



# FINAL MALL ROAD INTERCHANGE CONNECTOR FEASIBILITY STUDY

BOONE COUNTY, KY | ITEM NO. 6-446.00 | MARCH 2020



IN PARTNERSHIP WITH





## EXECUTIVE SUMMARY

The Kentucky Transportation Cabinet (KYTC) initiated this Mall Road Interchange Connector Feasibility Study to examine a potential new connection between KY 237 (Pleasant Valley Road) and the Mall Road interchange (I-71/I-75 exit 180A) in northeastern Boone County. The US 42 corridor, accessed via the next I-71/I-75 interchange to the south (exit 180) operates over capacity causing drivers to experience severe traffic congestion, especially during peak commute hours. Recent and planned large-scale developments further impact regional traffic flows.

### *Study Background*

The objective of the study is to identify a representative solution for improved east-west connectivity and improved mobility for all modes, beginning at KY 237 extending through KY 842 (Hopeful Church Road) to the Mall Road interchange with I-71/I-75.

Transportation needs within the study area (**Figure ES-1**) include:

- **Limited east-west connections.** Beyond US 42, the nearest arterial connection to the north is 2.5 miles away at KY 18 (Burlington Pike); to the south, 2.0 miles of travel is required to reach KY 536 (Mt. Zion Road).
- **Congested traffic operations.** The US 42 corridor is over capacity with limited opportunities for capacity improvements without large-scale property impacts to adjacent businesses. High traffic volumes contribute to elevated crash rates throughout the corridor, particularly the high number of rear end collisions.
- **Continuing development.** Boone County is one of the fastest-growing counties in Kentucky, with continued development in the region expected to exacerbate the safety and congestion trends in the study area.

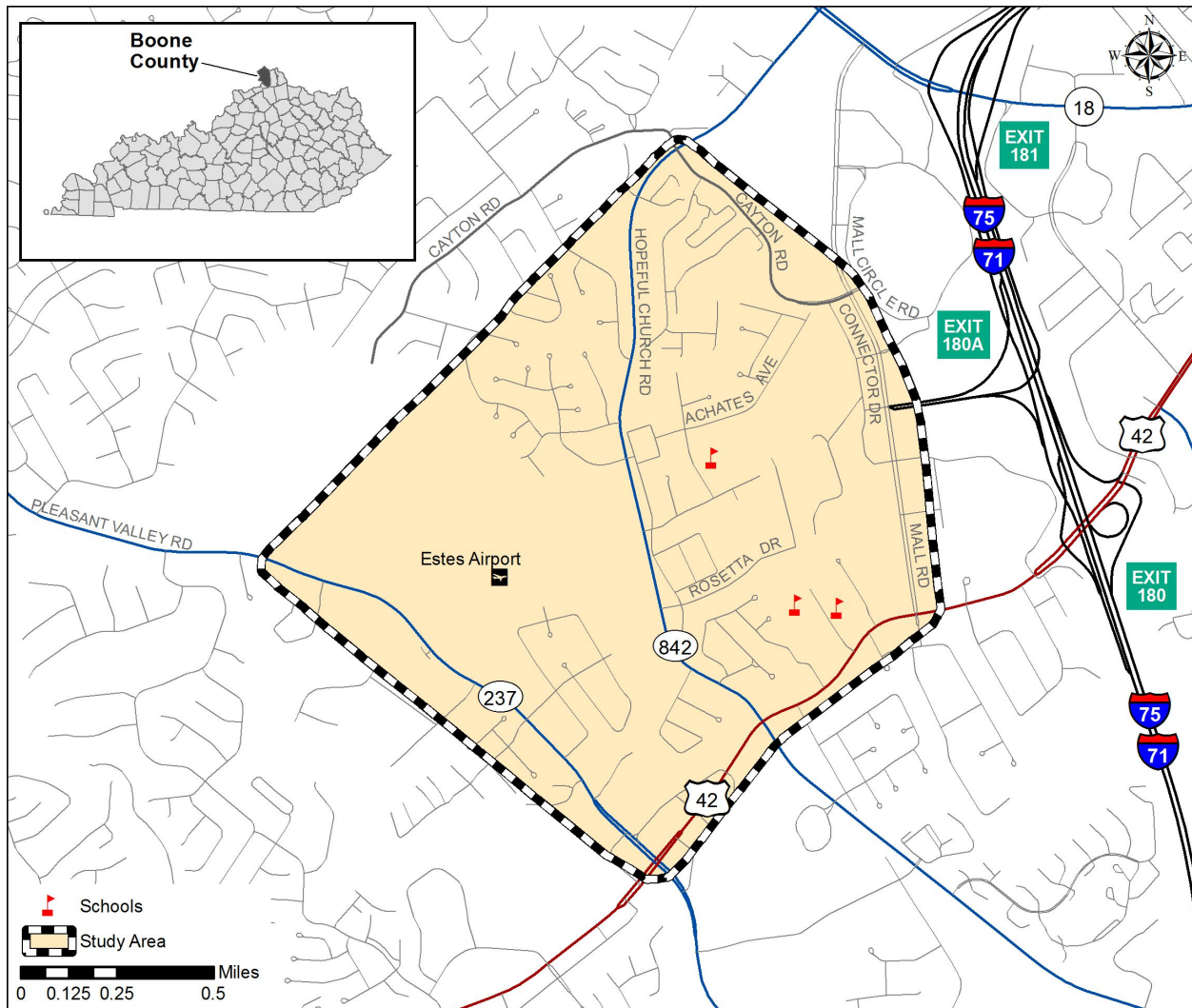
Two decades of studies along US 42 have determined major widening is necessary to accommodate peak traffic flows. This feasibility study examines a representative parallel route to estimate associated costs and impacts. Specifically, an east-west highway connection to the interchange is intended to alleviate congestion and safety issues along the built-out US 42 corridor.

Study tasks include creating an inventory of existing conditions, defining the study purpose, forecasting existing and future traffic, identifying red-flag environmental issues, developing build concepts with construction cost estimates, and documenting the study process and results.



*US 42 Congestion*





**Figure ES-1: Study Area Map**

### *Existing Conditions*

US 42 today has four 12-foot travel lanes, curb/gutter, sidewalks, and a 40-45 mph speed limit through the study area. It is part of the National Highway System and classified as an urban principal arterial, carrying 35,500 to 38,400 vehicles per day (vpd). Historic traffic counts show steady increases in traffic using the corridor since 2000. Average travel speeds decrease by 10 mph during the afternoon peak hour compared to overnight off-peak operations, which is another 10 to 15 mph below the posted speed limit.

During the course of the study, the US 42/KY 842 intersection was reconstructed as a “jug handle” style intersection (**Figure ES-2**), shifting left turns from the existing US 42/KY 842 intersection to the new Quadrant Road connector. Accordingly, five signalized study intersections in the existing scenario increased to six signalized study intersections in future year scenarios.





**Figure ES-2: New Jug Handle Layout at US 42/KY 842**

Level of Service (LOS) is a qualitative measure describing traffic conditions based on speed, travel time, freedom to maneuver, traffic interruptions, comfort, and driver convenience. It is rated on an A to F scale by density, with LOS A representing free-flow conditions through F representing oversaturated conditions with highly congested delays. Today, the five signalized study intersections along US 42 operate at LOS B-E during the AM peak hour and at LOS C-F during the PM peak hour.

Crash data for the five-year period from January 2014 through December 2018 were collected; 1,110 crashes were reported in the study area during the analysis period. US 42 data shows no fatalities, 68 injury collisions, and 573 property damage only crashes during this period. The majority of crashes were rear ends (54%) and angle/turning collisions (28%). Two crashes with bicycles and four pedestrian strikes were reported, with four (two bicycles and two pedestrians) clustered at the intersection with Mall Road. Statistical analysis shows numerous spots and segments along the corridor where reported crashes exceed expected rates.

#### *Future No-Build Traffic*

Future year traffic was generated using OKI's regional travel demand model, accounting for background socioeconomic growth predictions and committed transportation projects influencing regional traffic flows. In the 2045 No-Build scenario, US 42 volumes increase; the routes is projected to carry 51,000 to 56,000 vpd through the study area.

With the increased volumes, operational metrics continue to degrade. More turn movements operate at LOS F, particularly during the PM peak hour, with substantial queuing throughout the corridor. Overall, the six modeled intersections along US 42 operate at LOS C through F during the AM peak; all operate at LOS F during the PM peak.



### *Representative Concepts Considered*

Based on dense urban development patterns and other environmental constraints, KYTC explored a range of conceptual connector corridors throughout the study area. One general corridor emerged as an optimal location to minimize impacts: a representative parallel route on new alignment, intended solely as a baseline to estimate associated costs and impacts. From east to west, the representative alternative stretches from the Mall Road interchange, north of the Paddock Club Apartments, south along Surfwood Drive, then between the Villages of Florence and Boone Valley Estates neighborhoods to meet KY 237 approximately 900 feet northwest of the KY 237/Valleyview Drive intersection.

Within the corridor, two typical sections were examined as build alternatives:

- The three-lane build alternative includes one 12-foot travel lane per direction, a 14-foot two-way left-turn lane (TWLTL), curb/gutter, and 8-foot shared use paths on both sides.
- The four-/five-lane build alternative includes two 11-foot travel lanes per direction, a 9-foot grass median or 13-foot TWLTL, curb/gutter, and 8-foot shared use paths on both sides.

Plan views of the representative build alternatives are shown in **Figures ES-3** and **ES-4** on pages ES-5 and ES-6.

### *Future Build Traffic*

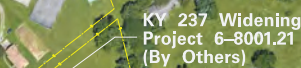
Again based on OKI's model, 2045 Build traffic forecasts were produced for each build scenario. Results show a three-lane alternative would carry an estimated 14,000 to 26,000 vpd with the higher volume on the eastern segment. By comparison, the four-/five-lane alternative would carry an estimated 21,000 to 32,000 vpd, suggesting the additional capacity of the wider alternative is warranted. US 42 volumes decrease by 4,000 to 10,000 vpd compared to the No-Build scenario.

Lower volumes along US 42 in the build scenarios lead to improved performance. Either build scenario results in similar LOS improvements for the congested corridor, shown in **Table ES-1**.

**Table ES-1: 2045 Intersection LOS along US 42 Corridor**

Intersection	AM Peak			PM Peak		
	No-Build	3-Lane	4/5-Lane	No-Build	3-Lane	4/5-Lane
US 42/KY 237	F	F	E	F	E	E
US 42/Harvey Quast Drive	D	B	B	F	C	C
US 42/Quadrant Road	D	B	B	F	B	B
US 42/KY 842	D	A	A	F	D	D
US 42/Ockerman Drive	C	C	C	F	D	D
US 42/Mall Road	E	D	D	F	F	F





An aerial photograph showing a coastal area. A yellow arrow points to a specific location on the shoreline, likely indicating the site of the study or a point of interest.



The Villages of Florence

An aerial photograph showing a proposed development site. A yellow line outlines a rectangular area on a grassy field. A yellow arrow points to a specific location within this area, likely indicating the proposed location of the building or structure.

Surlwood Drive

address  
rehouse

Commonwealth  
of Kentucky

Pep Boys - Manny Moe & Jack

— KY 237 Widening  
Project 6-8001.21  
(By Others)




**Boone  
Valley  
Estates**


842

City of Florence  
Public Services  
Maintenance Facility

Rosetta Drive



Ockerman  
Middle  
School



Ockerman  
Elementary  
School

**PLANNING CONCEPTS  
SUBJECT TO CHANGE**

### Figure ES-3: Three-Lane Build Concept

## MALL ROAD INTERCHANGE CONNECTOR FEASIBILITY STUDY 3-LANE CONCEPT

## PLANNING CONCEPTS SUBJECT TO CHANGE

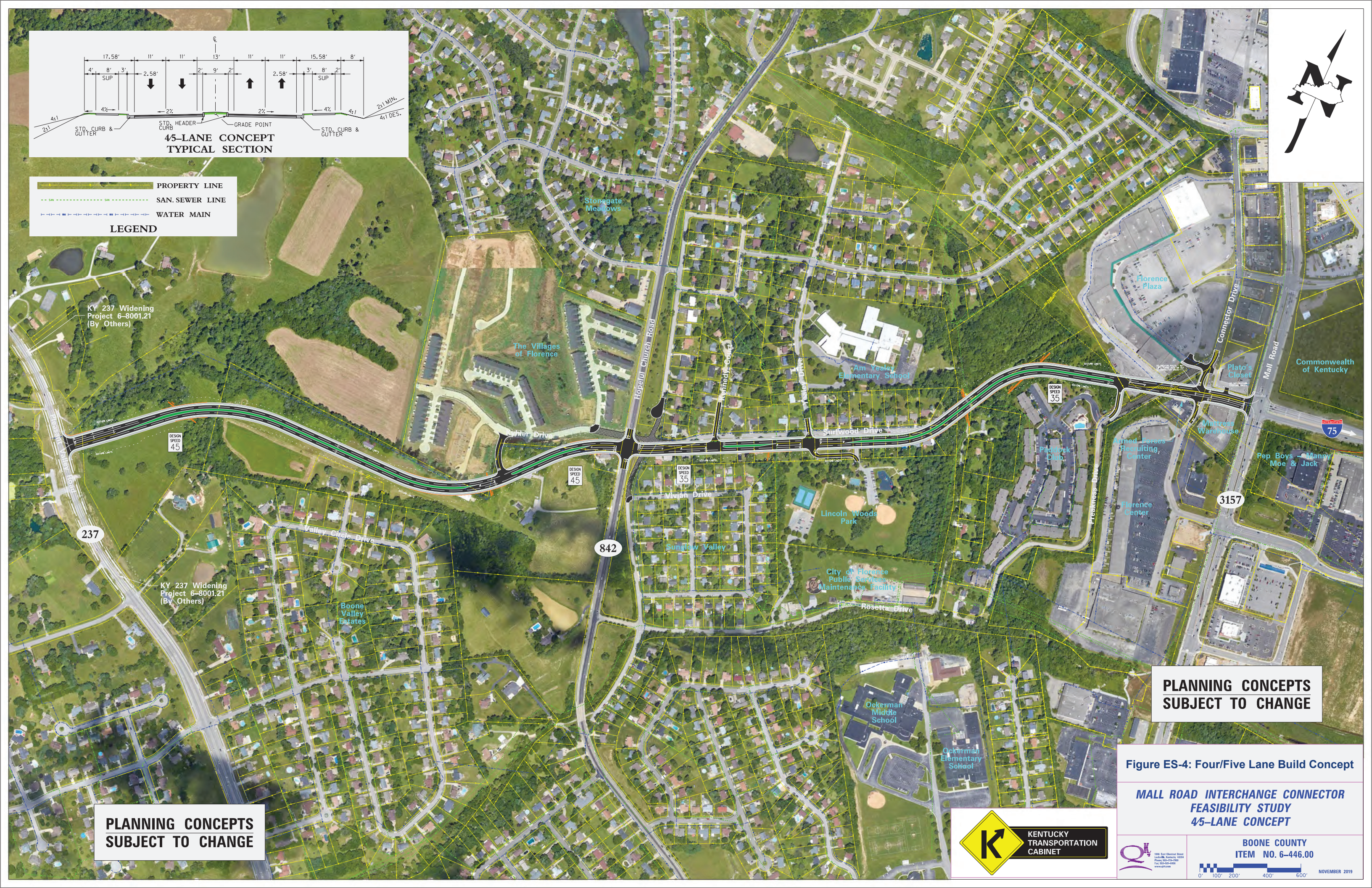
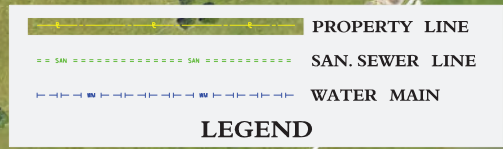
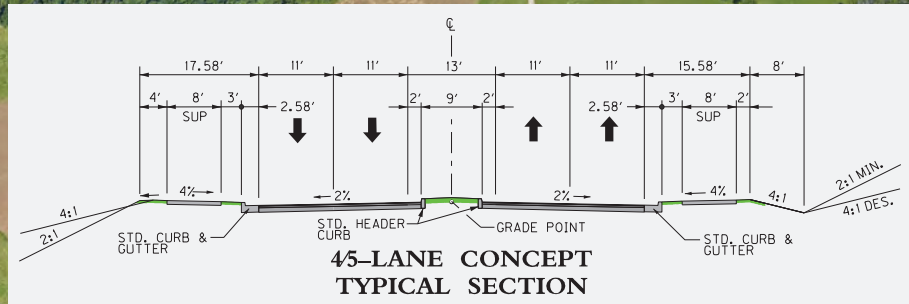


KENTUCKY  
TRANSPORTATION  
CABINET



BOONE COUNTY  
ITEM NO. 6-446.00





**PLANNING CONCEPTS  
SUBJECT TO CHANGE**

**PLANNING CONCEPTS  
SUBJECT TO CHANGE**

**Figure ES-4: Four/Five Lane Build Concept**

**MALL ROAD INTERCHANGE CONNECTOR  
FEASIBILITY STUDY  
45-LANE CONCEPT**





**Table ES-2** compares travel time along the US 42 corridor between scenarios, measuring between the center of the US 42/KY 237 intersection and the center of the US 42/Mall Road intersection.

**Table ES-2: US 42 Travel Time by Scenario**

Scenario	AM	PM
2019 Existing Eastbound	231 sec	239 sec
2019 Existing Westbound	244 sec	270 sec
2045 No-Build Eastbound	349 sec	266 sec
2045 No-Build Westbound	319 sec	1,538 sec*
2045 3-Lane Build Eastbound	220 sec	260 sec
2045 3-Lane Build Westbound	259 sec	359 sec
2045 4/5-Lane Build Eastbound	218 sec	218 sec
2045 4/5-Lane Build Westbound	219 sec	327 sec

\* Represents failure with complete breakdown of the model

The proposed Mall Road Connector increases traffic using the Mall Road interchange (exit 180A), nearly doubling in the build scenarios compared to No-Build volumes. The existing off-ramp provides over 2,600 feet of storage before impacting mainline I-71/I-75 operations; anticipated queue lengths in all future scenarios are well below this length.

#### *Estimated Costs and Likely Impacts*

As the footprints of the representative build alternatives are similar, the extent of impacts associated with each closely match. Preliminary disturb limits estimate 24 acres for the three-lane alternative versus 27 acres for the four-/five-lane alternative.

The representative build alternatives may displace an estimated 23 to 26 residences, concentrated along the south side of Surfwood Drive, but avoid denser residential developments and Lincoln Woods Park. The private airstrip off KY 842 and two commercial buildings opposite the current interchange would also likely be impacted.

Detailed analysis of noise impacts on adjacent noise-sensitive areas (i.e., neighborhoods, AM Yealey Elementary School, and Lincoln Woods Park) will be required to determine if mitigation is reasonable and feasible per current KYTC policy. If a build alternative advances, an assessment of potential socioeconomic impacts will also be required and will include public involvement activities and surveys distributed to potential residential relocatees.

The build alternatives cross three streams—unnamed tributaries to South Fork Gunpowder Creek—with an estimated 530 to 610 linear feet of impacts. Roughly five to six acres of wooded, threatened/endangered bat habitat could be disturbed. The preliminary footprints also impact farmland soils, which will require additional coordination if a build alternative is selected for implementation. Detailed surveys for historic and archaeological resources will be required although preliminary data identified no known red flags within the representative alternative footprint.



Conceptual design models of both build alternatives were used to estimate quantities of high-cost construction items including earthwork, pavement, and structures. KYTC District 6 provided right-of-way and utility cost estimates based on conceptual model disturb limits, aerial imagery, approximate locations of existing right-of-way and property lines. Summarized by phase in **Table ES-3**, either build alternative is anticipated to cost around \$25 million in 2019 dollars.

