



US 25

CORRIDOR STUDY ROCKCASTLE COUNTY, KY

MT. VERNON

prepared for:



in partnership with:



FINAL AUGUST 2022

EXECUTIVE SUMMARY

Study Background

The Kentucky Transportation Cabinet (KYTC) initiated a corridor study in the summer of 2021 for US 25 near the city of Mount Vernon in Rockcastle County. The study includes two distinct sections of US 25, surrounding its interchange with Interstate 75 (Exit 62). Combined, the study area is 2.3 miles in length, stretching between KY 461 approaching Mount Vernon to the south and Beiting Lane to the north. **Figure ES-1** depicts the limits.

Both study sections of US 25 provide a critical link in the local and regional transportation network. Beyond connecting Mount Vernon with I-75, the corridor provides the most direct connection to Lake Cumberland to/from the north and provides access to event venues such as Renfro Valley Entertainment Center and the Kentucky Music Hall of Fame. US 25 also provides a detour route when an incident disrupts I-75 operations.

Immediately south of the study corridor, an ongoing KYTC project (Item No. 8-8952) is underway to widen KY 461 between US 150 and US 25 to four lanes, a distance of 2.4 miles. It should be noted the I-75 interchange was reconstructed during 2017–2019, concurrent with a larger interstate widening effort.

Existing Geometry and Systems

Table ES-1 summarizes existing conditions for US 25 in both sections of the study area. As a principal arterial and component of both the National Highway System and National Truck Network, US 25 through the southern study area provides a much higher level of mobility than

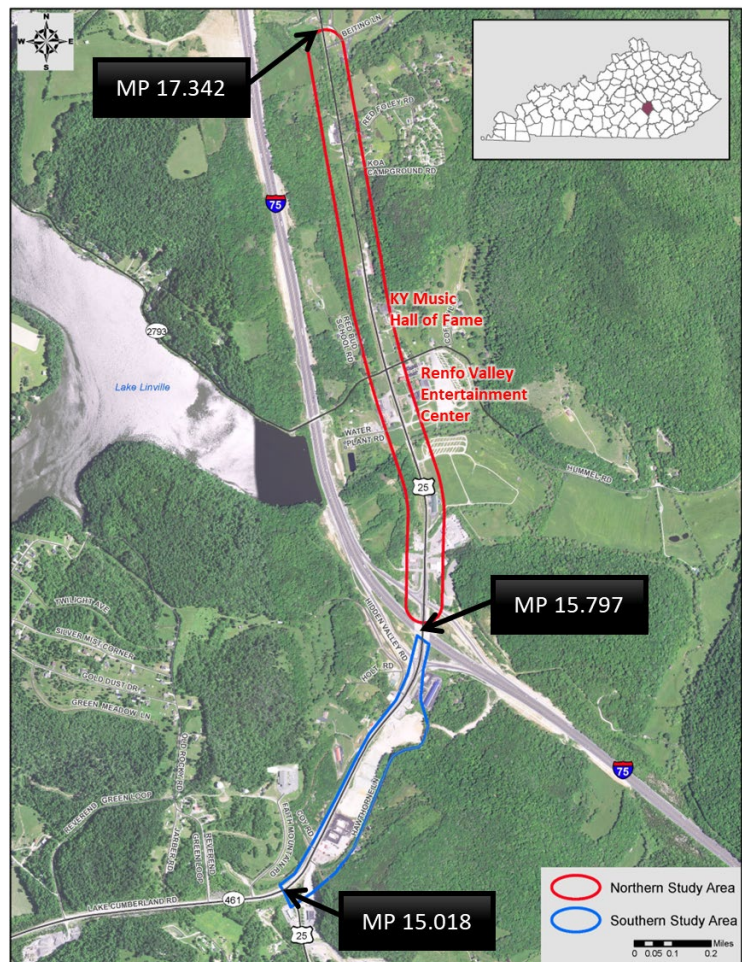


Figure ES-1: Study Area with Milepoints (MP)

through the northern study area. US Bike Route 21 (Daniel Boone Bike Tour) runs along the entirety of US 25 in the study area; however, no dedicated bike facilities exist.

Table ES-1: Existing Systems and Geometry Summary

	Northern Study Area	Southern Study Area
Highway Systems	• Rural Major Collector • Scenic Byway • US Bike Route 21 • State Secondary System	• Rural Principal Arterial • National Highway System • State-designated truck route • Scenic Byway • US Bike Route 21 • State Primary System
Geometry/ Design	• Two 11-ft-wide thru lanes + TWLTL • Curb/gutter or 1-ft paved shoulders • Some sidewalks, ped underpass • 45-55 mph • 5-6% grades • AAA (80,000 lb.) truck weight • Access by permit	• Three 12-ft-wide thru lanes + TWLTL • 10-ft-wide paved shoulders • No sidewalks • 45 mph • 5-7% grades • AAA (80,000 lb) truck weight • Access by permit

* TWLTL = two-way left-turn lane

Traffic Flows

Three different rounds of existing traffic data were collected:

- Summer weekend volumes ranged from 15,300 to 19,200 vehicles per day (vpd), with peak flows southbound—towards Lake Cumberland—on Friday and northbound on Sunday. A steady stream of slow-moving lake traffic is common, with queues for miles along US 25 on summer weekends and holidays (**Figure ES-2**).



Figure ES-2: Northbound Queue along KY 461 (upstream from study area)

- Weekday average daily traffic is 4,700–7,800 vpd north of the I-75 interchange and up to 15,400 vpd to the south. While these are lower than weekend traffic, they better correlate to future year traffic projections. Operationally, most intersections operate at Level of

Service (LOS) C or better during both weekday peak hours—except left turns from the stop-controlled southbound off-ramp (LOS E) and the US 25/KY 461 signal (LOS D during PM peak). Between intersections, closely spaced commercial driveways introduce turbulent flow characteristics with numerous conflict points.

- To measure travel times, traffic data was also collected during a sold-out concert at Renfro Valley during February 2021. Arriving before the event, travel times were 3.5 to 5 minutes to travel 2,100 feet from the interchange to the entrance, equating to speeds of 5 to 7 mph with traffic queuing up along US 25. However, no officers helped direct traffic and attendants were not in the parking lot to manage on-site navigation/queuing.

Coordination with local officials occurred to define a reasonable future No-Build scenario, reflective of current local land use development projections. Among other regional growth plans, site work is ongoing for seven parcels immediately east of US 25 (approximate MP 15.3—15.5, herein referred to as the “Ditch” development) that will directly impact US 25 traffic flows/access. While tenants have yet to be identified, a series of highway-oriented businesses and a small grocery could be expected to locate on the site with construction beginning as early as 2023.

KYTC’s current statewide travel demand model, along with 2021 weekday turning movement counts and input from community leaders, formed the basis of future year 2045 traffic projections. An annual growth rate of 0.6% south of the interchange and 0.2% north was applied to the 2021 Existing weekday scenario to project future 2045 No-Build traffic. The corridor is expected to carry 8,400 (north) to 17,600 (south) vpd in the No-Build scenario. Most study intersections and stop-controlled approaches operate at LOS D or better during both peak hours with the southbound off-ramp and US 25/KY 461 signal at LOS E.

Crash Trends

During the 2016-2020 analysis period, 127 crashes occurred along the US 25 corridor: 81 south of the I-75/US 25 interchange and 46 to the north. Of these crashes, there were no fatalities and 16 injury collisions. Most crashes are clustered near the I-75 interchange: 92 crashes (11 injuries) occurred in the half-mile stretch surrounding the interchange. It should be noted that crash patterns may not be representative of typical patterns, as both the I-75 widening project and the Covid pandemic influenced traffic patterns during the analysis period.

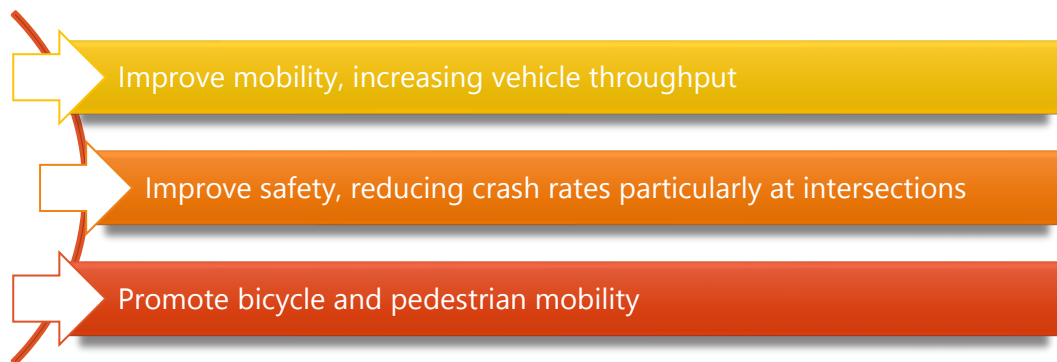
Statistical analysis shows most of the study area exhibits an elevated crash pattern and poor Level of Service of Safety (LOSS), with higher concentrations in the busier southern section.



Figure ES-3: Closely Spaced Driveways in Southern Study Area

Study Goals and Objectives

Finding an appropriate balance of mobility and access is one of the core challenges facing the US 25 corridor in the southern study area. Between KY 461 and the I-75 interchange, the goals of the proposed study are:



As secondary objectives, all concepts should also preserve reasonable, safe access to adjoining businesses and minimize right-of-way impacts.

The goals and objectives for improvements considered in the northern study area focus on enhanced bicycle and pedestrian mobility.

Build Concepts

Improvement concepts in the southern study area focus on access management strategies to streamline traffic flow and improve safety. Much of the discussion centers around the "Ditch" development (**Figure ES-4**) that extends along the eastern edge of US 25. While any internal roadway connections would be the responsibility of the developer, representative access options were presented to the project team and key stakeholders to facilitate discussions. The property's connection to US 25 is complicated by numerous factors: proximity to the interchange, nearby

clusters of closely spaced driveways, steep grades climbing to the south, steep terrain features parallel to US 25 and the development site, and the US 25/KY 461 signal.



Figure ES-4: Design Challenges in Southern Study Area

Improvement concepts were developed based on a combination of input from the project team, a review of existing conditions, stakeholder feedback, and field reconnaissance. The typical section south of the interchange is intended to match with the adjacent Item No. 8-8952 widening project: two 12-foot-wide thru lanes per direction, a 14-foot flush median, and 10-foot-wide paved shoulders.

- **Concept 1 (Figure ES-5)** widens US 25 south of the interchange, providing two 12-foot-wide thru lanes per direction, curb/gutter, a flush center median, and 10-foot-wide shared-use path on the east side. It creates a signalized "Green-T" intersection at US 25/KY 461 with a bulb out or "looon" for southbound U-turn traffic. A backage road connection provides access between approximate MP 15.12 and 15.55 with right-in/right-out (RI/RO) connections at either end and a Green-T.
- **Concept 2 (Figure ES-6)** widens US 25 south of the interchange, providing two 12-foot-wide thru lanes per direction, curb/gutter, a raised center median, and 10-foot-wide shared use path on the east side. It assumes a signalized Green-T intersection at US 25/KY 461 and adds a raised median to prevent cross-median traffic except at designated locations. The stop-controlled intersection with the I-75 southbound ramps is reconstructed as a roundabout with two northbound thru lanes.
- **Concept 2+ (Figure ES-7)** matches Concept 2 plus reconstructs the US 25 intersection with the I-75 northbound ramps as a single lane roundabout. With this improvement, northbound US 25 traffic to the northbound I-75 on-ramp is free-flow with no opposing movements after entering the southern roundabout.

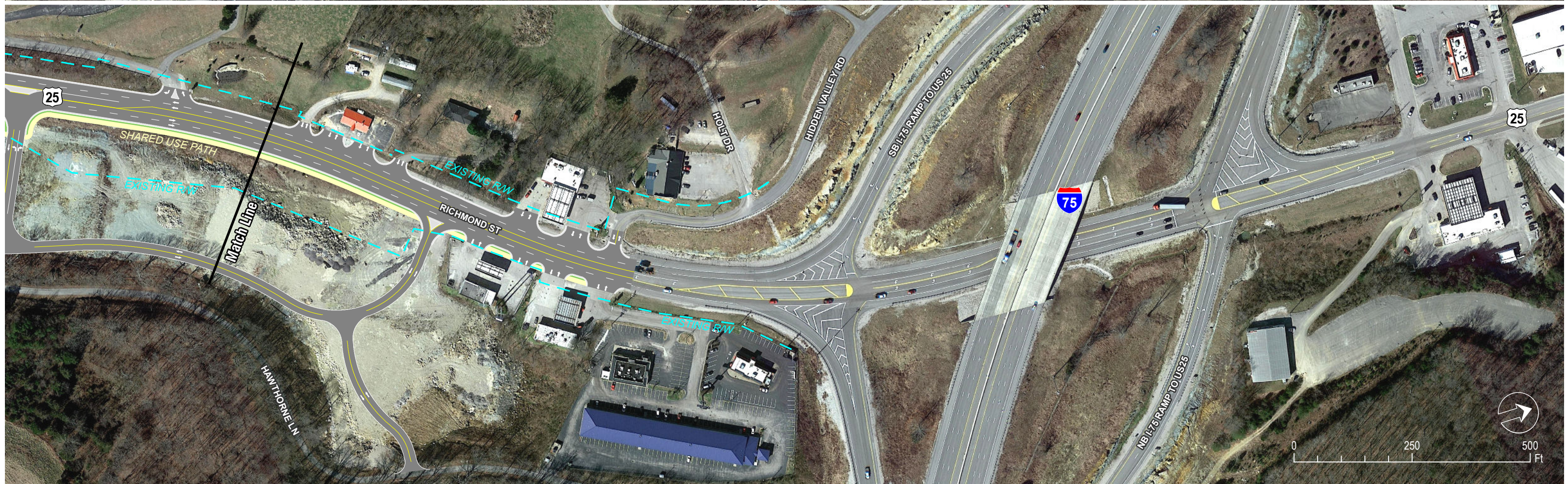


Figure ES-5: Access Management Concept 1

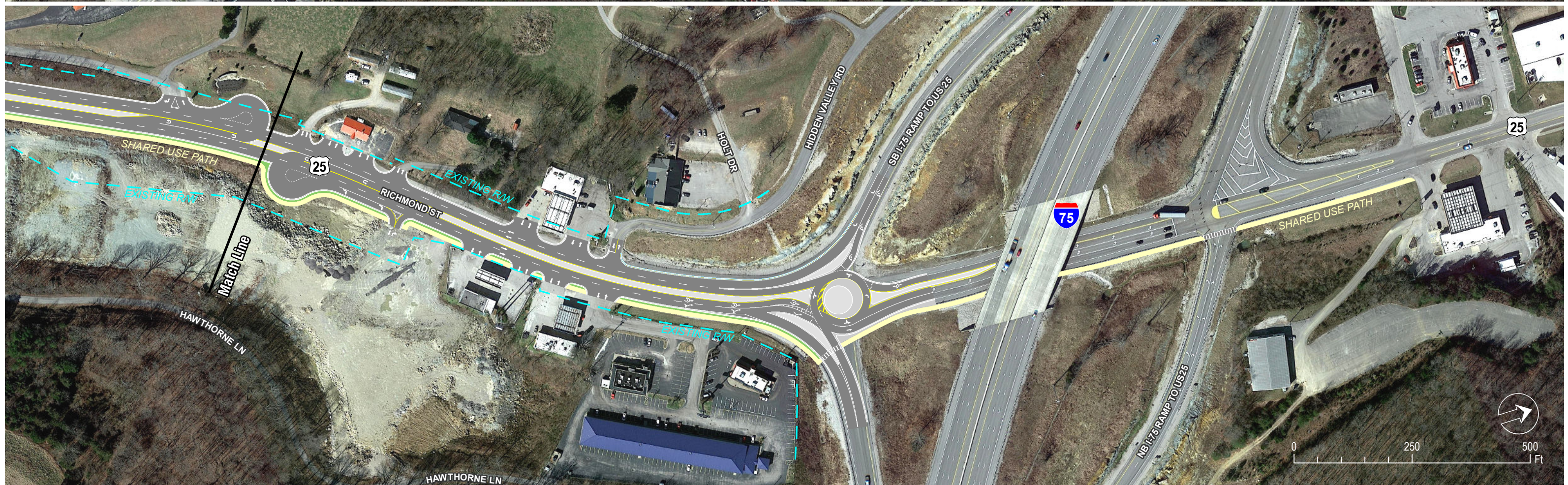


Figure ES-6: Access Management Concept 2

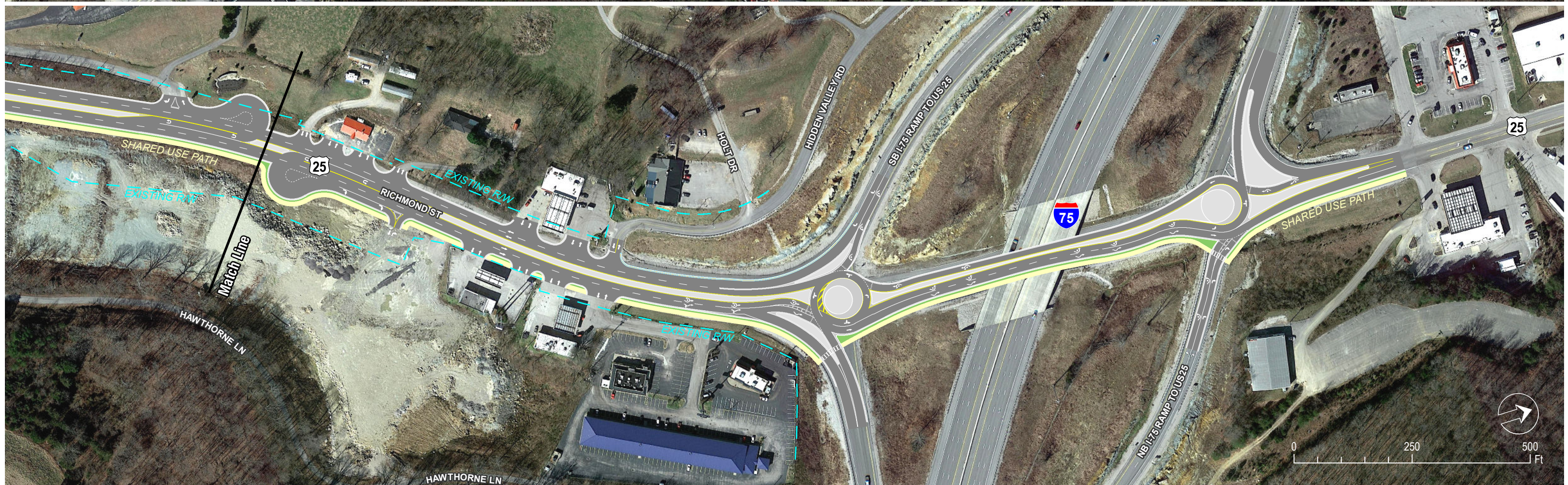


Figure ES-7: Access Management Concept 2+

Other spot improvements add/extend a lighted, 10-foot-wide **Shared Use Path** between US 25/KY 461 and the KOA Campground and replace asphalt pavement with concrete within the interchange where heavy trucks have begun to rut turn lanes.

Two other concepts were considered but dismissed:

- Reversible lanes to manage event traffic within existing pavement are more impactful and costly than assigning traffic control personnel at the venue.
- Safety concerns at the US 25/Holt Road intersection should be monitored to determine if recent improvements at the interchange addressed crash concerns.

Costs for each component are presented in **Table ES-2**.

Table ES-2: Cost Estimates by Phase (2022 Dollars)

Build	Total Cost	Design	Right-of-Way	Utilities	Construction
Shared-use Path to KOA	\$2.9M	\$250,000	--	\$400,000	\$2.2M
Widen existing sidewalk	\$700,000	\$50,000	--	\$200,000	\$450,000
Shared-use Path at Interchange*	\$3.2M	\$250,000	--	\$380,000	\$2.6M
Shared-use Path to KY 461**	\$4.0M	\$250,000	--	\$350,000	\$3.4M
Replace dual left pavement	\$1.3M	\$120,000	--	--	\$1.2M
Concept 1					
US 25/shared-use path	\$9.3M	\$1.0M	\$150,000	\$700,000	\$7.4M
Backage Road	\$3.6M	\$250,000	\$900,000	\$300,000	\$2.1M
Concept 2	\$18.0M	\$1.6M	\$170,000	\$700,000	\$15.5M
Concept 2+	\$20.1M	\$1.7M	\$170,000	\$950,000	\$17.3M

* Included in Concept 2+ costs shown but presented for reference as standalone element

** Included in Concepts 1, 2, and 2+ costs shown but presented for reference as standalone element

Operationally, Concepts 1, 2, and 2+ reduce delay south of the interchange compared to the 2045 No-Build scenario. Microsimulation of the proposed roundabouts indicates both Concepts 2 and 2+ would provide adequate capacity for anticipated 2045 PM peak hour traffic, reducing delay compared to the existing configuration and supplying adequate queue storage lengths between ramp termini.

