US 27
ALTERNATIVES STUDY

FINAL

Lincoln County | Item No. 8-167.00
February 2018

KENTUCKY TRANSPORTATION CABINET









Halls Gap, Gateway to the Southland, Halls Gap, Ky. (1904)

Picture Source: Kentucky Historical Society, Ronald Morgan Kentucky Postcard Collection, Graphic 5.

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EXECUTIVE SUMMARY

The Kentucky Transportation Cabinet (KYTC) initiated the US 27 Alternatives Study to evaluate impacts and costs of alternatives that widen US 27 from two to four lanes, and from two to three lanes incorporating a 2+1 design. These alternatives improve safety and congestion along an approximately 4.7-mile section of US 27 in Lincoln County just south of Stanford **(Figure ES 1)**. The study examines US 27 between milepoint (MP) 11.169 and MP 15.881 (KY 1247 and Education Way, respectively); provides a baseline impact evaluation, project cost estimates and an existing conditions analysis of:

- Traffic Crash History and Operations
- Environment, Natural and Built
- Geotechnical Conditions
- Utilities
- Commercial and Residential Right-of-Ways and Relocations

The 4.7-mile US 27 study corridor is a principal arterial roadway with 12-foot lanes and varying shoulder widths (two-foot, paved). The 2017 average daily traffic (ADT) is 10,000 vehicles per day (vpd) mid-corridor with 12,000 vpd closer to Stanford. Using a 1.0 percent growth rate, these volumes are expected to reach 13,000 vpd and 16,000 vpd in 2040. Truck percentages in 2017 range between 8.0 and 9.2 percent, and 2040 ADT truck percentages are anticipated to remain nearly the same as traffic volumes increase.

Passing opportunities are provided by passing lanes (dedicated) and by striping that permits passing when oncoming traffic is not present (shared). More passing opportunities are available in the southbound direction of travel than northbound. A total of 3.6 miles of passing opportunities is available for southbound traffic via shared (1.6 miles) and dedicated (2.0 miles), while northbound traffic is provided with a total passing opportunity of 1.5 miles (0.4 mile dedicated and 1.1 miles shared).

In 2040, the No Build/Do Nothing Alternative's level of service (LOS) averages E in AM and PM peak hours and speeds slow to 40 MPH, indicating congestion will occur. Motorists will spend over 83 percent of their time following slower vehicles. In the PM peak hour, the 0.91 volume to capacity (v/c) ratio on US 27 between KY 1274 at MP 11.820 and the southbound truck lane at MP 14.583 indicates congestion in the design year.

Halls Gap (MPs 11.840 to 13.100) is characterized by steep vertical grades (6.00 and 6.48 percent), and a history of embankment failures. To address these embankment failures, in 2002 the KYTC authorized $560,000 to utilize state force and price contracts to drive an estimated 16,000 linear feet (LF) of railroad steel between MP 12.000 and MP 12.300. In addition, a $561,080 supplemental construction contract was let in 2003 to install approximately 8,000 LF of 12 x 84 H-piles. These efforts have helped stabilize the area, but are not intended to be a permanent solution, as noted by the Preliminary Geotechnical Assessment's recommending these retaining structures (H-piles and railroad rails) be removed as part of the reconstruction.