**Table ES-3: Planning-Level Cost Estimates by Phase (2019 Dollars)**

Phase	3-Lane Build	4/5-Lane Build
Design	\$0.7 million	\$0.7 million
Right-of-Way	\$14.9 million	\$14.9 million
Utilities	\$0.3 million	\$0.3 million
Construction + 30% contingency	\$8.7 million	\$9.3 million
<b>Total</b>	<b>\$24.6 million</b>	<b>\$25.2 million</b>

## Table of Contents

EXECUTIVE SUMMARY .....	ES-1
1.0 INTRODUCTION .....	1
1.1 Study Area .....	1
1.2 Project Purpose and Need .....	2
1.3 Previous Transportation Studies and Projects .....	4
2.0 EXISTING CONDITIONS .....	6
2.1 Roadway Systems and Geometric Characteristics .....	6
2.2 Bridges .....	13
2.3 Bicycle and Pedestrian Accommodations .....	14
2.4 Transit .....	14
2.5 2019 Existing Traffic .....	15
2.6 Crash History .....	21
3.0 ENVIRONMENTAL OVERVIEW .....	26
3.1 Natural Environment .....	28
3.2 Human Environment .....	30
4.0 FUTURE (2045) NO-BUILD TRAFFIC .....	35
5.0 INITIAL COORDINATION EFFORTS .....	36
5.1 Project Team Meeting No. 1 .....	37
6.0 ALTERNATIVES DEVELOPMENT .....	37
6.1 Build Alternatives .....	37
6.2 2045 Build Scenario Traffic .....	41
6.3 Potential Environmental Impacts .....	47
6.4 Cost Estimates .....	49
7.0 FINAL COORDINATION MEETINGS .....	49
7.1 Project Team Meeting No. 2 .....	49
7.2 Resource Agency Coordination .....	50
8.0 ADDITIONAL INFORMATION .....	52



## Figures

Figure ES-1: Study Area Map .....	ES-2
Figure ES-2: New Jug Handle Layout at US 42/KY 842 .....	ES-3
Figure ES-3: Three-Lane Build Concept .....	ES-5
Figure ES-4: Four/Five-Lane Build Concept .....	ES-6
Figure 1: Study Area Map .....	2
Figure 2: Regional Highway Connections with Typical Weekday Delay .....	3
Figure 3: Planned Projects Near the Study Area .....	5
Figure 4: Lane Widths on Study Routes .....	7
Figure 5: Shoulder Widths on Study Routes .....	8
Figure 6: Speed Limits and Signalized Intersections on Study Routes .....	9
Figure 7: Observed Travel Speed during PM Peak Period .....	10
Figure 8: Truck Routes along Study Routes .....	11
Figure 9: Functional Classification of Study Routes .....	13
Figure 10: May 2019 Count Locations .....	16
Figure 11: 2019 ADT with AM and PM Peak Turn Volumes .....	17
Figure 12: Historic Traffic Counts at Study Area Stations .....	18
Figure 13: US 42 LOS by Intersection and Movement .....	20
Figure 14: Regional Highway Connections with Typical Weekday Delay .....	21
Figure 15: 2014-2018 Crashes by Severity and Manner of Collision .....	22
Figure 16: Reported Pedestrian Strikes and Bicycle Crashes .....	24
Figure 17: Sites Exceeding Expected Crash Frequencies .....	26
Figure 18: Environmental Overview Map .....	27
Figure 19: Farmland Soils Classifications .....	29
Figure 20: Block Groups for Socioeconomic Study .....	33
Figure 21: National Air Quality Trends .....	34
Figure 22: No-Build AM and PM Peak Turn Movements at Key Intersections .....	36
Figure 23: Three-Lane Build Typical Section .....	38
Figure 24: Four/Five-Lane Build Typical Section .....	38
Figure 25: Three-Lane Build Concept .....	39
Figure 26: Four/Five-Lane Build Concept .....	40
Figure 27: 3-Lane Build AM and PM Peak Turn Movements at Key Intersections .....	42
Figure 28: 4/5-Lane Build AM and PM Peak Turn Movements at Key Intersections .....	43
Figure 29: AM Peak Hour Operations along Proposed Mall Road Connector .....	46
Figure 30: PM Peak Hour Operations along Proposed Mall Road Connector .....	47
Figure 31: Potential Commercial Relocations .....	48

## Tables

Table ES-1: 2045 Intersection LOS along US 42 Corridor .....	ES-4
Table ES-2: US 42 Travel Time by Scenario .....	ES-7
Table ES-3: Planning-Level Cost Estimates by Phase .....	ES-8
Table 1: Study Area Roadways .....	1
Table 2: Study Area Bridges .....	14
Table 3: ADT by Route with Truck Percent.....	16
Table 4: 12-Hour Pedestrian Volumes at Select Intersections .....	18
Table 5: US 42 Travel Time by Direction .....	20
Table 6: Crashes Occurring on Study Routes .....	23
Table 7: Study Route High Crash Spots .....	25
Table 8: Protected Species Potentially Within Study Area .....	28
Table 9: Socioeconomic Statistics by Block Group.....	33
Table 10: US 42 Travel Time by Direction .....	35
Table 11: Volumes by Segment on US 42.....	41
Table 12: 2045 Intersection LOS along US 42 Corridor .....	44
Table 13: US 42 Travel Time by Scenario .....	44
Table 14: Volumes by Segment on Proposed Mall Road Connector.....	45
Table 15: Planning-Level Cost Estimates by Phase .....	49
Table 16: Summary of Resource Agency Comments.....	50

## Appendices

- A. Traffic Forecast Report
- B. Crash Records, 2014-2018
- C. Cultural Historic Overview Study for the Mall Road Planning Study in Boone County, Kentucky (Item No. 6-446)
- D. An Archaeological Overview Study for the Mall Road Connector Planning Study in Boone County, Kentucky  
*On file with KYTC, not available publicly*
- E. Socioeconomic Study
- F. Meeting Summaries
- G. Resource Agency Coordination



## List of Acronyms

ADT	Average Daily Traffic
CCRF	Critical Crash Rate Factor
CHAF	Continuous Highway Analysis Framework
EEC	Excess Expected Crashes
GIS	Geographic Information System
HIS	Highway Information System
HSM	Highway Safety Manual
KTC	Kentucky Transportation Center
KYTC	Kentucky Transportation Cabinet
LOS	Level of Service
LWCFA	Land and Water Conservation Fund Act
MP	Milepoint
mph	Miles per hour
MPO	Metropolitan Planning Organization
NBI	National Bridge Inventory
NEPA	National Environmental Policy Act
NKADD	Northern Kentucky Area Development District
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
OKI	Ohio-Kentucky-Indiana (MPO)
PDO	Property Damage Only
PVA	Property Valuation Administrator
SHIFT	Strategic Highway Investment Formula for Tomorrow
SHPO	State Historic Preservation Office
TANK	Transit Authority of Northern Kentucky
TED	Transportation Enterprise Database
TIP	Transportation Improvement Program
TWLTL	Two-way Left-Turn Lane
US EPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
VHD	Vehicle-hours of delay
vpd	Vehicles per day

## 1.0 INTRODUCTION

The Kentucky Transportation Cabinet (KYTC) initiated this Mall Road Interchange Connector Feasibility Study to examine a potential new connection between KY 237 (Pleasant Valley Road) and the Mall Road interchange (I-71/I-75 exit 180A) in northeastern Boone County. The study area is within the Ohio-Kentucky-Indiana (OKI) metropolitan planning area, approximately three miles south of the Cincinnati/Northern Kentucky International Airport. The US 42 corridor, accessed via the next I-71/I-75 interchange to the south (exit 180) operates over capacity causing drivers to experience severe traffic congestion, especially during peak commute hours. Recent and planned large-scale developments further impact regional traffic flows.

The objective of the study is to identify a representative solution for improved east-west connectivity and improved mobility for all modes, beginning at KY 237 (Pleasant Valley Road) extending through KY 842 (Hopeful Church Road) to the Mall Road interchange with I-71/I-75. Two decades of studies along US 42 have determined major widening is necessary to accommodate peak traffic flows. This feasibility study examines a representative parallel route to estimate associated costs and impacts. Specifically, an east-west highway connection to the interchange is intended to alleviate congestion and safety issues along the built-out US 42 corridor.

Study tasks include creating an inventory of existing conditions, defining the study purpose, forecasting existing and future traffic, identifying red flag environmental issues, developing build concepts with construction cost estimates, and documenting the study process and results. The following chapters explore these efforts.

This study was prepared with a portion of the federal National Highway System funds in the *FY 2018—2024 Highway Plan*, identified as Item No. 6-446.00. The Plan identified \$1.5 million of design funds in fiscal year 2020 with no additional funding for future phases.

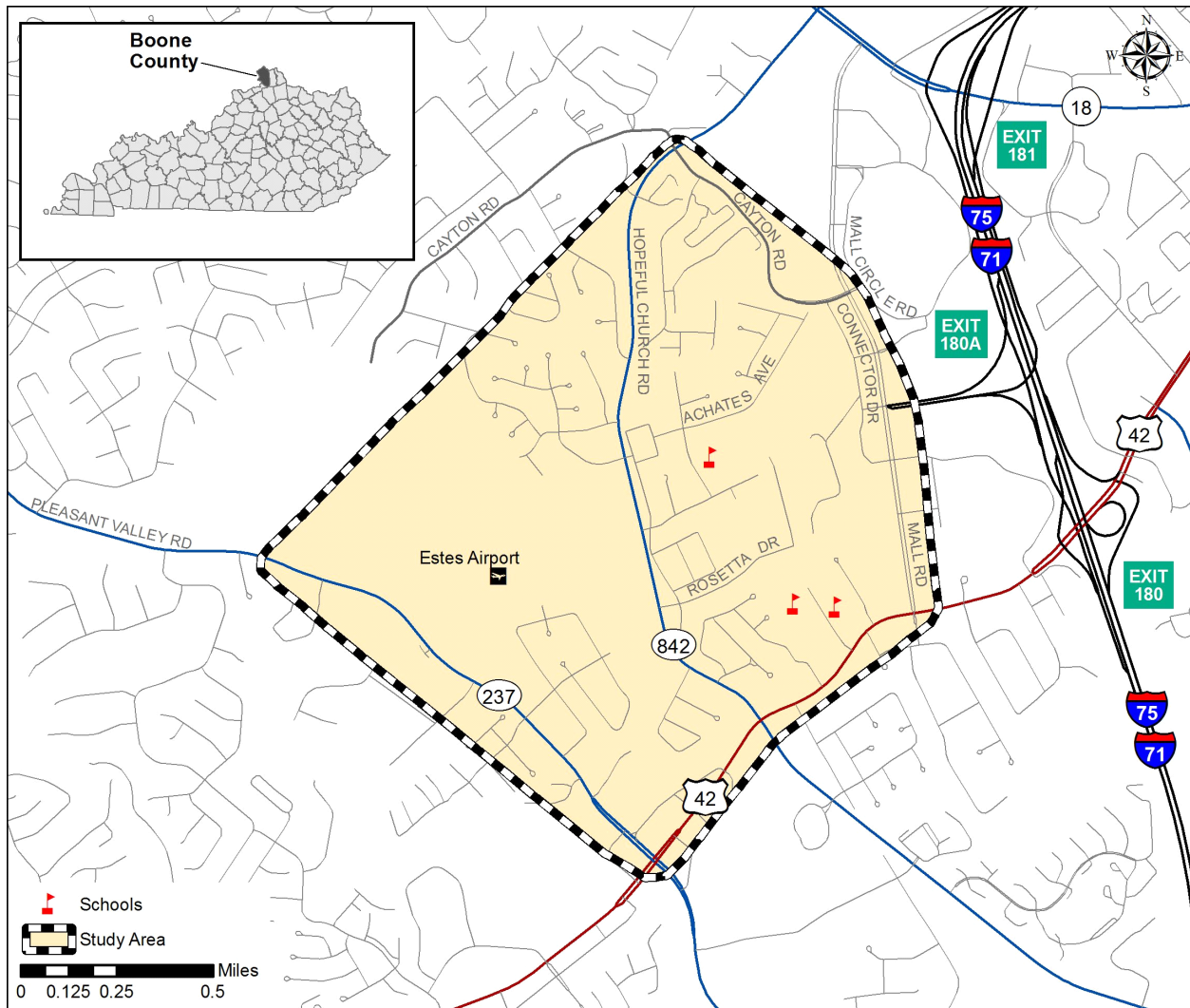
### 1.1 Study Area

The study area is shown on **Figure 1**. The area contains primarily commercial developments along its eastern and southern boundaries, with mostly residential areas beyond. The boundary generally follows Cayton Road, Mall Road, US 42, and KY 237 on the east, south, and west respectively. The northern boundary stretches from KY 237 near Lilac Drive to the KY 842 intersection with Cayton Road.

Study area roadways with milepoint (MP) limits are listed in **Table 1**.

**Table 1: Study Area Roadways**

Route	Local Name	MP Limits
US 42	US 42	12.350—13.550
KY 237	Pleasant Valley Road	1.500—2.500
KY 842	Hopeful Church Road	2.750—4.600
CR-1016J	Cayton Road	0.872—1.491
CS-1308		0.000—0.064
CS-1002	Mall Road	0.000—0.900



**Figure 1: Study Area Map**

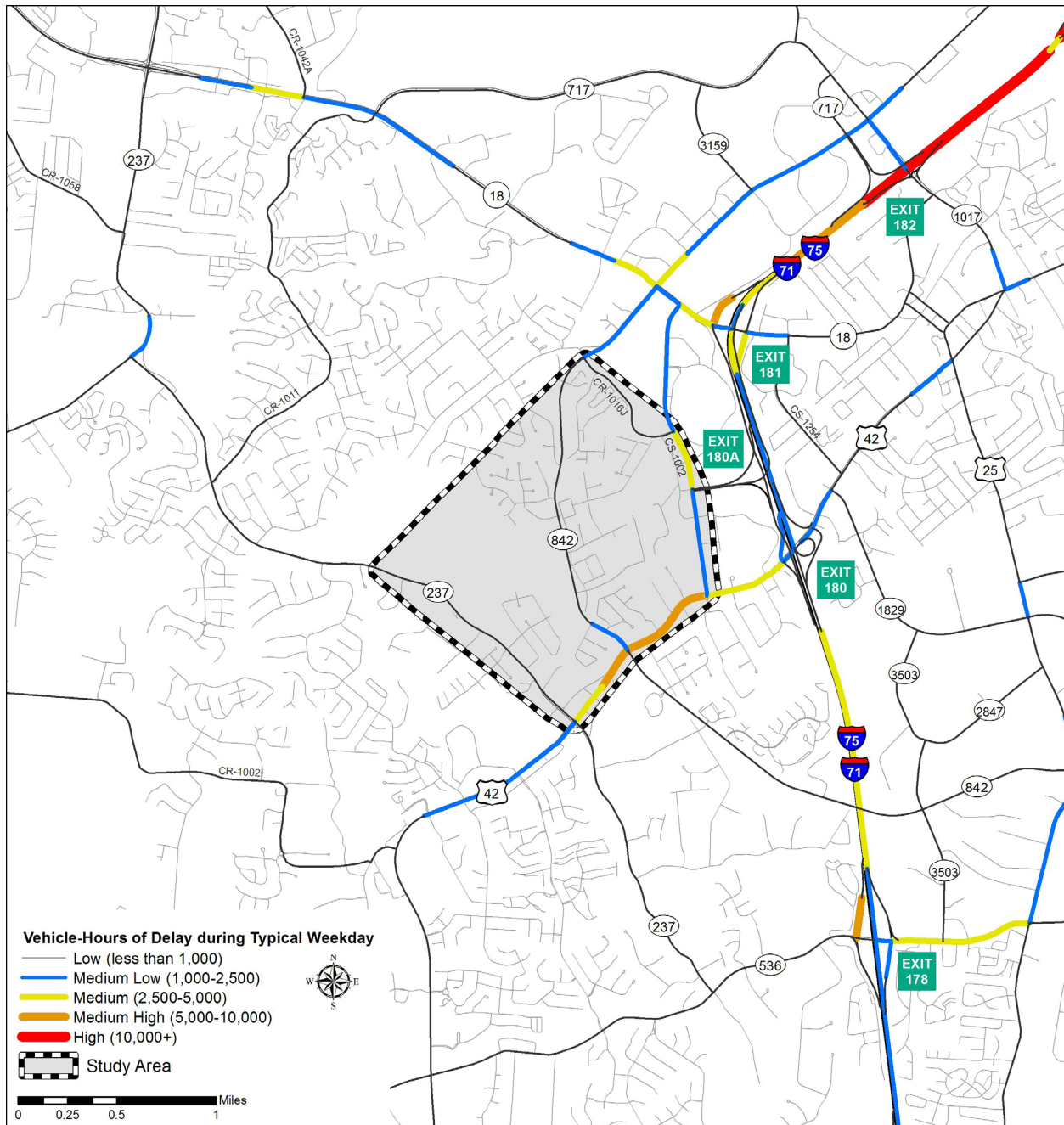
## 1.2 Project Purpose and Need

The purpose of the project is to improve east-west connectivity and mobility for all modes, beginning at KY 237 and extending through KY 842 to the Mall Road interchange with I-71/I-75 (exit 180A).

There are limited east-west connections in the vicinity of the study area. Beyond US 42, the nearest arterial connection to the north is 2.5 miles away at KY 18 (Burlington Pike); to the south, 2.0 miles of travel is required to reach KY 536 (Mt. Zion Road). Illustrated in **Figure 2**, each has an interchange with I-71/I-75 and carries substantial peak period traffic.

Alongside sparse highway connections, pedestrians and bicyclists in the study area attempting to reach AM Yealey Elementary School, Lincoln Woods Park, the Transit Authority of Northern Kentucky (TANK) transit hub, or Florence Mall require substantial detours using US 42.





**Figure 2: Regional Highway Connections with Typical Weekday Delay**

Discussed further in the following chapter, the US 42 corridor is over capacity with limited opportunities for capacity improvements without large-scale property impacts to adjacent businesses. High traffic volumes contribute to elevated crash rates throughout the corridor, particularly the high number of rear end collisions.

The posted speed limit on US 42 is 40 to 45 miles per hour (mph) along US 42. Overnight, off-peak travel speeds average 35 to 37 mph while congested afternoon peak operations further reduce speeds, averaging 25 to 27 mph.

Boone County is one of the fastest-growing counties in Kentucky, with continued development in the region expected to exacerbate the safety and congestion trends in the study area.

### 1.3 Previous Transportation Studies and Projects

A rich history of planning defines the rapidly developing study area. Recent key planning studies are listed below.

- The 2008 *US 42 Traffic Study*<sup>1</sup> supports the need for improvements to US 42 intersections with KY 237, KY 842, and Mall Road. The report states: “the suggestion to construct a new parallel roadway to the north and west of existing US 42, beginning at the intersection of Mall Road with the I-71/I-75 entrance/exit ramps, would appear to provide the greatest long-term relief in this corridor. This roadway should extend at least to Pleasant Valley Road, and ideally even further to the west and south, to provide additional capacity to serve this rapidly growing area.”
- TANK completed a 2013 update of its *Transit Network Study*,<sup>2</sup> a comprehensive plan analyzing and assessing existing trends and operations of the transit system. Ending just north of the study limits, Route 1 along Dixie Highway is TANK’s top route. Transit is discussed further in **Section 2.4**.
- In 2014, KYTC completed the *Mall Road Interchange Modification Report*,<sup>1</sup> a study to connect the existing collector ramp from the KY 18 southbound entrance to I-71/I-75.
- In 2019, Boone County updated its comprehensive plan, *Our Boone County Plan 2040*.<sup>3</sup> From a transportation perspective, the plan supports improvement to intersections and roadways throughout the study area, relying heavily on the 2018 update to the *Boone County Transportation Plan*. The 2018 Transportation Plan identified eight goals, supported by numerous objectives to address the county’s transportation needs and define a vision for the future. Specific project recommendations are illustrated below.
- The City of Florence issued a 2019 update to its *Bicycle and Pedestrian Plan*.<sup>4</sup> The plan recommended future needs and showed ultimate connections of sidewalks and multi-use paths throughout the county, including multi-use connections along Mall Road, KY 842, and KY 237 in the vicinity.

Arising from these plans are project concepts in and around the study area, as shown in **Figure 3**. Concepts are color-coded by source, pulling from Kentucky’s *FY 2018—2024 Highway Plan*, the Transportation Improvement Program (TIP) maintained by OKI, the 2017 *Boone County Transportation Plan* discussed above, and KYTC’s Continuous Highway Analysis Framework (CHAF) database, a collection of proposed projects identified statewide.

Furthermore, engineering efforts from individual US 42 intersection improvement projects over the past two decades affirm a consistent message: major widening to six lanes is necessary for US 42 to serve its peak traffic volumes. Short-term spot improvements and signal coordination updates alone cannot provide sufficient capacity.