Safety analyses demonstrate that Concepts 1, 2, and 2+ reduce conflict points compared to a five-lane typical section with no access management measures implemented. Converting a signal to a Green-T, restricting left turns, and constructing roundabout(s) can be expected to reduce US 25 crash rates through and south of the interchange.

Recommendations

Build concepts were developed to minimize right-of-way requirements and match the proposed typical section for the committed KY 461 widening project to the south. This could potentially allow the subject project to advance on an accelerated schedule, streamlining construction costs and impacts for the larger corridor by coordinating adjacent projects.

Study recommendations include constructing a lighted, 10-foot-wide shared use path along the east side of US 25 from KY 461 to the KOA campground and widening US 25 from KY 461 to the I-75 interchange, incorporating access management measures. While no single Build concept is recommended, Concept 2+ is generally preferred as it best meets the study's objectives and goals. Concept 1 would require right-of-way for the backage road, impacting the project development timeline. Dual roundabouts in Concept 2+ provide a smoother flow through the interchange with fewer conflict points and improved safety for pedestrians. However, other concepts may be explored in future design phases.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	ES-1
1.0 INTRODUCTION.....	1
2.0 EXISTING CONDITIONS.....	2
2.1 Roadway System Designations.....	2
2.2 Geometric Characteristics.....	5
2.3 Bridges and Other Structures.....	8
2.4 Bicycle and Pedestrian Facilities.....	8
2.5 2020 Traffic Volumes and Operations	9
2.6 Crash History	14
3.0 FUTURE NO-BUILD CONDITIONS	18
3.1 Nearby Transportation Plans/Studies	18
3.2 Local Outreach on Planned Growth.....	20
3.3 Future No-Build Traffic Volumes	21
4.0 ENVIRONMENTAL OVERVIEW.....	22
4.1 Natural Environment	24
4.2 Human Environment.....	25
5.0 STUDY GOALS AND OBJECTIVES	30
5.1 Southern Study Area: KY 461 to I-75.....	30
5.2 Northern Study Area: I-75 to Beiting Lane.....	31
6.0 CONCEPT DEVELOPMENT: ACCESS MANAGEMENT OPTIONS.....	32
7.0 INITIAL COORDINATION EFFORTS	34
7.1 Project Team Meeting No.1	35
7.2 Local Official and Stakeholder Meeting No. 1	35
8.0 CONCEPT DEVELOPMENT: OTHER SPOT IMPROVEMENTS.....	37
8.1 Project Team Meeting No. 2.....	38
8.2 Expanded Footprint: Interchange.....	39
9.0 FINAL CONCEPTS AND COORDINATION MEETINGS.....	39
9.1 Build Traffic Comparison.....	42
9.2 Build Safety Comparison.....	45
9.3 Planning-level Cost Estimates.....	48
9.4 Local Official and Stakeholder Meeting No. 2	48
9.5 Project Team Meeting No. 3.....	49
10.0 RECOMMENDATIONS	50
10.1 Project Sheets.....	50
11.0 ADDITIONAL INFORMATION.....	54

LIST OF FIGURES

Figure ES-1: Study Area with Milepoints (MP)	ES-1
Figure ES-2: Northbound Queue along KY 461 (upstream from study area).....	ES-2
Figure ES-3: Closely Spaced Driveways in Southern Study Area.....	ES-4
Figure ES-4: Design Challenges in Southern Study Area	ES-5
Figure ES-5: Access Management Concept 1	ES-6
Figure ES-6: Access Management Concept 2.....	ES-7
Figure ES-7: Access Management Concept 2+	ES-8
Figure 1: Study Area with Milepoints (MP).....	1
Figure 2: Study Tasks	2
Figure 3: Wilderness Road Heritage Highway.....	4
Figure 4: Lanes and Shoulders	5
Figure 5: I-75 Interchange Reconstruction	6
Figure 6: Curves and Grades	7
Figure 7: Study Area Structures	8
Figure 8: Directional Hourly Volume Comparison.....	10
Figure 9: Northbound Queue along KY 461 (upstream from study area)	11
Figure 10: What is Level of Service?	12
Figure 11: 2021 Existing Level of Service, Weekday AM (PM) Peak Hour	13
Figure 12: Travel Time Before (Top) and After (Bottom) Renfro Valley Concert.....	14
Figure 13: Crashes by Severity and Manner of Collision	15
Figure 14: Study Area Crashes by Year	16
Figure 15: Manner of Collision	16
Figure 16: Study Area LOSS.....	17
Figure 18: Planned Projects and Local Development Goals	19
Figure 18: 2045 No-Build LOS by Movement at US 25/KY 461 Intersection during AM (PM) Peak Hours	22
Figure 19: Environmental Resources in the Study Area.....	23
Figure 20: NRCS Farmland Soil Classifications.....	25
Figure 21: Listed NRHP Resources.....	27
Figure 22: Census Block Groups with Key Populations Exceeding County Thresholds	28
Figure 24: Mobility vs Access.....	30
Figure 24: US 25 Five-Lane Typical Section.....	32
Figure 25: Design Challenges in Southern Study Area	32
Figure 26: Continuous Green-T.....	34
Figure 27: Hilltop Development Concept	36
Figure 28: Access Management Concept 1	40
Figure 29: Typical Section for Concept 1	41
Figure 30: Typical Section for Concept 2	41
Figure 31: Access Management Concept 2.....	43

Figure 32: Access Management Concept 2+ 44

Figure 33: Conflict Points at Three-Leg Intersections 46

Figure 34: US 25/KY 461 Intersection Crashes 47

LIST OF TABLES

Table ES-1: Existing Systems and Geometry Summary ES-2

Table ES-2: Cost Estimates by Phase (2022 Dollars) ES-9

Table 1: National Bridge Inventory Condition Rating 8

Table 2: 2022-2028 Highway Plan Funding..... 18

Table 3: Listed Threatened and Endangered Species..... 24

Table 4: Comparison of PM Peak Traffic Operations..... 42

Table 5: Comparison of Crash Rates..... 45

Table 6: Cost Estimates by Phase (2022 Dollars)..... 48

Table 7: Comparison of Access Management Concepts..... 49

APPENDICES

- A. Traffic Forecast Report
- B. 2016-2020 Crash Records
- C. CVADD Socioeconomic Study
- D. Meeting Summaries

ACRONYMNS LIST

CHAF	Continuous Highway Analysis Framework
CMF	Crash Modification Factor
CVADD	Cumberland Valley Area Development District
DHV	Design Hourly Volume
EEC	Excess Expected Crashes
FHWA	Federal Highway Administration
HCM	Highway Capacity Manual
HDM	Highway Design Manual
HIS	Highway Information System
KYTC	Kentucky Transportation Cabinet
LEP	Limited English Proficiency
LOS	Level of Service
LOSS	Level of Service of Safety
LWCF	Land and Water Conservation Fund
MP	Milepoint
MPH	Miles Per Hour
MSAT	Mobile Source Air Toxics
NBI	National Bridge Inventory
NEPA	National Environmental Policy Act
NHS	National Highway System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NTN	National Truck Network
PDO	Property Damage Only
RCIDA	Rockcastle County Industrial Development Authority
RI/RO	Right-In/Right-Out
SHIFT	Strategic Highway Investment Formula for Tomorrow
STAA	Surface Transportation Assistance Act
STIP	Statewide Transportation Improvement Program
TED	Transportation Enterprise Database
TIF	Tax Increment Financing
TWLTL	Two-Way Left-Turn Lane
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
UST	Underground Storage Tank
v/c	Volume-to-Capacity Ratio
vpd	Vehicles per day

1.0 INTRODUCTION

The Kentucky Transportation Cabinet (KYTC) initiated a corridor study in the summer of 2021 for US 25 near the city of Mount Vernon in Rockcastle County. The study includes two distinct sections of US 25, surrounding its interchange with Interstate 75 (Exit 62). Combined, the study area is 2.3 miles in length, stretching between KY 461 approaching Mount Vernon in the south and Beiting Lane in the north. **Figure 1** depicts the limits.

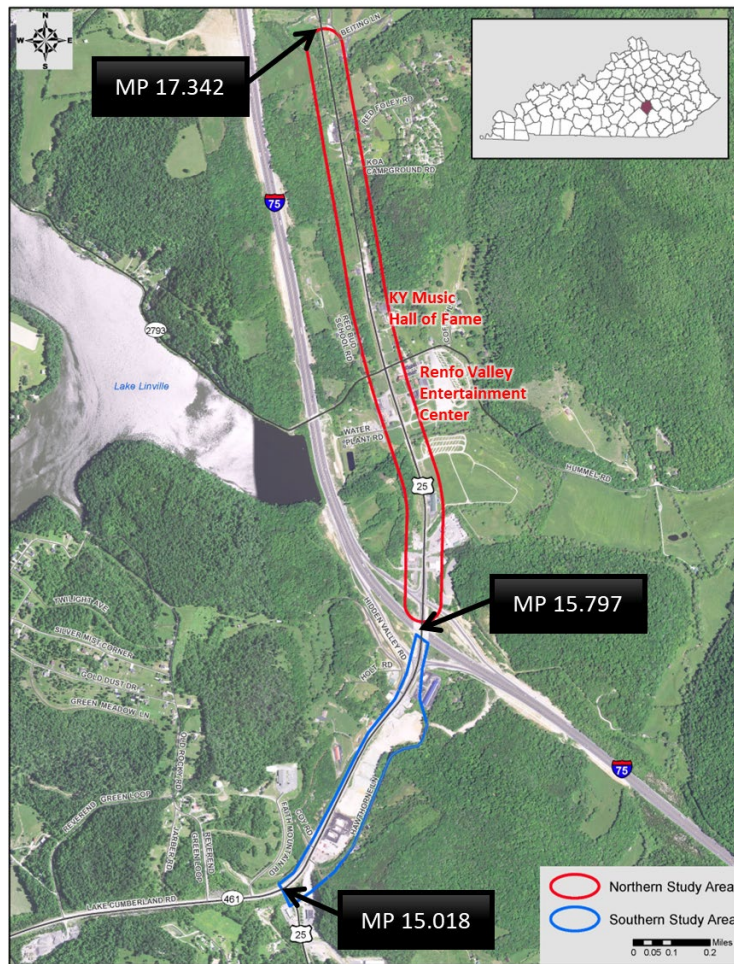


Figure 1: Study Area with Milepoints (MP)

Both study sections of US 25 provide a critical link in the local and regional transportation network. Beyond connecting Mount Vernon with I-75, the corridor provides the most direct connection to Lake Cumberland to/from the north. The lake attracts an estimated four million recreational visitors¹ each year. North of the interchange, US 25 provides access to event venues such as Renfro Valley Entertainment Center and the Kentucky Music Hall of Fame. US 25 also provides a detour route when an incident disrupts I-75 operations.

Immediately south of the study corridor, an ongoing KYTC project (Item No. 8-8952) is underway to widen KY 461 to four lanes between US 150 and US 25, a distance of 2.4 miles.

Study tasks (**Figure 2**) include creating an inventory of existing conditions, defining goals for the study, forecasting existing and future traffic, identifying red flag environmental issues, developing

¹ Somerset Pulaski Economic Development Authority; online at <https://somersestkyleads.com/newsroom/>

build concepts with construction cost estimates, seeking community input, and documenting the study process and results. The following chapters explore these efforts.

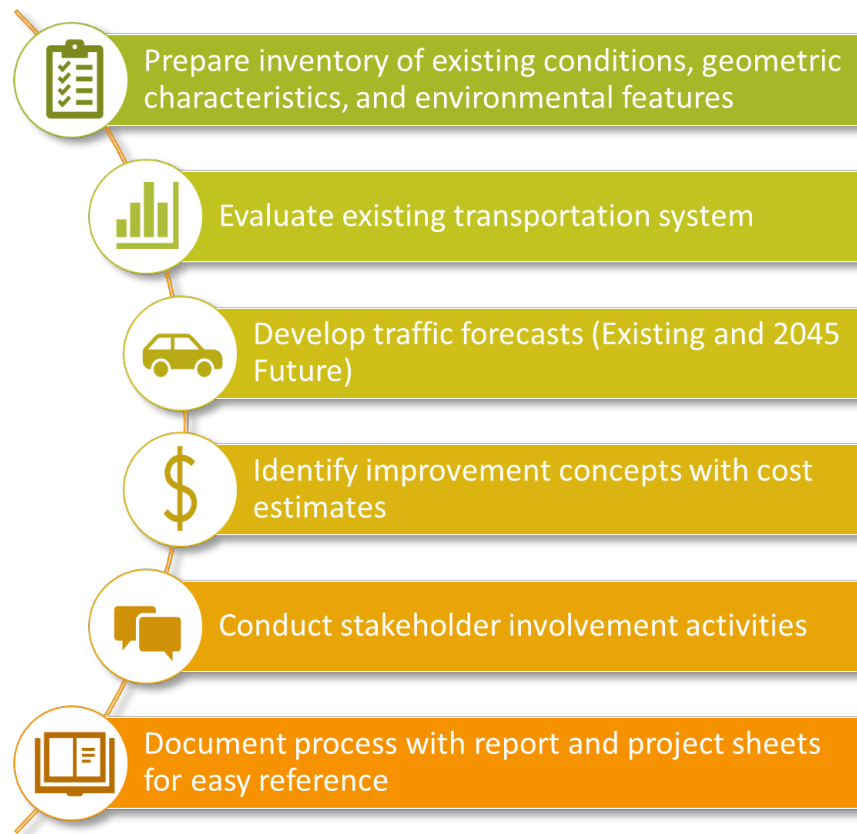


Figure 2: Study Tasks

2.0 EXISTING CONDITIONS

Existing transportation conditions along the corridor are described in the following sections. Information on the characteristics of the roadway geometry, functional classification, bridges, traffic volumes and operations, and crash history were obtained from KYTC's Highway Information System (HIS) database, KYTC's Transportation Enterprise Database (TED), bridge inspection reports, National Bridge Inventory forms, traffic counts, and field reviews.

2.1 Roadway System Designations

Functional Classification is the process of grouping streets and highways according to the character of travel service and access to adjacent land use they provide. This classification system recognizes that travel involves movement through a hierarchical system of facilities that progress from lower classifications handling short, locally oriented trips to higher classifications serving

longer distance travel at higher mobility levels. A roadway's classification is further designated as urban or rural based upon whether it is within the Federal Highway Administration's (FHWA) Adjusted Urban Area boundaries. The major functional classes with brief definitions are listed below.

Freeways & Interstates	Provide high speed, high mobility links for long distance trips.
Principal Arterials	Serve major centers for metropolitan areas, provide a high degree of mobility, and provide mobility through rural areas.
Minor Arterials	Provide service for trips of moderate length, serve geographic areas smaller than their Principal Arterial counterparts, and offer connectivity to the Principal Arterial system.
Collectors	Gather traffic from local roads and funnel them to the arterial network. Classified as either a major or minor collector, they generally serve intra-county travel and shorter trips.
Local Roads	Not intended for long distance travel, except at the origin or destination end of the trip, due to their direct access to abutting land. Often designed to discourage through traffic.

Additionally, functional classification is used as a tool for transportation agencies and designers. A roadway's functional class suggests expectations about roadway design: specifically, vehicle speed, capacity, and the roadway's relationship to land use development. Federal legislation uses functional classification in determining eligibility under the Federal-aid program. Transportation agencies typically describe roadway system performance, benchmarks, and goals by functional classification.

Functional Class. US 25 is a rural route with functional classification changing at I-75. Beginning in the south at KY 461, the route is a rural principal arterial to the I-75 overpass, converting to rural major collector north of the interstate. The principal arterial designation continues south along KY 461 to Somerset rather than following US 25 (a rural major collector) into Mount Vernon.

Highway Systems. The National Highway System (NHS) includes roadways important to the nation's economy, defense, and mobility. The Kentucky State Highway System classifies state-maintained roadways by the type of service and function they provide.

The southern section of US 25 (KY 461 to the I-75 overpass) is included in the Enhanced NHS and Kentucky's state primary system—meaning it is a high-volume intrastate route of statewide significance generally linking major urban areas within the state.

North of the interchange, US 25 is not included in the NHS. The northern section is in Kentucky's state secondary system, which identifies a regionally significant route of shorter distance providing mobility and access to land use activity, generally serving smaller cities and county seats within a region.

Truck Route. In compliance with the Surface Transportation Assistance Act of 1982 (STAA), Kentucky established a network of highways on which commercial vehicles with increased dimensions may operate. These STAA vehicles include semi-trucks with 53-foot-long trailers and single-unit trucks with a total length of 45 feet. STAA routing in Kentucky corresponds to the National Truck Network (NTN), 15 miles along a state-maintained highway from interstate or parkway interchanges, plus state-maintained highways within five driving miles of the NTN or one mile on other public highways.

Neither section of US 25 is listed on the NTN. South of I-75, the study section of US 25 is part of Kentucky's Highway Freight Network. It is listed as a Tier 3 (statewide regional connectivity) facility, meaning it is an NHS Intermodal connector. The truck weight limit is AAA or 40-ton gross vehicle weight along both sections of the study route.

Scenic Byway. Both study area sections of US 25 are part of Kentucky's Wilderness Road Heritage Highway, a national scenic byway. Shown in **Figure 3**, the Wilderness Road Heritage Highway is an important historic route and was crucial in the West's settlement and during the Civil War. In Kentucky, the route runs 94 miles, from Berea to Middlesboro before continuing into Tennessee.



Figure 3: Wilderness Road Heritage Highway

2.2 Geometric Characteristics

KYTC's HIS database was queried to obtain route geometric characteristics, including speed limits, number of lanes and lane widths, shoulder type and width, grade designations, and horizontal curve data.

Number of Lanes and Lane Widths. US 25 carries four lanes south of the I-75 interchange: two 12-foot-wide northbound thru lanes, one 12-foot-wide southbound thru lane, and a 14-foot-wide two-way left-turn lane (TWLTL). North of the interchange to MP 16.8, US 25 has a three-lane section: 12-foot-wide thru lanes with a 14-foot-wide TWLTL to MP 16.8. Further north, it drops to two 11-foot-wide thru lanes with no TWLTL.

The I-75 interchange was reconstructed during 2017–2019, concurrent with a larger interstate widening effort. Major changes for US 25 included signaling the intersection with the northbound ramp termini and providing dual left-turn lanes to access the northbound on-ramp. Before and after imagery are shown in **Figure 5** on the following page.

KYTC's 2020 *Highway Design Manual* (HDM)² recommends 12-foot-wide lanes for rural arterial highways and 11-foot-wide lanes for rural collector highways carrying 2,000 vehicles per day (vpd) or more.

Shoulder Types and Widths. HIS notes the shoulders are 10-foot-wide paved asphalt from KY 461 to the interchange, narrower through the interchange, transitioning to curb and gutter through the developed section in the north. Towards the far northern limit of the study corridor, shoulders drop to four-foot-wide (one foot paved).