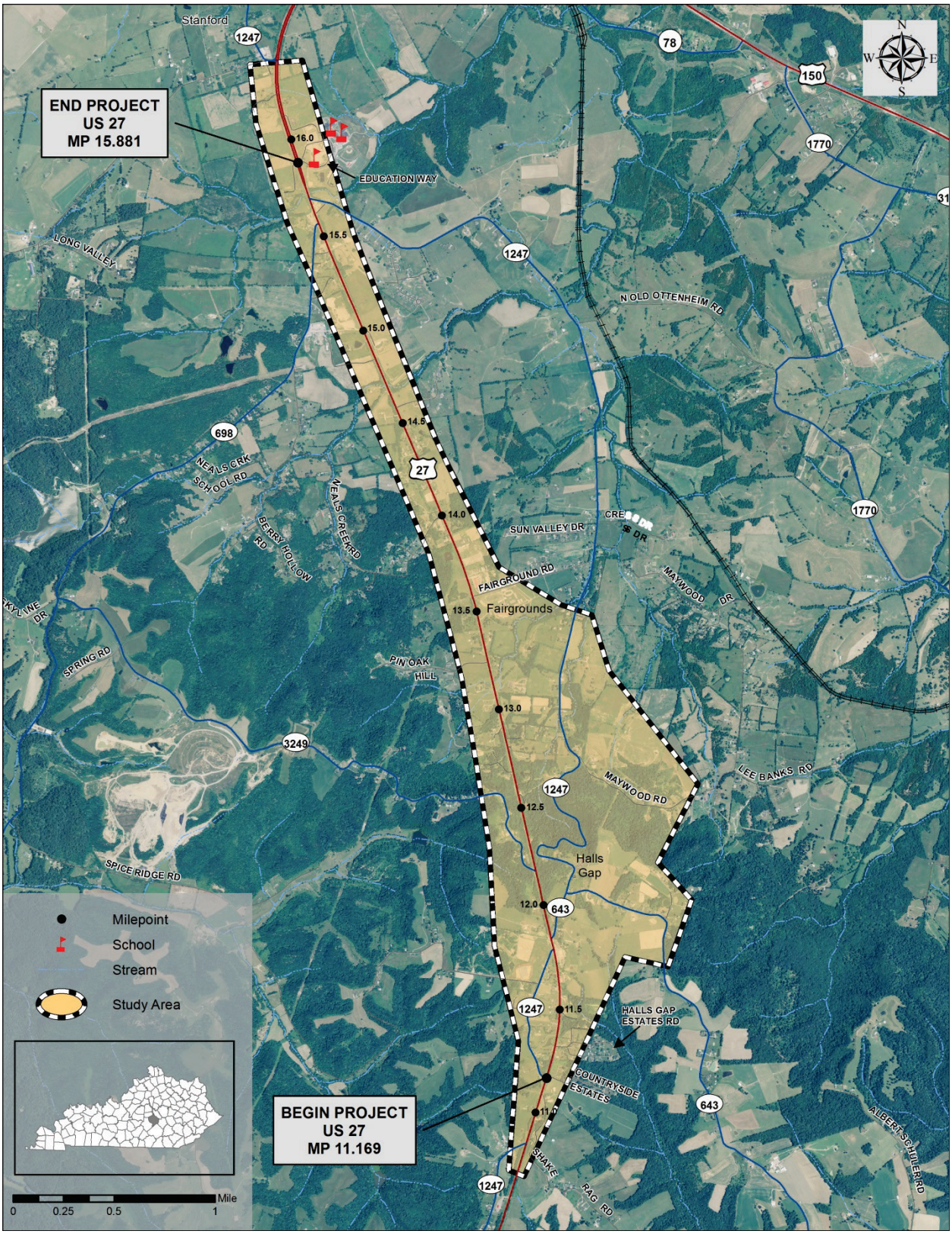


Figure ES 1: Study Area

Signs of stability issues are still present as evidenced by eroding fill slopes and concrete cross drains with visibly separated joints and dropped headwalls. Further investigation is needed to determine if damage to these structures extends under existing embankments.

This planning study represents the KYTC's first step toward identifying costs and impacts associated with US 27 improvements within the study area. A $2.1 million allocation of Federal National Highway System (NHS) funds was previously authorized for this project's Design phase in the KYTC's FY 2014–FY 2020 Highway Plan. However, future right-of-way, utility, and construction phases have not yet been funded.

Purpose and Need

As part of the planning process, a draft purpose and need statement was crafted for future project development efforts. The draft purpose and need statement establishes why the KYTC proposes to advance a transportation improvement and drives the decision-making process for alternative consideration, analysis, and selection.

The **purpose** of the US 27 project is to improve safety and mobility, reduce congestion, and provide a consistent and more efficient roadway from Somerset to Lexington.

The **need** for this improvement project is based on the following:

Safety: A five-year crash history between 2011 and 2016 identified 122 crashes on US 27, including two fatal, 32 injury, and 88 property damage only. Seven crashes involved single unit trucks (one) and semi-trucks (six). Two 0.1-mile high- crash spots, at Fairground Road and KY 698, were identified along the study corridor, with critical crash rate factors (CCRF) of 1.23 and 1.57, respectively. CCRFs over 1.0 indicate crashes are occurring more frequently within these two spot locations than on similar facilities in Kentucky. Most intersections along US 27 do not have left-turn lanes that allow vehicles to exit the through driving lane when preparing to make a turning movement, creating potentially unsafe conditions. Rear-end crashes are of particular concern.

