Procure Construction Section Contractors

<u>Kentucky</u>

5. Utilize KYTC staff for Design Section Management
6. Procure Design Section Consultants
7. Procure Construction Management Consultants
8. Procure Construction Section Contractors

These recommendations were developed to address the complexities of the corridor reconstruction, but also the existing staffing levels of each state. They recognize the complexities of utility impacts and relocation, right of way acquisition, and environmental coordination. It also seeks to address the need for a fully staffed construction inspection and QA/QC program.

The necessity of a bi-state management team is evident due to the massive coordination required in terms of funding acquisition; project lettings/sales; and phasing coordination. This management teamed must work as a unit to ensure the smooth transfer of information and opportunity. It is also essential to proactively address community/stakeholder involvement and communication.

8.1 Phasing Plan

The Brent Spence Bridge is part of the larger I-75 Improvement Program which extends from south of Dixie Highway in Kentucky to I-275 in Ohio. This program is subdivided into three major projects; the Mill Creek Expressway project, the Thru the Valley project, and the Brent Spence Bridge Replacement/Rehabilitation project. These Kentucky and Ohio projects are being developed under the Ohio Department of Transportation's (ODOT's) Major Project Development Process (PDP) and will utilize phased construction. The Mill Creek Expressway project will be constructed first, the Thru the Valley project will be constructed second, and the Ohio portion of the Brent Spence Bridge is third. Ohio may choose to complete portions of these other projects as the cost for the entire project areas may exceed current and foreseeable budgets. The construction sequencing for each of these programs of projects will need to be coordinated. Maintenance of traffic, lane continuity, and geometric design may dictate sensible construction termini that are different from the termini used for the planning and preliminary design efforts. Kentucky may begin its portion of the Brent Spence Bridge corridor at a different time due to budget constraints in Kentucky's Six-Year Transportation Plan. It is critical that phasing and connections of the main span with the Kentucky and Ohio approaches be coordinated between the two states. The delivery method should have a strong foundation in community awareness, maintenance of traffic, constructability, and safety.

Creative phasing allows for less complicated maintenance of traffic plans, while improving the interim performance and operational nature of the I-71/I-75 corridor. Building the entire Brent Spence Bridge corridor program in one phase would shorten the amount of time the public is affected; however, available funds may not permit this approach. Further refinements in the staging of the work will develop details of the phasing and funding plans, as well as coordination with the larger I-75 corridor. The integration and coordination of all I-75 construction projects is recommended.

9.0 Cost Estimates

The 2010 construction cost estimates were prepared as outlined by the Ohio Department of Transportation's (ODOT's) *Procedure for Construction Budget Estimating* (May 2010) and by use of the Transport Estimator, Version 2.5a, with 2010 catalogs. The inflation cost percentage was calculated as outlined by ODOT's *Procedure for Construction Budget Estimating* (May 2010) utilizing the FY10'-11' Business Plan Inflation Calculator. For the inflation cost percentage calculations, the date of July 22, 2010 was used for the Estimation Start Date with the mid-point of construction year based on anticipated contract dates. Based on these dates, the semi-annually compounded growth inflation cost percentage was calculated for the project. The inflation cost percentage is noted as Contingency on the cover page of the cost estimates in Appendix I as per the ODOT's procedures.

For quantity takeoff purposes, the project corridor was divided into contract segments (Exhibit 11 and Exhibit 12) consisting of eight segments in Kentucky and seven segments in Ohio. No costs were calculated for KY 1 as that segment is being developed beyond the scope of this project. One contract segment in Ohio has been split into two separate contracts (OH-1 and OH-1A).

The estimated quantities were calculated by manual take-offs from scale drawings and electronic CADD files utilizing plans and the associated cross sections of each conceptual alternative. The number of new lanes and shoulders determined the proposed work limits. In transition areas where the number of lanes changes, the cross sections were averaged and multiplied by the distance between the stations where the cross sections begin and end. The numbers of existing lanes and shoulders were counted to determine the demolition quantities. Each alternative was reduced into the item numbers and cost item descriptions from the current ODOT Construction Estimator database. The unit prices and quantities for each alternative are shown in Appendix I.