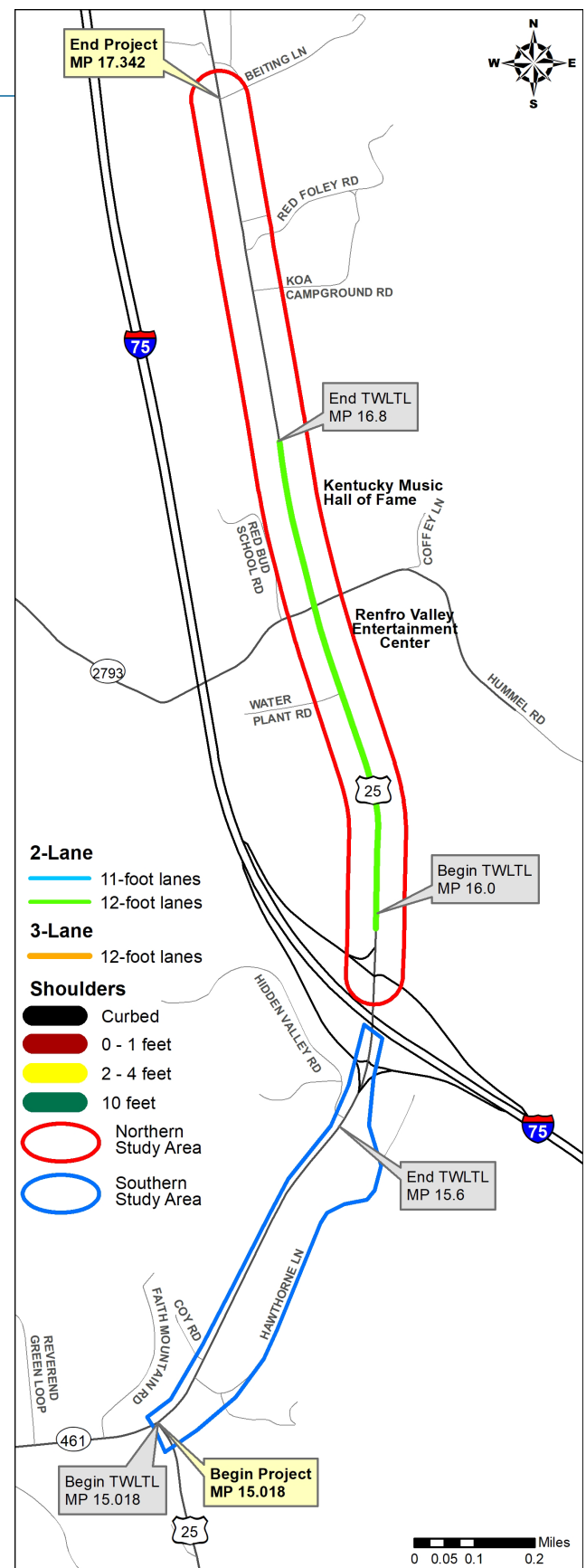


Figure 4: Lanes and Shoulders

² <https://transportation.ky.gov/Organizational-Resources/Policy%20Manuals%20Library/Highway%20Design.pdf>

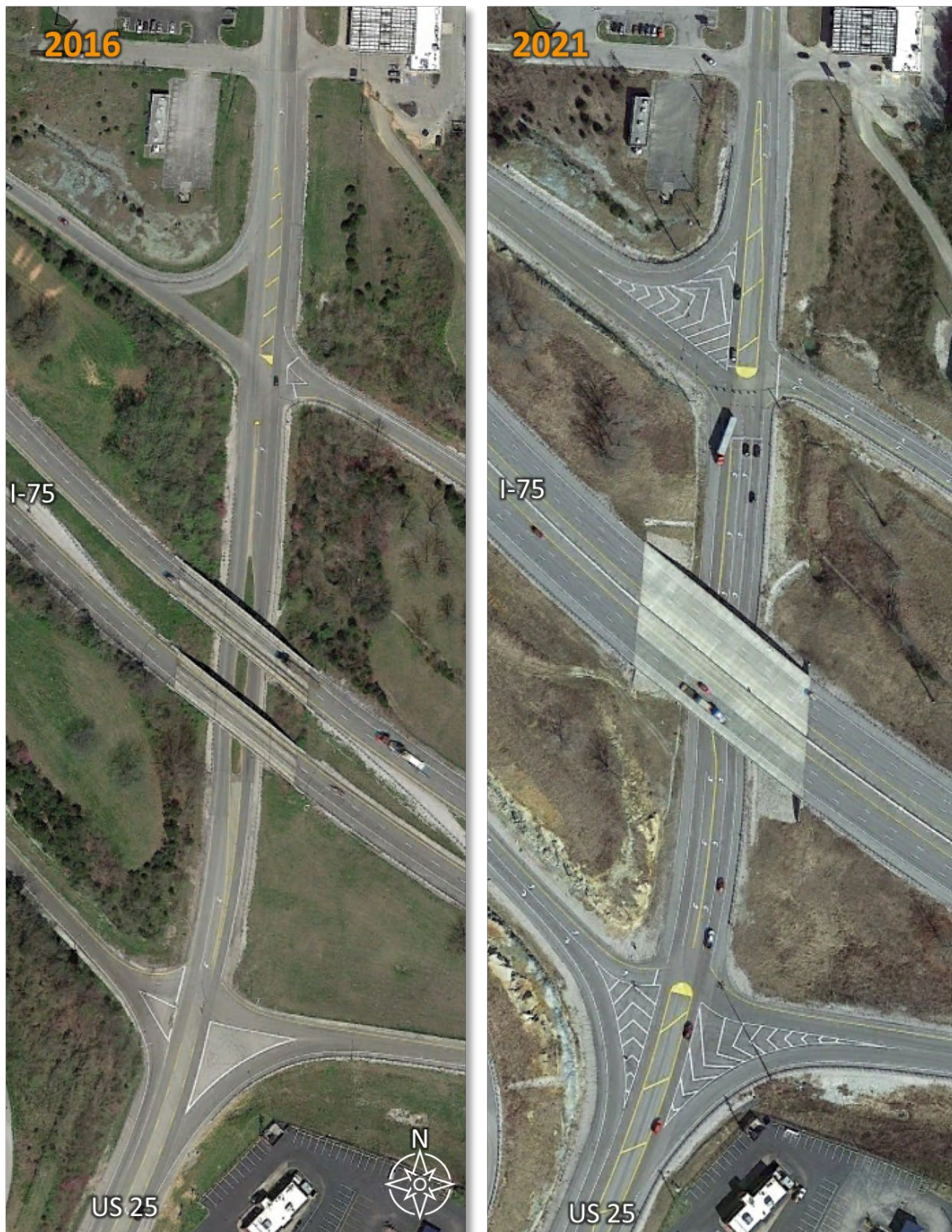


Figure 5: I-75 Interchange Reconstruction

Speed Limits. The posted speed limit is 45 mph through most of the study area, dropping to 35 mph for MP 16.2-16.8, then increasing to 55 mph beyond the developed area northward.

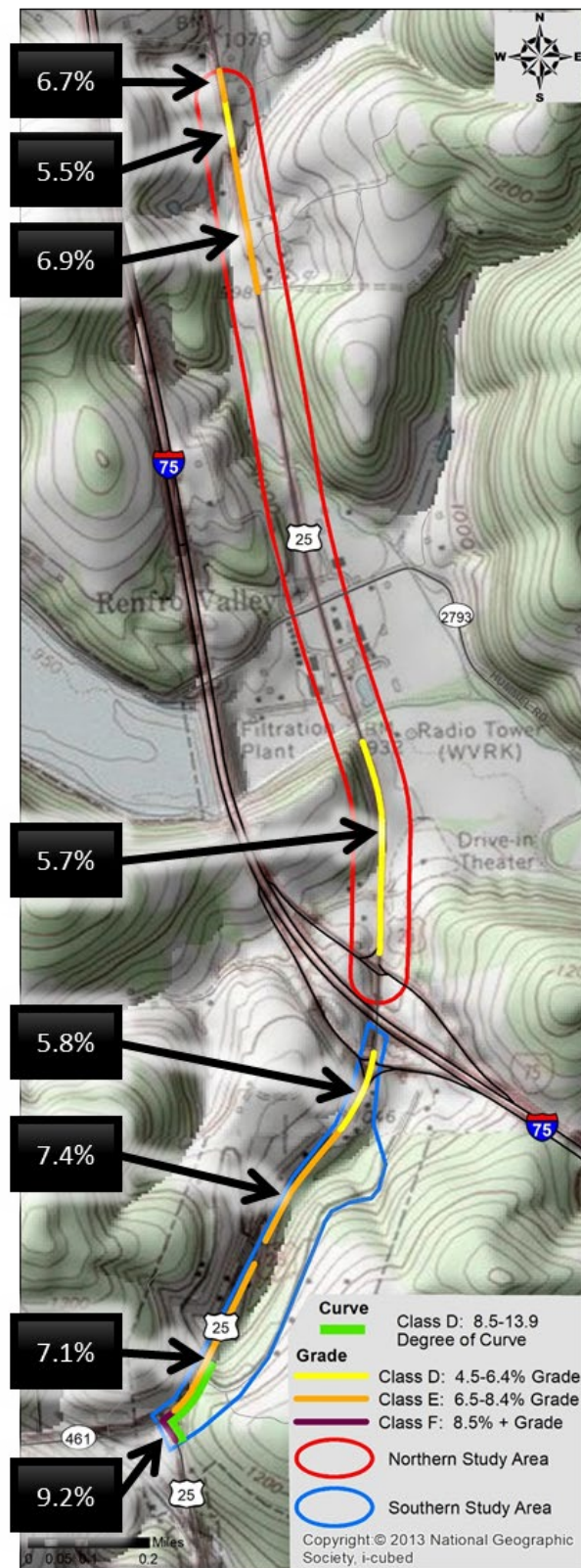


Figure 6: Curves and Grades

Vertical Alignment. HIS data were reviewed to identify any substandard grades. At a planning level, KYTC organizes vertical grades into six classes, graded A (flattest) through F (steepest). The HDM recommends maximum vertical grades of 4% for rural arterial highways or 6% for collectors—Class C or better.

Much of the study corridor passes through rolling terrain, contributing to the steep grades along the route. The steepest grades in the study area are south of the interchange.

Horizontal Curves. HIS data were also reviewed to identify substandard horizontal curves. KYTC organizes horizontal curves into six classes, graded A (most sweeping) through F (sharpest). While common practices vary based on design speed and superelevation, Class C or better horizontal curves are recommended for arterials and collectors. The sharpest curve in the corridor is Class D, corresponding to the US 25/KY 461 intersection approach.

Figure 6 identifies HIS curve and grade data; callout boxes note specific grades for each colored segment.

2.3 Bridges and Other Structures

The National Bridge Inventory (NBI) condition rating is determined by the lowest rating for the deck, superstructure, substructure, or culvert. The condition ratings are listed in **Table 1**, measured on a 10-point scale. A bridge is considered structurally deficient if any bridge component (deck, superstructure, substructure, or culvert) is in poor condition, warranting monitoring or repairs.

Table 1: National Bridge Inventory Condition Rating

Condition	Condition Rating
Good	≥ 7
Fair	5 – 6
Poor	≤ 4

There are two bridges along the study portion of US 25:

- The I-75 overpass (Bridge ID 102B00077N at MP 15.797) was reconstructed in 2018 and is in good condition. It has 16.1 feet of vertical under clearance below for US 25 traffic.
- Bridge 102B00064N, which carries US 25 over Renfro Creek (MP 16.29), was reconstructed in 2006 and is in good condition.

In addition, a pedestrian underpass connects attractions on both sides of US 25 near MP 16.4.

2.4 Bicycle and Pedestrian Facilities

Sidewalk exists north of the interchange, running along the east side of the highway between the first set of driveways north of the interchange and the Hall of Fame, between approximate MP 16.0 and 16.65.

US Bike Route 21 (Daniel Boone Bike Tour) connects along 793 miles of highway between Cleveland, Ohio and Atlanta, Georgia. Within Kentucky, it stretches north-south from Maysville to the Cumberland Gap. The route runs along the entirety of US 25 in the study area; however,



Figure 7: Study Area Structures

currently this section of the route has no dedicated bike facilities so bikes must share the road with vehicles. Locally, a bike plan is being developed concurrent with this study.

2.5 2020 Traffic Volumes and Operations

Recent traffic volumes for study area roadways, including truck percentages, K-factors³, and peak hour directional distributions were reviewed to understand historic trends.

- South of the interchange, the most recent count was conducted in 2018, reporting 15,000 vpd with 4.3% truck traffic. Volumes have been steadily growing along this section since the 2008 economic recession.
- North of the interchange, the most recent count was conducted in 2016, reporting 5,000 vpd with 4.3% truck traffic. Aside from a dip in 2010, volumes have been steady with minimal growth.

To supplement historic counts, three additional rounds of traffic data were collected during this study. Data collection efforts and other traffic details are discussed further in **Appendix A**.

Summer Weekend Traffic. As a gateway to Lake Cumberland, US 25 carries substantial weekend recreational traffic during summer months—including boats and RV's. Thursday through Sunday hourly volumes were counted south of the interchange during mid-August 2021. Vehicles were segregated into classes based on axle lengths. Daily total volumes ranged from 15,300 to 19,200 vpd, with peak flows southbound—towards Lake Cumberland—on Friday and northbound on Sunday. During the highest weekend peak hour (Sunday noon to 1 PM), trucks accounted for 12% of traffic. The remaining 88% represented passenger cars and pickups, with 7.6% oversize (i.e., drivers hauling boats, RVs, other trailers, etc.)

Typical Weekday Peak Traffic. Traditional planning efforts focus on peak hour commuter flows, generally occurring on weekdays between 7 to 9 AM and 4 to 6 PM during the school year. Video-based turning movement counts collected at five key study area intersections form the basis for the "2021 Existing Traffic" scenario discussed throughout this report. Study area intersections include US 25 with KY 461 (MP 15.018), the Wendy's/KFC driveway (approximate MP 15.2), the southbound I-75 ramps (approximate MP 15.7), the northbound I-75 ramps (MP 15.862), and KY 2793 (Lake Linville/Hummel roads, MP 16.487).

While these are not the highest observed volumes, they best correlate to future traffic projections discussed further in **Section 3.3** as modeling software is derived from growth patterns associated

³ K-factor is defined as the proportion of annual average daily traffic occurring in the design hour.

with population and employment. Existing weekday average daily traffic is 4,700–7,800 vpd to the north and up to 15,400 vpd south of the interchange.

Figure 8 compares hourly volumes by direction south of the interchange. Weekend counts are shown as solid lines; the later midweek counts are shown as a dotted line. Consistent with anecdotal input from key project team members, peak directional summer weekend traffic volumes—southbound towards the lake on Friday and returning northbound on Sunday—are notably higher than traditional mid-week peaks.

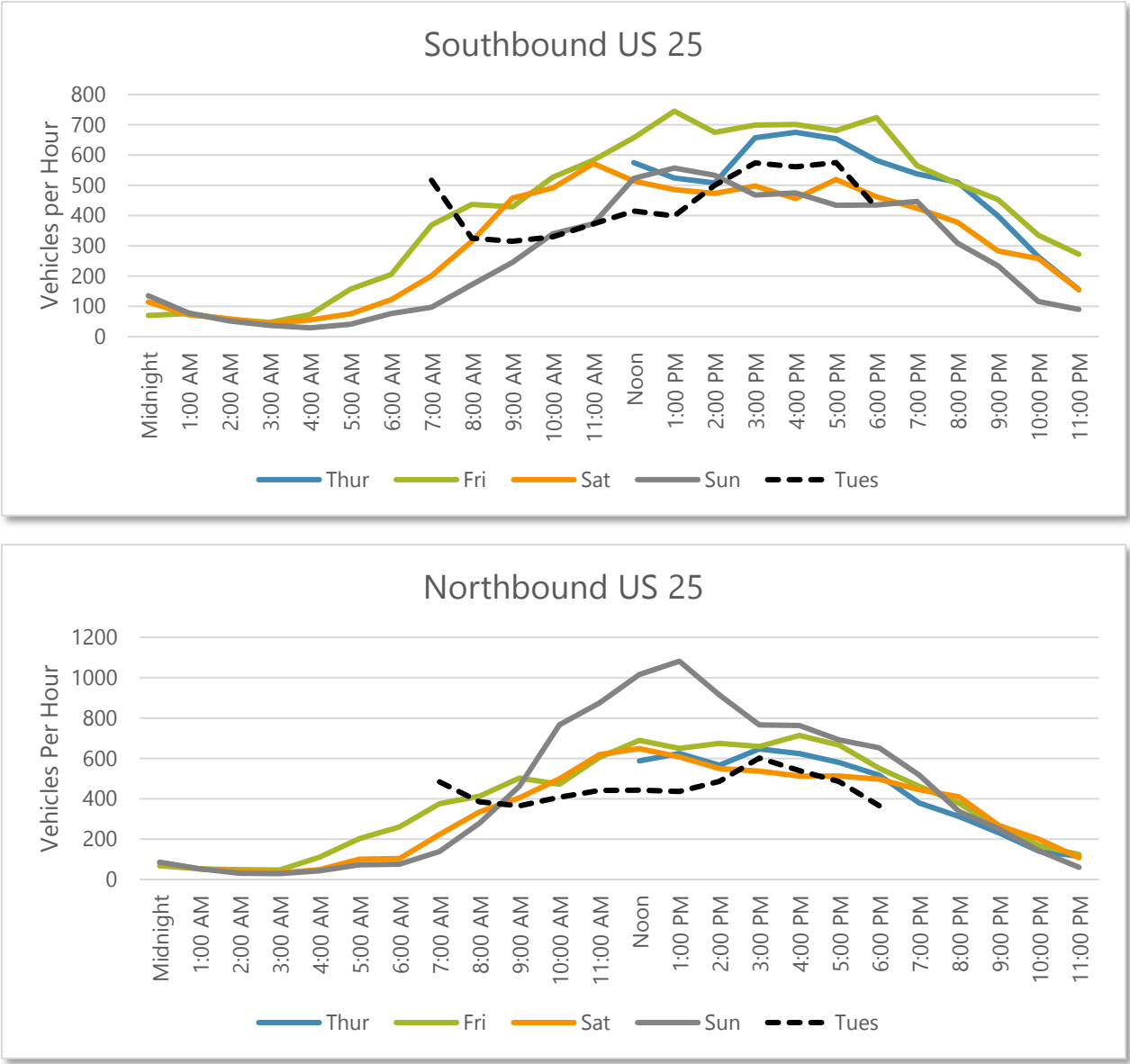


Figure 8: Directional Hourly Volume Comparison

Traffic leaving the lake midday Sunday shows a higher, shorter duration peak than its arriving equivalent on Friday, which is spread over more hours. Input from local stakeholders indicates a steady stream of slow-moving lake traffic is common, with queues for miles along US 25 on summer weekends and holidays.



Figure 9: Northbound Queue along KY 461 (upstream from study area)

Event Traffic. The third set of traffic data was collected during February 2022, corresponding to a sold-out concert at Renfro Valley Entertainment Center. Turning movement volumes were recorded at both entrances to the property. Visitors arriving at the venue stretched over a 75-minute period leading up to the concert start time whereas exiting traffic afterwards cleared within 45 minutes. Traffic counts showed 370 cars making northbound right turns into either driveway in the hour before the show versus 460 cars making left turns to head back to I-75 in the hour afterwards. It is worth noting that during data collection, no law enforcement officers helped direct traffic and no attendants were present in the parking lot to manage on-site navigation/queuing.

2.5.1 Traffic Operations

Two commonly applied highway performance indicators, level of service (LOS) and volume-to-capacity (v/c) ratios, were calculated to describe traffic operations along the corridor. Computations were performed in accordance with *Highway Capacity Manual (HCM) 6th Edition* procedures for study route segments.

Level of Service. LOS is a qualitative measure that describes traffic conditions based on measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. LOS typically represents a driver's perspective of traffic conditions based on perceived congestion. As illustrated in **Figure 10**, LOS A is associated with free flow conditions, high freedom to maneuver, and little or no delay. Conditions at or near capacity typically are associated with LOS E. LOS F represents oversaturated traffic conditions beyond capacity, with low

travel speeds, little or no freedom to maneuver, and lengthy delays. LOS D is generally considered acceptable for urban areas or LOS C for rural areas.

Existing LOS was calculated at key study intersections for one or more of the data collection periods. An overall LOS is calculated for signalized intersections while a LOS for each stop-controlled approach is used at unsignalized intersections.

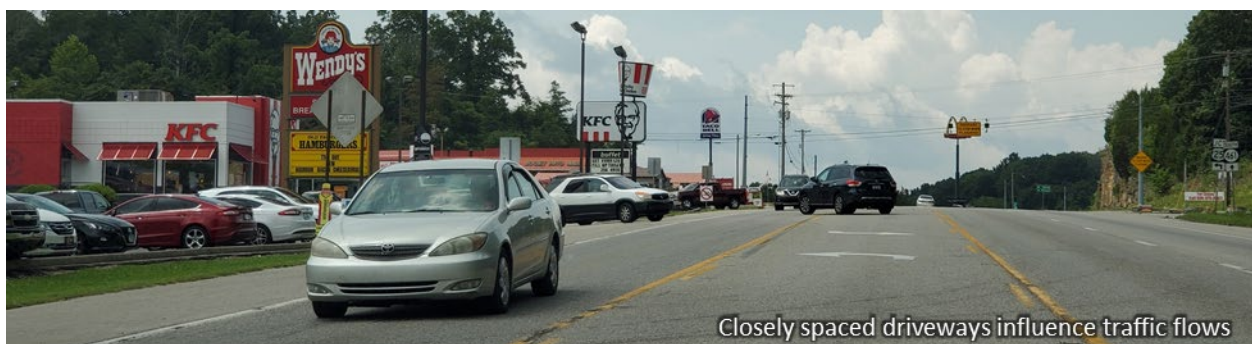
Summarized in **Figure 11**, results show most intersections operate at LOS C or better during both weekday peak hours. There are two exceptions:

- Left turns from the southbound off-ramp, which operates at LOS E during both weekday peak hours.
- The US 25/KY 461 intersection, which operates at LOS D during the weekday PM peak hour, at LOS C during the midday Friday summer rush, and at LOS E midday summer Sunday.

LEVEL OF SERVICE	INTERSECTION	
A	Highly stable, free-flow condition with little or no congestion. Delay: <10 seconds/vehicle	
B	Stable, free-flow condition with little congestion. Delay: 10 to 20 seconds/vehicle	
C	Free-flow condition with moderate congestion. Delay: 20 to 35 seconds/vehicle	
D	Approaching unstable condition with increasing congestion. Delay: 35 to 55 seconds/vehicle	
E	Unstable, congested condition. Delay: 55 to 80 seconds/vehicle	
F	Stop and go. Delay: >80 seconds/vehicle	

Figure 10: What is Level of Service?

Between intersections, closely spaced driveways introduce turbulent flow characteristics with numerous conflict points.