- Ninety percent of the crashes on US 27 at KY 698 were rear-end collisions. KY 698 links a large landfill to US 27.
- Thirty-nine percent of crashes at Fairground Road were rear-end collisions. Fairground Road is home to traffic-producing events held year round. The approach is located in a straight section of US 27, making it possible for motorists to travel at higher than average speeds. Left-turning vehicles must stop in the through lane, unprotected from high speed approaching traffic.
- Both fatalities occurring on US 27 were results of rear-end collisions.

Mobility and Congestion: 2017 traffic counts revealed this segment of US 27 serves 10,000 to 12,000 vehicles per day (vpd). Year 2040 traffic is projected to be between 13,000 and 16,000 vpd. It is now a moderately congested route operating at an average level of service (LOS) D. Year 2040 analysis predicts worsening congestion and operating conditions with LOS E. Volume to capacity (v/c) ratios increase from 0.75 to 0.91 from 2017 to 2040. Trucks on US 27 are projected to remain near current levels of 8.0 and 9.2 percent.

- Current travel speeds along the corridor average 43 miles per hour (mph), well below the posted 55 MPH speed limit, slowing to 40 MPH in 2040. No existing traffic signals are located within project limits to affect average speeds.
- Two-lane US 27 has limited passing opportunities in the northbound lane. It shares approximately one mile of passing lanes with southbound traffic between MP 11.169-11.575 and 13.940-15.090. Northbound dedicated passing opportunities are limited to a truck climbing lane at MP 14.710-15.120 or only 8.9 percent of the project length. This results in motorists following slower vehicles (platooning) nearly 80 percent of the time, which is forecasted to grow to 88 percent by 2040. In response to the KYTC's request for comments and through LO/S meeting discussions, the Kentucky State Police reported northbound vehicles routinely pass illegally through the Halls Gap area, possibly resulting from the combination of platooning and lack of dedicated passing opportunities.
- US 27 serves a host of users such as people traveling for work or school, trucks moving goods, recreation enthusiasts enjoying the area's attractions, consumers and clients making trips to Lexington for shopping and medical needs, and emergency responders performing their duties. A route operating at LOS D or E with a v/c ratio over 0.9 can hinder many of these activities.

Systems Connectivity: consistent and more efficient connection from Somerset to Lexington: Managing driver expectation is an important factor in creating a safe and efficient roadway. One way to accomplish this is providing a consistent design template throughout a corridor. For many years the KYTC has been pursuing widening US 27 between Somerset and Lexington, a distance of approximately 75.0 miles. To date, roughly 40.5 miles of this corridor have been widened to four lanes including: Somerset north, 13.0 miles; through Stanford, 2.5 miles; and from KY 34 in Garrard County north to Lexington, 25.0 miles. The 14.0 miles of unimproved US 27 from Stanford north to KY 34 are in design to widen to four lanes. The unimproved 17.0-mile section of US 27 from KY 70 in Pulaski County north to Stanford contains 14.7 miles that is the focus of this Alternatives Study. **Figure ES 2** shows US 27 lane configurations through Kentucky from Tennessee to Ohio.

Goals: In addition to the purpose and need to improve safety, reduce congestion and improve systems connectivity, three project goals are to:

- Avoid or minimize environmental impacts.
- Reconstruct the corridor to current design standards similar to other segments of US 27.
- Preserve or enhance scenic vistas in the Halls Gap area.