9.1 Alternative E

The total estimated project costs for Alternative E are construction costs which include a design contingency, a construction inflation factor based on median construction date for each construction contract, right of way for roadway and utility relocations, major utility, and project development costs Table 9-1. The associated costs for the new Ohio River Bridge, rehabilitation of the existing Brent Spence Bridge, and the Western Hills Viaduct Interchange SPUI and Tight Diamond options are also included in the costs for Alternative E. The total cost for Alternative E with the SPUI at the Western Hills Viaduct (WHV) is $2,745.1 million.

9.2 Alternative I

The total estimated project costs for Alternative I are construction costs which include a design contingency, a construction inflation factor based on median construction date for each construction contract, right of way for roadway and utility relocations, major utility, and project development costs Table 9-2. The associated costs for the new Ohio River Bridge, rehabilitation of the existing Brent Spence Bridge, and the Western Hills Viaduct Interchange SPUI and Tight Diamond options are also included in the costs for Alternative I. The total cost for Alternative I with the Tight Diamond Interchange design at the Western Hills Viaduct is $2,483.6 million.

Table 9-1. Total Cost Estimates for Mainline Alternative E in Projected Build Year Dollars

Component	Construction Costs (millions)	Construction Costs Inflation (millions)	Real Estate Costs (millions)	Utility Costs (millions)	Project Development Costs (millions)	Total Estimated Costs (millions)
Kentucky	$393.4	$222.3	$25.3	-	$59.2	$700.2
Ohio	$518.8	$278.2	$21.4	$93.0	$60.2	$971.6
WHV-SPUI	$160.1	$82.1	$4.6	$0.2	$22.6	$269.6
WHV-Tight Diamond	$84.8	$43.5	$1.3	$0.2	$12.0	$141.8
Existing Bridge	$40.6	$26.6	-	-	$6.3	$73.5
New Bridge	$474.2	$194.4	-	-	$61.6	$730.2
Totals						
Alt E with SPUI	$1,587.1	$803.6	$51.3	$93.2	$209.9	$2,745.1

Table 9-2. Total Cost Estimates for Mainline Alternative I in Projected Build Year Dollars

Component	Construction Costs (millions)	Construction Costs Inflation (millions)	Real Estate Costs (millions)	Utility Costs (millions)	Project Development Costs (millions)	Total Estimated Costs (millions)
Kentucky	$362.3	$204.4	$20.2	-	$54.5	$641.4
Ohio	$474.5	$255.8	$18.3	$93.0	$55.1	$896.7
WHV-SPUI	$160.1	$82.1	$4.6	$0.2	$22.6	$269.6
WHV-Tight Diamond	$84.8	$43.5	$1.3	$0.2	$12.0	$141.8
Existing Bridge	$40.6	$26.6	-	-	$6.3	$73.5
New Bridge	$474.2	$194.4	-	-	$61.6	$730.2
Totals						
Alt I with Tight Diamond	$1,436.4	$724.7	$39.8	$93.2	$189.5	$2,483.6

9.2.1 Right of Way Cost

Right of way cost estimates for both Kentucky and Ohio were done in accordance with Ohio's Office of Real Estate Guidelines with the exception of damages. Real property values utilized for this cost estimate were developed based upon appraised value indications from the Hamilton County Auditor's (Ohio) and Property Valuation Administrator's (Kentucky) records in the appropriate jurisdictions. The cost estimates are not of sufficient detail to be used for acquisition estimates, but are used as a benchmark to prepare the relative real estate costs between the conceptual alternatives. No actual appraisals were conducted. All valuations were created using readily available tax records. No entry to the property was allowed. An inflation factor was applied to the real estate costs.

The total new right of way required for Alternative E is 41.96 acres (28.76 acres in Kentucky and 13.2 acres in Ohio) including the SPUI option at WHV. The total new right of way required for Alternative I is 35.53 acres (24.88 acres in Kentucky and 10.65 acres in Ohio), including the TUDI at WHV. Right of way cost estimates were broken down by construction contract and by state, and include labor costs, non-labor costs, and inflation. The total right of way cost for Alternative E would be $51,331,000 ($25,284,000 for Kentucky and $26,047,000 for Ohio). Detailed right of way costs broken up by construction contract are provided in Table 9-3 for Kentucky and Table 9-4 for Ohio. The total right of way cost for Alternative I would be over ten million dollars less than that of Alternative E at: $39,798,000 ($20,204,000 for Kentucky and $19,594,000 for Ohio). Detailed right of way costs broken up by construction contract are provided in Table 9-5 for Kentucky and Table 9-6 for Ohio.