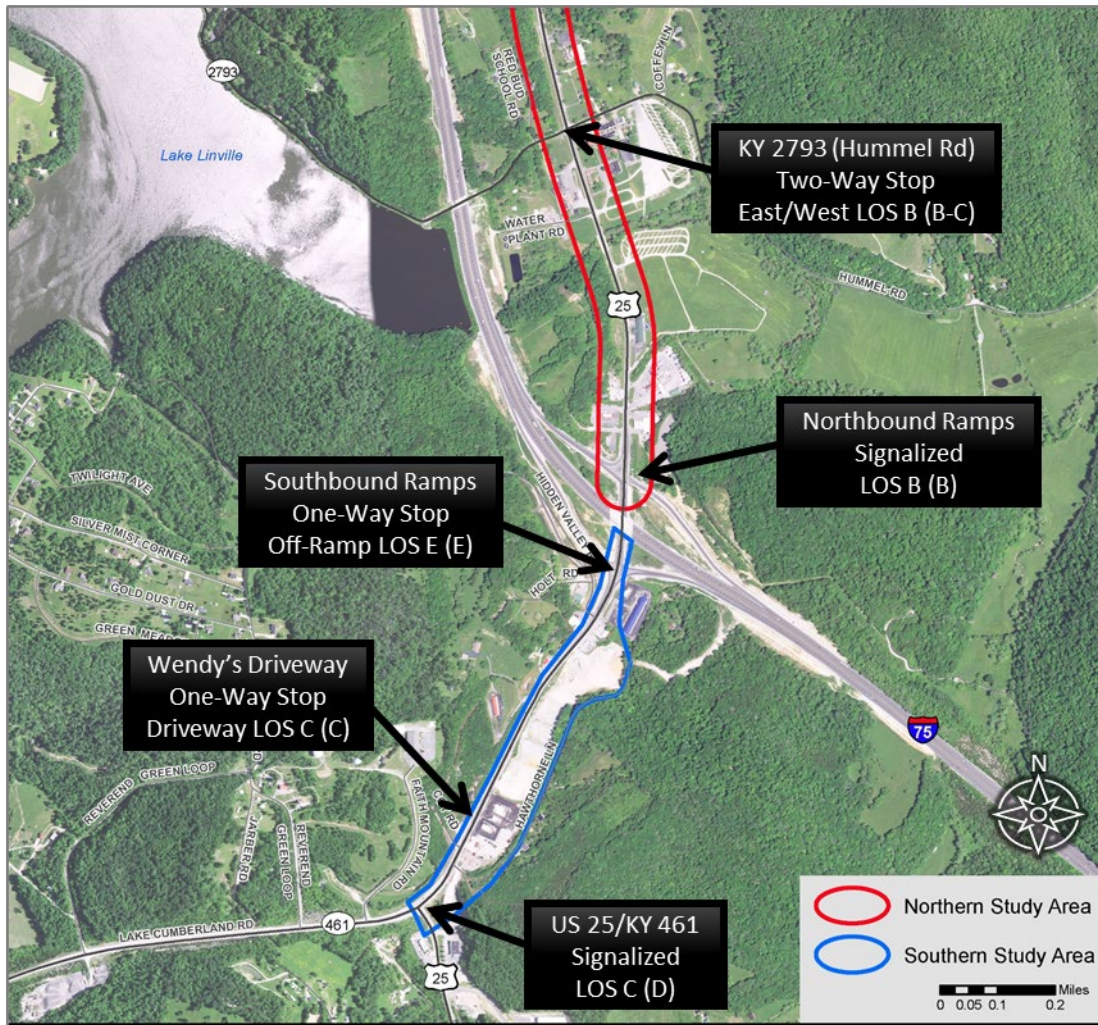


Figure 11: 2021 Existing Level of Service, Weekday AM (PM) Peak Hour

Volume-to-Capacity. Another measure, v/c , compares the traffic volume using a facility to its theoretical capacity over a specific duration, one hour in this instance. A v/c ratio greater than 1.0 indicates a route has exceeded its theoretical capacity and additional lanes may be justified. As v/c is measured over an hour period by segment, a roadway or intersection could be congested during peak commuter periods but show a relatively low v/c averaged over a longer duration.

Only one intersection exhibits v/c greater than 0.5 for any of its movements. Three turn movements at the US 25/KY 461 intersection are approaching capacity: the single lane northbound KY 461 to US 25 thru move and right/left turn movements between the two US 25 legs. Each has a v/c over 0.8 in the AM peak and over 0.9 in the PM peak with the current signal timing.

Travel Speed. A third operational measure was applied, quantifying average travel speeds and delays north of the interchange associated with event traffic. Linked cameras were set up at the

northbound ramp intersection and southern Renfro Valley entrance—approximately 2,100 feet apart—that collected travel times between locations before and after the February event. Given a posted speed limit of 45 mph, it takes about 30 seconds to travel this distance in free-flow conditions.

Figure 12 presents travel time before and after the event. Traffic began to arrive for the concert about 75 minutes prior to the start time; the longest travel times were about 5 minutes although the average was less than 3.5 minutes. This equates to speeds of 5 to 7 mph with traffic queuing up along US 25 while waiting to access the venue. Departing the event, most of the queuing occurred in the parking lots. Maximum travel times along US 25 were approximately one minute, equating to a 24-mph travel speed. Departing traffic cleared within 45 minutes of the event ending.

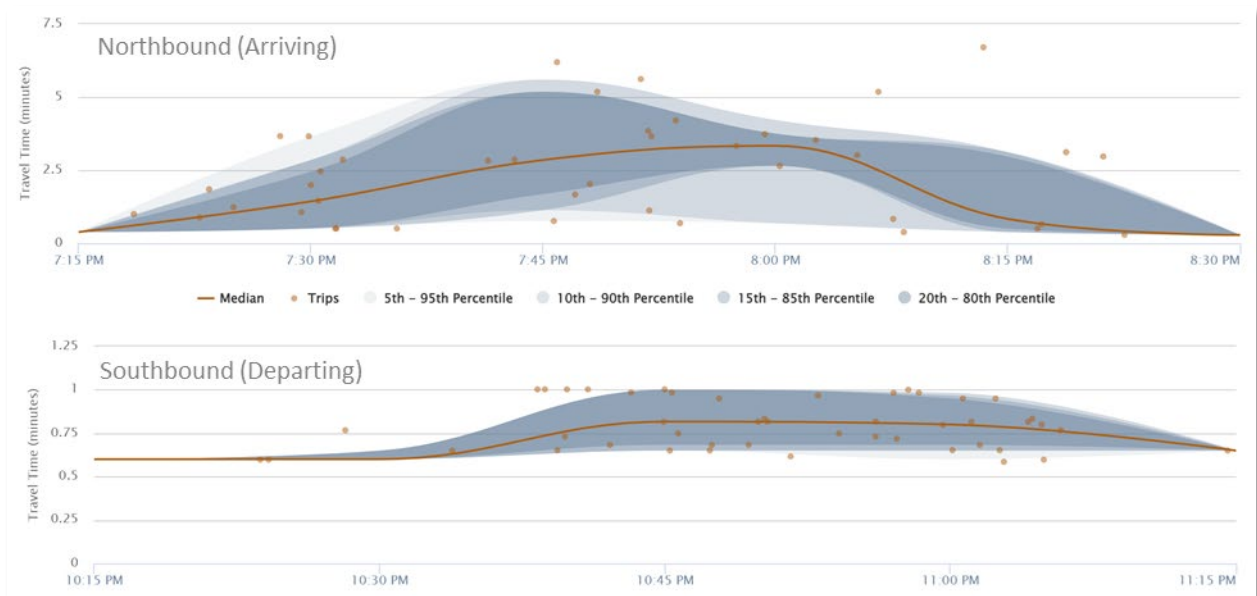


Figure 12: Travel Time Before (Top) and After (Bottom) Renfro Valley Concert

2.6 Crash History

Historical crash data retrieved from KYTC's TED warehouse were evaluated for study area roadways for a five-year period (January 2016 through December 2020). Crash location, severity, and manner of collision are shown in **Figure 13**. During this timeframe, 127 crashes occurred along the US 25 corridor: 81 south of the I-75/US 25 interchange and 46 to the north. Of these crashes, there were no fatalities and 16 injury collisions. The remaining 111 crashes were property damage only (PDO). Two injury crashes occurred north of the intersection at the northbound I-75 ramps. A table of corresponding crash data is in **Appendix B**.

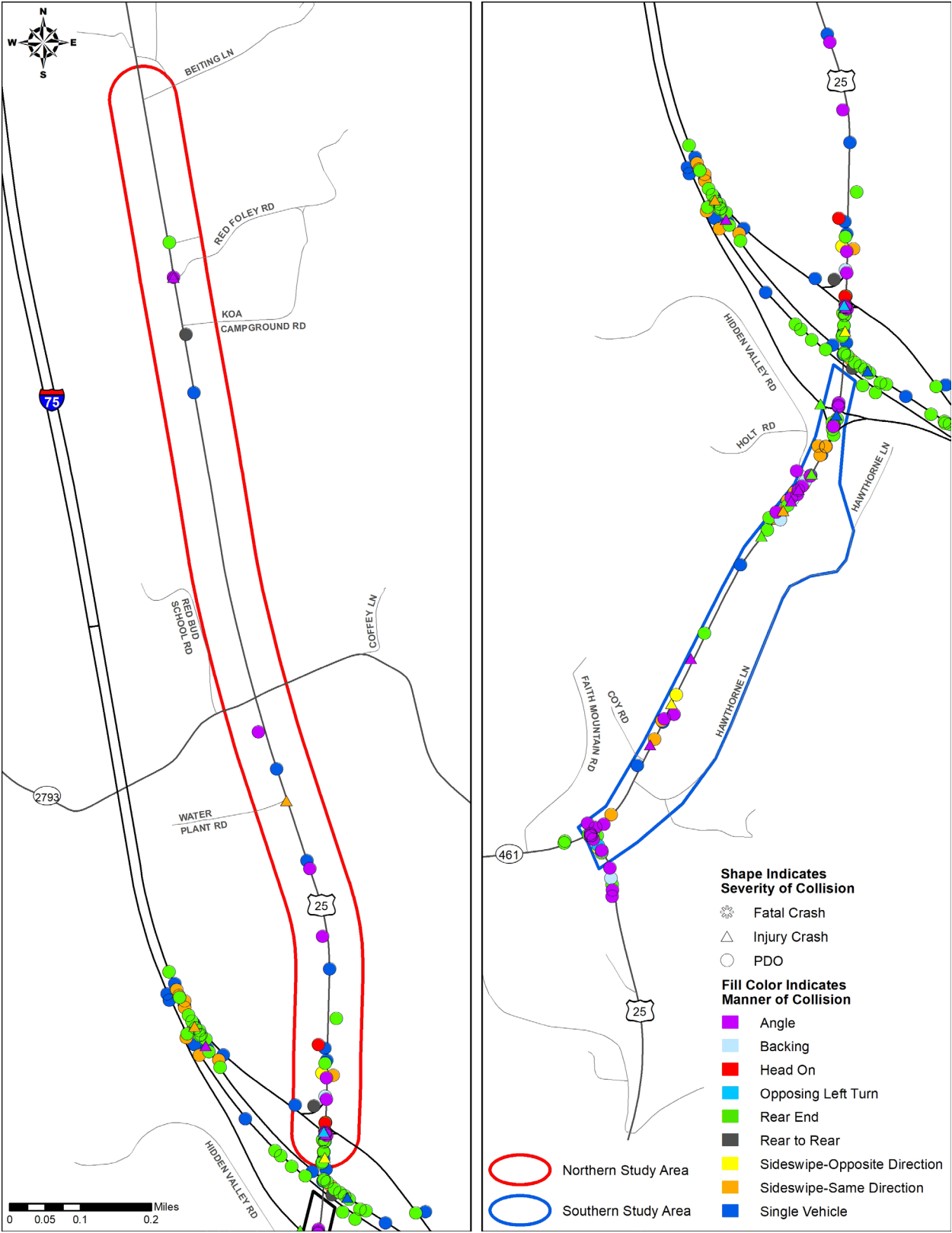


Figure 13: Crashes by Severity and Manner of Collision

It should be noted that crash patterns may not be representative of typical patterns, as both the I-75 widening project—including extensive reconstruction at the study interchange—and the covid pandemic influenced traffic patterns during the analysis period. **Figure 14** provides a comparison of crashes occurring by year.

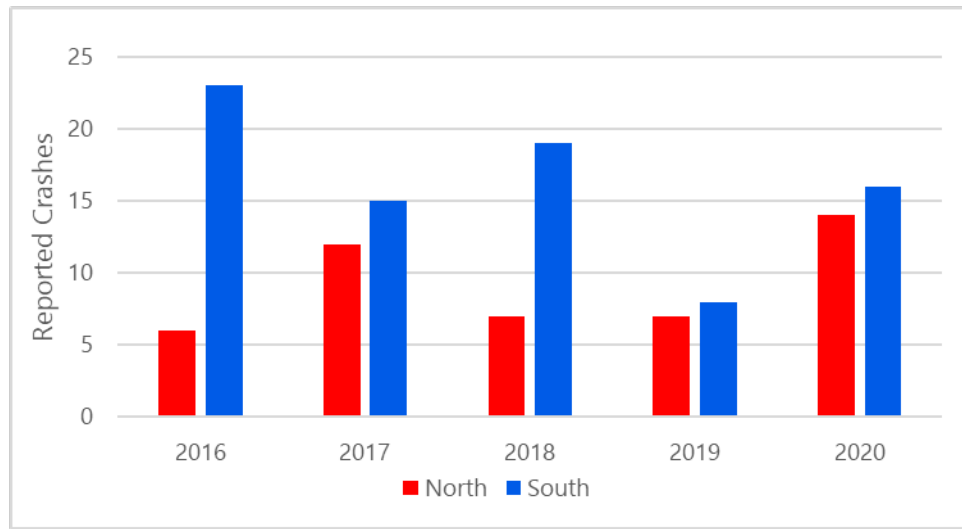


Figure 14: Study Area Crashes by Year

Manner of Collision. The manner of collision breakdown is shown in **Figure 15**. The majority are angle crashes, followed by rear-end crashes.

There were no bicycle or pedestrian crashes in the dataset. About 20% of reported crashes occurred in wet or icy conditions.

Most crashes are clustered near the I-75 interchange: 92 crashes (11 injuries) occurred in the half-mile stretch surrounding the interchange, including clusters of commercial driveways immediately north and south. Within this stretch, rear-end collisions represented 38% of the data and angle crashes represented 26%.

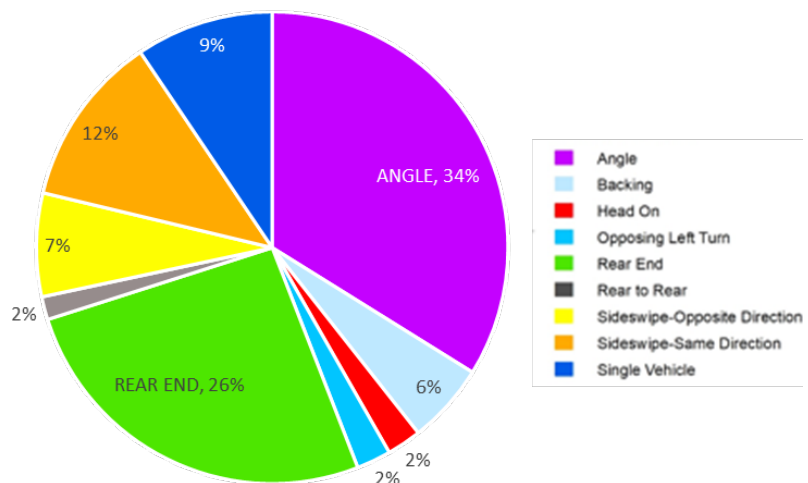


Figure 15: Manner of Collision

2.6.1 Statistical Analysis: Level of Service of Safety

Excess Expected Crashes (EEC) provides a statistical model to calculate crash distributions. Defined in the *Highway Safety Manual*, this methodology is based on a crash prediction model estimating the number of crashes expected on an average roadway segment of a given type and length. It represents the number of excess crashes a segment is experiencing compared to other roadways of its type, adjusting for traffic volumes and a statistical correction. EEC is positive when more crashes are occurring than expected and negative when fewer crashes are occurring than expected. EECs are then grouped into one of four categories, identified as the Level of Service of Safety (LOSS). LOSS categories 1 and 2 represent sites with fewer than anticipated crashes, while categories 3 and 4 represent sites with more than anticipated crashes. Because LOSS 4 sites experience such elevated crash rates, there is a higher probability that safety countermeasures at these locations will result in larger improvements.

Crashes are divided into five severity categories: fatalities (K=killed), severe injuries (A), minor injuries (B), possible injuries (C), and PDO (O). LOSS for the corridor was calculated for both severe (KAB) and non-severe (CO) crash distributions (**Figure 16**). As shown, most of the study area exhibits an elevated crash pattern, with higher concentrations in the busier southern section.

The only LOSS 4 site based on severe crashes is the intersection with Holt Road, immediately south of the US 25 intersection with the southbound I-75 off-ramp. Right turns from the off-ramp are free-flow moves, many accelerating to begin the uphill climb. Closely spaced driveways introduce conflict points and slower moving traffic. A rock cut to the west limits visibility from the Holt Road approach, although rock was cut back as part of the interchange reconstruction project.

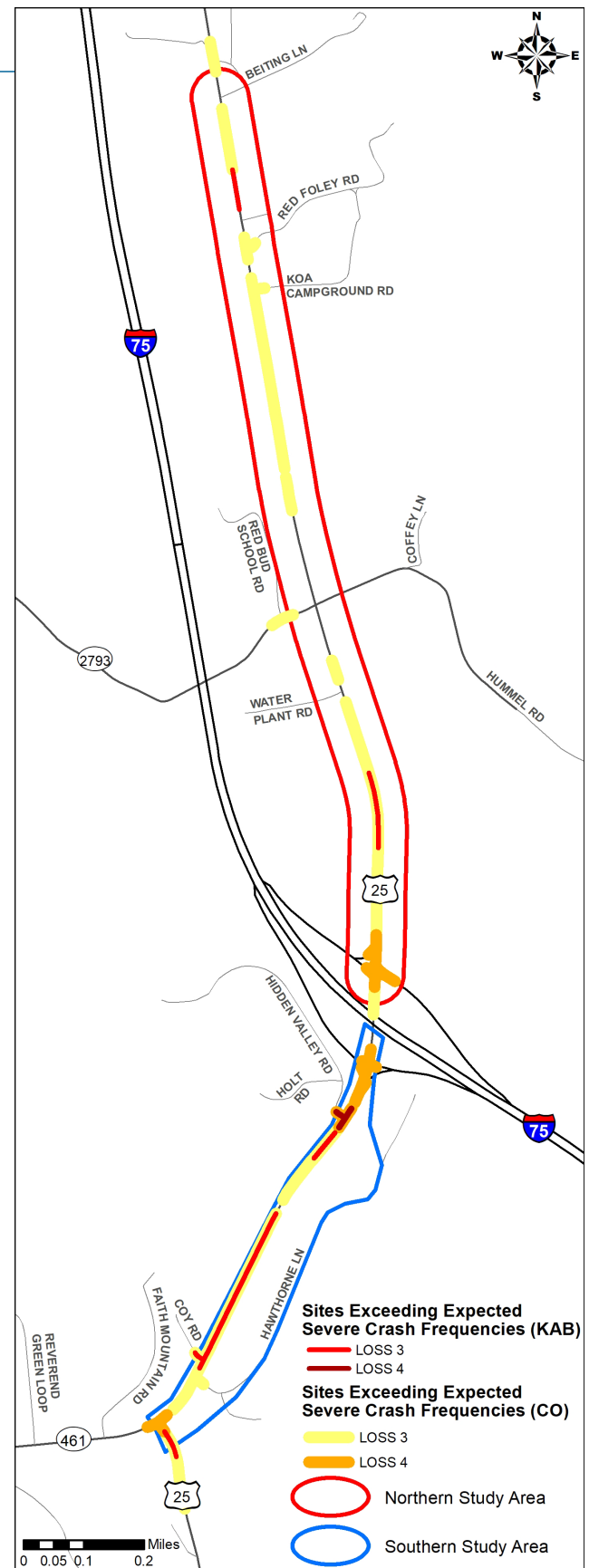


Figure 16: Study Area LOSS

3.0 FUTURE NO-BUILD CONDITIONS

Beyond the existing conditions, analysts also collected data to forecast transportation needs along the corridor in the 2045 future analysis year.

3.1 Nearby Transportation Plans/Studies

*Kentucky's 2022-2028 Enacted Highway Plan*⁴ includes three transportation projects in the study area vicinity:

- Item No. 8-8952 includes federal utility relocation and construction funds in the biennium to widen KY 461 between US 150 and US 25.
- Item Nos. 8-80106 and 8-80107 correspond to the limits of this planning study, with the first funding identified in fiscal year 2023. South of the interchange, the intent is to address safety, mobility, and congestion via access management. To the north, the focus is on economic development.

Each is shown in green in **Figure 17**; funding details are shown in **Table 2**.