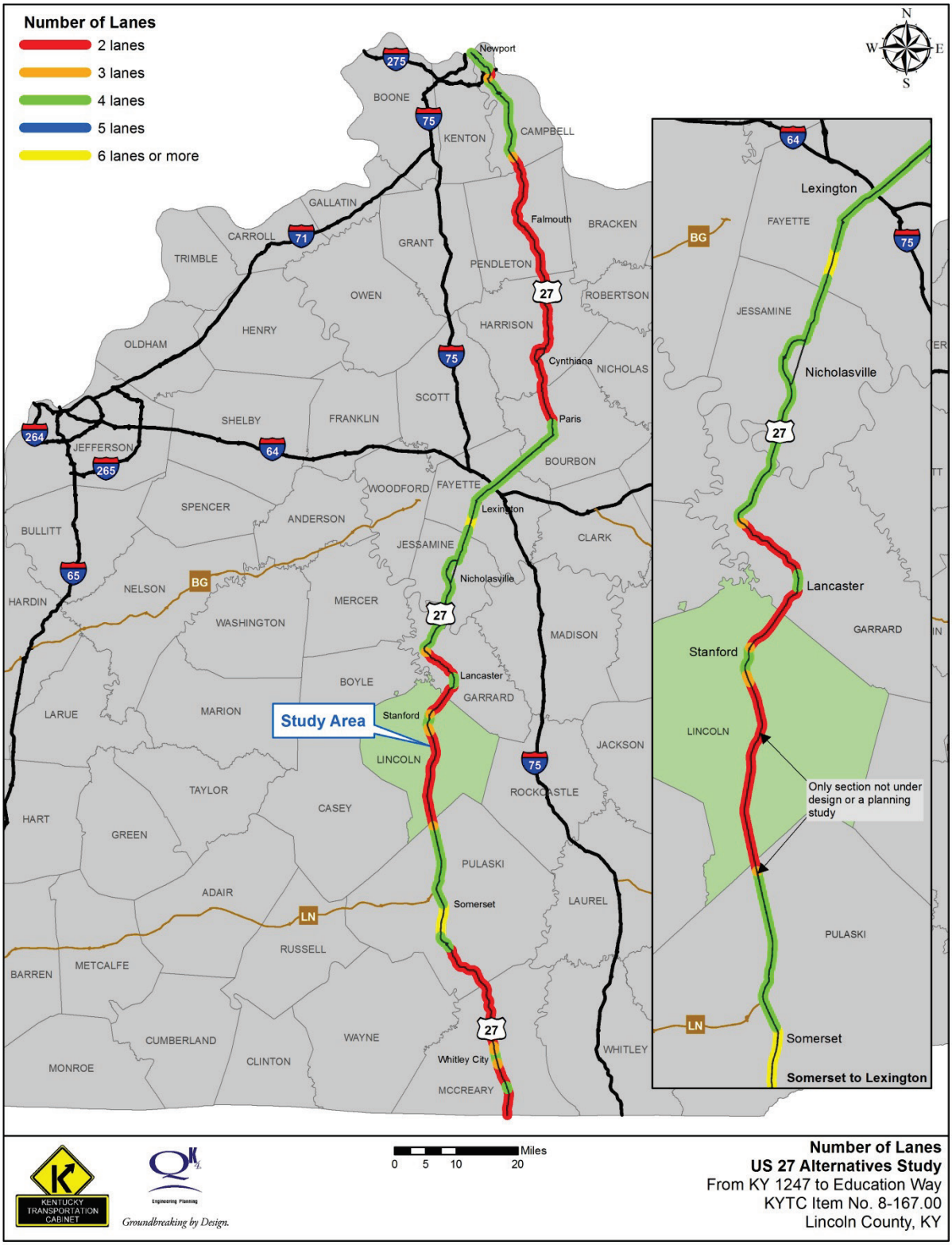


Figure ES 2: US 27 Number of Lanes Statewide

Alternatives Development

During the course of the study, the project team met three times and held two local officials/stakeholders (LO/S) meetings. During the first LO/S meeting, attendees voiced unanimous support for widening US 27. They contributed to the alternatives development process by communicating concerns about existing roadway issues including the need for wider paved shoulders, turn lanes, sight distance improvements, and traffic congestion relief along the corridor.

The following four-lane (Alternatives A#) and three-lane, with a 2+1 design, (Alternatives B#) alternatives were developed and evaluated to compare environmental, right-of-way, utility, traffic impacts and project costs.

No Build/Do Nothing—This alternative provides a baseline comparison for other design options. Existing conditions remain without improvement, and require only future maintenance expenditures.

Four-lane Roadway—This alternative would add two new travel lanes separated by a 40-foot-wide depressed median, and have partial access control.

- Widen Right (east)—widens east of existing US 27. (A1)
- Widen Left (west)—widens west of existing US 27. (A2)
- Widen Equally—widens equally east and west of existing US 27. (A3)
- Bifurcate and Bridge—A variation of Widen Left, but bifurcates (splits) southbound and northbound lanes, and provides a southbound bridge over the Columbia Gulf natural gas transmission line. The northbound lanes remain within the existing US 27 footprint. (A4)

Halls Gap Four-lane Roadway Alternatives—Because of the high costs and construction complexities of widening through Halls Gap, alternative concepts with partial control access were considered.