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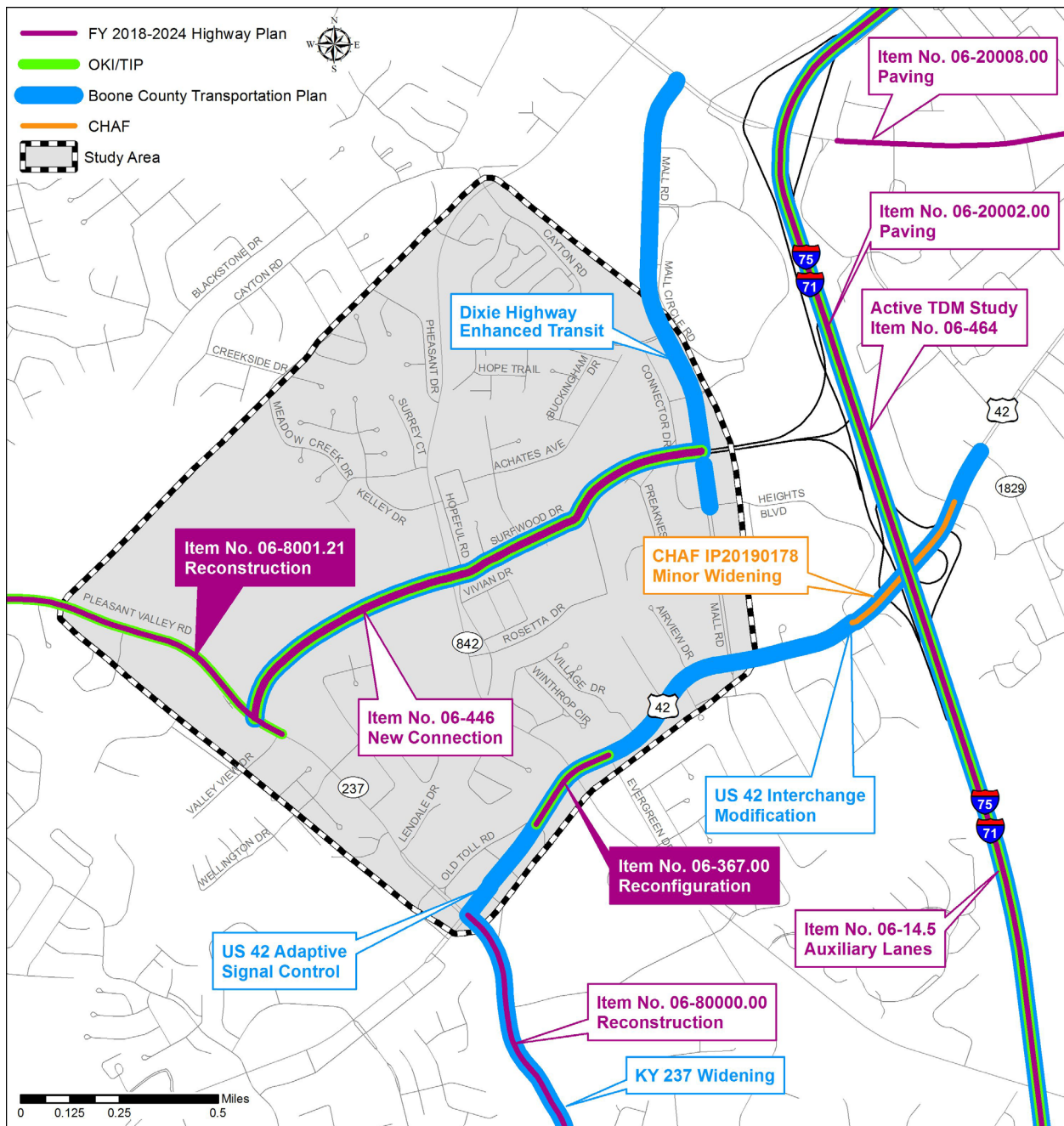
<sup>1</sup> Available online at <https://transportation.ky.gov/Planning/Pages/Planning-Studies-and-Reports.aspx>

<sup>2</sup> Available online at <https://www.tankbus.org/learn/network-study>

<sup>3</sup> Available online at [https://www.boonecountyky.org/planning\\_commission/plan\\_2040.aspx](https://www.boonecountyky.org/planning_commission/plan_2040.aspx)

<sup>4</sup> Available online at [https://www.boonecountyky.org/document\\_center/PlanningCommission/2019FlorenceBikePedPlan.pdf](https://www.boonecountyky.org/document_center/PlanningCommission/2019FlorenceBikePedPlan.pdf)





**Figure 3: Planned Projects Near the Study Area**

Shown as solid colored call-out boxes above, two projects were under construction as this study is being completed: Item No. 06-8001.21, widening KY 237 to five lanes; and Item No. 06-367.00, reconstruction of the US 42/KY 842 intersection to shift left turn movements to the adjacent jug handle formed by Quadrant Road. The reconstructed US 42/KY 842 intersection opened to traffic in Fall 2019.

## 2.0 EXISTING CONDITIONS

This section describes existing transportation network conditions within the study area and includes information on roadway systems and geometry, bridges, traffic volumes and operations, and crash history. Data were compiled from the KYTC's Highway Information System (HIS) database, KYTC's Transportation Enterprise Database (TED), bridge inspection reports, National Bridge Inventory (NBI) forms, traffic counts, aerial photography, and field reviews.

### 2.1 Roadway Systems and Geometric Characteristics

KYTC's HIS database was queried during July 2019 to obtain roadway systems information and geometric characteristics of study routes. Data assembled from HIS for analyses included:

- Number of lanes with lane widths
- Shoulder widths
- Speed limits
- Truck routes
- Functional classifications

#### *Lanes*

For study routes, **Figure 4** graphically depicts existing number of lanes and widths. Current KYTC design guidelines suggest a minimum of 11-foot-wide lanes on arterial and collector roadways and 12-foot-wide lanes for roads carrying 2,000 or greater vehicles per day (vpd). The narrowest (10-foot) lanes on study routes occur along the construction section of KY 237, which is widening the route to provide a five-lane cross-section. Following construction, KY 237 through the study area will provide two 11-foot travel lanes per direction with a 13-foot two-way left-turn lane (TWLTL). A 10-foot shared use path will run along both sides of the roadway.





Figure 4: Lane Widths on Study Routes



### Shoulders

**Figure 5** presents shoulder widths for study routes. The majority of the area employs an urban section with curbs and gutters. The remaining rural section lies along the construction section of KY 237, which will include curbs and gutters once completed.



**Figure 5: Shoulder Widths on Study Routes**



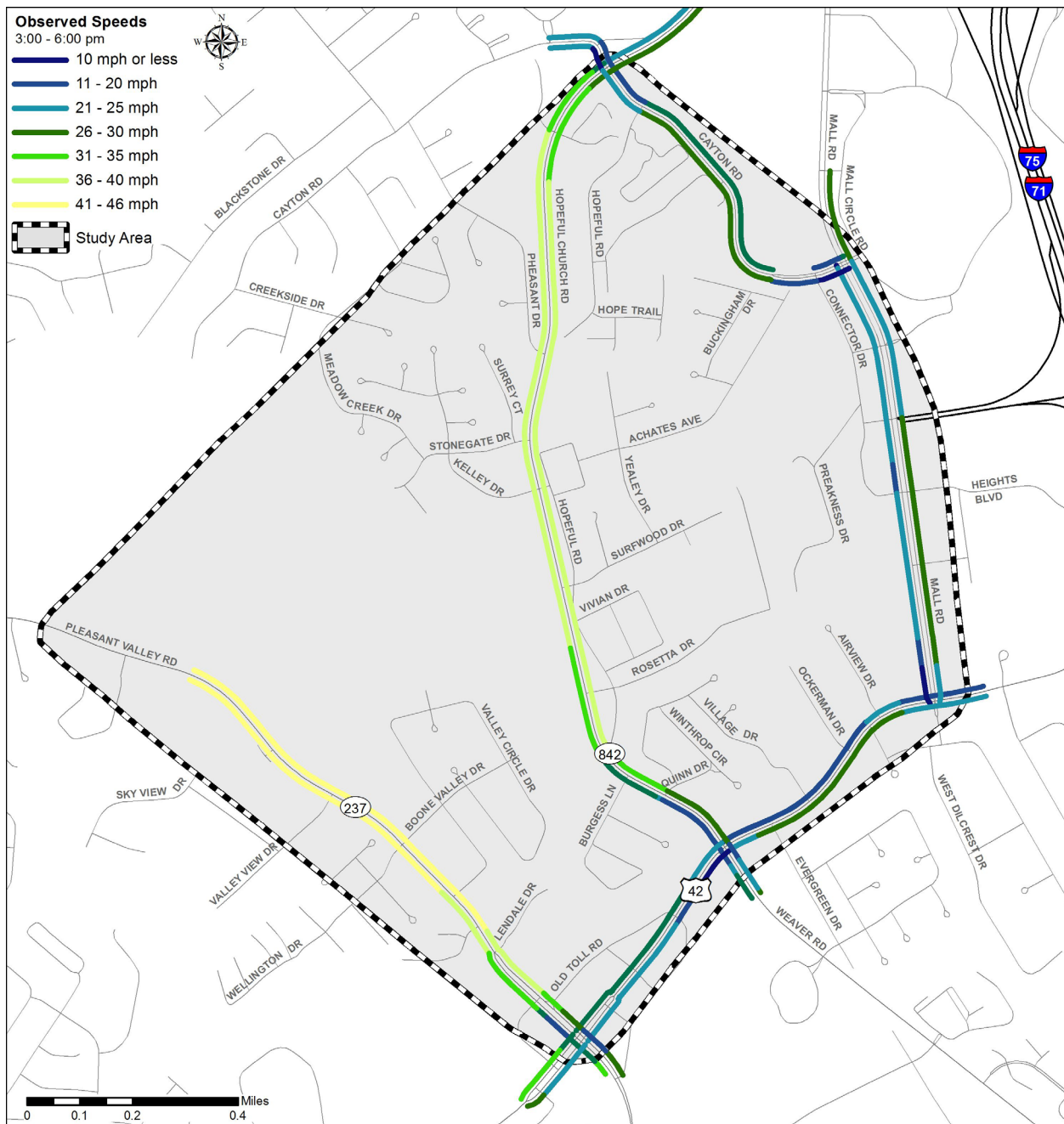
### Speed Limits and Travel Speeds

**Figure 6** highlights posted speed limits, noting the location of signalized intersections as well. Identifying posted speed limits can help suggest the character and intended function of highway segments. Limits range from 35 to 45 mph on study routes. For comparison, **Figure 7** presents observed travel times during the PM peak, which illustrates the effect of congestion on travel times.



**Figure 6: Speed Limits and Signalized Intersections on Study Routes**





**Figure 7: Observed Travel Speed during PM Peak Period**

Travel speeds along US 42 range from 13.8 to 29.0 mph along US 42 heading towards I-71/I-75 during the PM peak and from 16.8 to 32.3 mph heading away. For comparison, AM peak period speeds are slightly higher: 22.5 to 31.0 mph along US 42 towards the interstate and 20.0 to 32.9 mph heading away. Signals along the corridor constrain travel times beyond the posted 40-45 mph speed limit; overnight travel speeds peak at 35 to 37 mph.

Mall Road exhibits similar speed trends to US 42.



### Truck Routes

Designated truck routes within the study area are shown in **Figure 8**. Excluding Cayton Road, all study routes are listed in Kentucky's Highway Freight Network. Truck weight limits vary by highway: 40-ton gross vehicle weight on US 42, 31 tons on KY 842, and 22 tons on KY 237.



**Figure 8: Truck Routes along Study Routes**

### *National Highway System*

The National Highway System (NHS) consists of roadways important to the nation's economy, defense, and mobility. Within the study area, this includes both US 42 and KY 237.

### *Functional Classification*

Functional classification is the process of grouping streets and highways according to the character of travel service they provide. This classification system recognizes travel involves movement through a hierarchical system of facilities that progress from lower classifications handling short, local trips to higher classifications serving longer distance travel at a higher level of mobility.

Over the years, functional classification has come to assume additional significance. Functional classification includes expectations about roadway design, such as vehicle speed, capacity, and relationship to land use development. Federal legislation uses functional classification in determining eligibility for funding under the Federal-aid program. Transportation agencies often describe roadway system performance, benchmarks, and goals by functional classification.

The following are short definitions of major functional classes:

- Freeways and Interstates provide high speed, high mobility links for long distance trips.
- Principal Arterials serve major centers of metropolitan areas, provide a high degree of mobility, and can also provide mobility through rural areas.
- Minor Arterials provide service for trips of moderate length, serve geographic areas smaller than their higher arterial counterparts, and offer connectivity to the higher arterial system. The primary difference is usually multiple arterial routes serve a particular urban area, radiating from the urban center to serve the surrounding region. In contrast, an expanse of a rural area of equal size would often be served by a single arterial.
- Collectors gather traffic from local roads and funnel them to the arterial network. Within the context of functional classification, collectors are categorized as either major collectors or minor collectors. In the rural environment, collectors generally serve primarily intra-county travel and shorter trips.
- Local Roads are not intended for use in long distance travel, except at the origin or destination end of the trip, due to their direct access to abutting land. They are often designed to discourage through traffic.

**Figure 9** shows the functional classification of roadways within the study area.

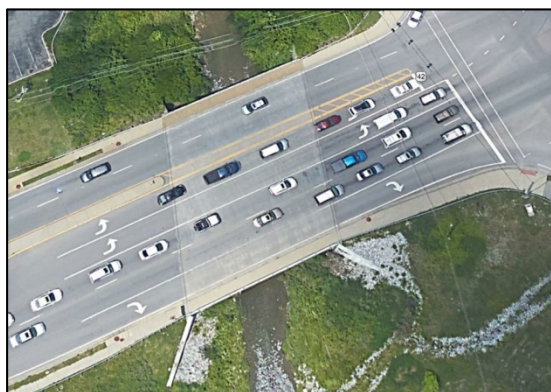




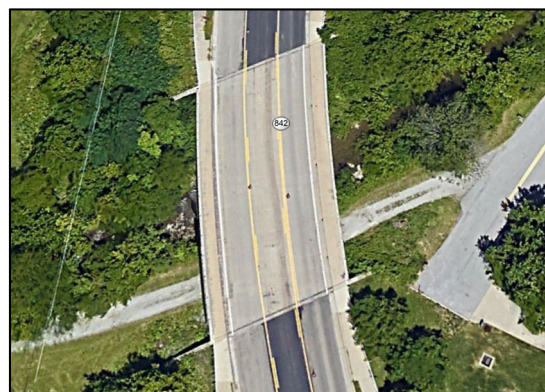


**Table 2: Study Area Bridges**

Route	US 42	KY 842
Bridge Number	008B00070N	008B00081N
Location	0.02 MI SW KY 237	N/A
Midpoint MP	12.467	3.167
Feature Intersected	S. FK GUNPOWDER CREEK	UTTERBACK CREEK
Sufficiency Rating	<b>88.4</b>	<b>97.5</b>
Status	<b>Not Deficient</b>	<b>Not Deficient</b>
Bridge Length	85 feet	107 feet
Deck Width	108 feet	51.8 feet
Maximum Span	80.1 feet	106 feet
Road Width	94 feet	40.4 feet
Number of Lanes	4 Lanes plus 2 Lefts and 1 Right	2
Sidewalk Width Right	6 feet	5.2 feet
Sidewalk Width Left	6 feet	5.2feet
Restrictions	Open - no restrictions	Open - no restrictions
Year Built	1987	1996
Historical Status	Bridge is not eligible for the National Register of Historic Places	Bridge is not eligible for the National Register of Historic Places
Bridge Description	85 Foot - Single Span Prestressed concrete Stringer/Multi-beam or Girder	107 Foot - Single Span Prestressed concrete Stringer/Multi-beam or Girder
Year Reconstructed	2011	N/A
Inspection Date	6/10/2019	6/10/2019



*US 42 Bridge*



*KY 842 Bridge*

## 2.3 Bicycle and Pedestrian Accommodations

Pedestrian facilities exist along one or both sides of study roadways—excluding the construction section of KY 237. Once completed, this section will include 10-foot shared use paths along both sides of the roadway.

## 2.4 Transit

Regional transit operations are run by TANK, which provides a variety of services throughout Boone, Kenton, and Campbell counties and into downtown Cincinnati. Services include fixed route buses, commuter express lines, and demand-response for senior and disabled riders.



Currently, Route 1 serves the Florence area, traveling between downtown Cincinnati and Florence Mall via Dixie Highway daily. Runs alternate between the northern Turfway Road loop and eastern Industrial Road loop throughout the day. Per TANK's 2013 *Transit Network Study*, "Route 1 has the highest ridership of all TANK routes, and serves a corridor with many ridership generators and two very strong anchors (downtown Cincinnati and Florence Mall). However, the route is very long (more than an hour end-to-end) and experiences heavy boarding and alighting activity. As a result, Route 1 has several trips approaching or exceeding seating capacity and a below average on-time performance rate."

The Florence Hub Park & Ride lot on Heights Boulevard opened in 2015 and provides 168 parking spaces with a large shelter and bike racks. Two express routes also travel through the corridor, stopping at the facility: Route 35X, the East-West Express; and Route 42X, the Florence Hub Express.



*Florence Hub Park & Ride*

The 2013 study notes that "while the Florence/Elsmere area is served by numerous express routes connecting it to the downtown areas, its only local bus service is Route 1, limiting accessibility for both work and non-work trips. There may be a market for increased transit service to employment sites and other destinations...most successful if it can serve short to medium distance trips in both peak and off-peak time periods. However, given the dispersed suburban nature of development in the area, it can be difficult to serve with transit, and issues such as first/last mile accessibility must be considered. This geographic area will continue to grow in importance."

Long term, the study recommends consideration of a neighborhood circulator between the Florence Mall transit center, Burlington Park & Ride, and neighborhoods west of the mall. The service would potentially be a combination of fixed route and demand-response operations.

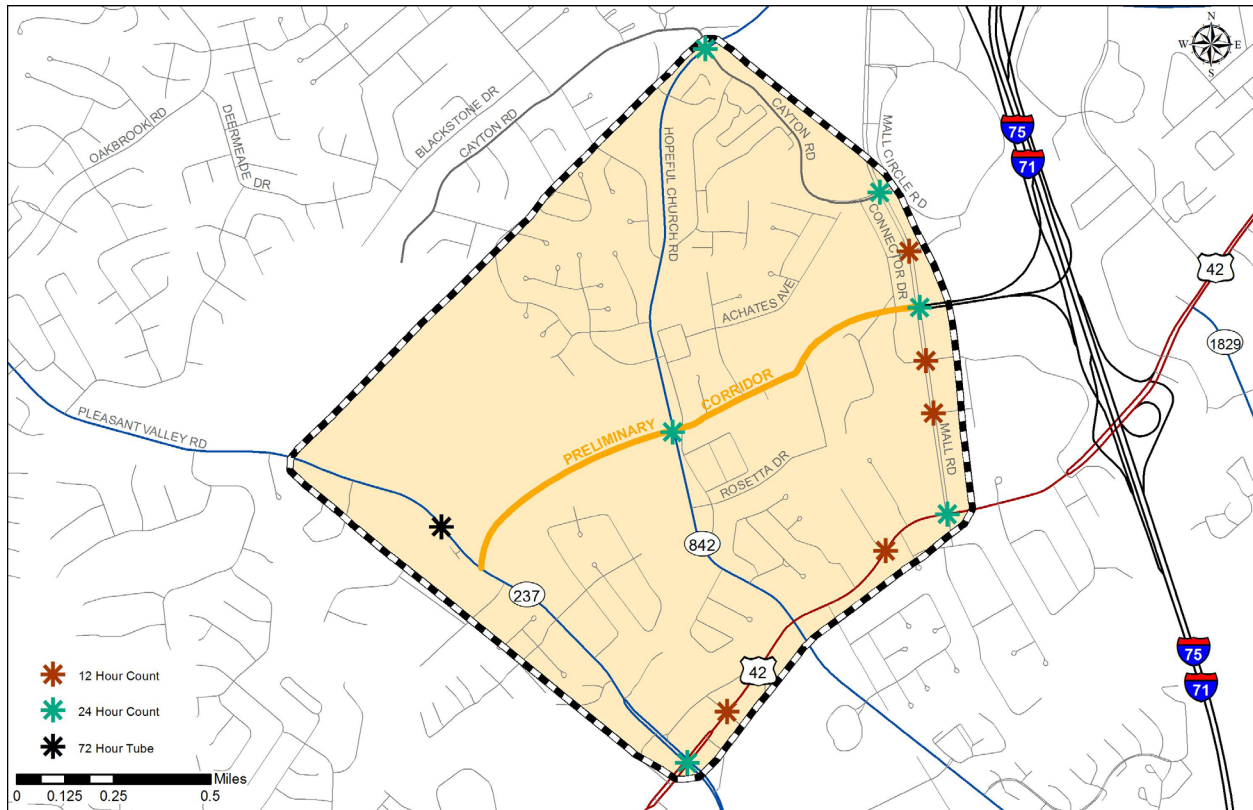
Currently, TANK's 2020 System Redesign is underway, anticipated for completion in spring 2020. The goals of the redesign are to reduce the downward trend in ridership observed since 2012, boost efficiency in meeting current needs, and address shifting demographic and employment trends.