Table 9-3. Right of Way Costs – Alternative E – Kentucky

Construction Contract	Total Labor	Total Non-Labor	Inflation	Total Right of Way Costs
KY-5	$353,000.00	$4,728,000	$417,000	$5,498,000
KY-6	$192,000.00	$3,674,000	$317,000	$4,183,000
KY-7	$1,273,000.00	$13,148,000.00	$1,182,000	$15,603,000
Kentucky Total:				**$25,284,000**

Table 9-4. Right of Way Costs – Alternative E – Ohio

Construction Contract	Total Labor	Total Non-Labor	Inflation	Total Right of Way Costs
OH-2	$27,000	$112,000	$8,000	$147,000
OH-3	$21,000	$9,000	$2,000	$32,000
OH-4	$36,000	$7,325,000	$449,000	$7,810,000
OH-5	$772,000	$3,497,000	$350,000	$4,619,000
OH-7	$357,000	$12,059,000	$1,018,000	$13,434,000
Ohio Total:				**$26,042,000**

Table 9-5. Right of Way Costs – Alternative I – Kentucky

Construction Contract	Total Labor	Total Non-Labor	Inflation	Total Right of Way Costs
KY-5	$353,000	$4,728,000	$417,000	$5,498,000
KY-6	$192,000	$3,674,000	$317,000	$4,183,000
KY-7	$895,000	$8,831,000	$797,000	$10,523,000
Kentucky Total:				**$20,204,000**

Table 9-6. Right of Way Costs – Alternative I – Ohio

Construction Contract	Total Labor	Total Non-Labor	Inflation	Total Right of Way Costs
OH-2	$9,000	$9,000	$1,000	$19,000
OH-3	$36,000	$3,000	$2,000	$41,000
OH-4	$22,000	$4,270,000	$262,000	$4,554,000
OH-5	$159,000	$1,037,000	$98,000	$1,294,000
OH-7	$379,000	$12,270,000	$1,037,000	$13,686,000
Ohio Total:				**$19,594,000**

9.2.2 Utility Cost

The costs for utility relocations will be calculated by KYTC District 6 and ODOT District 8 and added to the utility cost estimates. As a supplement to ODOT calculations of utility costs, the Project Team has received preliminary utility relocation costs from public utility companies. The Project Team reviewed the provided utility relocation costs with the alternatives and included appropriate costs in the estimated costs. Table 9-7 summarizes the utility costs by utility company by construction contract.

Table 9-7. Cost by Utilities

Construction Cost	Utility Company	Correspondence Date	Estimated Costs	Mid-Year Construction	Inflation Rate	Total Cost with Inflation
OH-2	Cincinnati Bell	Aug-09	$87,000	Dec-15	29.2%	$112,000
	Metropolitan Sewer District	Mar-09	$520,000	Dec-15	29.2%	$672,000
OH-3	Metropolitan Sewer District	Mar-09	$178,000	Jul-16	32.9%	$237,000
OH-5	Cincinnati Bell	Aug-09	$159,000	Mar-19	51.3%	$241,000
OH-6	Cincinnati Bell	Aug-09	$808,000	Jan-20	57.6%	$1,273,000
	Metropolitan Sewer District	Mar-09	$605,000	Jan-20	57.6%	$953,000
OH-7	AT&T Fiber Optic	Jun-09	$33,685,000	Jan-20	57.6%	$53,088,000
	Duke Energy Electric	May-10	$31,150,000	Jan-13	11.6%	$34,763,000
	Cincinnati Bell	Aug-09	$1,175,000	Jan-20	57.6%	$1,852,000

The Project Team has been in close coordination with Duke Electric and Duke Transmission Group regarding their facilities located along the western side of the I-71/I-75 corridor. As a result of this coordination, Duke Electric and Duke Transmission Group completed an assessment of the costs and relocation impacts.

The real estate utility costs have been included in the right of way cost for each contract segment.