- Barrier Median—Utilizes a minimized typical section to reduce impacts through Halls Gap. (A5)
- Re-grade—Reconstructs US 27 through Halls Gap to lessen the roadway's steepness. (A6)
- New Eastern Alignment—Bypasses existing Halls Gap, meeting current design guidelines. (A7)

Three-lane Roadway with 2+1 Design—This alternative provides a continuous three-lane cross section with alternating northbound and southbound dedicated passing lanes. This alternative can be developed with or without partial access control measures. Three-lane (2+1) alternatives discussed in this study include partial access control (B1 and B2) for fair comparisons to four-lane alternatives.

Following alternatives development, the project team met with the LO/S. Alternatives were divided into Section 1 (South) and Section 2 (North) **(Figure ES 3)** to allow for various improvement option combinations. The LO/S were given a survey to capture feedback and preferences. A total of five surveys were completed and returned. The results revealed all responders favored improving US 27, all preferred a four-lane alternative, and three of five preferred the equal widening alignment through the south and north sections.

(*The low participation in the LO/S survey may indicate the need for a more in-depth public involvement campaign in future project phases.)*

Traffic Operations

2040 average daily traffic (ADT) volumes are projected between 13,000 and 16,000 vpd including eight to nine percent truck traffic. The 2040 traffic operations analysis showed the following average projections for No Build, four-lane, and three-lane alternatives:

2040 No Build LOS averages E in AM and PM peak hours and speeds slow to 40 MPH, indicating congestion will likely occur as motorists will spend over 83 percent of their time following slower vehicles. From KY 1247 (MP 11.169) to the southbound truck lane (MP 13.107), the 0.91 PM peak hour v/c ratio indicates congestion in the design year.

2040 Four-lane Build LOS averages A in AM and PM peak hours, indicating free-flowing travel experiencing minimal or no delays. Average travel speeds increase to 55 MPH, and motorists will spend 10 to 11 percent of their time following slower vehicles. The low v/c ratios, all below 0.27, signify adequate lanes.

2040 Three-lane (2+1) Build LOS averages D and C in AM and PM peak hours, respectively, suggesting moderate congestion in the morning but becoming less congested in the evening. Travel speeds remain below the 55 MPH posted speed limit, at 47–48 MPH; motorists will spend between 58 and 72 percent of their time following slower vehicles.