## 2.5 2019 Existing Traffic

During May 2019, turning movement counts were collected at eleven intersections, used to generate existing year traffic forecasts including daily, AM, and PM peak hour volumes. Additional information about this effort is documented in the *Traffic Forecast Report* in **Appendix A**. Count locations are presented in **Figure 10**.

- 24-hour Miovision turning movement counts were conducted at six major intersections, classifying each vehicle into one of five categories: motorcycle, car, bus, single-unit truck, and articulated truck. Pedestrians and on-road bicyclists were also recorded.
- 12-hour Miovision turning movement counts were conducted at five additional intersections, classifying vehicles into the same five categories.
- A 72-hour tube count was performed on KY 237, collecting directional traffic data separated by the Federal Highway Administration's 13-bin vehicle classifications.





**Figure 10: May 2019 Count Locations**

**Figure 11** summarizes the average daily traffic (ADT) for highway segments, along with AM and PM peak hour turning movements at key study intersections. Truck percentages compared to ADT volumes are shown in **Table 3**.

**Table 3: ADT by Route with Truck Percent**

Route	ADT	Percent Trucks & Buses
US 42	35,500—38,400 vpd	2.2—2.7%
Mall Road	22,600—26,100 vpd	1.6—1.9%
KY 842	17,000—18,300 vpd	2.5—3.8%
KY 237	14,800—15,200 vpd	3.6—4.0%
Cayton Road	7,200—8,900 vpd	0.6—0.7%

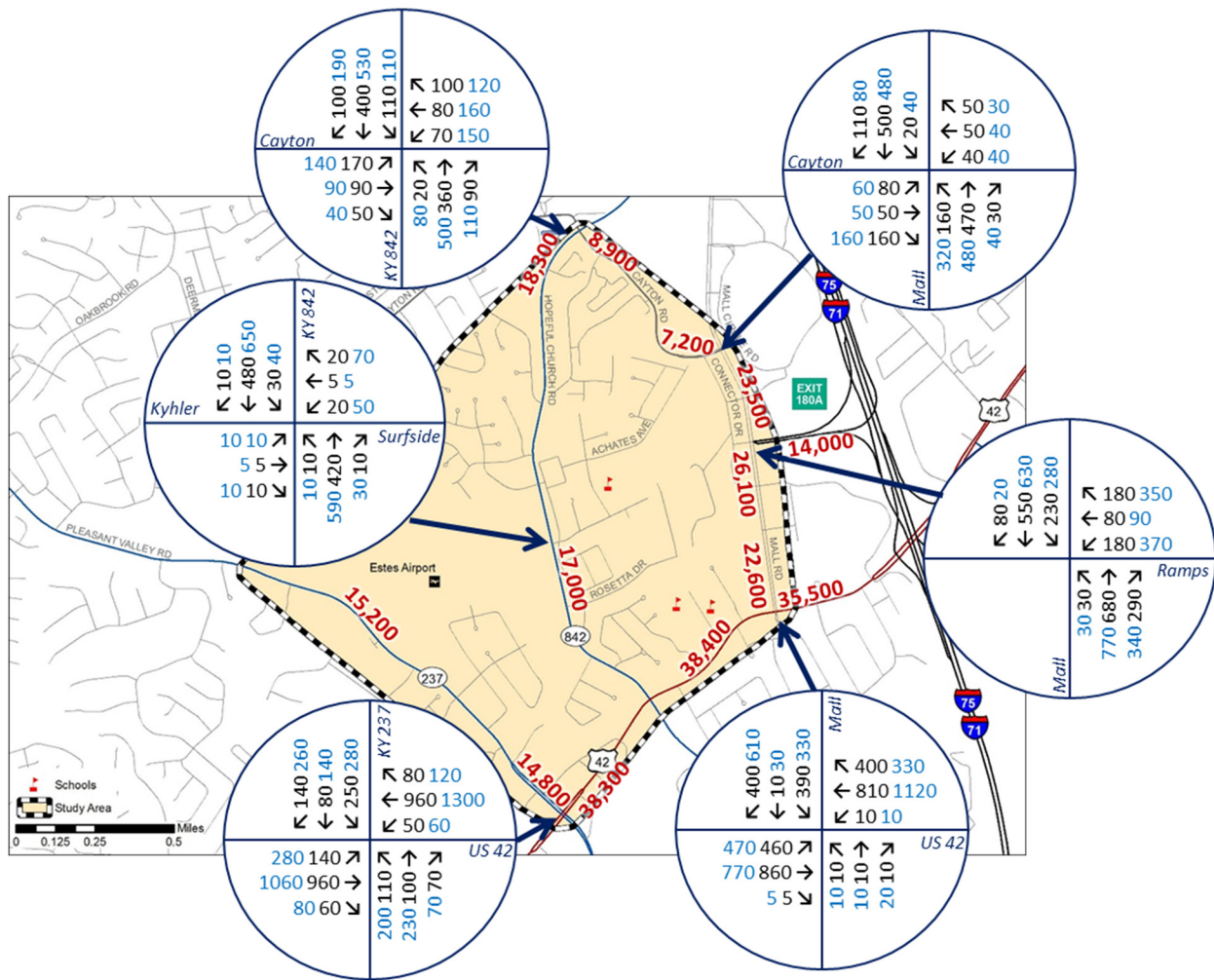
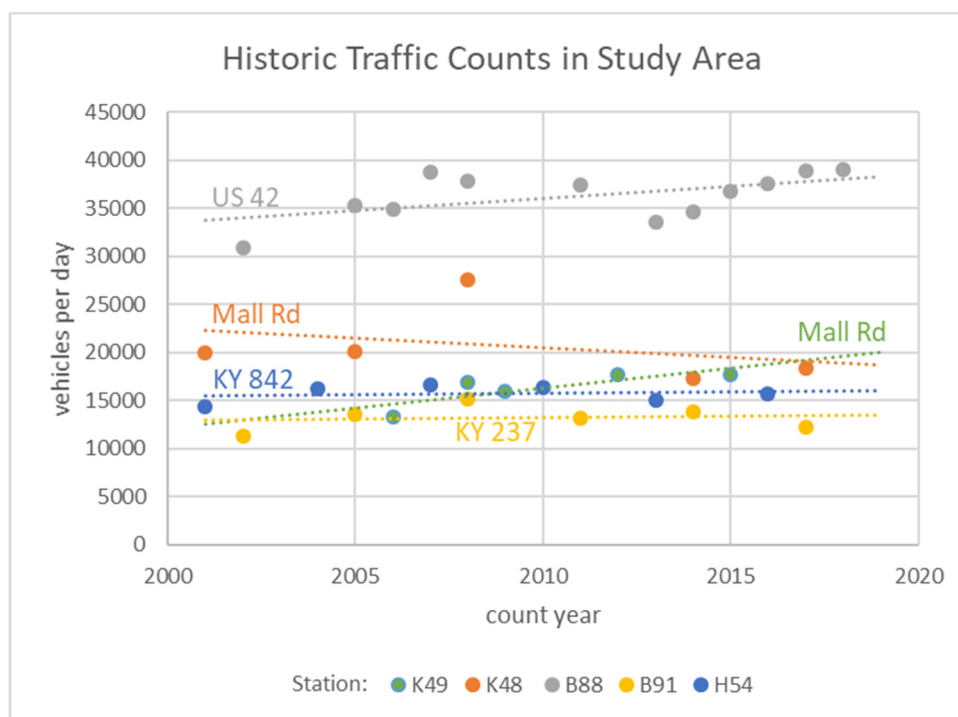


Figure 11: 2019 ADT with AM and PM Peak Turn Volumes

### 2.5.1 Historic Traffic Growth Trends

Figure 12 presents growth trends over the past two decades for the five KYTC count stations within the study area. As shown, the US 42 (gray) and northern Mall Road (green) corridors have experienced consistent growth while others have been moderate to negative.





**Figure 12: Historic Traffic Counts at Study Area Stations**

### 2.5.2 Bicyclists and Pedestrians

No bicyclists were observed during the traffic counts. Pedestrians counted crossing during 12-hour counts at key intersections are summarized in **Table 4**. The street listed first in the left column is assumed to be the north/south street in the results. Asterisks note approaches with no marked crosswalk.

**Table 4: 12-Hour Pedestrian Volumes at Select Intersections**

Intersection	North Leg	East Leg	South Leg	West Leg
Mall Road at US 42	23	13	13	0*
Ockerman Drive at US 42	11	2	15	8
KY 237 at US 42	10	0*	2	1
Mall Road at I-71/I-75 Ramps	3	6	0*	21
Mall Road at Cayton Road	5*	10	4	10
KY 842 at Cayton Road	1	8	11	3

### 2.5.3 Existing Traffic Operations

A number of metrics exist to measure traffic operations, such as level of service (LOS), delay, and queue lengths at intersections. LOS is a qualitative measure describing traffic conditions based on speed, travel time, freedom to maneuver, traffic interruptions, comfort, and driver convenience.

LOS A is associated with free flow conditions, high freedom to maneuver, and little or no delay. LOS E represents conditions at or near capacity. At LOS F, traffic conditions are oversaturated and beyond capacity, with low travel speeds, little or no freedom to maneuver, and high delays. As a rule of thumb, LOS C or better is desirable in urban areas; however, LOS D is generally acceptable.

#### Microsimulation







For this *Mall Road Interchange Connector Feasibility Study*, Vissim microsimulation software was used to model corridor operations. While any model has limitations—particularly in over-capacity congested conditions—the model represents the best tool available to approximate current and future traffic scenarios. To calibrate the model, analysts collected information regarding existing traffic conditions: signal timing plans, queue lengths, operating speeds, etc.

Queue lengths at signalized cross-streets were observed throughout the PM peak period. Along US 42, congested mainline conditions showed consistent westbound queues backing up beyond the adjacent upstream intersection, from near Harvey Quast Drive back to the bridge over I-71/I-75. Mall Road also experienced multi-intersection queuing; these backups cleared earlier than queues along US 42. Southbound KY 842 approaching US 42 exhibited substantial queuing, even with improved signal phasing after reconstruction shifted left turn movements to the jug handle intersection with Quadrant Road.<sup>5</sup>

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In **Figure 13** (page 20), Vissim results show left turns from US 42 operate at LOS E or F during both peak hours. The majority of turns to US 42 from a signalized cross-street operate at LOS E or F during the PM peak hour. Maximum queue lengths exceed available storage capacity for numerous turn movements, particularly during the PM peak. Maximum queue length represents the longest instantaneous queue over the hour period—even just for a few seconds, and tends to overstate queues. By contrast, average queue measures the average over each second of the hour, including many times with no queue, leading to underestimated results. Additional data are provided in **Appendix A**.

Travel times by direction are presented in **Table 5**, measured from the center of the Mall Road intersection to/from the center of the KY 237 intersection.

LEVEL OF SERVICE	DESCRIPTION
<b>A</b>	 <ul style="list-style-type: none"> <li>Average Travel Speed.</li> <li>Free traffic flow with few restrictions on maneuverability or speed.</li> </ul> <p><b>NO DELAYS</b></p>
<b>B</b>	 <ul style="list-style-type: none"> <li>Stable traffic flow.</li> <li>Speed becoming slightly restricted.</li> <li>Low restriction on maneuverability.</li> </ul> <p><b>NO DELAYS</b></p>
<b>C</b>	 <ul style="list-style-type: none"> <li>Stable traffic flow, but less freedom to select speed, change lanes or pass.</li> </ul> <p><b>MINIMAL DELAYS</b></p>
<b>D</b>	 <ul style="list-style-type: none"> <li>Traffic flow becoming unstable.</li> <li>Speeds subject to sudden change.</li> <li>Passing is difficult.</li> </ul> <p><b>MODERATE DELAYS</b></p>
<b>E</b>	 <ul style="list-style-type: none"> <li>Unstable traffic flow.</li> <li>Speeds change quickly and maneuverability is low.</li> </ul> <p><b>SIGNIFICANT DELAYS</b></p>
<b>F</b>	 <ul style="list-style-type: none"> <li>Heavily congested traffic.</li> <li>Demand exceeds capacity and speeds vary greatly.</li> </ul> <p><b>SIGNIFICANT DELAYS</b></p>

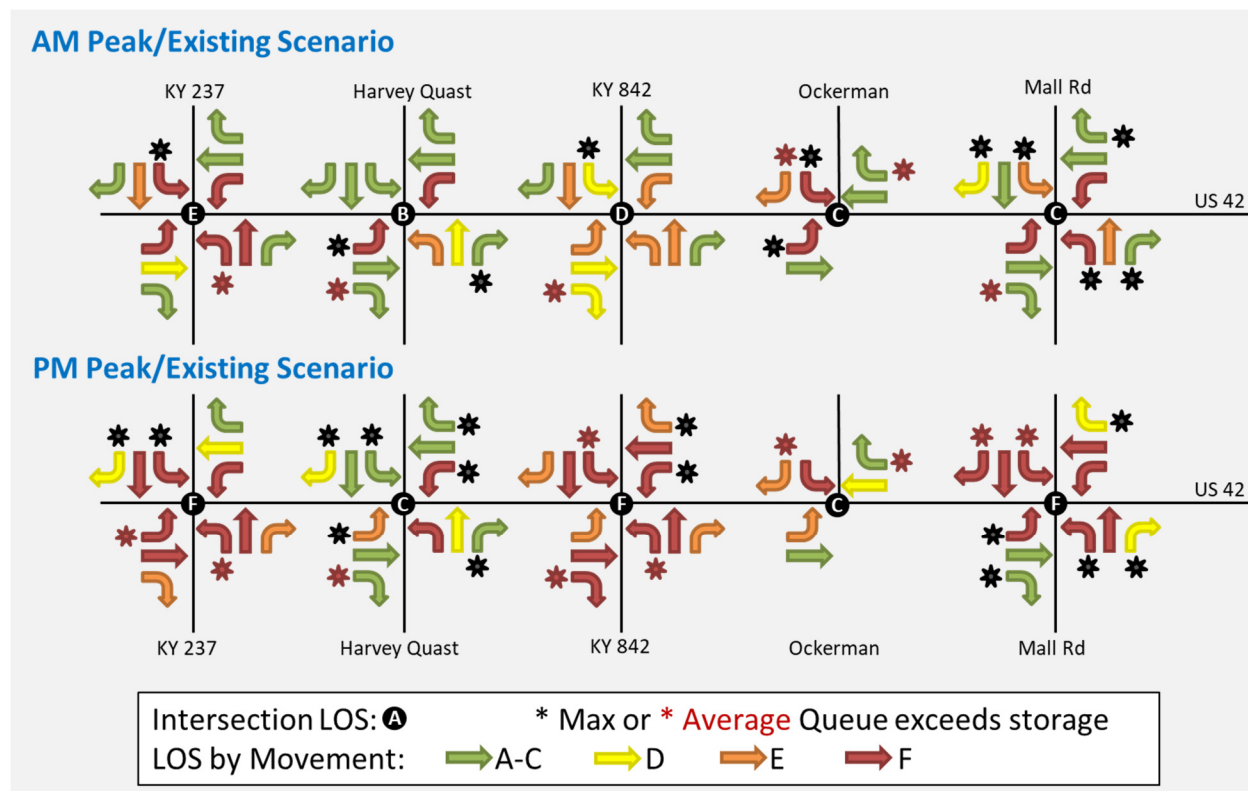
*Description of Level of Service (LOS)*

<sup>5</sup> A few months after traffic counts were collected, the US 42/KY 842 intersection opened to traffic as a reconstructed jug handle intersection. Accordingly, five signalized study intersections in the existing scenario increased to six signalized study intersections in the future year scenarios, adding the new US 42/Quadrant Road intersection.



**Table 5: US 42 Travel Time by Direction**

Direction	AM Peak	PM Peak
Eastbound US 42	231 seconds	239 seconds
Westbound US 42	244 seconds	270 seconds



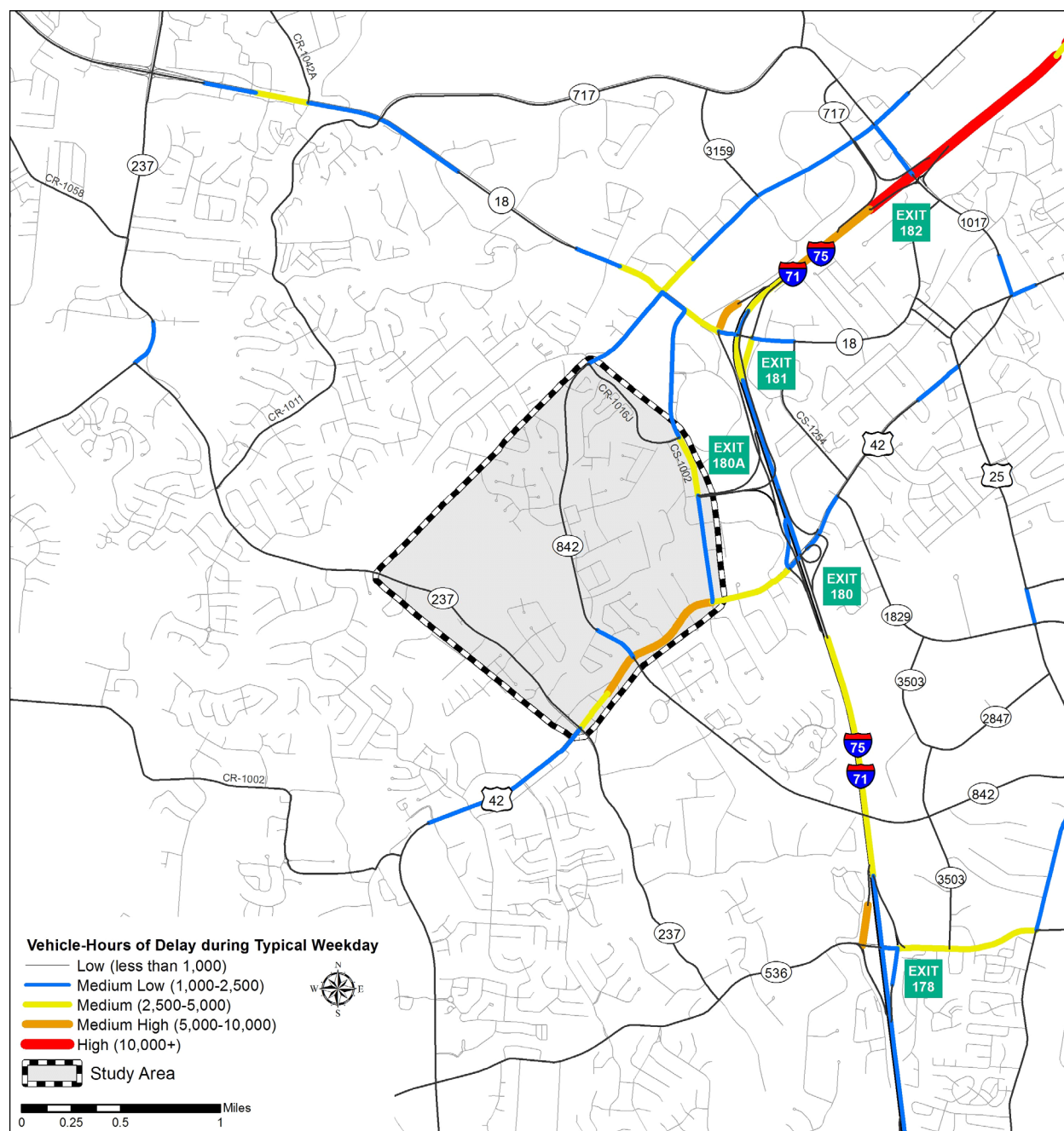
**Figure 13: US 42 LOS by Intersection and Movement**