Table 2: 2022-2028 Highway Plan Funding

Item No.	Phase	Source	Year	Amount
8-8952 KY 461, US 150 to US 25	U	NH	2022	\$3,350,000
	C	NH	2023	\$5,000,000
	C	NH	2024	\$5,000,000
	C	NH	2025	\$9,470,000
8-80106 US 25, KY 461 to I-75	D	SPP	2023	\$1,100,000
	R	SPP	2024	\$250,000
	U	SPP	2025	\$1,250,000
	C	--	2026	\$5,500,000
8-80107 US 25, north from I-75	P	SPP	2023	\$300,000

KYTC also maintains a Continuous Highway Analysis Framework (CHAF) database to track proposed projects before they are funded. There are four CHAFs near the study corridor, shown in blue in **Figure 17**.

⁴ Online at <https://transportation.ky.gov/Program-Management/Pages/default.aspx>

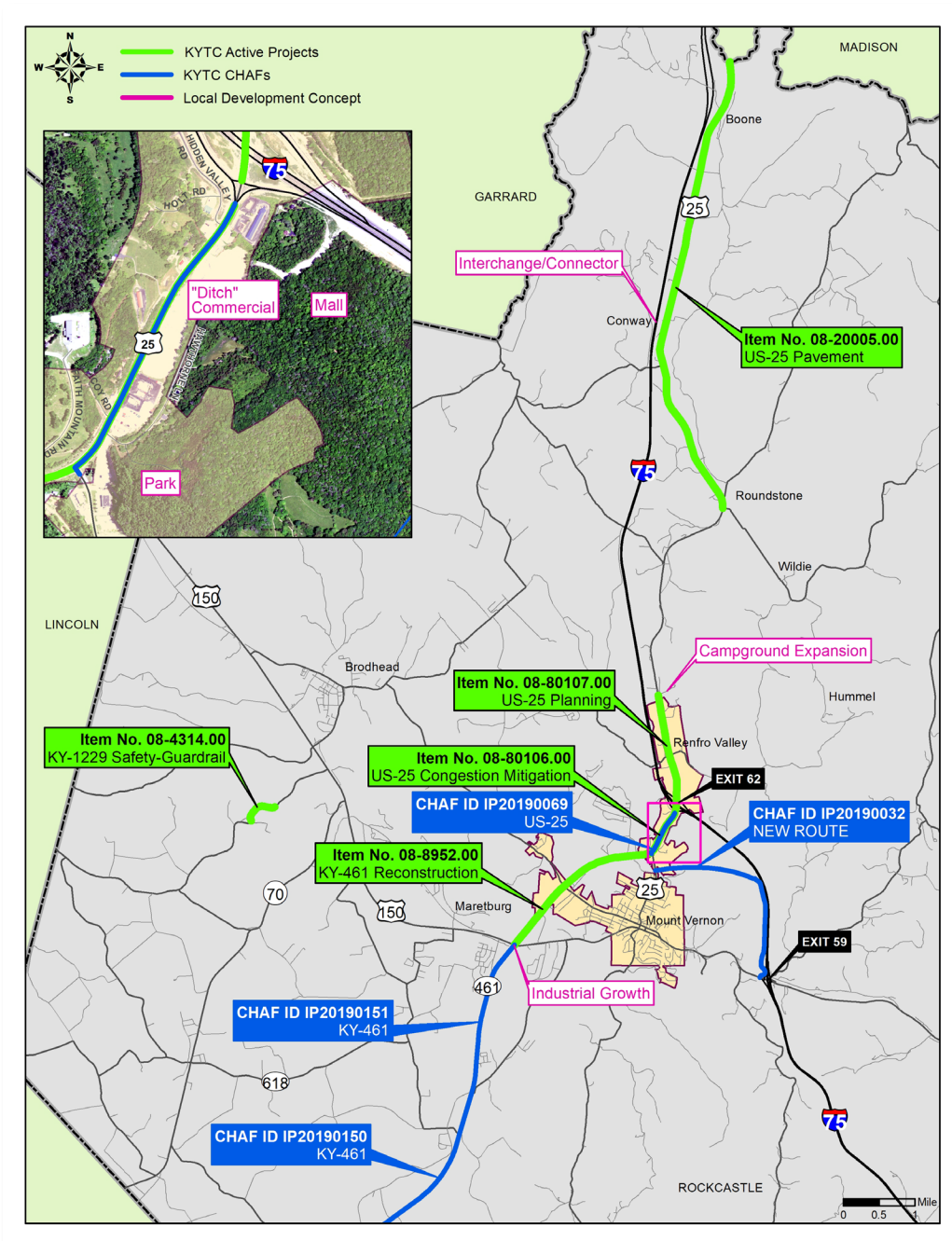


Figure 17: Planned Projects and Local Development Goals

- CHAFs IP20190150 and IP20190151 correspond to future KY 461 widening efforts, extending the wider section from the end of Item 8-8952 towards Somerset.
- CHAF IP20190069 corresponds to this planning study.

- CHAF IP20190032 represents a planning study to look at connectivity between I-75 Mount Vernon interchanges associated with a potential future development.

3.2 Local Outreach on Planned Growth

On September 14, 2021, consultant staff held initial kick-off meetings with area developers, local government representatives, and other community leaders to review ongoing and planned development projects in the study's vicinity. Beyond a quick overview of the upcoming study, the meetings represented an informal conversation to make informed adjustments to the growth assumptions in KYTC's statewide travel demand model.

While some concepts are highly speculative and/or likely to occur beyond the 2045 analysis year, the following potential developments were identified:

- Fill material from the I-75 widening project has been used to fill in the "Ditch" area, southeast of US 25 between MP 15.3—15.5. While tenants have yet to be identified, a series of highway-oriented businesses and a small grocery could be expected to locate on the site with construction beginning as early as 2023.



- There are two industrial parks near the KY 461/US 150 intersection. The Chapin plant is developing with sites in both industrial parks, expected to add up to 400 jobs. Exela is adding 500 jobs in the north industrial park and Highland Equipment is coming to the south industrial park with an additional 50 to 140 jobs.
- New housing will be needed to support these employment increases.
- Any growth is likely to be centralized in/near Mount Vernon, along the KY 461 corridor, or along US 150 towards Lincoln County.
- Near the northern study area limit, expansion plans at the KOA campground show it will triple in size, jumping from 12,000 visitor-nights in 2020 to 45,000 visitor-nights by 2030.

- The tax increment financing (TIF) district and plans for a hilltop shopping and park development southeast of Exit 62 were also mentioned, discussed further in **Section 7.2**. The development is expected to provide access from US 25 near both Mount Vernon interchanges, served by the connector described in CHAF IP20190032.
- A new I-75 interchange at Conway (near MP 69) could open new areas for development and provide an alternate route for lake traffic.

Each is shown in pink in **Figure 17**.

3.3 Future No-Build Traffic Volumes

KYTC's current statewide travel demand model, along with 2021 weekday turning movement counts and input from community leaders, formed the basis of future year 2045 traffic projections. The complete *Traffic Forecast Report* is in **Appendix A**.

KYTC's statewide travel demand model estimated future year growth for all study area roadway segments. The model simulates a 24-hour period, relying on factors to derive design hourly volumes (DHV). At a high level, the model overlays the roadway network over anticipated changes in household and employment levels for geographic zones to project changes in traffic flows. It is built to examine typical weekday traffic patterns for a broad area rather than specialized recreational or event flows.

Socioeconomic assumptions were reviewed and adjusted to reflect the latest plans for growth. While the background model projects negative growth in households and employment for most zones throughout the county, adjustments were made to increase employment associated with the industrial parks and "Ditch" development discussed above. While specific tenants are unknown, trip generation rates for the "Ditch" development assumed a small grocery store, coffee shop, and fast-food restaurant. Due to the anticipated costs and speculative timeline, the proposed hilltop mall/park development was not reflected in 2045 employment forecasts.

Considering historic traffic growth rates, population projections, anticipated development, and model projections, an annual growth rate of 0.6% south of the interchange and 0.2% north was applied to the 2021 Existing scenario to project future 2045 No-Build traffic. The corridor is expected to carry 8,400 (north) to 17,600 (south) vpd in the 2045 No-Build scenario, compared to 7,800 to 15,400 in the Existing scenario.

3.3.1 2045 No-Build Traffic Operations

In the No-Build scenario, future traffic volumes are applied to the existing highway geometry. The analysis showed that most study intersections and stop-controlled approaches operate at LOS D or better during both peak hours. There are two exceptions:

- The left-turn movement from the southbound I-75 off-ramp operates at LOS E in both peak hours. However, 95th percentile queues for this movement are less than two vehicles in length.
- As shown in **Figure 18**, the southbound US 25 left-turn and northbound US 25 right-turn movements at the US 25/KY 461 operate at LOS E in the PM peak hour.



Figure 18: 2045 No-Build LOS by Movement at US 25/KY 461 Intersection during AM (PM) Peak Hours

Only one intersection exhibits a v/c ratio greater than 0.6 for any of its movements. Three turn movements are approaching capacity: the single lane northbound KY 461 to US 25 thru move and right/left turn movements between the two US 25 legs. As in the 2021 Existing scenario, each has a v/c ratio over 0.8 in the AM peak and over 0.9 in the PM peak.

4.0 ENVIRONMENTAL OVERVIEW

An environmental overview was prepared to identify sensitive resources for consideration during the development of transportation improvement concepts. Natural and human environmental resources were identified from available literature, database review, and site visits. Study area resources are shown in **Figure 19** and are summarized in the following sections.

The purpose of this overview was not to quantify potential environmental impacts, but instead to identify potential environmental issues to consider during any future project development process. This information should aid the project team in making decisions to avoid, minimize, and/or plan for mitigation of potential project impacts, as appropriate. Should future projects develop following this study, additional environmental studies will likely be required.

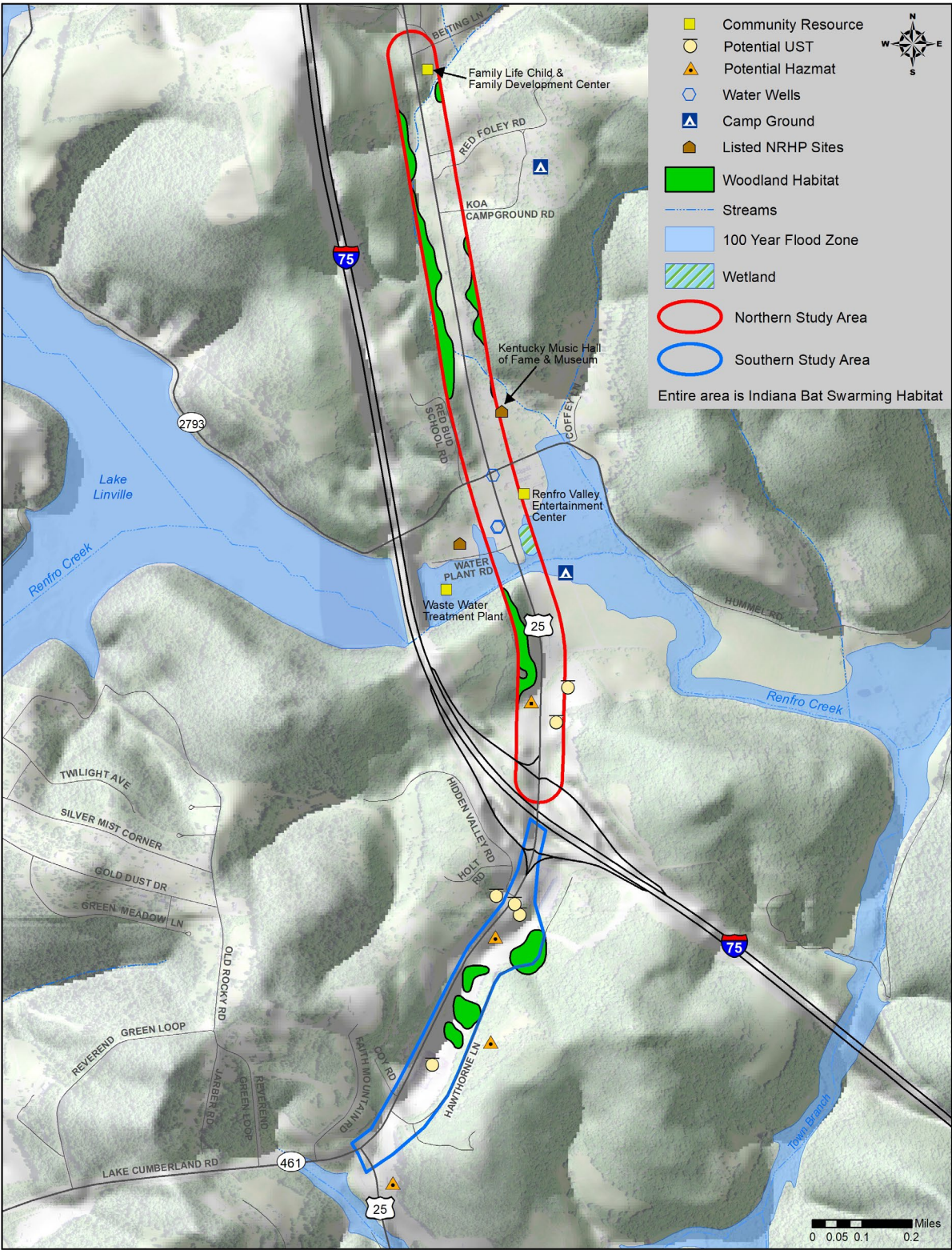


Figure 19: Environmental Resources in the Study Area

If federal funds, easements, or permits are needed on a future project, then the procedures established from the National Environmental Policy Act (NEPA) must be followed. NEPA requires, to the fullest practicable extent, that federal actions be interpreted and administered in accordance with its environmental protection goals. It requires an interdisciplinary approach in planning and decision-making for any action that adversely impacts the environment. The potential environmental impacts and need for safe and efficient transportation must be considered to reach a decision that is in the best overall public interest.

4.1 Natural Environment

The natural environment includes all living and non-living things occurring naturally (not artificial or human-built). This includes aquatic ecology, such as rivers, streams, and wetlands; threatened and endangered species; farmlands; and geotechnical resources.

Water Resources. Renfro Creek crosses east-west through the study area, feeding into Lake Linville to the west. No federally designated Wild or Scenic Rivers or Outstanding State Resource Waters exist in the study area. 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.

Listed Species. The US Fish and Wildlife Service (USFWS) maintains a database of federally protected species—listed as endangered or threatened under the *Endangered Species Act*. There are four listed bat species, six clam species, and one flowering plant that have the potential to occur within the study area. Additionally, monarch butterflies are under consideration for official listing. Listing statuses for all species are shown in **Table 3**. There is no designated critical habitat within the study area; however, the entire area is classified as swarming habitat for Indiana bats.

Table 3: Listed Threatened and Endangered Species

Group	Name	Scientific Name	Status
Mammals	Gray bat	<i>Myotis grisescens</i>	Endangered
Mammals	Indiana bat	<i>Myotis sodalis</i>	Endangered
Mammals	Northern Long-eared bat	<i>Myotis septentrionalis</i>	Threatened
Mammals	Virginia Big-eared bat	<i>Corynorhinus townsendii virginianus</i>	Endangered
Clams	Cumberland bean	<i>Villosa trabalis</i>	Endangered
Clams	Cumberland elktoe	<i>Alasmidonta atropurpurea</i>	Endangered
Clams	Cumberland combshell	<i>Epioblasma brevidens</i>	Endangered
Clams	Fluted kidneyshell	<i>Ptychobranchus subtentus</i>	Endangered
Clams	Littlewing pearlymussel	<i>Pegias fabula</i>	Endangered
Clams	Tan riffleshell	<i>Epioblasma Florentina walkeri</i>	Endangered
Flowering Plant	Virginia spiraea	<i>Spiraea virginiana</i>	Threatened

Group	Name	Scientific Name	Status
Insect	Monarch butterfly	<i>Danaus plexippus</i>	Candidate

A habitat assessment should be completed in the early stages of project development for future project(s) to assess potential project impact to threatened and endangered species. Projects that occur within an area of known bat habitat will require project-specific evaluation to assess appropriate minimization/mitigation measures. For other 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 will be necessary to determine the need for future project-specific surveys.

Farmland Classifications. Natural Resource Conservation Service (NRCS) soil survey maps were reviewed to identify farmland classifications within the study area. The geographic distribution of the farmland classifications is shown in **Figure 20**. The southern study area is primarily developed; the northern study area includes 17% prime farmland soils; an additional 27% is considered prime farmland if protected from flooding. Farmlands of statewide importance represent another 17%.

4.2 Human Environment

The human environment includes people and the resources they define like land use, community features, cultural resources, pollution (hazardous materials, air quality, noise), etc. Each could potentially be impacted by any future projects. The following sections identify these resources for consideration during the project development process.

Land Use. From just north of the interchange area to the south, the corridor is primarily lined by highway-oriented businesses: gas stations, fast food restaurants, and hotels.

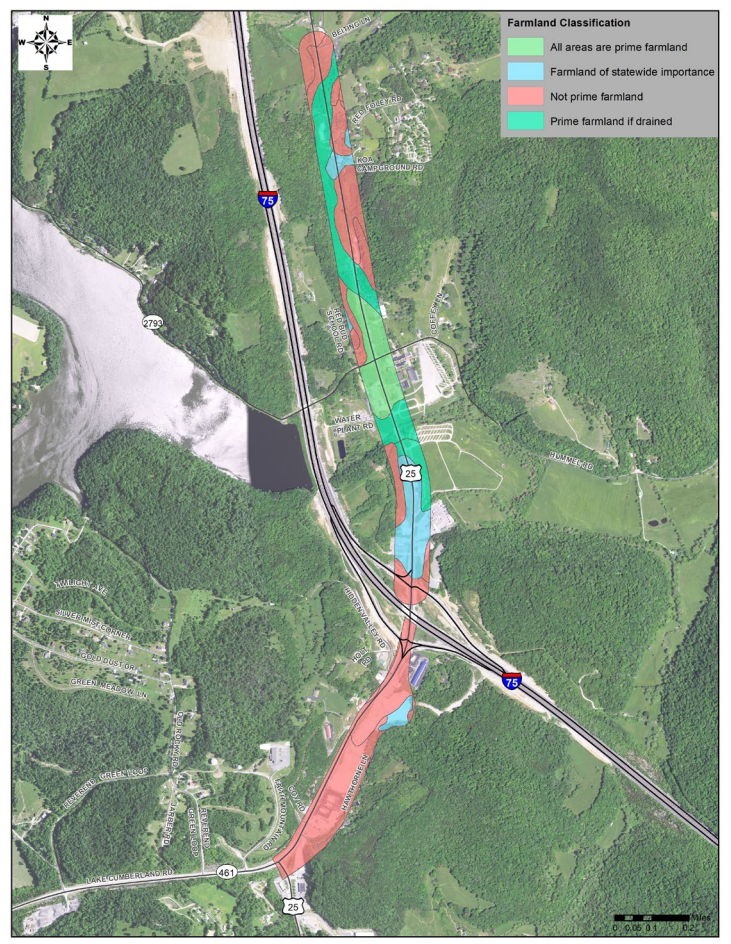


Figure 20: NRCS Farmland Soil Classifications



To the north, tourist attractions dominate land use, transitioning to a more rural setting further north. While events have been limited throughout the covid pandemic, Renfro Valley represents a regional tourist attraction dating back to the 1930s. The 55-acre complex features an event venue, RV park, and historic-themed outbuildings with small shops. Located just north of Renfro Valley, the Kentucky Music Hall of Fame and Museum complements the area's tourism draw with a collection of artifacts and memorabilia. There is also a KOA campground near the northern study area limits to offer accommodations to visitors.



Beyond parcels abutting US 25, much of the surrounding area is wooded, with steep slopes limiting development. However, the Rockcastle County Industrial Development Authority (RCIDA) has identified the knob south and east of the study area as a potential future commercial development. A TIF district is proposed to support these efforts. Per the 2019 development plan, the hilltop site "is expected to include new and rehabilitated retail space, restaurants, and hotel rooms, and the construction and renovation of public buildings and spaces that will provide significant recreational and entertainment space within the community, including sports fields facilities, that will support and draw visitors from the entire region." Additional detail is provided in **Section 7.2**.

Community Features. Other community features—schools, hospital, civic services, churches, etc.—are concentrated within downtown Mount Vernon, located a mile south of the study area along US 25.

Lake Linville, north and west of the study area, offers opportunities for boating, camping, and fishing with a playground at its northern tip.

Historic Resources. Few of the built structures lining the corridor are 50+ years old. Shown in **Figure 21**, there are two listed National Register of Historic Places (NRHP) sites in the vicinity:

- The Kentucky Music Hall of Fame resides within the stables of John Lair, founder of the Renfro Valley Barn Dance radio show. The property was listed in 1995 for its association with the commercialization of country music from 1937 to 1966.
- Located west of US 25 just north of the wastewater treatment plant, the Bennett Hiatt log cabin is significant for its association with the exploration and settlement of Rockcastle County. It was listed on the NRHP in 1984.



Figure 21: Listed NRHP Resources

Should federal funding or permits be included in future projects, field survey and coordination with the Kentucky Heritage Council will be required to assess project impacts to cultural historic resources.