9.2.3 Project Development Cost

In order to completely include all project costs in the estimates, project development costs, which consist of detailed design and construction management, are included. In Kentucky, the detailed design cost is calculated to be eight percent of the construction cost (2010 dollars) adjusted for three percent inflation compounded to mid-year design. In Ohio, the detailed design costs are calculated, using three to ten percent (per ODOT) of the construction coast (2010 dollars) with no inflation adjustment. The construction management cost is calculated at three percent of the construction cost including inflation adjusted for three percent inflation compounded to mid-year of construction for both Ohio and Kentucky. Table 9-8 summarizes the project development costs.

Table 9-8. Project Development Costs (in millions)

Alternative	Detail Design 3 - 10% of Construction Costs[1]	Construction Management 3% compounded to mid year construction[2]	Total Project Development Costs
Alternative E Kentucky	$34.4	$24.8	$59.2
Alternative I Kentucky	$31.7	$22.8	$54.5
Alternative E Ohio	$28.5	$31.7	$60.2
Alternative I Ohio	$26.0	$29.1	$55.1
Western Hills Viaduct - SPUI	$12.8	$9.8	$22.6
Western Hills Viaduct - Tight Diamond	$6.8	$5.2	$12.0
New Ohio River Bridge - Alternative 1	$32.7	$21.1	$53.8
New Ohio River Bridge - Alternative 3	$36.1	$25.4	$61.5
New Ohio River Bridge - Alternative 6	$33.2	$24.6	$57.8
Rehabilitation of Existing Brent Spence Bridge	$3.5	$2.8	$6.3

1. Includes 3% inflation compounded to mid-year design
2. Includes 3% inflation compounded to mid-year construction

9.3 Schedule

Key dates for the Brent Spence Bridge Replacement/Rehabilitation Project activities are:

- Access Point Request
  - Prepare Access Point Request Report - August 2010
  - FHWA Review and Comment - 2011
  - ODOT/KYTC/FHWA Approval - 2011
- Environmental Assessment
  - FHWA Review and Approval - 2011
  - Prepare Notice of Availability (NOA) - 2011
  - Publish NOA - 2011
- Hold Concurrence Point
  - Prepare and Hold public hearing - 2011
- Finding of No Significant Impact (FONSI)
  - Development Draft of FONSI - 2011
  - FHWA Review and Approval - 2011
  - FHWA Issues FONSI - 2011

The detail design and construction schedule will be finalized upon issuing of the FONSI. The Brent Spence Bridge Replacement/Rehabilitation Project corridor has been divided into multiple design and construction contract packages as described in Section 7.1. Tentative dates are:

- Begin Detailed Design - 2011
- Right of Way Acquisition Start - November 2012
- Right of Way Acquisition End - October 2014
- Begin Construction - April 2014
- End Construction - July 2022

10.0 Comments and Coordination

10.1 Public Involvement

Public participation for the Brent Spence Bridge Replacement/Rehabilitation Project has been in accordance with the Ohio Department of Transportation's (ODOT's) Major Project Development Process (PDP). Public involvement was initiated in Step 1 of the PDP and will continue through to Step 14 of the process. In Kentucky, public involvement has been in accordance with the Kentucky Transportation Cabinet's (KYTC's) Project Delivery Core Process. Public involvement was initiated during the Transportation Decision Making Process and will continue through project development. All public involvement activities are communicated to, approved by, and coordinated through the project managers for KYTC and ODOT.

A Public Involvement Plan (PIP) was prepared for the Brent Spence Bridge Replacement/Rehabilitation Project for Steps 1 through 4 of the PDP, and updated in Step 5. KYTC and ODOT recognize that a proactive, effective communications effort will enhance this project's outcome. Soliciting ideas and input from stakeholders and residents will provide the constructive feedback necessary for the successful implementation of needed transportation improvements. A coordinated communications program also educates the public on the long-term benefits of the infrastructure improvements under consideration, such as increased travel safety and improved mobility.

All informational materials are updated as new information becomes available to keep information accurate and to ensure up-to-date communication is being maintained. Since public involvement is a fluid process, all communication tools used in this plan must remain flexible to meet the changing needs of the Advisory Committee and the general public. The following lists a summary of the public involvement activities that have taken place:

- Establishment of project identity,
- Establishment of an Advisory Committee,
    - Advisory Committee meetings
    - Advisory Committee survey
- Establishment of an Aesthetic Committee,
- Identification and engagement of environmental justice populations,
- Stakeholder meetings,
- Community meetings and presentations,
- Public meetings,
- Project newsletters and E-newsletters,
- Website coordination,
- Media relations,
- Project fact sheets, and
- Roving information display

10.1.1 Public Meetings

A series of public meetings have been held for both Concurrence Point #1 to present the work completed in Steps 1 through 4 of the PDP and for Concurrence Point #2 to present the work completed up through Step 5 of the ODOT PDP.