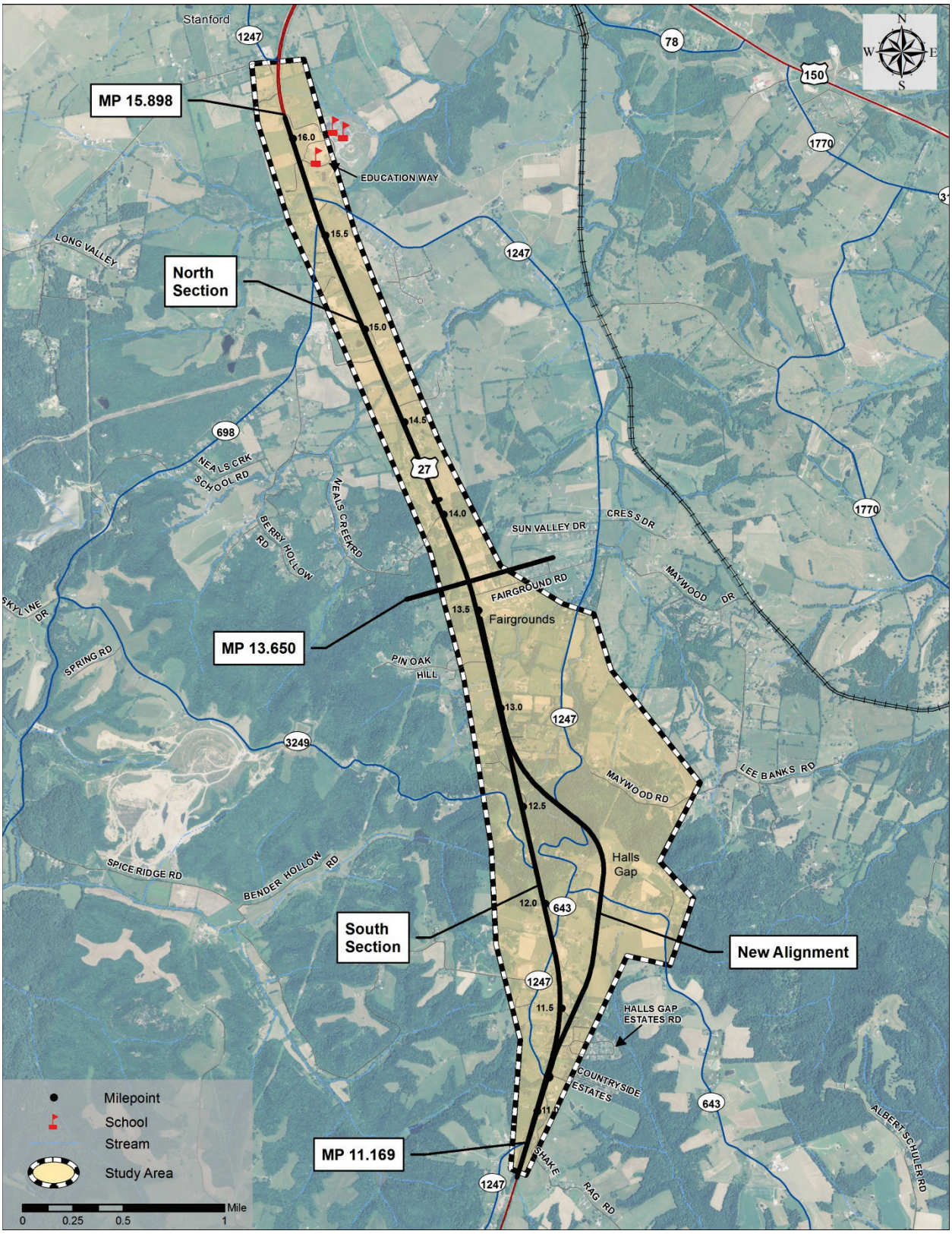


Figure ES 3: Section 1 (South) and Section 2 (North)

Environmental Considerations

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies to take into account the effects of their undertakings on historic properties. Using available mapping, 142 structures over 50 years old were identified in the study area. Early evaluation of structures and resources, including Halls Gap Overlook, is necessary to determine eligibility for listing in the National Register of Historic Places (NRHP) and potential impacts to eligible sites.

Environmental Justice requires the consideration and meaningful involvement of minority and low-income populations. Findings reported in the Bluegrass Area Development District's Socioeconomic Study indicate minority and low-income populations could be affected by all build alternatives. Age 65 and over residents positioned between KY 643 and KY 698, and disabled populations located from KY 643 north may also be affected. Further analysis may be required to determine the potential impacts to these groups.

Section 4(f) of the U.S. Department of Transportation Act of 1966 requires consideration of public owned park and recreational lands, wildlife and waterfowl refuges, and historic sites in transportation project development. The alternatives east of US 27 could affect the publicly owned recreational, fairgrounds property located on Fairground Road.

Section 6(f) of the Land and Water Conservation Act requires protection of recreation lands or facilities funded with Land and Water Conservation Act funds (LWCF). The recreation fields located adjacent to US 27 on the Lincoln County School complex were modified using a LWCF grant. Therefore, further research is required to determine Section 6(f) involvement. If eligible for protection, avoidance of this site must be explored. If avoidance is not prudent or feasible, then mitigation would be required through coordination with the Kentucky Department for Local Government and the school district.

Geotechnical Considerations

Halls Gap—Alternative impacts through Halls Gap are based on conservative 2H:1V (typical) excavation and embankment slopes. Existing excavation through Halls Gap shows the presence of multiple rock formations. Impacts can be minimized and project costs reduced if steeper excavation slopes are acceptable. It is recommended geotechnical investigation through Halls Gap take place early in the next project phase so impacts can be precisely determined, including potential impacts to Halls Gap Overlook.

Formations—New Albany Shale is present in the area. Embankment and excavation areas must be encapsulated with an impermeable material (typically clay) to prevent acidic runoff.

Cost Estimates

Phased cost estimates are shown in **Table ES 1**. Conceptual design models generated quantities of high-cost construction items including earthwork, pavement, and structures. Construction item unit costs were established based on KYTC average unit bid prices for similarly sized projects. These items were used as the basis to develop construction cost estimates, and were inflated by 45% to account for additional project costs and contingencies. KYTC District 8 provided right-of-way and utility cost estimates.