Socioeconomic Profile. Cumberland Valley Area Development District (CVADD) completed a socioeconomic study for the corridor (**Appendix C**) to highlight potential areas statistically likely to contain elevated concentrations of minority, elderly, economically disadvantaged, limited English proficiency (LEP), and/or disabled populations. The study corridor covers portions of four US Census block groups though there are very few residences within the study area itself. Statistical block group geographies are shown in **Figure 22**. Statistics are reported from the 2020 American Community Survey five-year estimates.

- Minority population concentrations exceed the county threshold (8.8%) in two block groups: 12.8% for Tract 9502.02 BG 1 (the area west of the corridor) and 10.% for Tract 9501 BG 1 (the area north of Renfro Creek).
- At 31.6%, Tract 9501 BG 1 exceeds the concentration of persons aged 65+ for the county (18.3%).

- Within the county, 19.4% of the population over age 16 has a disability. Two areas exceed that threshold: Tract 9504 BG 2 (the area between Renfro Creek and I-75, 32.4%) and Tract 9502.02 BG 3 (the area south of I-75/east of US 25, 27.8%).
- At 45.4%, Tract 9502.02 BG 3 exhibits almost twice the county threshold (21.4%) for low-income populations.
- Tract 9504 BG 2 exceeds the county threshold for LEP (0.05%) but this group only represents 0.4% of residents.

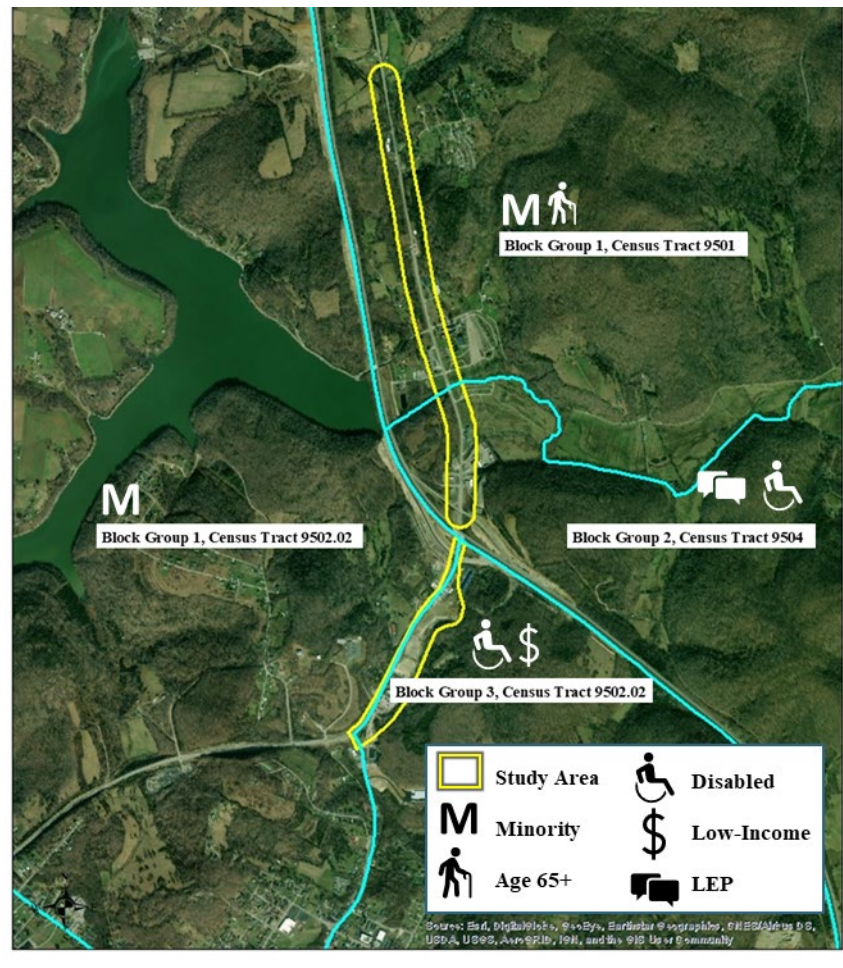


Figure 22: Census Block Groups with Key Populations Exceeding County Thresholds

Section 4(f). Section 4(f) of the Department of Transportation Act of 1966 is a substantive law that applies to federally funded projects using land from publicly owned parks, recreation areas, wildlife and waterfowl refuges, or public or private historic sites eligible for or listed on the NRHP. A federally funded highway project that uses a Section 4(f) property can only be approved if no prudent or feasible alternative to the use of the property exists and project planning minimizes harm to Section 4(f) sites.

Potential Section 4(f) protected properties within the study area are recreational areas at Lake Linville and the two NRHP-listed sites referenced earlier. No other public parks, recreation areas, or wildlife and waterfowl refuges are located along the corridor.

Section 6(f). Section 6(f) of the Land and Water Conservation Fund (LWCF) Act applies to both state and federally funded projects. The LWCF provides federal grants to acquire land for outdoor recreation, protect important natural areas, and develop or renovate outdoor recreation facilities (campgrounds, picnic areas, swimming facilities, etc.). Impacts must be addressed when projects result in permanent conversion of outdoor recreation property that was acquired or developed using LWCF grant assistance. No properties that have received LWCF funds were identified along the project corridor.

Storage Tanks/Hazardous Materials Considerations. Readily available records from the US Environmental Protection Agency (USEPA) were compiled to illustrate the range of monitored sites within the study area. Underground storage tanks (UST) are associated with several gas stations along the corridor, as shown in **Figure 19**. Of the four sites noted on the mapping as potential hazmat sites, three are associated with construction permits and the fourth is the Rite-Aid drug store located south of the study area limits and listed in the Resource Conservation and Recovery Act database.

Air Quality Considerations. USEPA has established National Ambient Air Quality Standards for six criteria pollutants: ozone, lead, nitrogen dioxide, sulfur dioxide, carbon monoxide, and particulate matter (PM_{2.5} and PM₁₀). Rockcastle County is in attainment for all criteria pollutants.

The study area is not located within a metropolitan area; therefore, any federally funded transportation projects should be included in the statewide transportation improvement program (STIP) to ensure air quality conformity requirements are satisfied. Future federal projects may need to analyze potential Mobile Source Air Toxics (MSAT) impacts based on the project type. FHWA has developed a tiered approach for three categories to analyze MSAT in NEPA documents, depending on specific project circumstances. The three tiers and associated level of analysis are no potential/exempt projects requiring no analysis, low potential requiring a qualitative analysis, and higher potential requiring quantitative analysis. Based on traffic volumes, all proposed improvement concepts fall into either the no- or low-potential category.

Noise Considerations. Noise sensitive receptors include all outdoor areas of frequent human use such as residential areas, parks, cemeteries, hospitals, churches, schools, and some commercial properties with exterior uses. Noise sensitive land uses along the corridor include homes, campgrounds, hotels, and some outdoor event spaces.

Specific traffic noise impact analyses may be required during future project development activities if capacity is added or travel lanes shift closer to noise-sensitive receptors.

5.0 STUDY GOALS AND OBJECTIVES

A project's Purpose and Need defines the transportation problem a project is intended to solve. It sets the stage for the range of solutions considered and helps identify which represent the best options available to advance for further development.

The objective of this planning study is to develop conceptual improvement options to address traffic flow and safety along the US 25 corridor near its interchange with I-75 serving Mt. Vernon, integrating with the KY 461 widening project immediately south.

5.1 Southern Study Area: KY 461 to I-75

South of the I-75 interchange, the corridor serves dual functions.

Its designation as a principal arterial and component of the National Highway System suggests a high degree of mobility—prioritizing thru movements to efficiently move high traffic volumes along the corridor. This section of US 25 provides the most direct access for recreational traffic to/from the north to reach Lake Cumberland.

Simultaneously, individual driveways to adjacent businesses tie directly to US 25, making turning movements to/from the highway critical to access surrounding land uses. With more commercial developments slated for construction over the next few years, the accessibility demands placed on US 25 will increase. More access points, cross-streets, and driveways means more potential conflict points between vehicles.

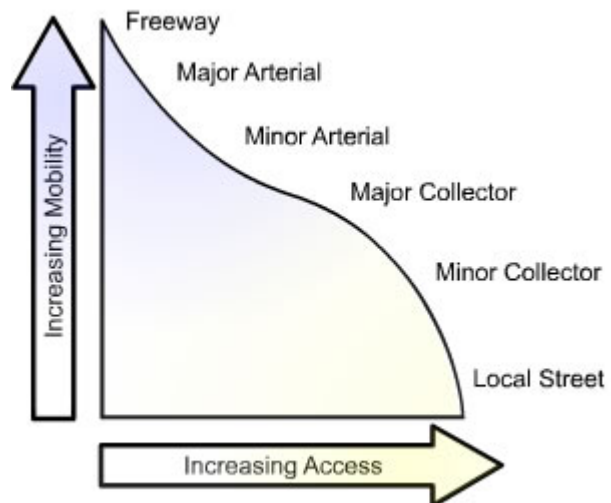


Figure 23: Mobility vs Access

Finding an appropriate balance of mobility and access is one of the core challenges facing the corridor. Between KY 461 and the I-75 interchange, the purpose of the proposed US 25 improvement project is three-fold:

- Improve mobility, increasing vehicle throughput for the congested corridor
- Improve safety, reducing crash rates particularly at intersections
- Promote bicycle and pedestrian mobility

Mobility

- As summarized throughout **Chapter 2.0**, this stretch of US 25 carries 15,400 vpd on a typical weekday and over 19,000 vpd during peak summer weekends. Traffic regularly backs up especially when northbound leaving-the-lake traffic is condensed over a few hours and served by a single thru lane. Traffic is expected to continue growing—up to 17,600 vpd for 2045 weekday traffic—with new developments imminent along the adjacent “Ditch” property.

Safety

- During 2016-2020, 81 crashes occurred south of the interchange including 9 injuries and 72 PDO crashes. By type, most crashes were angle collisions (34%) and rear ends (28%). While crashes were along most of the 0.7-mile corridor, the highest concentrations are surrounding the interchange and the US 25/KY 461 intersection.

Bicycle/Pedestrian

- US Bike Route 21, Daniel Boone Bike Tour, runs along the entirety of US 25 in the study area. Conversations with local officials indicated interest in providing non-motorized connections between hotels and businesses along the developed portion of the route, helping to reduce short-distance vehicle trips.

As secondary objectives, all improvement concepts should also preserve reasonable, safe access to adjoining businesses and minimize right-of-way impacts.

5.2 Northern Study Area: I-75 to Beiting Lane

North of the interchange, the corridor is classified as a major collector and provides access to two primary tourist attractions: Renfro Valley Entertainment Complex and the Kentucky Music Hall of Fame. Aside from events at these venues, typical weekday traffic volumes are 7,800 vpd with adequate capacity provided for typical traffic flows. Crash rates were lower than those in the south section as well, with 46 crashes (7 injury collisions) along the 1.6-mile corridor over five years. Most occurred within 600 feet of the I-75 northbound ramps. The route was reconstructed in the early 2000s to provide a TWLTL and pedestrian amenities.

The improvement concepts considered in this section focus on enhanced bicycle and pedestrian mobility.

6.0 CONCEPT DEVELOPMENT: ACCESS MANAGEMENT OPTIONS

Improvement concepts were developed based on a combination of input from the project team, a review of existing conditions, stakeholder feedback, and field reconnaissance.

To match the footprint of the adjacent Item No. 8-8952 widening project, KYTC District 8 developed a five-lane typical section through the southern study area, following the existing US 25 alignment. Shown in **Figure 24**, the initial template assumes two 12-foot-wide travel lanes per direction, a 14-foot-wide TWLTL, curb/gutter, and 5-foot-wide sidewalks on either side.

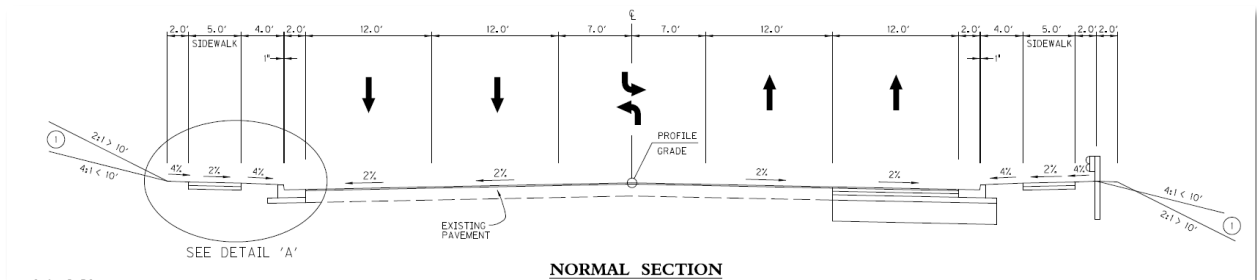


Figure 24: US 25 Five-Lane Typical Section

Improvement concepts in the southern study area focus on access management strategies to streamline traffic flow and improve safety. Much of the discussion centers around the “Ditch” development (shown in orange in **Figure 25**) that extends along the eastern edge of US 25.



Figure 25: Design Challenges in Southern Study Area

While any internal roadway connections would be the responsibility of the developer, representative access options were evaluated. The property’s access to US 25 is complicated by

numerous factors (**Figure 25**): proximity to the interchange, nearby clusters of closely spaced driveways, steep grades climbing to the south, steep terrain features parallel to US 25 and the development site, and the US 25/KY 461 signal. Each of these elements plays an important role in determining the best location for driveway(s) to access the abutting property.

Three representative access management scenarios were presented at the first project team meeting:

Existing Access Patterns	TWLTL + Backage Road	Divided Section
• Each new parcel gets 1+ new driveway. • Existing crash trends associated with numerous conflict points at closely spaced driveways would be propagated along the corridor.	• A backage road allows driveways on US 25 to be consolidated, still providing access but with fewer conflict points. • Backage road could serve just “Ditch” parcels or extend to existing businesses to the south.	• The TWLTL becomes a raised median so driveways function as right-in/right-out. • This requires downstream U-turns to preserve business access.

While each site has its own geometric layout and traffic patterns, fewer driveways result in fewer conflict points between vehicles, translating to fewer crashes.

Assuming access points are consolidated and the property is served by an internal backage road, several intersection configurations were considered at a potential new access point to the “Ditch” development.

One potential intersection configuration installs a traditional signal, coordinated with the adjacent US 25/KY 461 signal. The location of the driveway should balance signal spacing and the distance to the southbound ramps to ensure neither is negatively impacted by delays introduced at the new intersection. Grades along US 25 are steeper south of the Rodeway Inn Motel driveway opposite (approximately MP 15.43)—complicating stop-and-go maneuvers, especially for trucks and trailers. This concept’s configuration maintains the TWLTL at either end of the southern study area, using the space for dedicated left-turn lanes at the new signal.

Another possible intersection configuration creates a Continuous Green-T with a traffic signal but no stop phase for the southbound thru movement. **Figure 26** provides a concept sketch showing how different users navigate a Green-T style intersection. Green-T intersections provide operational benefits by decreasing delay and the number of stops; however, limited research has been completed regarding safety benefits.

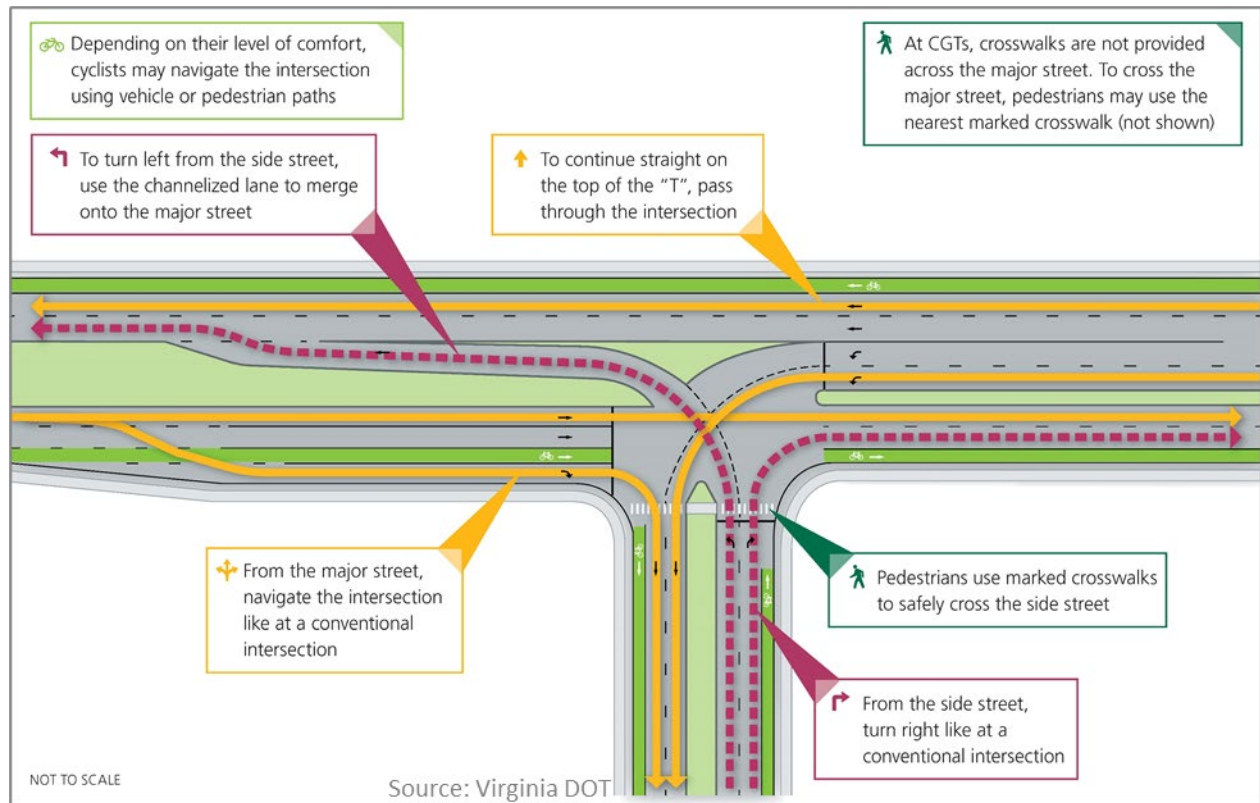


Figure 26: Continuous Green-T

Green-T's were considered at both the "Ditch" development main access point and the US 25/KY 461 intersection. While there is sufficient room along southbound KY 461 to extend the merge area for left turns, the merge area south of the potential "Ditch" development driveway eliminates a portion of the proposed TWLTL, thereby eliminating the left turn storage space for existing businesses including Wendy's and KFC. Access could be preserved via a backage road, but it would become a public street if extended beyond the single property.

7.0 INITIAL COORDINATION EFFORTS

Collaborative project team meetings were held throughout the course of the study. The project team included KYTC District 8 and Central Office staff from various disciplines, CVADD staff, and consultant personnel. Conversations with local officials and key stakeholders also provided insights into the community's use of the corridor today and its plans for the future. Coordination efforts were essential for identifying areas of concern and potential improvement opportunities. Summaries of all meetings are arranged chronologically in **Appendix D**.

7.1 Project Team Meeting No.1

The project team met on November 17, 2021, to review existing conditions information and prepare for community outreach. The team reviewed existing conditions including roadway geometry, traffic flow, high crash locations, and environmental resources. The team then discussed how other regional projects (**Section 3.1**) were being addressed in KYTC's 2022 SHIFT⁵ process and reviewed input from local leaders regarding likely future developments (**Section 3.2**).

The three levels of access management in the southern study area (**Section 6.0**) were discussed: options to preserve existing access patterns, incorporate a backage road system, or add a raised median along US 25. Numerous intersection configurations, U-turns, elevations, and feasible driveway connection sites were examined, and advantages and disadvantages of each combination of options were listed. Steep terrain features coupled with potential access impacts to existing businesses complicate designs. Additional stops for southbound traffic climbing the hill would increase queuing towards the interchange, creating a challenging situation for heavy truck traffic that represents 7% of traffic at the southbound ramp intersection. Concepts with minimal right-of-way impacts possibly could be combined with the adjacent 8-8952 widening to accelerate implementation for the larger corridor.

The team agreed to present options that show existing access patterns and that include a backage road along the "Ditch" development to local officials and stakeholders for discussion.

7.2 Local Official and Stakeholder Meeting No. 1

On December 15, 2021, the project team met with local officials and other stakeholders at the Kentucky Music Hall of Fame. The purpose of this meeting was to review existing conditions, seek input on access management options in the southern study area, and discuss transportation needs in the northern study area.

The project team presented two representative access management scenarios for the south section, paired with the five-lane US 25 section developed by KYTC District 8 to mimic the Item No. 8-8952 widening template to the south.

- One option preserves existing access patterns, assuming seven new "Ditch" parcels develop with at least one new driveway for each. This option increases the number of conflict points, degrading safety and traffic flow through the corridor.

⁵ SHIFT or the Strategic Highway Investment Formula for Tomorrow, is a data-driven project scoring process to compare and prioritize capital improvement projects to make better use of the limited transportation funds in the biennial budget.

- Another option creates a backage road for the new “Ditch” development; the initial sketch showed a signalized three-leg intersection between Wendy’s and the motel driveway with a right-in/right-out (RI/RO) adjacent to the Marathon gas station. This consolidates the number of access points, reducing impacts on traffic flow and vehicle conflict points.