#### Vehicle-hours of delay (VHD)

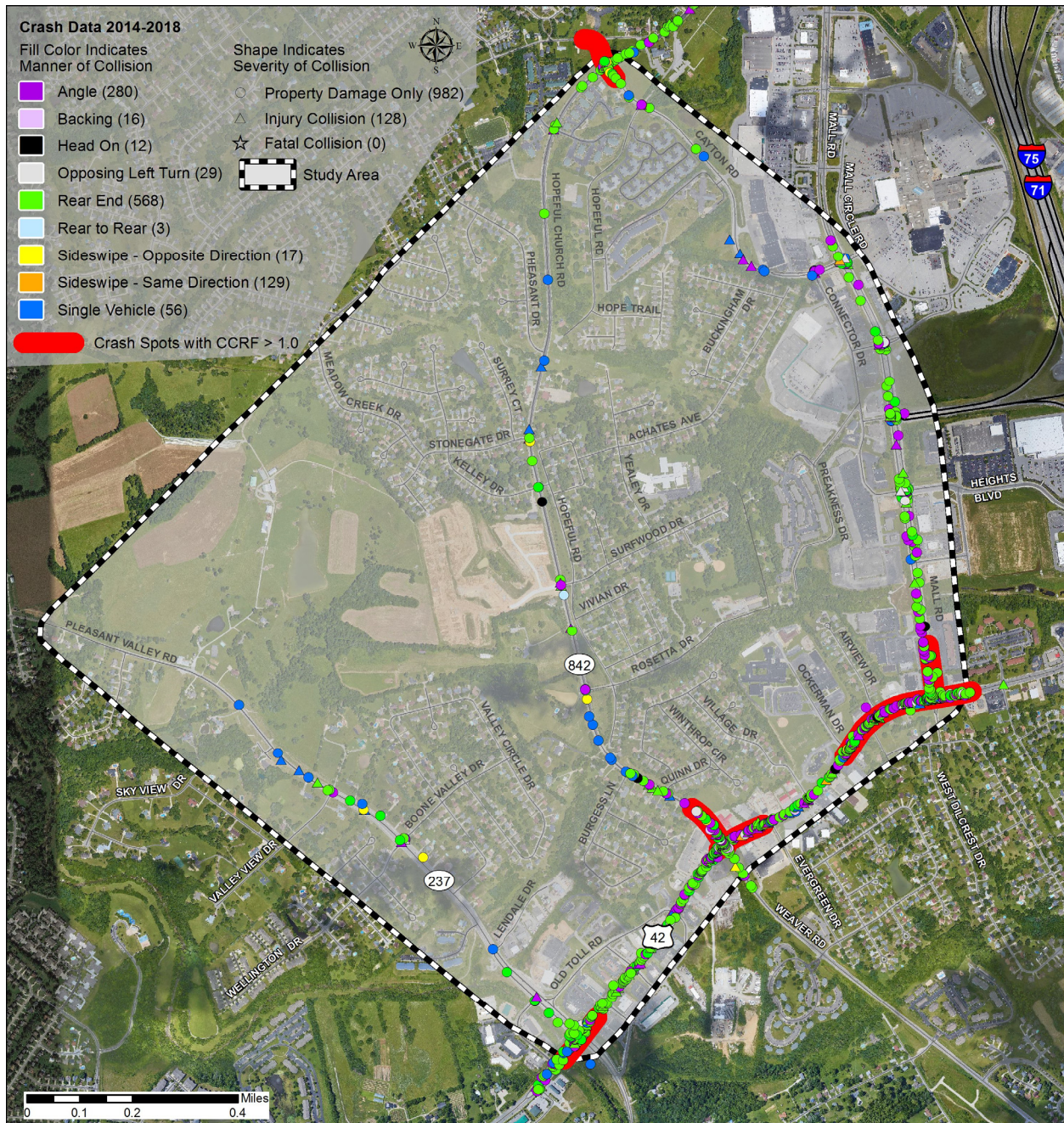
As an independent metric for comparison, KYTC provided GIS-based delay data describing congestion in vehicle-hours of delay, one of the scoring inputs used for the 2020 SHIFT process.<sup>6</sup> This VHD data are built on 2015–2017 speed data and represents excess time spent on a trip during congested periods compared to time required for the same trip in uncongested conditions. VHD represents total delay experienced by all vehicles traveling a highway section during an analysis period, divided into five categories: low, medium low, medium, medium high, and high.

As shown in **Figure 14**, US 42 through the study area exhibits medium to medium high delay by segment, representing 4,000 to 6,800 vehicle-hours of delay per segment during a typical weekday.

<sup>6</sup> Strategic Highway Investment Formula for Tomorrow (SHIFT) is the data-driven mechanism used to prioritize projects for Kentucky's biennial highway plan.







**Figure 15: 2014-2018 Crashes by Severity and Manner of Collision**

**Table 6** tabulates the crash data for each study route. Crashes were sorted by severity into one of three categories: fatal, injury, or property damage only (PDO). Of the 1,110 reported crashes, 83–90% on each study route were PDOs and 10–17% resulted in injuries. No fatalities occurred on study routes during the analysis period.

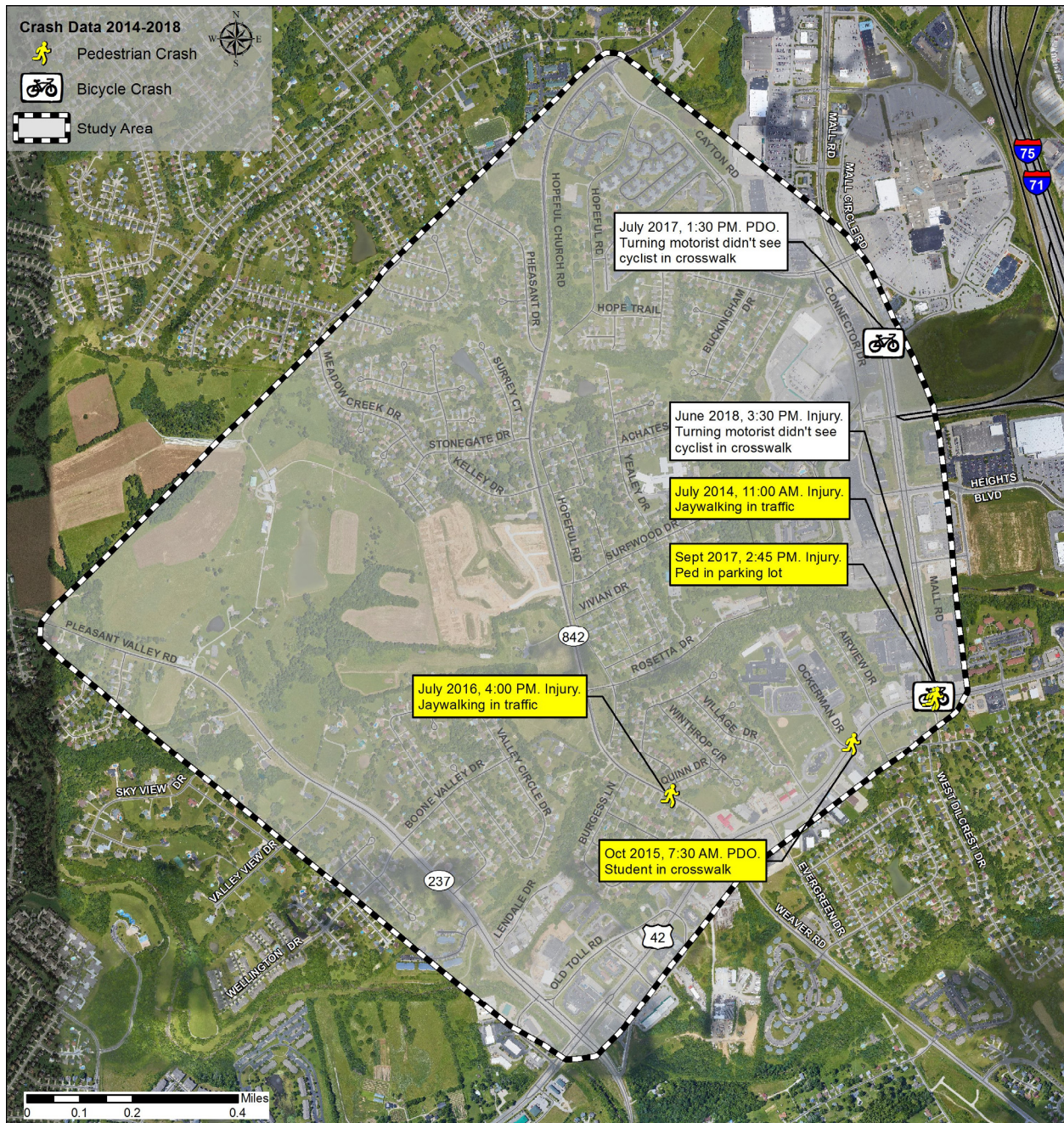
Rear end crashes were the predominant crash type occurring on five of the six study area routes, consistent with typical patterns for congested urban roadways. The city-owned section of Cayton Road (CS-1308) was the exception with 13 angle crashes (93%) as the predominant crash type.

**Table 6: Crashes Occurring on Study Routes**

	US 42		KY 237		KY 842		CR-1016J Cayton Road		CS-1308 Cayton Road		CS-1002 Mall Road	
LENGTH	1.2 mi		1.0 mi		1.9 mi		0.6 mi		<0.1 mi		0.9 mi	
FATAL	0		0		0		0		0		0	
INJURY	68	11%	8	15%	19	10%	6	17%	2	14%	22	13%
PDO	573	89%	46	85%	176	90%	30	83%	12	86%	148	87%
ANGLE	167	26%	7	13%	33	17%	9	25%	13	93%	51	30%
BACKING	8	1%	1	2%	6	3%	1	3%				
HEAD ON	7	1%			3	2%					2	1%
LEFT TURN	15	2%	1	2%	3	2%					10	6%
REAR END	344	54%	19	35%	120	62%	12	33%			76	45%
SIDESWIPE	82	13%	14	26%	16	8%	8	22%			26	15%
SINGLE	18	3%	12	22%	14	7%	6	17%	1	7%	5	3%
Total	641		54		195		36		14		170	

Two crashes with bicycles and four pedestrian strikes were reported, as shown in **Figure 16**. Three of the six crashes are clustered at the US 42/Mall Road intersection. Three pedestrian strikes and one bicycle crash resulted in injuries.





**Figure 16: Reported Pedestrian Strikes and Bicycle Crashes**

### 2.6.1 Critical Crash Rate Factors (CCRF)

KYTC uses a systematic procedure to identify locations having high crash rates. The actual number of crashes, as obtained from KYTC's database, occurring within a roadway segment is used to calculate the Actual Crash Rate using the roadway length, annualized ADT, and the number of years for which crash data are being examined. Using an analysis procedure from the Kentucky Transportation Center (KTC) and referenced in *The Analysis of Traffic Crash Data in Kentucky (2013—2017)*, Actual Crash Rates are compared to the Critical Crash Rate for similar



types of Kentucky roadways. The Critical Crash Rate is the rate that is statistically greater than the average crash rate for similar roadways and represents a rate above which crashes may be occurring in a non-random fashion. This ratio of Actual Crash Rate to the Critical Crash Rate is the Critical Crash Rate Factor (CCRF). A CCRF greater than 1.0 indicates crashes may be occurring more often than can be attributed to random occurrence. This procedure is a screening technique indicating locations where further analysis may be needed. It is neither a definitive statement of nor a measurement of a crash problem.

As defined in the KTC methodology report, two analysis types exist: “segments” and “spots.”

- Segments vary in length and are divided along roadways as geometry or traffic volumes change.
- Spots are defined by analyzing 0.1-mile-long sections where crashes are concentrated.

As the resulting segments break down into such short lengths, the spot analysis provides a more appropriate measure.

**Figure 8** contains spot level crash analyses, shown in red in **Figure 15**. US 42 contains five high crash spots. KY 842, Cayton Road, and Mall Road each have one high crash spot.

**Table 7: Study Route High Crash Spots**

Route	Spot		ADT	Total Crashes	Fatal	Injury	PDO	CCRF	Location Description
	BMP	EMP							
US 42	12.45	12.55	30,708	73	0	7	66	2.04	EAST OF HAINES TO JUST PAST KY 237
	12.95	13.05	37,472	99	0	13	86	1.78	KY 842 EAST
	13.25	13.35	37,232	61	0	0	61	1.10	OCKERMAN DR TO JUST PAST MALL RD
	13.35	13.45	37,232	42	0	8	34	1.00	
	13.45	13.55	37,232	116	0	14	102	2.76	
KY 842	2.85	2.95	15,642	44	0	1	43	1.82	NEAR US 42
Cayton Rd CR-1016J	0.80	0.90	9,459	20	0	1	19	1.22	KY 842 TO JUST EAST OF HOPEFUL RD
Mall Rd CS-1002	0.00	0.10	18,348	38	0	2	36	1.60	NEAR US 42

### 2.6.2 Exceeds Expected Crashes (EEC) Comparison

KYTC and KTC developed a new methodology based on the *Highway Safety Manual* (HSM) to rank safety needs of projects included in the 2020 SHIFT process. EEC is based on a crash prediction model estimating the number of crashes expected on an average roadway segment of that type and length. It suggests the number of excess crashes a segment is experiencing compared to others of its type. GIS-based data are measured for both segments and intersections. Legend categories break the data into quartiles, categorizing sites as Minimal, Low, Medium, or High.

Illustrated in **Figure 17**, the US 42 corridor shows up as a concentrated crash location using this procedure as well. Sections of Mall Road also exceed expected rates but by a lesser amount. The highest EEC section in the study area lies along KY 842.





Figure 17: Sites Exceeding Expected Crash Frequencies

### 3.0 ENVIRONMENTAL OVERVIEW

An environmental overview was conducted to identify resources and potential issues for consideration during the development of build alternatives. Natural and human environmental resources were identified from a literature/database review. Study area environmental resources are shown in **Figure 18** and described in the following sections. The intent is to identify potential



environmental issues that merit investigation during any future project development activities. Potential environmental impacts associated with the build alternatives are discussed further in **Section 6.3**.

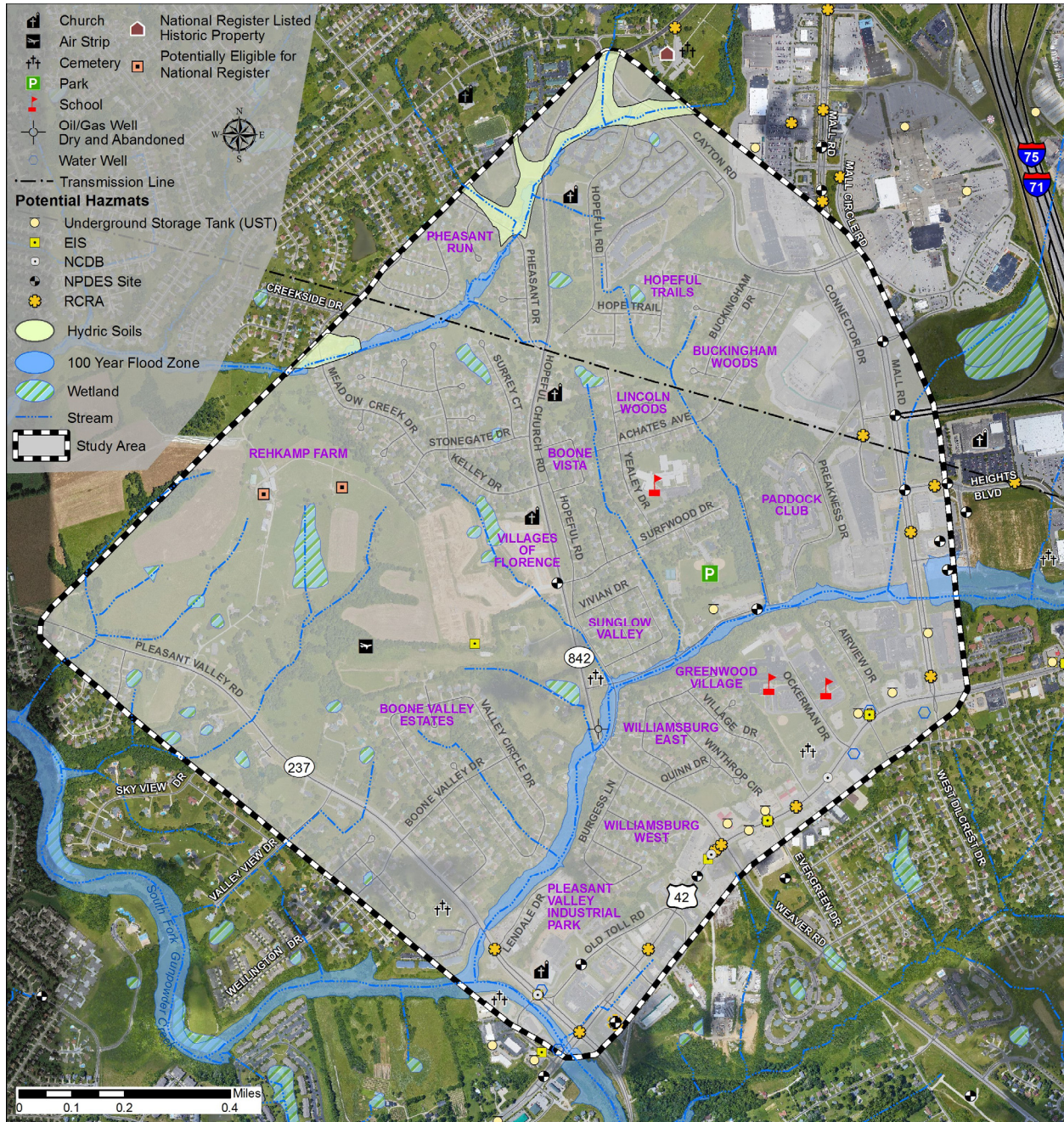


Figure 18: Environmental Overview Map



### 3.1 Natural Environment

Natural environment typically refers to all living and non-living things found to occur in nature and includes aquatic ecology such as rivers, streams, and wetlands; threatened and endangered species; and farmlands.

#### 3.1.1 Water Resources

The South Fork of Gunpowder Creek flows along the southern boundary of the study area, fed by Utterback Creek, a perennial stream that drains the southern half of the study area.

Gunpowder Creek has been listed on the Kentucky Division of Water's 303(d) List for Impaired Waters for sediment, bacteria, and nutrients as a result of its streambank erosion/instability, excess sedimentation, degraded biological communities, and loss of ecological function. To combat these impairments, the Gunpowder Creek Watershed Initiative was developed by the Boone County Conservation District. A *Gunpowder Creek Watershed Plan* was developed in 2014 to better understand conditions and to define a plan of action to protect the resources of the watershed. The entire region—from the Cincinnati/Northern Kentucky International Airport to Richwood—lies within the Gunpowder Creek watershed protection area.

Scattered wetlands exist throughout the study area, primarily along stream channels and associated with small ponds. The National Wetlands Inventory dataset documents 15.8 acres of wetlands throughout the area with the majority being freshwater ponds.

Impacts to streams and wetlands require permit coordination with the US Army Corps of Engineers, US Coast Guard, and/or Kentucky Division of Water, depending on the scale of the water resource and potential disturbance.

#### 3.1.2 Listed Species

US Fish and Wildlife Service (USFWS) maintains a database of federally protected species—listed as endangered or threatened under the *Endangered Species Act*. Four listed species, identified in **Table 8**, have the potential to occur within the study area.