Two public meetings were held for Concurrence Point #1 on May 2 and 4, 2006. These public meetings were held to present work completed in Steps 1 through 4 of the PDP. The purpose of the meetings was to inform the public about the Purpose and Need Statement, Red Flag Summary, Existing and Future Conditions, and Conceptual Alternatives Solutions.

Based on the public comments received, there was a general consensus that improvements are needed in the I-71/I-75 corridor. The comments provided by the public and community representatives from Concurrence Point #1 were used to refine the conceptual alternatives throughout Step 5. A summary of Concurrence Point #1 and public comments received are available in the Conceptual Alternatives Study (April 2009).

Two meetings were held for Concurrence Point #2 on May 6 and 7, 2009 to present the conceptual alternatives for the project. These meetings presented the feasible alternatives recommended for further study and the results of this Conceptual Alternatives Study.

The next round of public meetings will be conducted as part of Steps 6 and 7 of the PDP. The focus of the meetings will be the selection of the recommended Preferred Alternative for the alignment and the new bridge crossing over the Ohio River. Public comments will be solicited during these meetings and a public comment period will follow the meetings.

10.1.2 Public Comments

During Steps 6 and 7 of the PDP, the public was asked to comment on the bridge types developed for the project. KYTC's Bridge Type Selection Process was conducted for the new Ohio River Bridge to select the best design for the new Ohio River crossing.

10.1.3 Project Web Site

The project website established for the Brent Spence Bridge Replacement/Rehabilitation Project is www.brentspencebridgecorridor.com. The website has been active and media coverage of alternatives and other elements of the project have generated an increase in website visits and web comments. The website is updated to reflect the latest information and technical reports associated with the project development. The project website includes a feedback link that provides an opportunity for anyone to make comments and ask questions about the project.

10.1.4 Project Newsletters

Two traditional newsletters were prepared and distributed to approximately 250 individuals and organizations to date. The first newsletter was mailed in February 2006 and provided background, project purpose, contact information, project schedule, a list of Advisory Committee member organizations, and a map of the project study area. The second was mailed in January 2007 and provided details about the alternatives that were carried forward through Step 4.

E-Newsletters were developed to facilitate communications with the Advisory Committee between general mail newsletters, public meetings, and Advisory Committee meetings. The first E-Newsletter was sent out in June 2007 and the second in August 2007. A third was distributed in advance of the Concurrence Point #2 public meetings in May 2009. Since August 2009, E-newsletters have been distributed monthly.

10.1.5 Presentations

Project managers from KYTC and ODOT have met individually with local government officials, residential organizations, professional societies, and other interested parties in the greater Cincinnati-Northern Kentucky area to discuss the project, answer questions, and address concerns.

10.1.6 Advisory Committee

A total of six Advisory Committee meetings have been held to date. Three meetings were held during Step 5 of the PDP on July 27, 2006, February 25, 2008, and April 20, 2009. Agendas and meeting minutes for each Advisory Committee Meeting are posted to the project website.

The next Advisory Committee meeting has not been scheduled but will be held in 2011.

10.1.7 Aesthetic Committee

Two Aesthetic Committee meetings were held during Steps 1 – 5 of the PDP. The first meeting was held on December 16, 2005 and the second on August 29, 2006. Agendas and meeting minutes for each Aesthetic Committee meeting are posted to the project website.

Three Aesthetic Committee meetings were held during Steps 6 and 7 of the PDP. These meetings focused on KYTC's Bridge Type Selection Process conducted for the new Ohio River Bridge to select the best design for the new Ohio River crossing. The Bridge Type Selection Process is a three step process, which involves developing and analyzing numerous bridge concepts leading to a recommendation of three final bridge type alternatives. The meetings were held on September 25, 2009, January 29, 2010, and April 15, 2010.