Total project and phase cost estimates for four-lane alternatives are determined by adding a cost from Section 1 (South) to a cost from Section 2 (North). Total project phase costs for three-lane (2+1) options are shown.

Four-lane project costs range from $49.3 million (South A1 + North A4) to $70.9 million (South A7 + North A3). Three-lane (2+1) project costs range from $37.2 million to $40.7 million.

Table ES 1: Improvement Alternative Phase Cost Estimates

	4-LANE ALTERNATIVES											3-LANE	
	Section 1 - South (2.48 Miles)							Section 2 - North (2.25 Miles)				4.7 Miles 4' Flush Median	
Project Phase / Cost Estimate ($ Million)	Widen RT (East)	Widen LT (West)	Equal Widen	Halls Gap Barrier Wall	Halls Gap Regrade	Halls Gap New Eastern Alignment		Widen RT (East)	Widen LT (West)	Equal Widen	Bifurcate & Bridge	6' paved shoulders	10' paved shoulders
Design	$ 1.8	$ 2.4	$ 2.3	$ 2.2	$ 2.8	$ 3.3		$ 1.2	$ 1.3	$ 1.4	$ 1.4	$2.2	$2.4
Right-of-Way	$ 6.3	$ 5.2	$ 5.6	$ 7.8	$ 7.5	$ 5.6		$ 7.0	$ 4.5	$ 6.7	$ 4.5	$8.0	$8.8
Utility	$ 2.2	$ 1.1	$ 2.7	$ 2.5	$ 2.3	$ 1.8		$ 5.4	$ 4.0	$ 4.9	$ 0.6	$5.5	$5.7
Construction	$ 18.4	$ 24.4	$ 23.0	$ 21.5	$ 27.5	$ 33.2		$ 12.4	$ 12.6	$ 14.0	$ 14.1	$21.5	$23.8
Section Total	$ 28.7	$ 33.1	$ 33.6	$ 33.9	$ 40.1	$ 43.9		$ 26.0	$ 22.3	$ 27.0	$ 20.6	$37.2	$40.7
Alternative	A1	A2	A3	A5	A6	A7	+	A1	A2	A3	A4	B1	B2

Alternatives Comparison

Potential impacts were estimated within the mainline disturb limits and proposed right-of-ways of new access control frontage roads. The alternatives impact comparisons matrix **(Table ES 2)** was used to facilitate discussion of alternatives in project team and LO/S meetings. The matrix features environmental, historical, geotechnical, utility, and right-of-way impacts; project cost by phase; and LOS and v/c ratios. To calculate total four-lane alternative impacts, add Section 1 (South) to Section 2 (North). Total three-lane (2+1) impacts are shown.

Study Conclusions

The US 27 Alternatives Study describes the process used to evaluate and compare environmental, right-of-way, utility, traffic impacts, and costs of each alternative. This report is intended to provide decision-makers with relevant information to facilitate logical, sound, and informed decision making in the KYTC Highway Plan process.