Attendees generally preferred the backage road concept with consolidated access points. Adding sidewalks or a multi-use path along the corridor would be a benefit.

An initial concept plan for the hilltop development (**Figure 27**) includes a 50-store shopping destination with a hotel and park. The plan assumes three roadway connections: a new roadway parallel to I-75 between the Mount Vernon exits, Heritage Way (microfoodery driveway), and a 4- or 5-lane connection to US 25 opposite the motel entrance. Parties have shown interest in the site, but traffic connections are critical to reaching an agreement.



Figure 27: Hilltop Development Concept

North of the interchange, the transportation needs are largely driven by event traffic. Event venues are returning to business following pandemic closures. The county hosted a food truck fair at Renfro Valley in 2021 that saw 5,000+ participants and backed up US 25 traffic to the interchange. One long-term vision calls for an attraction similar to Louisville’s “Fourth Street Live” style event venue.

8.0 CONCEPT DEVELOPMENT: OTHER SPOT IMPROVEMENTS

Beyond the access management considerations discussed in **Section 6.0**, smaller scale spot improvement concepts focusing on pedestrian connections were proposed in both study areas and the interchange footprint. Following initial meetings, the sidewalks shown in the initial design concept (**Figure 24**) were adjusted, creating a single 10-foot-wide shared-use path along the east side of US 25.

Extend Shared-use Path to KOA. One spot improvement extends the existing US 25 shared-use path approximately 0.4 mile north, from the existing endpoint near the Hall of Fame to the KOA campground.

Widen Sidewalk North of Interchange. Another improvement concept widens 1,800 feet of existing sidewalk just north of the interchange. Once widened, the new footprint matches the 10-foot section assumed for connecting sections north and south.

Pedestrian Connection at Interchange.

Another potential spot improvement includes a shared-use path through the I-75 interchange, connecting the proposed path on either side. Similar to the recently reconstructed US 68/KY 4 interchange in Lexington, a short retaining wall will be necessary to accommodate the path. Pedestrian-level lighting and advance warning signage are also included in cost estimates. Unobstructed visibility for pedestrians and cyclists is critical for safety.



FHWA counts high-visibility crosswalks and rectangular rapid flashing beacons among their proven safety countermeasures.

Repave Dual Lefts. While the interchange was recently reconstructed, the left-turn lanes onto the northbound I-75 on-ramp show evidence of wear. This spot improvement concept replaces existing asphalt with concrete in the affected area.

Southbound I-75 Off-Ramp/Holt Road. Safety at the Holt Road intersection/Shell driveways was a common theme during conversations with local stakeholders. This is the only LOSS 4 segment for severe crashes in the study area. Right turns from the off-ramp are a free-flow movement, many motorists accelerating to begin the uphill climb. Closely spaced driveways



introduce nearby conflict points and slower moving traffic. An embankment to the west limits visibility, although it was cut back in 2019 as part of the interchange reconstruction project.

Crashes evaluated for the 2019–2020 timeframe showed a decline (5 crashes) versus 2017-2018 (10 crashes), but the small sample size available does not represent a statistically valid comparison.

Event Traffic. Per feedback from local stakeholders, the project team also considered options to address event traffic north of the interchange. Reversible lanes between the northbound ramps and KY 2793 (Hummel Road) were initially considered, providing two northbound lanes prior to events and two southbound lanes following events within the constraints of the existing pavement.

8.1 Project Team Meeting No. 2

On February 8, 2022, the project team met to discuss stakeholder input, review 2045 traffic assumptions, and refine the preliminary improvement concepts described above. A summary of the meeting is in **Appendix D**. The project team discussion included:

A Green-T intersection at US 25/KY 461 could eliminate stops for motorists climbing the hill. There is sufficient space south along KY 461 to extend the merge lane. In the 2045 PM peak hour, the Green-T reduces intersection LOS from D in the No-Build scenario (45 seconds delay) to LOS C (22 seconds delay).

A second Green-T intersection at the “Ditch” development entrance includes a signalized intersection for the development without requiring stops heading up the hill or potentially backing up traffic towards the interchange. However, the merge lane for westbound left-turning traffic onto US 25 blocks southbound motorists from turning to/from the existing strip of commercial businesses (i.e., Wendy’s and KFC). To eliminate this potential conflict, a longer backage road could be constructed to serve the existing businesses south of the “Ditch” property.

Existing access points to US 25 between the potential Green-T's could convert to RI/RO only. Alternatively, U-turns for southbound traffic could be accommodated at the US 25/KY 461 intersection; U-turns for northbound traffic cannot fit at the "Ditch" Green-T driveway without an additional lane, which would lead to substantial right-of-way and earthwork costs.

Regarding a potential safety improvement at Holt Road, additional monitoring is recommended to determine if cutting back the embankment in 2019 addressed the elevated crash trend.

Reversible lanes for event traffic were dismissed from further consideration due to the loss of the TWLTL, abrupt lane transitions approaching the ramps, and inconsistent scheduling/duration of events. On-site traffic management strategies by the venue—like parking attendants or officers to direct traffic—provide similar benefits with less disruption to US 25 operations.

8.2 Expanded Footprint: Interchange

Following the second project team meeting, District 8 decided to expand the footprint of the study to include improvements within the recently reconstructed interchange. This expansion allows for additional flexibility for U-turns in conjunction with access management scenarios that replace the proposed TWLTL with a raised median.

A roundabout at the US 25 intersection with the southbound ramps could give northbound US 25 motorists a convenient U-turn option and minimize stops/delay at the interchange. The proximity of the signalized intersection at the northbound ramps is a concern if northbound US 25 traffic queues extend too far. Analysts looked at the proposed roundabout scenarios in a localized Vissim microsimulation network to determine the feasibility of each scenario.

9.0 FINAL CONCEPTS AND COORDINATION MEETINGS

Following concept development efforts described in **Chapter 8.0**, the project team refined two build concepts for the southern study area to present to stakeholders alongside corridor-wide bicycle/pedestrian connectivity concepts.

Concept 1 (Figure 28) widens US 25 south of the interchange, providing two 12-foot-wide thru lanes per direction, curb/gutter, a flush center median, and 10-foot-wide shared-use path along the east side of the roadway. The typical section is shown in **Figure 29** (page 41).

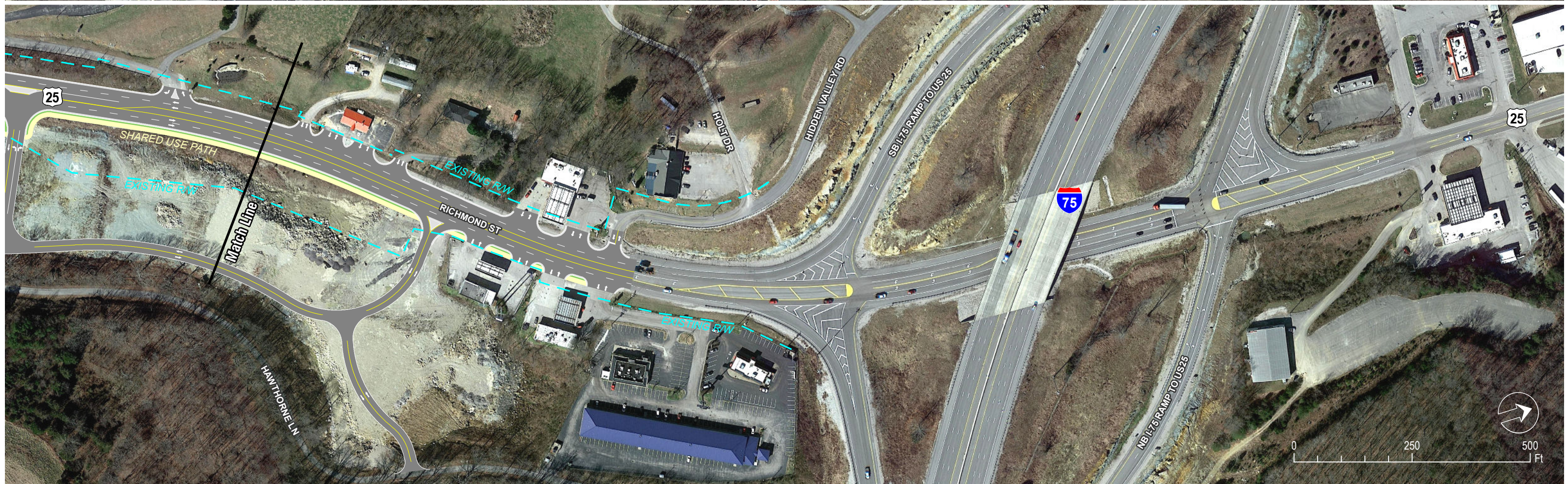


Figure 28: Access Management Concept 1

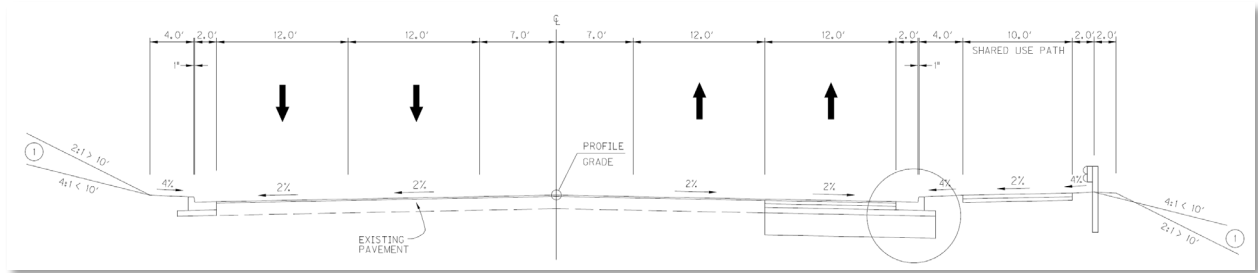


Figure 29: Typical Section for Concept 1

Concept 1 also creates a signalized Green-T intersection at US 25/KY 461 with a bulb out or “loon” for southbound U-turn traffic. A backage road connection provides access between approximate MP 15.12 and 15.55 with RI/RO connections to US 25 at either end. There is also a signalized Green-T near MP 15.4—a third connection between US 25 and the backage road. A raised median prevents left turns between approximate MP 15.1 and 15.25 to reduce conflict points for the southbound merge from the northern Green-T. Access to the gas stations adjacent to the interchange remains unchanged; there are no improvements to the interchange itself.

Concept 2 widens US 25 south of the interchange, providing two 12-foot-wide thru lanes per direction, curb/gutter, a raised center median, and 10-foot-wide shared use path to the east. The typical section is shown in **Figure 30**.

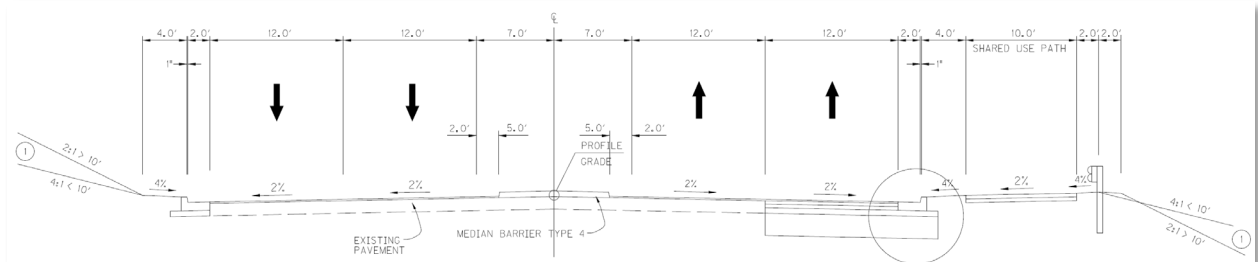


Figure 30: Typical Section for Concept 2

Concept 2 is shown with a signalized Green-T intersection at US 25/KY 461 but could remain as a standard signal if preferred. Either configuration adds a loon for southbound U-turn traffic. A raised median prevents cross-median traffic except for the following turning opportunities:

- A left-turn lane near MP 15.25 for southbound traffic to access KFC/Wendy's.
- A left-turn lane near MP 15.46 for northbound traffic to make a U-turn; the loon extends south, ending with a right-turn lane to the motel.
- A left-turn lane near MP 15.48 for southbound traffic to make a U-turn; the loon extends north, ending with a right-turn lane into the “Ditch” development driveway.

The US 25 intersection with the I-75 southbound ramps is reconstructed as a roundabout to provide another northbound U-turn opportunity. The roundabout carries two northbound thru lanes; slip lanes to/from the ramps remain as they exist today. The concept is shown on **Figure 31**.

While Concept 2 ends with the southbound ramp roundabout, Concept 2+ (**Figure 32**, page 44) reconstructs the US 25 intersection with the northbound ramps as a single lane roundabout. With this improvement, northbound US 25 traffic to the northbound I-75 on-ramp is free-flow with no opposing movements after entering the southern roundabout. Also, there are fewer lanes needed between ramp terminals, so the shared-use path could either follow the existing shoulder or remain outside the piers, separated from the road by a low retaining wall, as discussed above.

9.1 Build Traffic Comparison

Table 4 contains a summary of traffic operations at key intersections for the Existing, No-Build, and two Build scenarios. Each cell notes the assumed intersection configuration, LOS, and total delay. As shown, either Build scenario reduces delay south of the interchange compared to the 2045 No-Build scenario.

Table 4: Comparison of PM Peak Traffic Operations

Location	2021 Weekday (3 lane + TWLTL)	2045 No-Build (3 lane + TWLTL)	2045 Build 1 (4 lane + TWLTL)	2045 Build 2+ (4 lane divided)
US 25 at KY 461	Signalized LOS C 26 sec	Signalized LOS D 45 sec	Signalized Green-T LOS C 22 sec	Signalized Green-T LOS C 22 sec
Wendy's Driveway	Any Turns WB: LOS C 24 sec	Any Turns WB: LOS D 34 sec	Right-in/Right-out WB: LOS B 12 sec	Right-in/Right-out WB: LOS B 12 sec
"Ditch" Development Driveway	-	-	Signalized Green-T LOS A 8 sec	Indirect Lefts LOS A-B WBR: 13 sec
I-75 Southbound Off-Ramp	EBL Stops LOS E 36 sec	EBL Stops LOS E 46 sec	EBL Stops LOS E 46 sec	Roundabout LOS A 3 sec
I-75 Northbound Ramps	Signalized LOS B 18 sec	Signalized LOS B 18 sec	Signalized LOS B 18 sec	Roundabout LOS A 4 sec

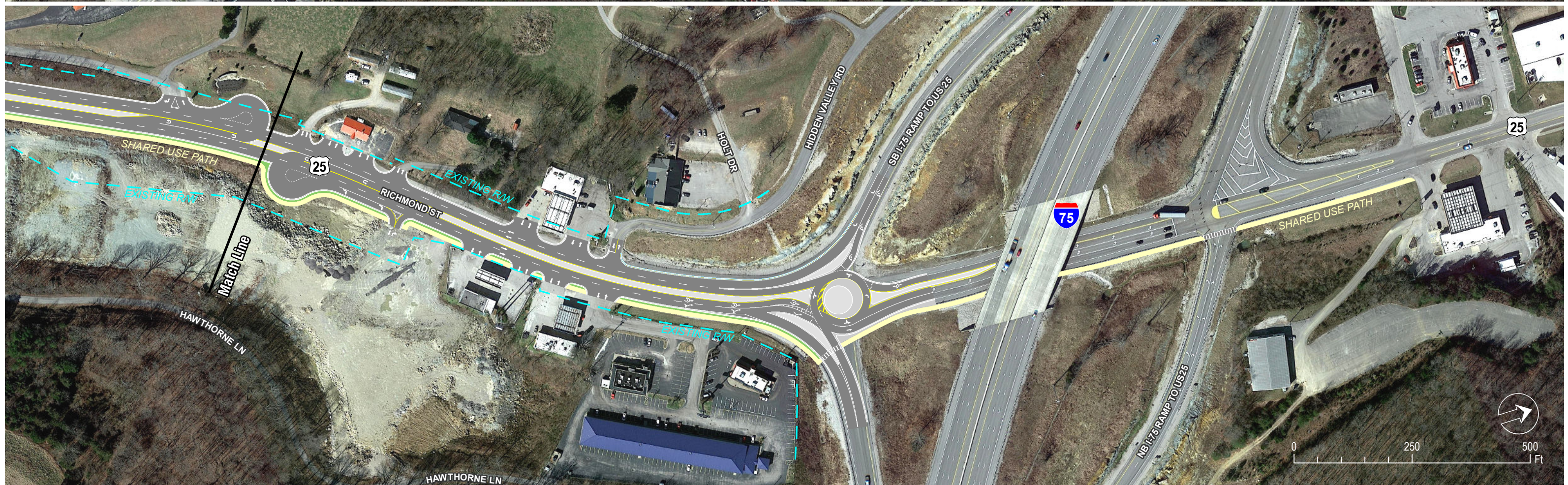


Figure 31: Access Management Concept 2

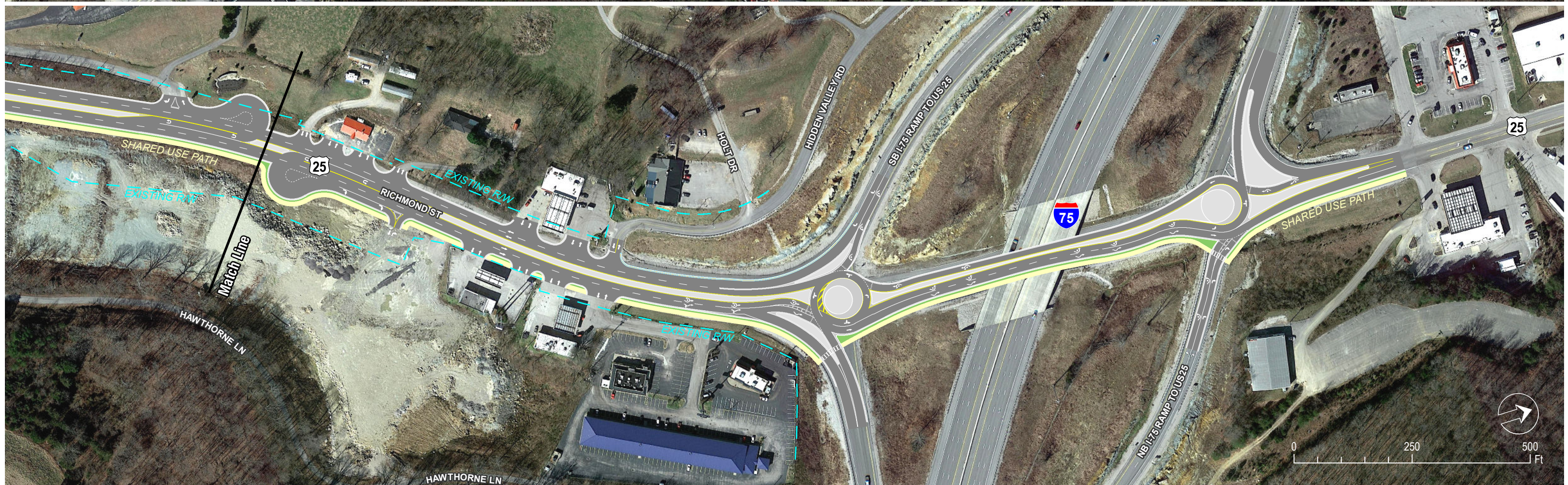


Figure 32: Access Management Concept 2+

Microsimulation of the proposed roundabouts indicates both Concepts 2 and 2+ would provide adequate capacity for anticipated 2045 PM peak hour traffic, reducing delay compared to the existing configuration.

Queuing between ramp termini could be a concern; roundabouts reduce stops to promote a steady traffic flow while signals increase stops to increase efficiency by platooning. For the PM peak hour with 2045 projected volumes, northbound queue lengths are about 400 feet in the both No-Build and Concept 2 scenarios—well within the 650 feet of available queue storage between intersections. In Concept 2+, there is no conflicting movement for northbound US 25 traffic at the roundabout with the northbound I-75 ramps; therefore, there is no resulting queue length.

9.2 Build Safety Comparison

Based on 2016–2020 crashes and statistical analyses, the current US 25 configuration south of the interchange demonstrates higher than expected crash rates. During the five-year analysis period, 93 crashes occurred between the intersections with KY 461 and the I-75 northbound ramps (MP 15.018–15.900). As shown in **Figure 16** (page 17), the entire length of the southern section of the study corridor is in the LOSS 3 or 4 categories.

Because the existing three-lane plus TWLTL configuration is atypical, no directly applicable crash modification factors (CMF) exist in the CMF Clearinghouse.⁶ However, applying CMFs and other safety research for similar scenarios illustrate general trends if not an exact forecast. **Table 5** compares three basic scenarios, discussed in the following subsections.