10.2 Coordination

10.2.1 Agency Coordination

An important element of the environmental process is the integration of the National Environmental Policy Act (NEPA) with other planning and environmental review procedures required by law or agency practice (i.e. Section 106 of the National Historic Preservation Act). KYTC, ODOT, and the FHWA have entered into agreements with federal and state resource agencies in an effort to standardize procedures for environmental investigations and project reviews, streamline the review process, and develop mitigation measures (Table 6-1).

10.2.2 Railroad Coordination

The existing rail lines in the project area include:

- CSX Transportation,
- Norfolk Southern,
- Indiana and Ohio (I&O), and
- Amtrak (passenger rail).

CSX Transportation and Norfolk Southern have classification and intermodal yards in the Queensgate area of Cincinnati. CSX Transportation's Queensgate Yard has the capacity for 4,000 rail cars, and is one of the busiest freight rail yards in the Midwest.

CSX Transportation and Norfolk Southern have lines that parallel I-75. Two other railroads, Amtrak and the Indiana and Ohio Railway have "trackage rights" over these rail lines. More than 90 trains per day use the tracks in this corridor. Even though the two major railroads are competitors, they have a special operating agreement that allows each railroad to use the other's tracks due the rail congestion issues in this corridor.

Initial coordination with railroad companies provided the following clearance information:

- The required minimum overhead clearance is 23 feet, and
- The required minimum lateral clearance (from centerline of track) is 25 feet, less would require crash walls.

No additional railroad coordination has been conducted throughout the project development process because the railroads will not be impacted by the project.

10.2.3 Future Light Rail Coordination

Planning for regional light rail was developed as part of the *North-South Transportation Initiative* (2004). The planned regional light rail line would follow the I-75 corridor and provide service to Cincinnati and northern Kentucky. It is anticipated that light rail would use the Clay Wade Bailey Bridge to cross the Ohio River and not the Brent Spence Bridge, however each of the feasible alternatives has been designed to not preclude light rail in the future as identified in the rail plan.

10.2.4 Utility Coordination

Coordination with utility companies was initiated in 2006. The following 13 utility companies have been identified as having facilities in the study area:

- AT&T Fiber Optics,
- Cincinnati Bell (telephone),
- Cincinnati Water Works,
- Duke Energy (gas and electric),
- Insight Communications,
- Level 3 Communications, LLC,
- MCI/Verizon Fiber Optic,
- Metropolitan Sewer District (Greater Cincinnati),
- Northern Kentucky Water District,
- Qwest National Network Services,
- Sanitation District Number 1 (Northern Kentucky),
- Sprint Fiber Optic, and
- Time Warner Cable.

A utility coordination meeting was held on March 16, 2006. The purpose of the meeting was to provide initial project information and to begin coordination between the Project Team and utility companies. The result of the meeting led to the formation of a utility coordination team consisting of utility and Project Team representatives that will continue to coordinate preliminary engineering to ensure that no loss of service occurs during construction or operation. ODOT sent out letters to all utility companies on March 2, 2009 depicting potential utility impacts. In the March 2, 2009 letter, ODOT requested the utility companies provide back an estimate of the cost to relocate their facilities.

The Project Team has continued coordination with the utility companies since the March 16, 2006 meeting. A summary of the utility coordination conducted for the project is provided in Table 10-1. Additional utility coordination information is available in Appendix E.

Table 10-1. Utility Coordination

Date	Description
August 21, 2009	Meeting with Sanitation District Number 1
October 16, 2009	Meeting with Duke Energy
October 26, 2009	Meeting with Duke Gas
November 16, 2009	Meeting with Metropolitan Sewer District
December 9, 2009	Meeting with Duke Energy
March 14, 2010	Meeting with Duke Energy
April 6, 2010	Meeting with Duke Energy
April 12, 2010	Meeting with Sanitation District Number 1
April 14, 2010	Meeting with Duke Energy

11.0 Conclusions and Recommendations

11.1 Summary of Alternatives

11.1.1 No Build Alternative

The No Build Alternative is retained as a baseline for evaluation of the feasible alternatives. The No Build Alternative consists of minor, short-term safety and maintenance improvements to the Brent Spence Bridge and I-75 corridor, which would maintain continuing operations.