**Table 8: Protected Species Potentially Within Study Area**

Scientific Name	Common Name	Federal Status
<i>Myotis grisescens</i>	gray bat	Endangered
<i>Myotis septentrionalis</i>	northern long-eared bat	Threatened
<i>Myotis sodalis</i>	Indiana bat	Endangered
<i>Trifolium stoloniferum</i>	running buffalo clover	Endangered

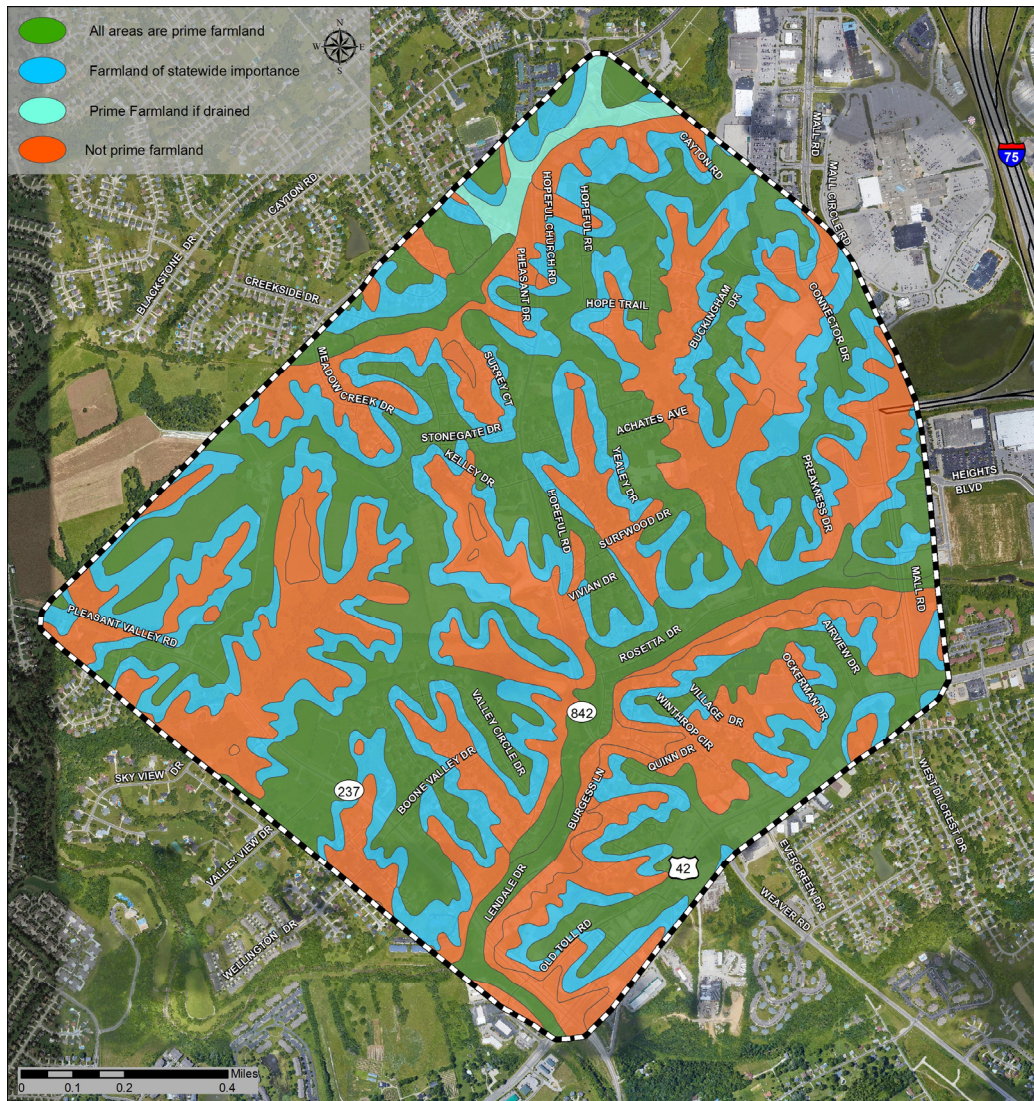
Gray bats dwell in caves throughout the year, relying on streams and waterbodies to forage at night. Both Indiana and northern long-eared bats live in caves during winter months, roosting in small trees or manmade structures (e.g., barns, bridges, etc.) during summer months. Stream corridors and forested wetlands provide foraging habitat. Per the Kentucky Geological Survey, the entire area has a low potential for karst topography. To streamline the project development process, KYTC often employs programmatic agreements with the USFWS regarding impacts to bat species.

Running buffalo clover is a plant found primarily in shaded woodlots, mowed areas (e.g., lawns, parks, cemeteries), and along streams and trails. No critical habitats exist within the study area.

For federally listed species, specific ecological surveys may be required for projects that have the potential to impact habitat. Coordination with the USFWS Kentucky Field Office may be necessary to determine the need for future project-specific surveys. Seasonal restrictions on field surveys for running buffalo clover can impact project development timelines if likely habitat exists.

### 3.1.3 Farmland Classifications

The Natural Resource Conservation Service (NRCS) soil survey shows 456 acres (37% of soils) in the study area represent prime farmlands. If drained or otherwise protected from flooding, an additional 15 acres (1%) of soils meet the criteria for prime farmland. Additionally, 340 acres (27%) represent farmlands of statewide importance. The remaining 420 acres (35%) are not prime farmland soils. The geographic distribution of these designations is shown in **Figure 19**. No Kentucky Division of Conservation agricultural districts or other conservation easements have been identified in the vicinity.



**Figure 19: Farmland Soils Classifications**



## 3.2 Human Environment

The human environment is often defined as the built environment or as the communities where we live. Such resources that could be impacted by roadway projects are discussed in the following sections.

### 3.2.1 Land Use

The southern and eastern edges of the study area is zoned for commercial land uses along Mall Road and US 42. The remainder is primarily suburban residential. Between Mall Road and KY 842, the land use transitions between the two, with areas of urban residential, public, and recreational uses. One small pocket of industrial uses exists along Lendale Drive, off KY 237 near US 42.

### 3.2.2 Community Features

Numerous community resources are located within the study area.

- Lincoln Woods Park covers 13 acres with access from Surfwood or Rosetta drives. The park contains two baseball fields, two tennis courts, a basketball court, playground, picnic shelter, and restrooms. The park is managed by Boone County Parks and Recreation. Along with wildlife refuges and historic sites, public parks are protected by Section 4(f) of the *US Department of Transportation Act*, which protects these areas from conversion to a transportation use.
- There are three schools within the study area. AM Yearly Elementary School, located just north of Surfwood Drive, serves Kindergarten through 5<sup>th</sup> grade with around 550 students. Ockerman Elementary and Middle schools are located near the southern boundary of the study area along Ockerman Drive. The county Board of Education Building is located immediately to the south of the Ockerman schools off US 42.
- Four churches are in the study area: Torch Community Church at 6767 Hopeful Church Road, Kingdom Hall of Jehovah's Witnesses at 7106 Hopeful Church Road, Florence Church of God Family Worship Center at 7275 Hopeful Church Road, and Florence United Methodist Church at 8585 Old Toll Road.
- Estes Airport is a grass airstrip located west of KY 842, just north of the Boone Valley Estates neighborhood. The field is privately owned and must coordinate flights with nearby Cincinnati/Northern Kentucky International Airport, three miles to the north. FAA does not maintain a published instrument approach plan for the Estes Airport; any further coordination should be undertaken directly with the property owner.
- Four cemeteries existed within with study area. From west to east, these include:
  - Abraham Rouse Cemetery, located west of KY 237 and north of Quiet Creek Drive. One tombstone remains, which dates to 1835. The site has been fenced for preservation.
  - The former Tanner-Utz Cemetery, relocated to Hopeful Lutheran Church property just north of the study area.



Lincoln Woods Park

- The former Zimmerman Cemetery, also relocated to Hopeful Lutheran Church property.
- Holsclaw Cemetery, located just behind the Board of Education building on Ockerman Drive. The site contains two tombstones dating to the 1850s.
- The city maintains its public services maintenance facility off Rosetta Drive, including a fire training facility.
- Parks/recreation areas that received grants through the Land and Water Conservation Fund Act (LWCFA) are protected by Section 6(f) regulations. No LWCFA resources were identified in the study area although there are 15 grants within Boone County.



*City Maintenance Facility*

### 3.2.3 Historic Resources

During July 2019, a windshield survey was conducted throughout the study area to inventory previously surveyed historic resources and identify any additional sites that may meet eligibility criteria for the National Register of Historic Places (NRHP). The NRHP, administered by the National Park Service, is the nation's official list of properties recognized for their significance in American history, architecture, archaeology, engineering, and culture. Properties are protected under the *National Historic Preservation Act* and Section 4(f) of the *US Department of Transportation Act*.

One NRHP-listed property lies immediately adjacent to the northern boundary of the study area. Hopeful Lutheran Church (BE-171) at 6430 Hopeful Church Road is listed on the NRHP under Criteria A and C. It represents a symbol of the German Lutheran community that settled in Boone County in the early nineteenth century and a good example of the Late Gothic Revival architectural style in Boone County in the early twentieth century.



*NRHP-Listed Hopeful Lutheran Church*

While no other NRHP-listed or eligible sites were identified, two other properties were not visible from the public right-of-way but merit further evaluation if likely to be impacted:



- The former Standard Club Clubhouse (BE-576) was originally built as a country retreat where members could enjoy hunting, fishing, and swimming. As an example of a rural men's club retreat, a probable uncommon mid-twentieth-century resource remaining in Boone County, the property could potentially meet NRHP criterion A, B, or C. The 1996 *Comprehensive Architectural Survey for Boone County, Kentucky* prepared for the Boone County Historic Preservation Board identified the site as not eligible due to diminished integrity but a 1999 multiple property form identified it as part of a potential group.
- Along the northwestern boundary of the study area, the Rehkamp Farm property represents one of the last remaining large agricultural properties in the area and could qualify as historic. Two previously surveyed residences on the property have been demolished but several agricultural outbuildings remain per aerial imagery.

Additional discussion is provided in **Appendix C**. If any proposed improvements involve additional right-of-way from within a listed historic site or a site meeting the criteria to qualify for NRHP eligibility, Section 4(f) requirements should be considered during future project development phases. Consultation with the Kentucky Heritage Council would also be required.

#### *Archaeological Potential*

An archaeological overview was compiled for the study area. Twelve professional archaeological surveys have been conducted within the study area with nine known sites discovered in the vicinity. Four of the nine previously identified sites are associated with historic farms/residences.

Records show 564 archaeological sites identified within Boone County; the majority are open habitations without mounds (54%), followed by historic farms/residences (19%) and undetermined site types (12%). Temporally, the majority are indeterminate prehistoric in age (45%), followed by historic (25%) and Woodland ages (13%). The majority of sites are located in dissected uplands (43%) or floodplains (27%).

While most study area soils suggest any deposits would be found on or very near the ground surface, soils associated with floodplains make up approximately 6% of the study area with a high potential to contain significant intact prehistoric cultural deposits.

Field surveys and coordination with the Kentucky Heritage Council will be required if a build alternative is selected for implementation. **Appendix D**, on file with KYTC, contains additional information about the archaeological overview. To protect these resources, known site locations are not included on public mapping.

#### *3.2.4 Socioeconomic Profile*

Included as **Appendix E**, an assessment of demographic trends was completed by the Northern Kentucky Area Development District (NKADD) to identify potential sensitive population concentrations. This socioeconomic study reviewed current US Census estimates to identify geographies where readily identifiable populations of low-income, minority, elderly, disabled, or limited English proficiency persons could be present in the study area and potentially affected by the project.

Summarized in **Table 9** and **Figure 20**, the analysis concluded that members of these potential environmental justice populations exceed county averages for several block groups within the study area. An assessment of potential effects of the project on environmental justice populations in the study area will be required as part of any future project development phases.





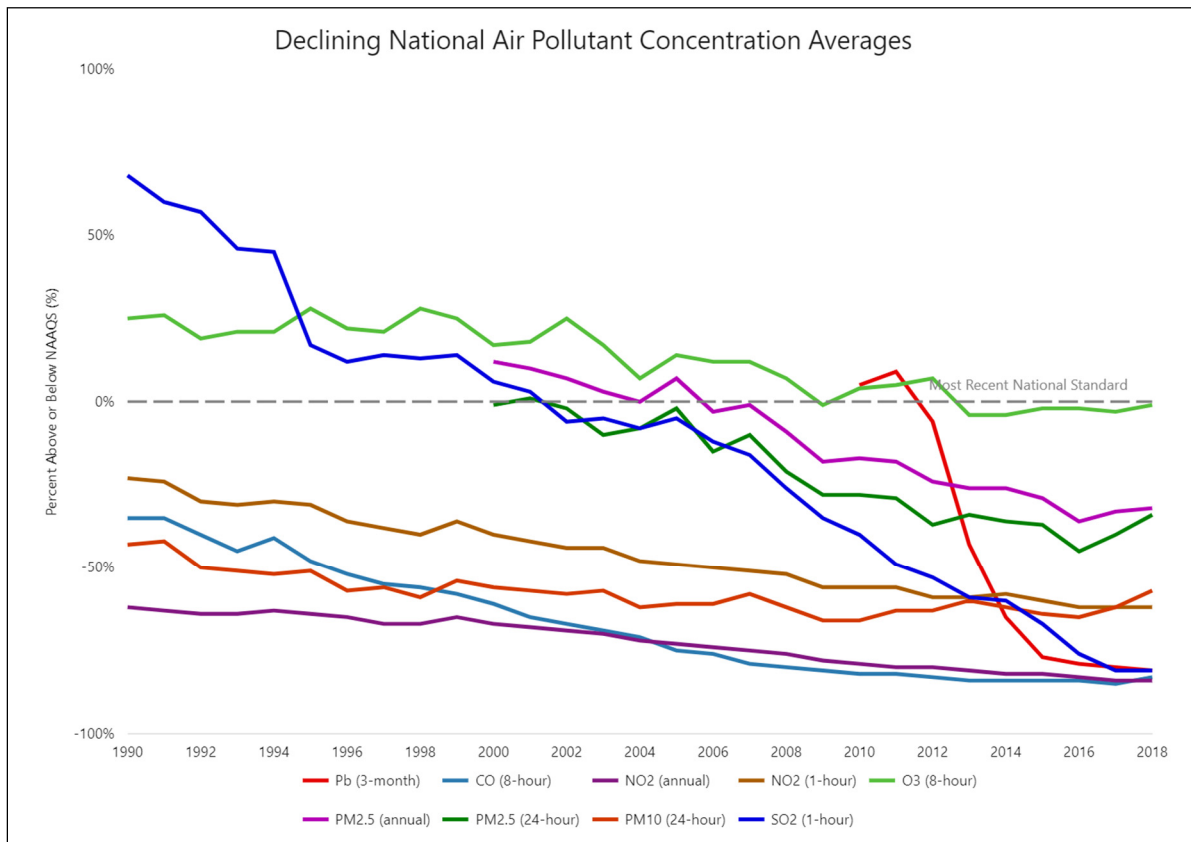
### 3.2.5 Hazardous Materials Considerations

Readily available records from the US Environmental Protection Agency (US EPA) were compiled to illustrate the range of monitored sites within the study area. Records range from short-term construction permits to large-scale industrial pollutant handlers/generators. Most sites are concentrated along the commercial US 42 and Mall Road corridors along the southern and eastern boundaries of the study area.

### 3.2.6 Air Quality

Select criteria pollutants are monitored by US EPA: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), particulate matter (PM), and sulfur dioxide (SO<sub>2</sub>). With its proximity to the Cincinnati metropolitan area, the study area is classified as a Nonattainment area for ozone per the 8-hour standard. The region is also considered a Maintenance area for PM<sub>2.5</sub> based on earlier violations that have been addressed. Nationally, air quality has been steadily improving with criteria pollutants declining, as shown in **Figure 21**.

The state and each metropolitan planning organization (MPO) demonstrate air quality compliance for projects through their Transportation Improvement Program (TIP). OKI includes Project #6-446 in its FY 2020—2023 TIP for Boone County. Likewise, KYTC lists the project in its FY 2019—2022 Statewide TIP.



Source: US EPA

**Figure 21: National Air Quality Trends**

### 3.2.7 Noise Considerations

Federally funded transportation projects that add capacity or include new alignments require consideration of noise impacts. Noise sensitive receptors in the vicinity of improvements include residential areas, parks, cemeteries, churches, schools, etc. Some commercial properties with exterior uses are also considered noise sensitive. Specific traffic noise impact analyses may be required as part of future project development activities if projects are identified that add capacity or shift traffic closer to sensitive receptors.

## 4.0 FUTURE (2045) NO-BUILD TRAFFIC

Year 2045 traffic was generated using OKI's regional travel demand model with a 2040 horizon year. Future year 2045 No-Build and Build forecasts were determined, extrapolated from model runs for 2020 and 2040. Background socioeconomic growth assumptions were reviewed to project future household and employment growth patterns in the vicinity. Committed transportation projects that could influence regional traffic flows were discussed and incorporated into future year scenarios as well. Additional detail is provided in **Appendix A**.

In the 2045 No-Build scenario, the model shows US 42 volumes increase to 51,000 to 56,000 vpd through the study area, compared to 38,400 to 39,000 vpd in 2019. Peak hour turn movement volumes at key intersections are summarized in **Figure 22** (page 36).

With the increased volumes, operational metrics on US 42 continue to degrade. More turn movements operate at LOS F, particularly during the PM peak hour, with substantial queuing throughout the corridor. Overall, the six modeled intersections along US 42 operate at LOS C through F during the AM peak; all operate at LOS F overall during the PM peak. Shown in **Table 10**, US 42 travel times between Mall Road and KY 237 reflect this trend.

**Table 10: US 42 Travel Time by Direction**

Direction	AM Peak	PM Peak
<b>Eastbound US 42</b>		
2019 Existing	231 seconds	239 seconds
2045 No-Build	349 seconds	266 seconds
<b>Westbound US 42</b>		
2019 Existing	244 seconds	270 seconds
2045 No-Build	319 seconds	1,538 seconds*

\* Represents failure with complete breakdown of the model



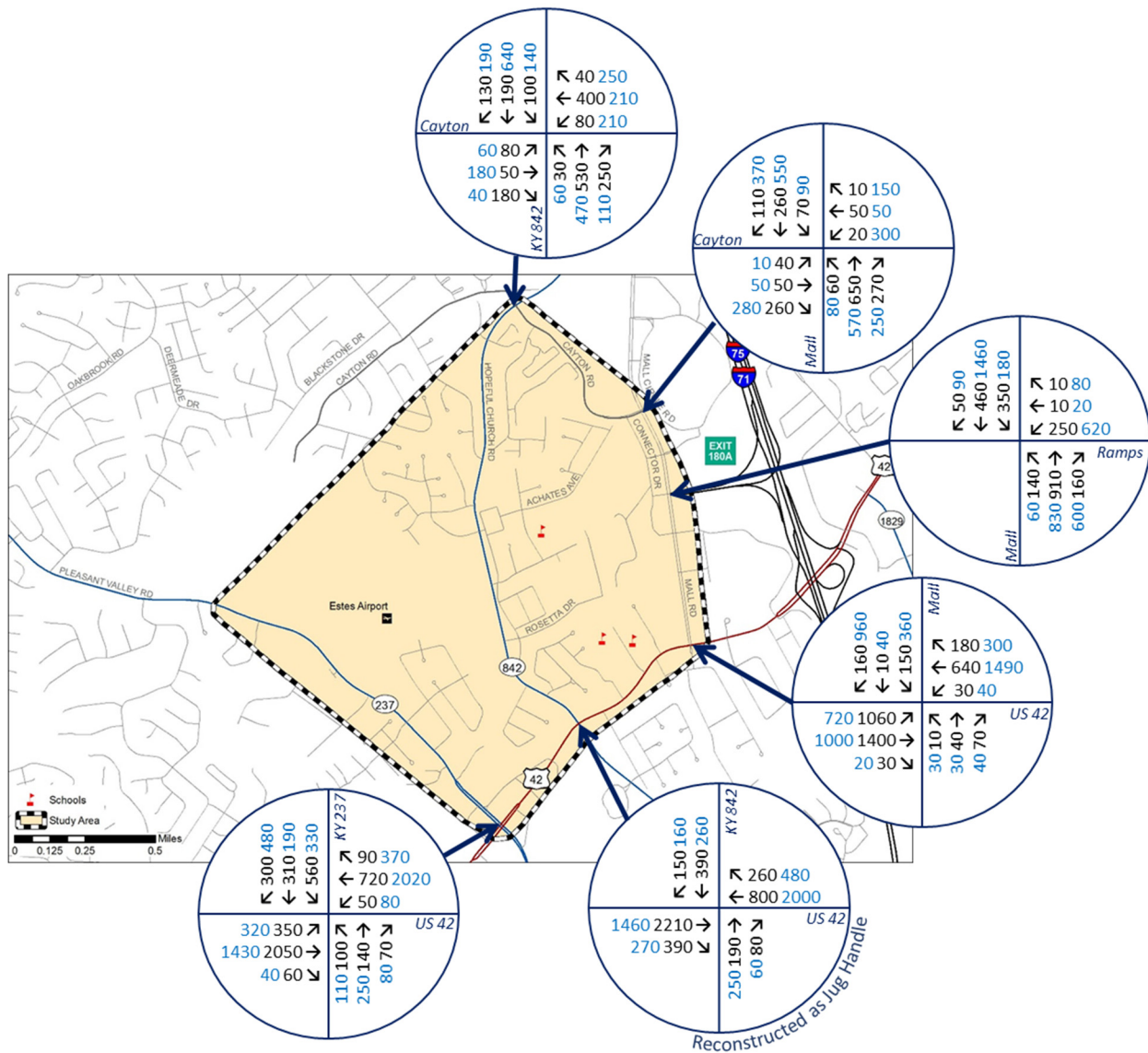


Figure 22: No-Build AM and PM Peak Turn Movements at Key Intersections

## 5.0 INITIAL COORDINATION EFFORTS

Coordination with the project team occurred throughout the study process. The project team consists of KYTC District 6 and Central Office staff, along with OKI, NKADD, and the consultant. Summaries of project team meetings are in **Appendix F**.

## 5.1 Project Team Meeting No. 1

The first project team meeting was held August 1, 2019 at KYTC District 6 in Covington. The purpose of the meeting was to review the existing conditions data, including existing traffic counts and preliminary traffic model results, crash analyses, and environmental features.

The US 42 corridor is over capacity with limited opportunities for improvement without large-scale property impacts to adjacent businesses. Signals have been optimized. The proposed Mall Road connector provides an alternate route for east-west travel, diverting some traffic away from US 42.