Table 5: Comparison of Crash Rates

Scenario	Elements that Increase Crashes	Elements that Decrease Crashes	Relative Safety Ranking
Widen US 25 No access mgmt.	Add Thru Lane	-	Worst
	More Driveways		
Concept 1	Add Thru Lane	Convert to Green-T	Medium
	More Driveways	Fewer Left Turns	
Concept 2/2+	Add Thru Lane	Convert to Green-T	Best
	More Driveways	Raised Median	
		Roundabout(s)	

⁶ Online at <https://www.cmfclearinghouse.org/index.cfm>

9.2.1 Widen US 25 but No Access Management

One of the early scenarios discussed with local officials/stakeholders was to widen US 25 to a five-lane section and preserve existing access patterns: each newly developed “Ditch” parcel would have one or more new driveways with a TWLTL through the entirety of the southern study area. Two primary elements involved with this option influence crash rates:

Adding Thru Lanes. With no other changes, adding a thru lane adds a theoretically infinite number of conflict points, increasing opportunities for two vehicles to collide.

Increasing Driveways. Decades of research document that adding driveways increases the number of expected crashes. CMF 2507 contains a mathematical formula to calculate how the number of driveways on an urban highway with a TWLTL impacts crash rates for select crash types. For example, increasing the number of access points from 20 to 30 would increase angle, rear end, sideswipe, head on, and single vehicle crashes by 9%.

Further, closely spaced driveways have more potential conflict points than the same number of driveways a greater distance apart (**Figure 33**). NCHRP Report 420⁷ documents how the spacing of access points and their volume affect thru traffic in the right lane, each representing a potential rear-end crash opportunity. For example, low-volume driveway connections spaced at 500 feet affect an estimated 6% of traffic in the curb lane while at 200 feet, it’s 15% of traffic and at 100 feet, it’s 27%.

Conflict points are locations in or on the approaches to an intersection where vehicles paths merge, diverge, or cross.

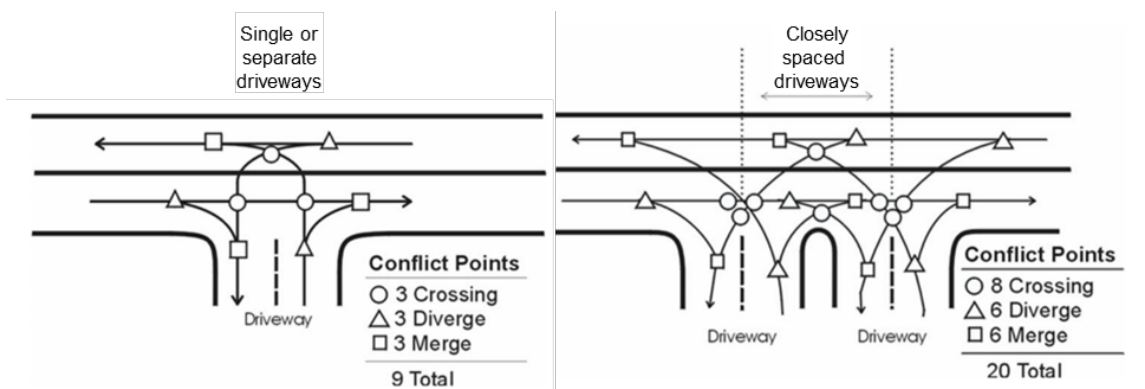


Figure 33: Conflict Points at Three-Leg Intersections

⁷ Impacts of Access Management Techniques. Online at https://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_420.pdf

9.2.2 Concept 1: Widen US 25 with Some Access Management

Beyond widening to five lanes, Concept 1 includes additional physical elements that will influence crash rates: primarily converting the US 25/KY 461 signalized intersection to a Green-T and reducing left turns at driveways since a backage road provides additional connections. Each represents a reduction in anticipated crash rates compared to widening without access management discussed in **Section 9.2.1**.

Constructing Green-T. Two CMFs address conversion of a signalized T-intersection to a Green-T. CMF 8656 shows a 15% decrease in fatal and injury crashes and CMF 8655 shows a 4% decrease in PDO crashes. There were 27 crashes within 200 feet of the US 25/KY 461 intersection during the five-year analysis period—all PDOs and primarily rear ends (**Figure 34**).

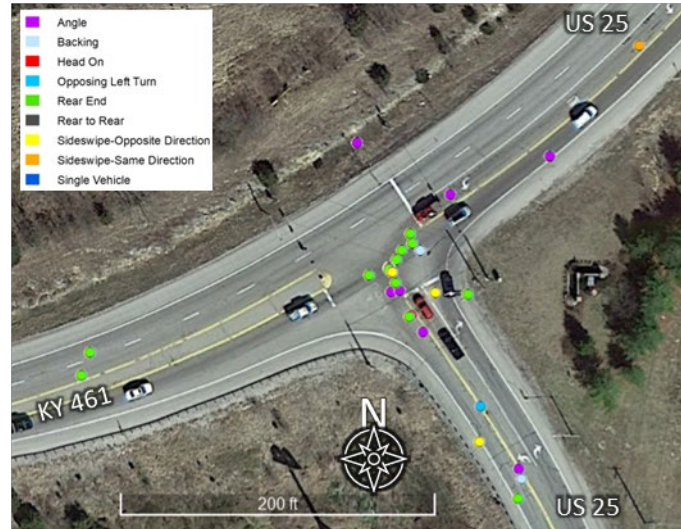


Figure 34: US 25/KY 461 Intersection Crashes

Fewer Left Turns. FHWA identifies intersections that reduce left-turn conflicts as a category of proven safety countermeasures, noting “these intersections simplify decision-making for drivers and minimize the potential for higher severity crash types, such as head-on and angle.”⁸ NCHRP Report 420 states “U-turns result in a 20% crash rate reduction by eliminating direct left turns from driveways.” In Concept 1, left turns are eliminated along 37% of the 0.9-mile study area, relying on the Green-T and backage road for access instead. A right-in/right-out (RI/RO) T-intersection has two conflict points compared to nine at a traditional T-intersection (**Figure 33**, left).

9.2.3 Concept 2/2+: Widen US 25 with Divided Typical Section

Concept 2 and 2+ applies the same physical elements as Concept 1, plus further reductions associated with the divided median and one or more roundabouts at the interchange.

Raised Median. CMF 2514 shows a 23% decrease in most crash types when a TWLTL is replaced with a raised median. Based on the distribution of crashes in the southern study area, this equates to 2.6 fewer crashes per year, independent of other factors.

⁸ Online at https://safety.fhwa.dot.gov/provencountermeasures/reduced_left.cfm

Roundabout(s). CMF 9445 shows a 24% decrease in crashes when one or both ramp termini at an interchange are reconstructed as roundabouts. FHWA identifies roundabouts as a proven safety countermeasure, citing 78% reductions in fatal and injury crashes when roundabouts replace signalized intersections.⁹

9.3 Planning-level Cost Estimates

Planning-level designs for all improvement concepts were used to estimate preliminary quantities of high-cost construction items including earthwork, pavement, and structures. Construction costs were tabulated using KYTC average unit bid prices. Separate estimates were prepared for an asphalt or concrete shared use path; concrete is presented herein as a more conservative cost. All calculations for shared-use path sections include pedestrian-level lighting. KYTC District 8 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, and utility records.

Planning-level cost estimates by phase are presented in **Table 6** with costs shown in 2022 dollars. Each construction phase estimate includes an additional 25% for contingencies.

Table 6: Cost Estimates by Phase (2022 Dollars)

Build	Total Cost	Design	Right-of-Way	Utilities	Construction
Shared-use Path to KOA	\$2.9M	\$250,000	--	\$400,000	\$2.2M
Widen existing sidewalk	\$0.7M	\$50,000	--	\$200,000	\$450,000
Shared-use Path at Interchange*	\$3.2M	\$250,000	--	\$380,000	\$2.6M
Shared-use Path to KY 461**	\$4.0M	\$250,000	--	\$350,000	\$3.4M
Replace dual left pavement	\$1.3M	\$120,000	--	--	\$1.2M
Concept 1					
US 25/shared-use path	\$9.3M	\$1.0M	\$150,000	\$700,000	\$7.4M
Backage Road	\$3.6M	\$250,000	\$900,000	\$300,000	\$2.1M
Concept 2	\$18.0M	\$1.6M	\$170,000	\$700,000	\$15.5M
Concept 2+	\$20.1M	\$1.7M	\$170,000	\$950,000	\$17.3M

* Included in Concept 2+ costs shown but presented for reference as standalone element

** Included in Concepts 1, 2, and 2+ costs shown but presented for reference as standalone element

9.4 Local Official and Stakeholder Meeting No. 2

The project team engaged with stakeholders to discuss concepts. Meeting summaries for each coordination point are included in **Appendix D**, arranged chronologically.

⁹ Online at <https://safety.fhwa.dot.gov/provencountermeasures/roundabouts.cfm>

A second virtual meeting with local officials and stakeholders occurred on June 6, 2022. Following a brief review of existing conditions and supplemental traffic data collected, the project team presented Concepts 1, 2, 2+, and the potential shared-use paths. Build concepts were developed to reduce the number of conflict points, preserve business access, and remain within existing right-of-way. Analyses show each Build concept improves traffic flow over the No-Build scenario and reduces the number of conflict points.

While there was no clear consensus regarding which option represents a best-fit solution for the community, the group discussed the roadway concepts at length. Main discussion topics were as follows:

- Business owners will not like losing left-turn access to/from US 25 into their properties.
- The raised median can complicate emergency response situations, depending on the type of median proposed.
- US 25 carries I-75 detour traffic when a crash affects mainline operations.
- Roundabouts provide significant safety savings and reduce the number of stops. It takes a while to get used to them, but most motorists eventually like them.
- It is not possible to maximize throughput, safety, and access all at the same time.

Future community engagement is important if any of the individual planning concepts are advanced for further project development activities.

9.5 Project Team Meeting No. 3

The project team held a third coordination meeting on June 29, 2022, to review the improvement concepts, discuss costs/impacts, and concur on recommendations. **Table 7** provides a side-by-side comparison of key performance metrics between access management concepts for the southern study area. As shown, Concept 2/2+ provide better mobility and fewer conflict points at the interchange. Either Build concept reduces conflict points along US 25 compared to the current four-lane or possible future five-lane configuration with a TWLTL.

Table 7: Comparison of Access Management Concepts

Metric	Concept 1	Concept 2	Concept 2+
Cost	\$12.9M	\$16.3M	\$18.6M
NB Ramps LOS	LOS B at Signal	LOS B at Signal	LOS A at Roundabout
SB Ramps LOS	LOS E for EB Lefts	LOS A at Roundabout	LOS A at Roundabout
Interchange Conflict Points	Same as existing	Fewer	Fewest

Metric	Concept 1	Concept 2	Concept 2+
Stops along US 25 south of I-75	0 southbound (uphill) ≤2 northbound	0 southbound (uphill) ≤1 northbound	0 southbound (uphill) ≤1 northbound
US 25 Conflict Points	Fewer than today but two left merges	Fewer than today but one left merge	Fewer than today but one left merge
“Ditch” Access	Green-T (all turns)	Indirect left with RI/RO	Indirect left with RI/RO
KFC/Wendy’s Access	RI/RO and Backage	RI/RO with U-turns	RI/RO with U-turns

10.0 RECOMMENDATIONS

Based on technical analyses and input from local officials and stakeholders, the project team recommends the following concepts advance for additional project development activities:

- Widen US 25 from KY 461 to the I-75 interchange, incorporating access management measures. This represents a high priority as design funding is available in the current Highway Plan and the adjacent Item No. 8-8952 widening project has construction funding in the biennium.
- Construct a lighted, 10-foot-wide shared use path along the east side of US 25 from KY 641 to the KOA campground.

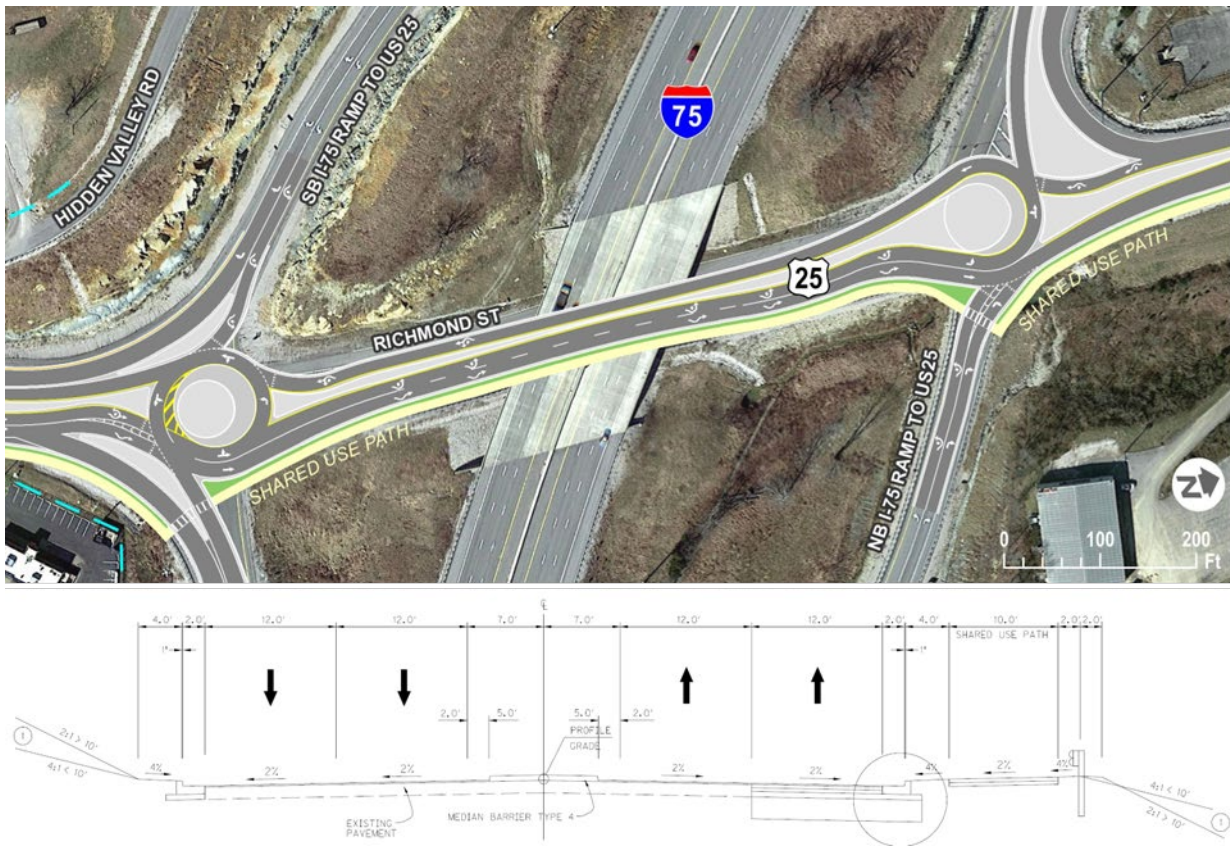
While no single Build concept is recommended, Concept 2+ is generally preferred as it best meets the study’s goals and objectives. Concept 1 would require right-of-way for the backage road, impacting the implementation timeline. Dual roundabouts in Concept 2+ provide a smoother flow through the interchange with fewer conflict points and improved safety for pedestrians. However, other concepts may be explored in future design phases.

The next phase in any future project development process is Phase I Preliminary Design, likely including environmental analyses to be eligible for federal funding for future phases. Likewise, KYTC’s STIP should be amended to reflect any future project development phases. Continued coordination with local officials, key stakeholders, and the public should be considered as part of the design process.

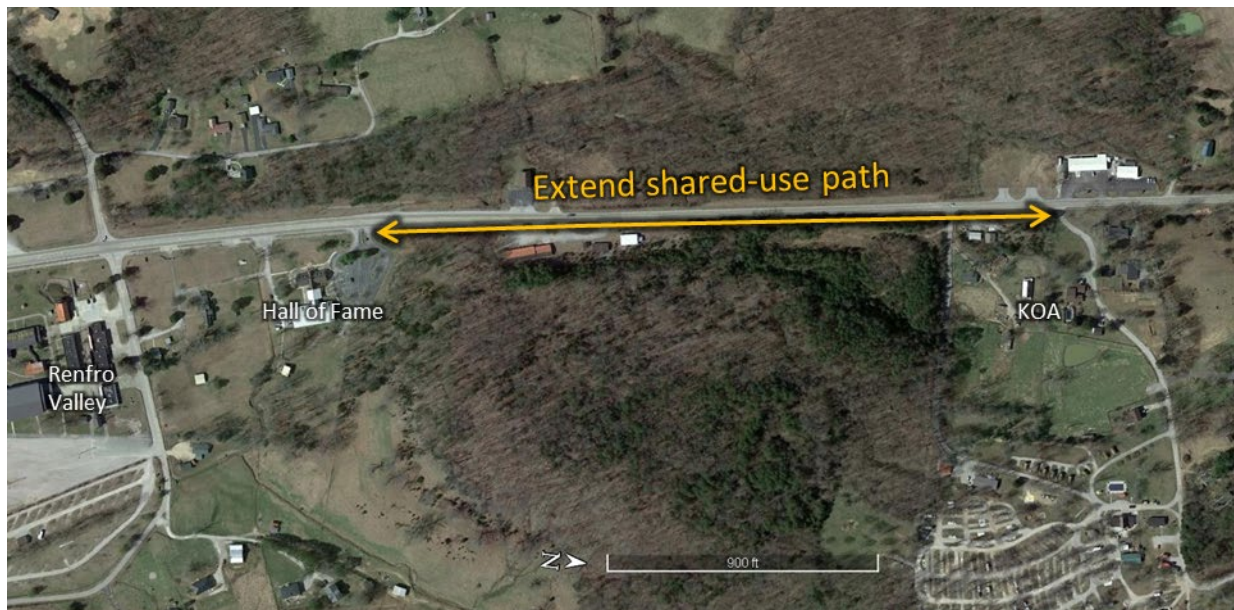
10.1 Project Sheets

Individual information sheets for improvement concepts are presented in this section.

US 25 Widening with Access Management and Shared-Use Path

Concept 2+		US 25 MP 15.018 – 15.900	
IMPROVEMENT DESCRIPTION: Widen US 25 to provide a four-lane divided section with raised median; reconstruct both ramp termini intersections as roundabouts; add lighted 10-ft-wide shared-use path on east side	Phase Estimate	(2021 dollars)	
	Design:	\$1,700,000	
	Right-of-Way:	\$170,000	
	Utilities:	\$950,000	
	Construction:	\$17,300,000	
	Total Cost:	\$20,100,000	
EXISTING CONDITIONS:			
2021 Traffic:	11,500-15,400 vpd weekdays and 17,000+ vpd summer weekends US 25/KY 461 intersection at LOS C AM peak and LOS D PM peak		
2045 Traffic:	16,800-17,600 vpd weekdays 25/461 intersection at LOS D in both peaks		
2016-2020 Crashes:	93 crashes (12 injury) with 37% angle and 27% rear ends		
Other:	US Bike Route 21 Three lanes + TWLTL 5-7% grades 45 mph		
ENVIRONMENTAL RED FLAGS:		N/A within existing right-of-way	
PROJECT LOCATION:			
			

US 25 Sidewalk Widening		
Rockcastle County	US 25 Approx. MP 16.0-16.25	
IMPROVEMENT DESCRIPTION: Widen 1,800 ft of existing sidewalk from truck stop to Renfro Valley to provide 10-ft-wide shared-use path	Phase Estimate	(2021 dollars)
	Design:	\$50,000
	Right-of-Way:	--
	Utilities:	\$200,000
	Construction:	\$450,000
	Total Cost:	\$700,000
EXISTING CONDITIONS:		
2021 Traffic:	4,700-7,800 vpd at LOS C or better during peak hours	
2045 Traffic:	5,000-8,400 vpd at LOS C or better during peak hours	
2016-2020 Crashes:	N/A – no bike/ped crashes reported	
Other:	US Bike Route 21 Two lanes + TWLTL 45 mph	
ENVIRONMENTAL RED FLAGS:	N/A – within existing right-of-way	
PROJECT LOCATION:		
		

US 25 Extend Shared-use Path North		
Rockcastle County		US 25 MP 16.650-17.018
IMPROVEMENT DESCRIPTION: Extend 10-ft-wide shared use path between KY Music Hall of Fame and KOA Campground Road	Phase Estimate	(2021 dollars)
	Design:	\$250,000
	Right-of-Way:	--
	Utilities:	\$400,000
	Construction:	\$2,200,000
	Total Cost:	\$2,900,000
EXISTING CONDITIONS:		
2021 Traffic:	4,700-7,800 vpd at LOS C or better during peak hours	
2045 Traffic:	5,000-8,400 vpd at LOS C or better during peak hours	
2016-2020 Crashes:	N/A – no bike/ped crashes reported	
Other:	US Bike Route 21 Two lanes 55 mph	
ENVIRONMENTAL RED FLAGS:	Tree impacts (bat habitat)	
PROJECT LOCATION:		
		

11.0 ADDITIONAL INFORMATION

Written requests for additional information should be sent to:

KYTC Division of Planning
ATTN: Director
200 Mero Street
Frankfort, KY 40622
Phone: 502.564.7183