The No Build Alternative does not address any of the Purpose and Need elements. It would not improve traffic flow or level of service (LOS), improve safety, correct geometric deficiencies, or improve connections to key local, regional, and national transportation corridors. Because the No Build Alternative would not correct the geometric deficiencies that currently exist throughout the corridor, congestion would continue to worsen, causing traffic flow problems. Additionally, safety concerns would remain since the areas that have high crash rates would not be improved. Most segments of the No Build Alternative would have a failing LOS (E or F) in 2035 or sooner. While the No Build Alternative would allow for existing connections to local, regional and national transportation corridors to be maintained, these connections would not be upgraded to current design standards, and therefore would leave the majority of ramp connections with a failing level of service.

No additional right of way is needed for the No Build Alternative. The No Build Alternative does not impact any wetlands, streams, woodlots, or threatened and endangered species. The Ohio River is not impacted by this alternative. The No Build Alternative would not impact cultural or Section 4(f) resources.

The No Build Alternative would not impact community cohesion and community resources. The No Build Alternative would not impact any social clusters in the study area. The No Build Alternative would not have an impact on environmental justice populations. Land use would remain unchanged and future land use plans would not be affected with the No Build Alternative. The No Build Alternative would not result in any residential, business, or utility displacements and would not change any patterns or accessibility.

The No Build Alternative would have noise impacts in both Kentucky and Ohio. In 2035, noise levels for the No Build Alternative would approach or exceed the Noise Abatement Criteria (NAC) of 66 dBA (Category B) at all receptor locations in Kentucky and Ohio. Noise levels for the No Build Alternative will approach or exceed the NAC of 71 dBA (Category C) at all but six noise receptors in Kentucky. In Ohio, all but eight receptors will approach or exceed the FHWA NAC of 71 dBA.

No public or agency comments in support of the No Build Alternative have been received to date.

There are no right of way acquisition or construction costs associated with the No Build Alternative.

11.1.2 Alternative E

Alternative E would provide a new bridge alignment just west of the existing Brent Spence Bridge. Alternative E would provide two direct access points to Covington in the northbound direction and one in the southbound direction. In the northbound direction, access would be provided by the local collector-distributor (C-D) roadway at KY 12th Street and KY 5th Street. In the southbound direction, access would be provided by the local C-D roadway, off of I-71 and I-75 at KY 9th Street. Access to the interstate system from Covington would be provided by local city streets. In the northbound direction, access to I-75 would be provided at KY 9th Street, access to I-71 would be provided Crescent Avenue utilizing a loop ramp. Access to I-75 northbound would also be provided at KY 4th and Street through the local C-D roadway across the lower deck of the existing Brent Spence Bridge. In the southbound direction, access to I-71/I-75 would be provided at KY 12th Street.

All access to downtown Cincinnati from I-75 would be provided by a C-D roadway that would require a decision point outside of the downtown area, KY 12th Street for northbound traffic and Ezzard Charles Drive for southbound traffic. Access from the northbound C-D roadway is provided at OH 2nd, 5th, and 8th streets, and Ezzard Charles Drive/Winchell Avenue. Access from the southbound C-D roadway is provided at OH 7th, 5th, and 2nd streets. Access to I-75 northbound would be provided at OH 4th Street through the local C-D roadway and at OH 6th and 9th streets through Winchell Avenue. Southbound I-75 access would be provided at Western Avenue, OH 8th Street, and OH 4th Street through the local C-D roadway across the upper deck of the existing Brent Spence Bridge.

The Western Hills Viaduct Interchange will be reconfigured to provide a full movement interchange to improve safety and traffic flow and increase capacity around the interchange. The interchange reconfiguration will also eliminate the left-hand exit from I-75 northbound. A single point urban interchange (SPUI) alternative and a tight urban diamond interchange (TUDI) alternative were developed for the WHV Interchange. While the SPUI is included with Alternative E, the geometric layout of either interchange would work with either Alternative E or Alternative I.

11.1.3 Alternative I

Alternative I would provide a new bridge just west of the existing Brent Spence Bridge similar to Alternatives E. Alternative I would provide interstate access to both Covington and Cincinnati and provide a separation of local and regional traffic in both downtown areas through the use of C-D roadways. Access into Covington from the interstate would be provided by the local C-D roadway at KY 12th Street for northbound traffic and at KY 5th and 9th streets for southbound traffic. Direct access to the interstate system from Covington would be provided at Pike Street for I-71 northbound traffic and at KY 12th Street for southbound traffic. Access would be provided by the local C-D roadway to I-71 and I-75 northbound traffic at Pike Street and from KY 4th Street.