Residential development continues throughout the region. The 170-home Villages of Florence neighborhood is under construction along KY 842, accessed via Kyhler Drive. Rehkamp Farm, covering over 260 acres near the western study area limit, is planned for residential development although the timeline is uncertain. The parcels will likely develop as single- and multi-family homes at a similar density to adjacent subdivisions.

Based on development patterns and environmental constraints, KYTC explored a range of conceptual connector corridors, favoring a path west from the Mall Road interchange ramp termini, along Surfwood Drive, near the southern boundary of Rehkamp Farm to KY 842. The preliminary corridor is shown in **Figure 10** (page 16); the improvement concept development process is discussed further in **Chapter 6.0**. Preliminary traffic analyses suggest a build option at this location could attract up to 32,000 vpd, indicating a 4- to 5-lane typical section would be appropriate.

## 6.0 IMPROVEMENT CONCEPT DEVELOPMENT

Based on dense urban development patterns and other environmental constraints, KYTC explored a range of conceptual connector corridors throughout the study area.

One general corridor emerged as an optimal location to minimize impacts: a representative parallel route on new alignment, intended solely as a baseline to estimate associated costs and impacts. Within the corridor, two typical sections were examined as build options—a 3-lane section and a 4- to 5-lane section. It should be noted that the corridor alignment is likely to evolve during subsequent project development phases and does not represent a preferred alternative.

### 6.1 Build Options

Both build concepts share the same centerline throughout the corridor. From east to west, the corridor begins opposite the I-71/I-75 ramps at Mall Road, with three lanes eastbound and two westbound between intersections with Mall Road and Connector Drive. Continuing west, the corridor runs south of the Florence Mall and north of the Paddock Club subdivision before curving south to run parallel to and immediately south of Surfwood Drive. Cross-street connections provide access to Preakness Drive, Yealey Drive/Lincoln Woods Park, and Kennedy Court. Within the corridor, either concept creates a new signalized intersection with KY 842 south of the existing Surfwood Drive/Kyhler Drive intersection, eliminating a section of Hopeful Road in the vicinity. Continuing west, the corridor runs along the existing private airstrip—south of the new Villages of Florence subdivision and north of the Boone Valley Estates neighborhood. A connection to Kyhler Drive is provided but there are no other intersections until the corridor ties into KY 237 approximately 900 feet northwest of the KY 237/Valleyview Drive intersection. The preliminary alignment is based on design requirements for a 45 mph urban collector to the west of KY 842 and a 35 mph urban collector to the east.



### Typical Section

Shown in **Figure 23**, the three-lane build concept includes one 12-foot travel lane per direction, a 14-foot TWLTL, curb/gutter, and 8-foot shared use paths on both sides. Access is partially controlled to limit driveway connections, improving corridor throughput. Shown in **Figure 24**, the four-/five-lane build concept includes two 11-foot travel lanes per direction, a 9-foot grass median or 13-foot TWLTL, curb/gutter, and 8-foot shared use paths on both sides.

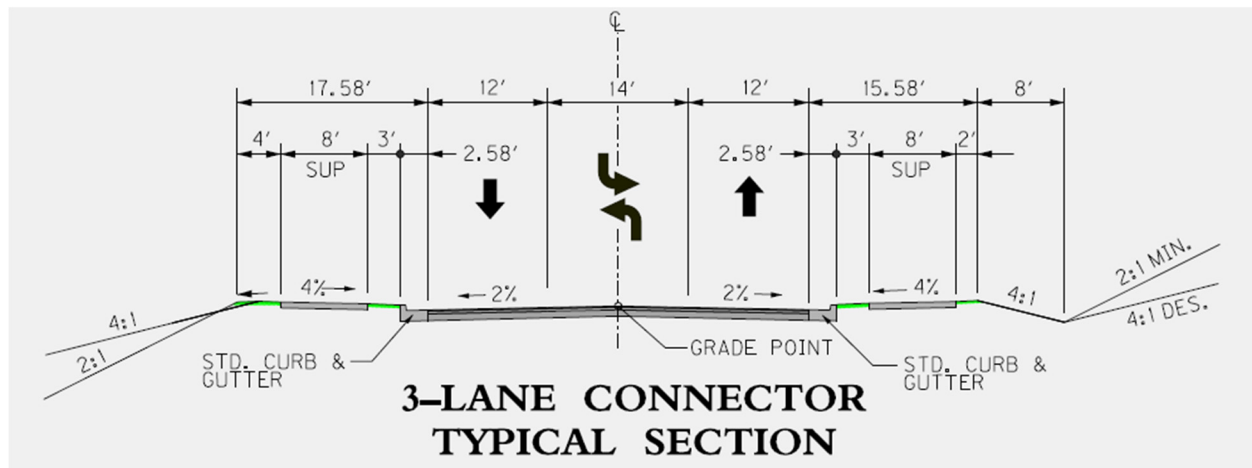


Figure 23: Three-Lane Build Typical Section

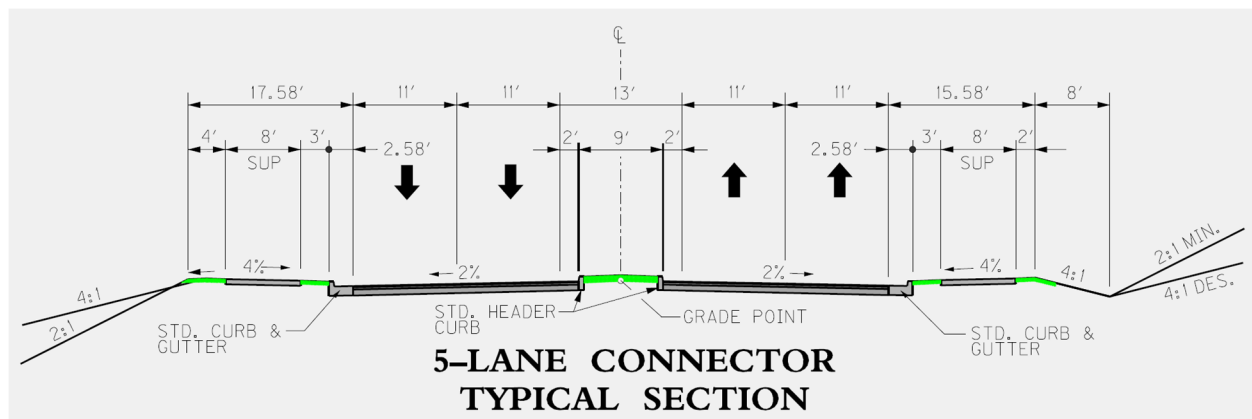
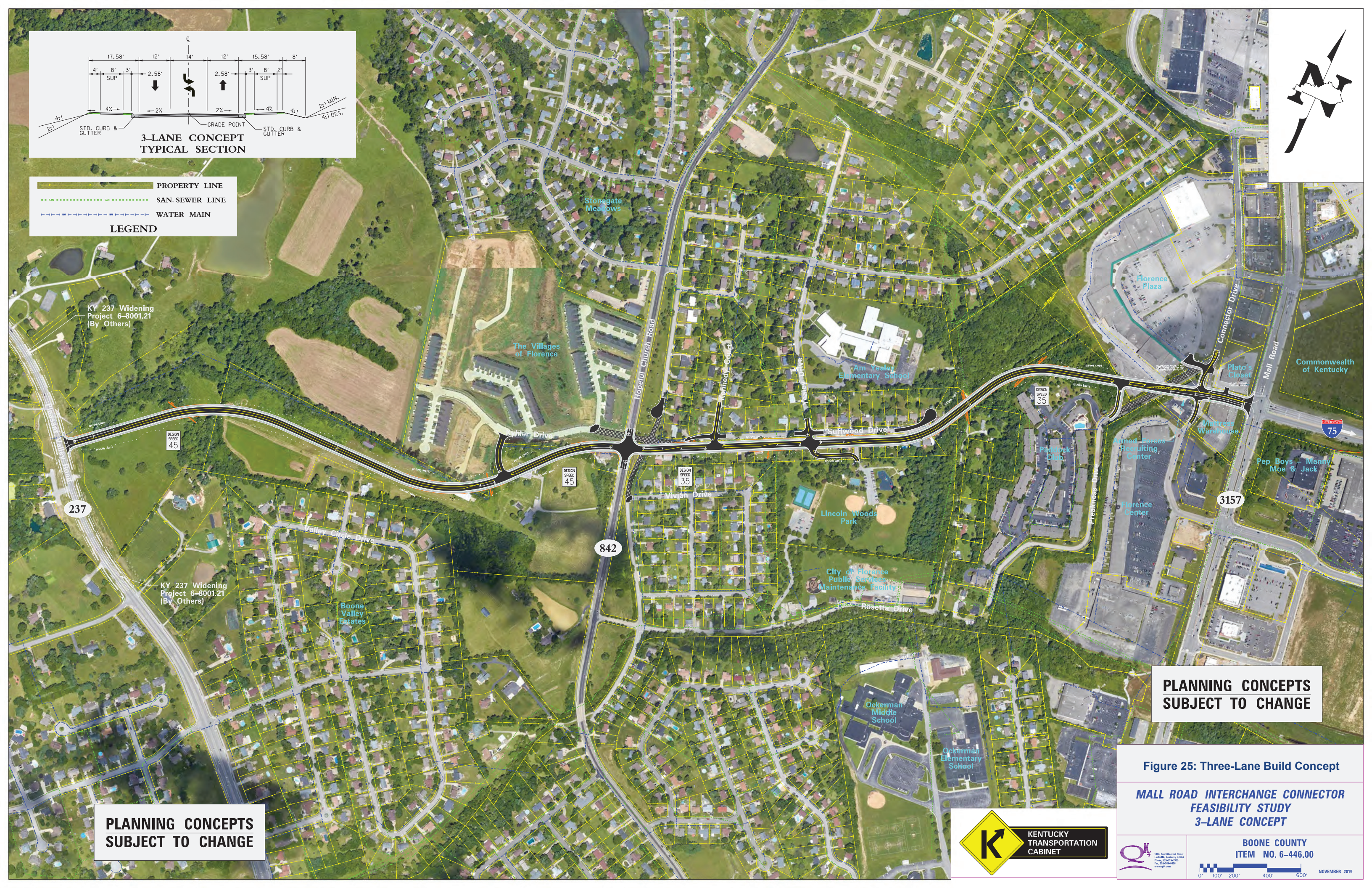
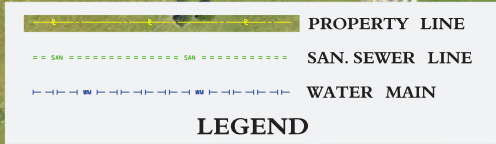
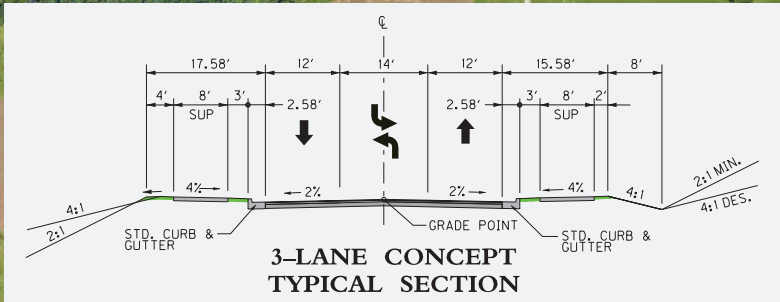


Figure 24: Four/Five-Lane Build Typical Section

Plan views of the representative build concepts are shown in **Figure 25** (page 39) and **Figure 26** (page 40).





**PLANNING CONCEPTS  
SUBJECT TO CHANGE**

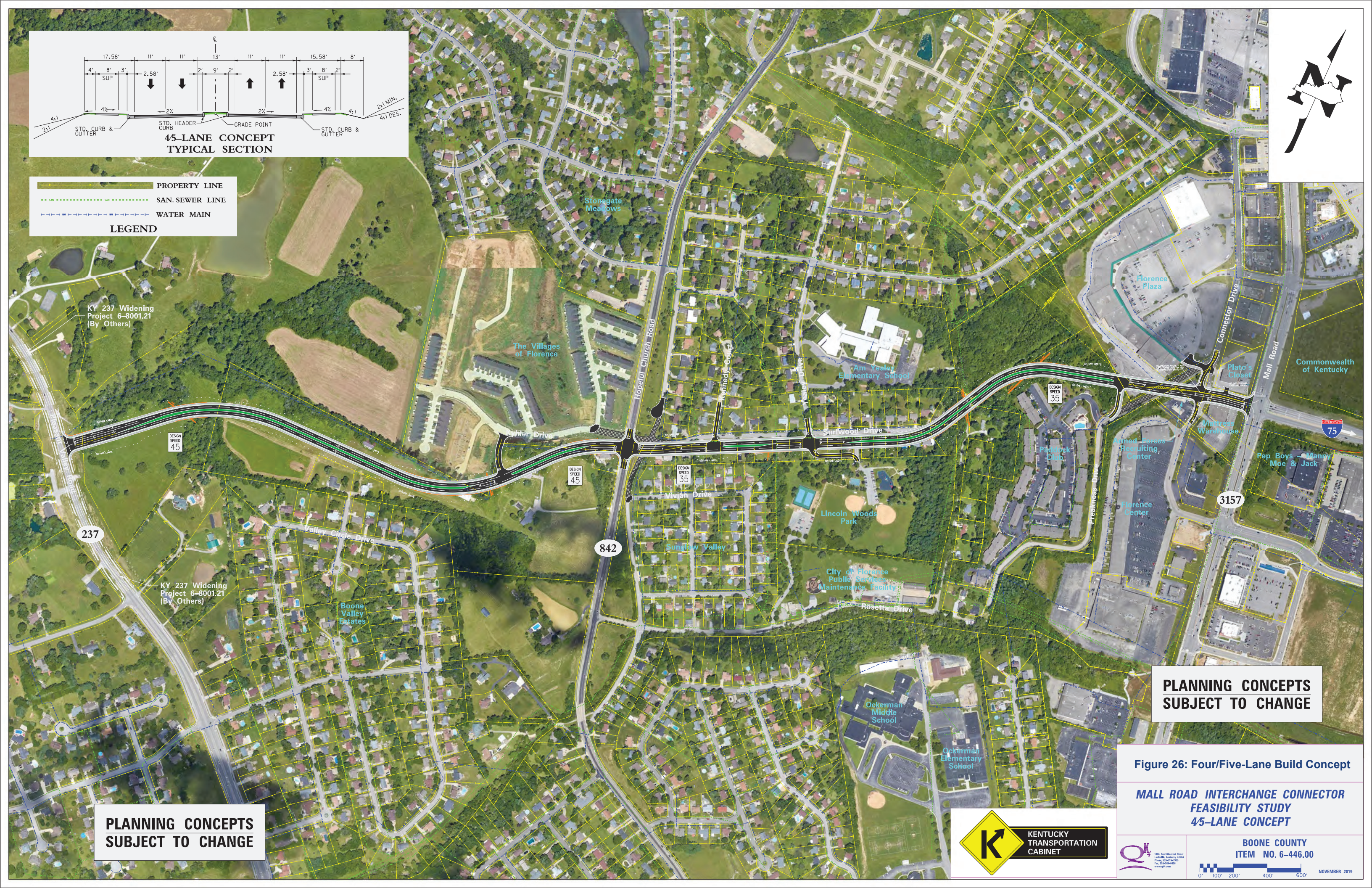
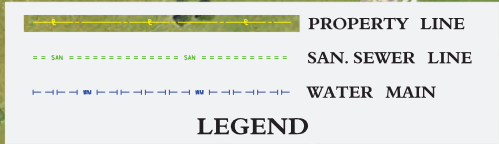
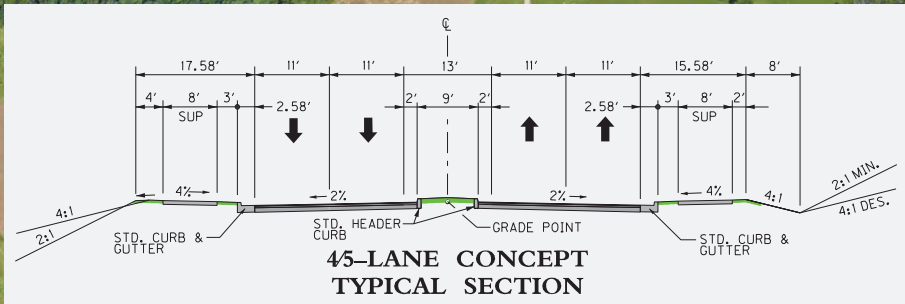
**PLANNING CONCEPTS  
SUBJECT TO CHANGE**

**Figure 25: Three-Lane Build Concept**

**MALL ROAD INTERCHANGE CONNECTOR  
FEASIBILITY STUDY  
3-LANE CONCEPT**







**PLANNING CONCEPTS  
SUBJECT TO CHANGE**

**PLANNING CONCEPTS  
SUBJECT TO CHANGE**

Figure 26: Four/Five-Lane Build Concept

**MALL ROAD INTERCHANGE CONNECTOR  
FEASIBILITY STUDY  
45-LANE CONCEPT**





## 6.2 2045 Build Scenario Traffic

Again based on OKI's model outputs, 2045 Build traffic forecasts were produced for the three-lane and four-/five-lane concepts. Results show a three-lane corridor would carry an estimated 14,000 to 26,000 vpd with the higher volume on the eastern segment. By comparison, the four-/five-lane corridor would carry an estimated 21,000 to 32,000 vpd, suggesting the additional capacity of the wider concept is warranted. **Table 11** summarizes how each scenario affects US 42 traffic, including daily, AM, and PM peak estimates by segment.

**Table 11: Volumes by Segment on US 42**

Scenario	West of KY 237	KY 237 to KY 842	KY 842 to Mall Rd	East of Mall Rd
<b>ADT</b>				
2019 Existing	39,000	38,400	38,400	35,500
2040 No-Build	52,000	56,000	51,000	40,000
2040 Build (3-Ln)	54,000	50,000	44,000	36,000
2040 Build (4/5-Ln)	54,000	46,000	42,000	37,000
<b>AM Peak Hour</b>				
2019 Existing	2,400	2,400	2,500	2,500
2040 No-Build	3,600	3,700	3,300	2,500
2040 Build (3-Ln)	3,700	3,300	3,000	2,500
2040 Build (4/5-Ln)	3,800	3,000	2,700	2,600
<b>PM Peak Hour</b>				
2019 Existing	3,200	2,900	3,000	2,600
2040 No-Build	4,400	4,400	4,200	3,200
2040 Build (3-Ln)	4,600	4,000	3,400	2,700
2040 Build (4/5-Ln)	4,600	3,700	3,200	2,700

Turn movements for each build scenario are presented in **Figure 27** (page 42) and **Figure 28** (page 43).