All access to downtown Cincinnati from I-75 would be provided by a C-D roadway that will require a decision point outside of the downtown area, KY 12th Street for northbound traffic and Ezzard Charles Drive for southbound traffic. Access from the northbound C-D roadway would be provided at OH 2ndand 5th streets, and Ezzard Charles Drive/Winchell Avenue. Access from the southbound C-D roadway would be provided at OH 7th, 5th, 3rd, and 2nd streets. Access to I-75 northbound would be provided at OH 3rd with direct access to I-75 with additional access at OH 4th Street through the local C-D roadway, and at OH 6th and 9th streets through Winchell Avenue. Southbound I-75 access would be provided at Western Avenue, OH 9th Street, and OH 3rd Street through the local C-D roadway across the lower deck of the new Ohio River Bridge.

The Western Hills Viaduct Interchange will be reconfigured to provide a full movement interchange to improve safety and traffic flow and increase capacity around the interchange. The interchange reconfiguration would also eliminate the left-hand exit from I-75 northbound. A single point urban interchange (SPUI) alternative and a tight urban diamond interchange (TUDI) alternative were developed for the WHV Interchange. While the TUDI is included with Alternative I, the geometric layout of either interchange would work with either Alternative E or Alternative I.

11.2 Preferred Alternative Recommendation

Both Alternatives E and I would provide greater operational improvements over the No Build Alternative due to the operations provided by their design and the capacity expansion of the additional lanes for the freeway mainline. While both feasible alternatives are better operationally than the No Build Alternative, their design, connection points and operations are different from each other.

The design features of Alternative I would provide a better freeway system from the traffic operations perspective compared to Alternative E. Alternative I contains only one location where the level of service is below LOS D. This location is northbound I-71, where I-71 is restricted to two travel lanes and the LOS is E. Alternative E contains six freeway locations (four in Kentucky and two in Ohio) where the level of service is either LOS E or LOS F.

In Kentucky, Alternative I would provide a direct connection to KY 5th Street in Covington in the southbound direction, which Alternative E would not. Alternative E would provide a direct ramp connection in Covington to northbound I-71 and I-75. Alternative E would provide a ramp connection from the northbound C-D roadway to KY 5th Street.

In Ohio, Alternative I's design is based on a C-D system, which provides free-flow movements. For example, Alternative I would provide a direct connection via a C-D system in Ohio to northbound I-75 and I-71, which is free-flow. Alternative E's design is based on a service road system, which provides interrupted flow due to four signalized intersections

The primary differences between Alternatives E and I in Kentucky are that in the southbound direction, motorists in Alternative I can exit to KY 5th Street, but cannot in Alternative E. In the northbound direction motorists for Alternative E have a direct ramp access connection to I-71 and to I-75, but in Alternative I they only have direct access to I-75.

Alternatives E and I have similar impacts to ecological resources, community resources, hazardous material sites, and utilities. While the feasible alternatives have similar property impacts, Alternative I would have fewer displacements and requires slightly less acres. Both feasible alternatives would be compatible with existing land use plans, would support the Queensgate redevelopment plans, and help Cincinnati facilitate its economic renewal goals. Alternatives E and I differ in their impacts to Section 4(f) resources. Alternative E impacts more Section 4(f) resources than Alternative I. Overall, the impacts to these resources caused by Alternative E are more extensive than Alternative I.

Alternative E with the SPUI at the Western Hills Viaduct would cost more than Alternative I with a Tight Diamond interchange at the Western Hills Viaduct. The total cost for Alternative E with the SPUI at the Western Hills Viaduct is $2,721.9 million. The total cost for Alternative I with the Tight Diamond interchange design at the Western Hills Viaduct is $2,400.7 million.

Alternative I is recommended as the preferred alternative with the inclusion of the Western Hills Viaduct Tight Diamond Interchange Option 1, the Alternative I High Speed Exit Option, and Without OH 3rd Street/Clay Wade Bailey Bridge Connection Option. This recommendation is based on the design features, local access features, traffic operations, estimated costs, environmental impacts, and stakeholder coordination.

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