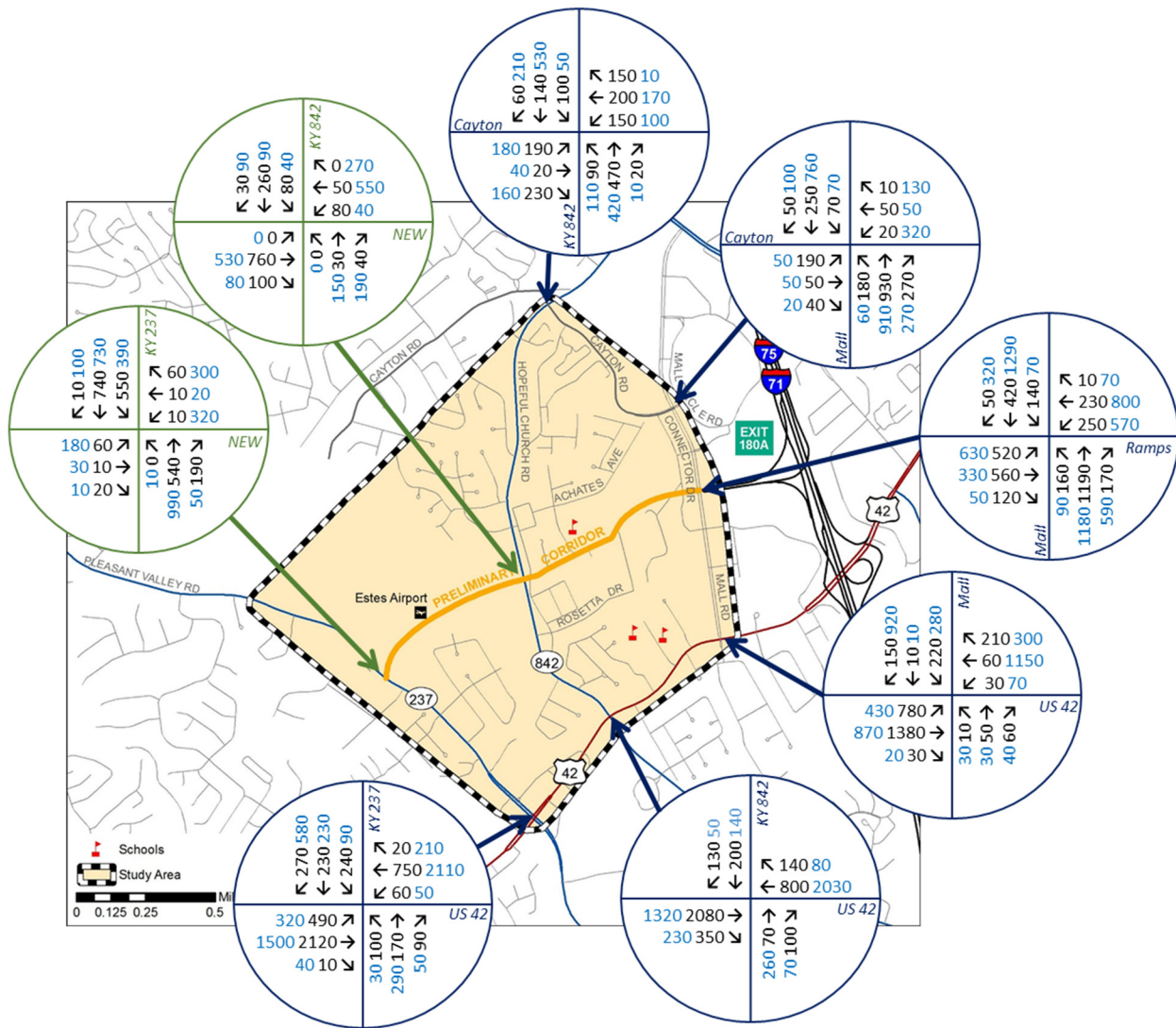


Figure 27: 3-Lane Build AM and PM Peak Turn Movements at Key Intersections





**Table 12: 2045 Intersection LOS along US 42 Corridor**

Intersection	AM Peak			PM Peak		
	No-Build	3-Lane	4/5-Lane	No-Build	3-Lane	4/5-Lane
US 42/KY 237	F	F	E	F	E	E
US 42/Harvey Quast Drive	D	B	B	F	C	C
US 42/Quadrant Road	D	B	B	F	B	B
US 42/KY 842	D	A	A	F	D	D
US 42/Ockerman Drive	C	C	C	F	D	D
US 42/Mall Road	E	D	D	F	F	F

**Table 13: US 42 Travel Time by Scenario**

Scenario	AM	PM
2019 Existing Eastbound	231 sec	239 sec
2019 Existing Westbound	244 sec	270 sec
2045 No-Build Eastbound	349 sec	266 sec
2045 No-Build Westbound	319 sec	1,538 sec*
2045 2045 3-Lane Build Eastbound	220 sec	260 sec
2045 3-Lane Build Westbound	259 sec	359 sec
2045 4/5-Lane Build Eastbound	218 sec	218 sec
2045 4/5-Lane Build Westbound	219 sec	327 sec

\* Represents failure with complete breakdown of the model

The new connector increases traffic using the Mall Road interchange (exit 180A), summarized in **Table 14**. Ramp traffic nearly doubles in the build scenarios compared to no-build volumes. The existing off-ramp provides over 2,600 feet of storage before impacting mainline I-71/I-75 operations; anticipated queue lengths in all future scenarios are well below this length. **Figure 29** (page 46) and **Figure 30** (page 47) summarize connector LOS and ramp queue lengths between scenarios for the AM and PM peak hours, respectively.

**Table 14: Volumes by Segment on Proposed Mall Road Connector**

Scenario	KY 237 to KY 842	KY 842 to Mall Rd	Mall Rd Ramps
<b>ADT</b>			
2019 Existing	-	-	14,000
2040 No-Build	-	-	15,000
2040 Build (3-Ln)	14,000	26,000	26,000
2040 Build (4/5-Ln)	21,000	32,000	29,000
<b>AM Peak Hour</b>			
2019 Existing	-	-	950
2040 No-Build	-	-	780
2040 Build (3-Ln)	940	1,600	1,400
2040 Build (4/5-Ln)	1,500	2,300	1,600
<b>PM Peak Hour</b>			
2019 Existing	-	-	1,400
2040 No-Build	-	-	1,500
2040 Build (3-Ln)	1,200	2,200	2,400
2040 Build (4/5-Ln)	1,700	2,700	2,700



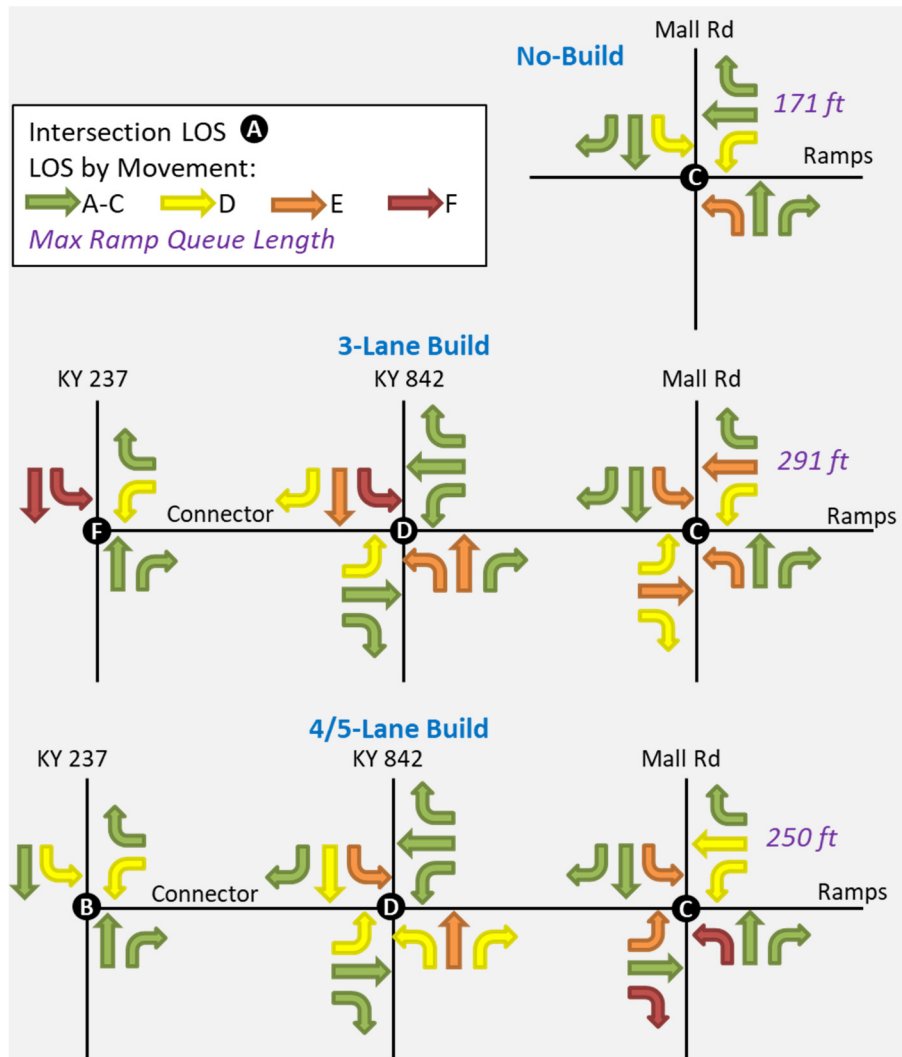
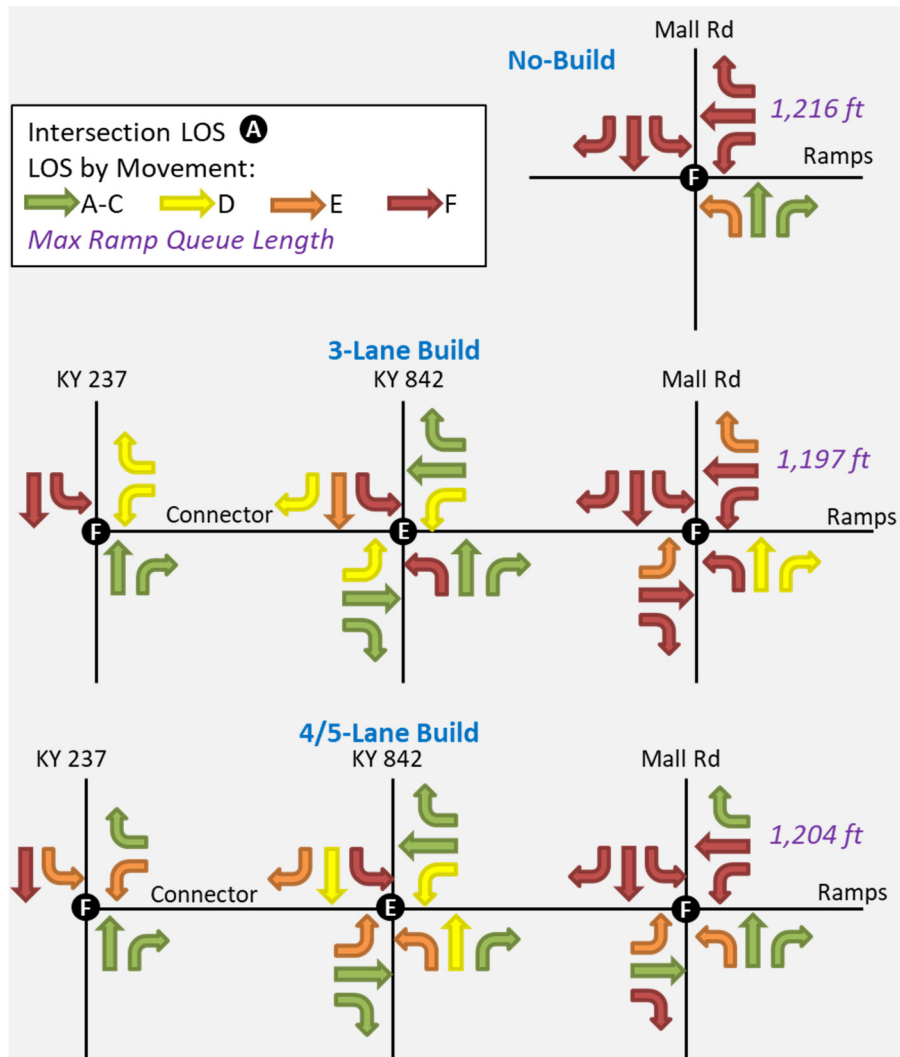


Figure 29: AM Peak Hour Operations along Proposed Mall Road Connector



**Figure 30: PM Peak Hour Operations along Proposed Mall Road Connector**

### 6.3 Potential Environmental Impacts

As the footprints of the representative build concepts are similar, the extent of impacts associated with each closely match. Preliminary disturb limits estimate 24 acres for the three-lane concept versus 27 acres for the four-/five-lane concept. It should be noted that the alignment is likely to be refined during subsequent project development phases; thus, additional field studies, analyses, and coordination will be required to satisfy the *National Environmental Policy Act* (NEPA) if a build option advances.

#### *Relocations and Community Resources*

The proposed build concepts may displace an estimated 23 to 26 residences, which would be concentrated along the south side of Surfwood Drive based on the preliminary alignment. This corridor avoids denser residential developments—such as the Paddock Club Apartments and newly constructed Villages of Florence—and Section 4(f) concerns associated with Lincoln



Woods Park. Detailed analysis of noise impacts on these adjacent noise-sensitive areas will be required to determine if mitigation is reasonable and feasible per current KYTC policy. If a build option advances, an assessment of potential socioeconomic impacts (see **Section 3.2.4**) will also be required, with public involvement activities and surveys distributed to potential residential relocatees. Most of the potential relocations are within Tract 703.12 Block Group 2, which exceeds county averages in each demographic category studied.

The private airstrip would be acquired in either scenario. In addition, two commercial buildings opposite the current interchange (**Figure 31**) would also likely be impacted.



**Figure 31: Potential Commercial Relocations**

### *Historic and Archaeological Resources*

No direct effects to aboveground historic resources are anticipated although further study and consultation with the State Historic Preservation Officer (SHPO) will be required if a build option advances. Archaeological investigations in consultation with the SHPO will also be required along the preferred footprint, once identified.

### *Hazmat Concerns*

Hazmat concerns noted within the preliminary footprint are primarily associated with construction permits.

- A Resource Conservation and Recovery Act (RCRA) site near the eastern terminus is associated with a former dry cleaners at 8117 Connector Drive. RCRA tracks hazardous

waste through its generation, transportation, treatment, storage, and disposal, covering a wide range of facility types.

- Adjacent to the preliminary footprint, the private airstrip is listed in the US EPA's emission inventory system.

### Natural Environment

The build concepts cross three streams—unnamed tributaries to South Fork Gunpowder Creek—with an estimated 530 to 610 linear feet of impacts. Roughly five to six acres of wooded, threatened/endangered bat habitat could be disturbed.

The preliminary footprints of the build concepts also impact farmland soils, which will require additional coordination with the NRCS if a build alternative is selected for implementation. Preliminary impacts include 6.5 to 7.3 acres of prime farmland soils and 6.9 to 7.8 acres of statewide important farmland soils. Aside from the Rehkamp property, few active agricultural land uses remain in the study area.

## 6.4 Cost Estimates

Analysts used Bentley MicroStation and Inroads software to create conceptual design models of both build concepts. These design models were used to estimate quantities of high-cost construction items including earthwork, pavement, and structures. Construction costs were tabulated using the KYTC District 6 average unit bid prices. KYTC District 6 provided right-of-way and utility cost estimates based on conceptual model disturb limits, aerial imagery, approximate locations of existing right-of-way and property lines generated from property valuation administrator (PVA) data, and utility records. Summarized by phase in **Table 15**, either build option is anticipated to cost around \$25 million in 2019 dollars. Right-of-way impacts represent over half the estimated project costs.

**Table 15: Planning-Level Cost Estimates by Phase**

Phase	3-Lane Build	4/5-Lane Build
Design	\$0.7 million	\$0.7 million
Right-of-Way	\$14.9 million	\$14.9 million
Utilities	\$0.3 million	\$0.3 million
Construction + 30% contingency	\$8.7 million	\$9.3 million
<b>Total</b>	<b>\$24.6 million</b>	<b>\$25.2 million</b>

## 7.0 FINAL COORDINATION MEETINGS

Once the representative build concepts were defined, the project team met again and reached out to resource agencies to solicit feedback.

### 7.1 Project Team Meeting No. 2

The final project team meeting was held November 20, 2019 at KYTC District 6. The purpose of the meeting was to present the representative build concepts, estimated costs, and potential



impacts for group discussion. Meeting minutes are included in **Appendix F**. The traffic operations models were discussed in detail along with potential alignment shifts to minimize impacts, particularly to residences. The team agreed these refinements could be considered in subsequent design phases. KYTC District 6 will reach out to city officials to collect feedback throughout the design process, independent of this planning study.

## 7.2 Resource Agency Coordination

Resource agency coordination was conducted to help identify potential environmental resources, development plans, or other potential issues. The KYTC Division of Planning mailed applicable resource agencies a packet of project-related information including purpose and need, existing traffic and safety information, preliminary build concepts, and an environmental overview exhibit. Responses are summarized in **Table 16** and provided in full in **Appendix G**.

**Table 16: Summary of Resource Agency Comments**

Resource Agency	Comment(s)
Kentucky Airport Zoning Commission	<ul style="list-style-type: none"> <li>➤ No permit is required as highway structures will be shielded by surrounding structures unless a crane is used that exceeds the height of surrounding structures.</li> </ul>
Kentucky Department of Agriculture	<ul style="list-style-type: none"> <li>➤ There are no PACE properties in Boone County at this time.</li> </ul>
Kentucky Department for Environmental Protection: Division of Water	<ul style="list-style-type: none"> <li>➤ Construction, reconstruction, relocation or improvement of any dam, embankment, levee, dike, bridge, fill or other obstruction across or along any stream, or in the floodway of any stream constructed by the Department of Highways is exempt from the permitting or approval by the Kentucky Division of Water.</li> <li>➤ A Section 401 permit is required for the project.</li> <li>➤ The proposed project is within the Louisville Water Company designated Source Water Protection Area (Zone 3).</li> <li>➤ The proposed work is in an area with a high potential for karst development where the groundwater is susceptible to direct contamination from surface activities. A Groundwater Protection Plan is recommended.</li> <li>➤ Project plans should include an approved Division of Water permit for stormwater impacts. A Best Management Plan and Stormwater Pollution Prevention Plan should be developed to mitigate runoff and protect water quality.</li> </ul>
Kentucky Department for Environmental Protection: Division of Waste Management	<ul style="list-style-type: none"> <li>➤ The Division of Waste Management providing location information for USTs, superfund sites, solid and hazardous waste sites in the vicinity.</li> <li>➤ All solid wastes generated by the project must be disposed of at a permitted facility.</li> <li>➤ If asbestos, lead paint, or other contaminants are encountered, contact the Division of Waste Management for more information.</li> </ul>

Resource Agency	Comment(s)
Kentucky Department for Environmental Protection: Division for Air Quality	<ul style="list-style-type: none"> <li>➤ Measures to prevent particulate matter from becoming airborne are required.</li> <li>➤ Open burning is prohibited except as specifically provided per 401 KAR 63:005.</li> <li>➤ To conform with National Ambient Air Quality Standards, the Division recommends utilizing alternatively fueled equipment, reducing idling time, and following other emission controls.</li> </ul>
Kentucky Department of Fish and Wildlife Resources	<ul style="list-style-type: none"> <li>➤ Federally listed Indiana bat is known to occur within 10 miles of the project site. Five state-listed species are known to occur within one mile of the site.</li> <li>➤ Contact the US Army Corps and Kentucky Division of Water prior to any work within waterways or wetlands.</li> <li>➤ Measures to minimize stream impacts are identified: using natural stream design for channel changes, using culverts that allow for the passage of aquatic organisms and minimize degradation, excavating during low flow periods, placing erosion control structures properly, planting native vegetation, returning disturbed instream habitat to stable condition, and preserving tree canopy.</li> </ul>
Kentucky Division of Forestry	<ul style="list-style-type: none"> <li>➤ There are no State Forests, Champion Trees, or other ongoing projects within the study area.</li> </ul>
Kentucky Heritage Council	<ul style="list-style-type: none"> <li>➤ No comment.</li> </ul>
Northern Kentucky Chamber of Commerce	<ul style="list-style-type: none"> <li>➤ The Chamber supports efforts to create a new connector route. The concept is consistent with the county's Transportation Plan and its vision for improved bicycle/pedestrian connectivity and safety.</li> <li>➤ Due to continued development in the region, the Chamber strongly encourages KYTC to develop the five-lane road.</li> <li>➤ Effective stormwater management must be considered. Gunpowder Creek and nearby streams show moderate channel instability risk with unstable portions just downstream. Coordination with local jurisdictions on stormwater management strategies is suggested.</li> </ul>
US Department of Agriculture: NRCS	<ul style="list-style-type: none"> <li>➤ NRCS does not anticipate the proposed actions will affect prime farmland soils, farmlands of statewide importance, watershed structures, wetlands, Wetland Reserve/Grassland Reserve easements or special environmental concerns.</li> <li>➤ To satisfy NEPA, further coordination will be required for conversion of wetlands or prime farmlands to non-agricultural uses.</li> </ul>
US Department of Health and Human Services	<ul style="list-style-type: none"> <li>➤ Contact the Boone County Health Department to ensure there are no environmental factors that may impact health outcomes.</li> </ul>



## 8.0 NEXT STEPS

The next phase in the project development process is Phase I Preliminary Design, including environmental analyses to satisfy NEPA as federal NH design funds are identified in the *FY 2018—2024 Highway Plan*. Analysis suggests a four/five-lane connector is appropriate based on anticipated future traffic volumes. Coordination with local officials, key stakeholders, and the public will be critical considering the potential for impacts to nearby community resources.

## 9.0 ADDITIONAL INFORMATION

Any written requests for additional information regarding the study should be sent to:

Kentucky Transportation Cabinet, District 6  
Branch Manager for Project Development  
c/o Mr. Mike Bezold, PE  
421 Buttermilk Pike  
Covington, KY 41017  
Phone: 859-341-2700

## MALL ROAD INTERCHANGE CONNECTOR FEASIBILITY STUDY



*Groundbreaking by Design.*

LOUISVILLE | FRANKFORT | SOMERSET | RATCLIFF | OWENSBORO | HENDERSON