Table ES 2: Alternative Impact Comparison Matrix

LINCOLN COUNTY US 27: ALTERNATIVE IMPACT COMPARISIONS														
KENTUCKY TRANSPORTATION CABINET			4-LANE ALTERNATIVES										3-LANE	
			Section 1 - South (2.48 Miles)						Section 2 - North (2.25 Miles)				With Access Control	
			Widen RT (East)	Widen LT (West)	Equal Widen	Halls Gap Barrier Wall	Halls Gap Regrade	Halls Gap New Eastern Alignment	Widen RT (East)	Widen LT (West)	Equal Widen	Bifurcate (Bridge over Nat. Gas Lines)	4' Median 6' paved shoulders	4' Median 10' paved shoulders
Feature			A1	A2	A3	A5	A6	A7	A1	A2	A3	A4		
ENVIRONMENTAL	COMMUNITY	Cemeteries	1	1	1	1	1	0	0	0	0	0	1	1
		Churches	0	0	0	0	0	0	0	0	0	0	0	0
		Schools & Ball Fields	0	0	0	0	0	0	0	0	0	0	0	0
	HISTORICAL	Historic Marker	1	1	1	1	1	0	0	0	0	0	1	1
		NRHP	0	0	0	0	0	0	0	0	0	0	0	0
		Overlook	1	0	1	1	1	0	0	0	0	0	0	0
		Structure 50 yrs. old	13	19	13	14	15	4	0	0	0	0	14	14
	UST	Oil/Gas Wells	0	0	0	0	0	0	0	0	1	1	0	0
		UST/Hazmat (Potential)	4	5	4	4	5	0	4	4	3	3	7	7
		UST (Field Review)	0	0	1	1	0	0	2	4	3	1	1	1
	STREAMS WETLANDS	100 YR Flood (ACS)	0	0	0	0	0	0	0.94	1	0.92	1.5	0.5	0.5
		Wetlands (ACS)	1.4	2.5	1.7	1.7	1.4	1.4	0	0.9	0.9	0.9	1.9	1.9
		Intermittent (LF)	1,380	1,160	1,230	1,130	1,430	1,570	0	70	0	100	1,030	1,030
		Perennial (LF)	0	0	0	0	0	0	500	350	460	440	230	230
		Water Wells	6	7	6	6	3	0	0	0	0	0	6	6
	FARM	Prime Farmland	9	9	9	9	9	14	23	23	23	25	20	20
		Farmland of Statewide Importance	39	39	39	39	51	43	22	22	23	23	50	50
GEOTECH		Fault (LF)	0	0	0	0	0	0	1,940	1,470	1,440	1,760	1,200	1,200
		New Albany Shale (Acres)	8	8	8	8	11	6	18	18	18	18	16	16
UTILITIES		Sewer Line (LF)	0	0	0	0	0	0	650	650	650	660	700	700
		Columbia Gulf Natural Gas Transmission Lines (2-30" & 1-36") (LF)	0	0	0	0	0	0	350	350	300	0	300	300
		ATT Fiber Optic (LF)	1,900	0	1,900	730	1,880	1,830	9,200	0	9,260	0	11,200	11,200
		Water Lines (LF)	3,180	3,090	4,810	4,810	3,910	2,840	4,330	4,730	4,600	5,030	11,400	11,400
		Overhead Utility Lines - 1 Line (LF)	17,390	16,500	23,900	20,620	17,960	10,870	11,760	6,570	11,850	7,190	17,600	20,500
RIGHT OF WAY		R/W (Acres)	59.9	75.7	71.1	69.4	71.5	102.1	43.3	40.8	45.2	50.1	78	80
		Commercial Relocations (each)	2	2	2	1	2	1	2	2	2	2	0	0
		Residential Relocations (each)	21	18	20	29	22	12	24	16	25	15	26	27
PROJECT COSTS		Design Costs (10% of Construction; $ Millions)	$1.84	$2.44	$2.30	$2.15	$2.75	$3.32	$1.24	$1.26	$1.40	$1.41	$2.15	$2.38
		Right of Way Costs ($ Millions)	$6.28	$5.16	$5.63	$7.78	$7.50	$5.60	$7.00	$4.48	$6.70	$4.48	$8.00	$8.80
		Utility Costs ($ Millions)	$2.20	$1.10	$2.70	$2.50	$2.30	$1.80	$5.40	$4.00	$4.90	$0.60	$5.50	$5.70
		Construction Costs ($ Millions)	$18.40	$24.40	$23.00	$21.50	$27.50	$33.20	$12.40	$12.60	$14.00	$14.10	$21.50	$23.80
		TOTAL COSTS ($ Millions)	$28.72	$33.10	$33.63	$33.93	$40.05	$43.92	$26.04	$22.34	$27.00	$20.59	$37.15	$40.68
*LOS		CURRENT YEAR LOS	D										D	
		NO BUILD DESIGN YEAR LOS	E										E	
		BUILD DESIGN YEAR LOS	A						A-B				D (AM) / C (PM)	
v/c ratio		CURRENT YEAR v/c ratio	0.48-0.75						0.48-0.60				0.48-0.75	
		NO BUILD DESIGN YEAR v/c ratio	0.58-0.91						0.58-0.74				0.58-0.91	
		BUILD DESIGN YEAR v/c ratio	0.25-0.28						0.25-0.32				0.58-0.91	

*LOS Averaged over all project segments.

Category Impacts

Least — Most

1.0 INTRODUCTION

The Kentucky Transportation Cabinet (KYTC) initiated the US 27 Alternatives Study to evaluate alternatives that widen US 27 from two to four lanes, and two to three lanes with a 2+1 design template. These alternatives improve safety and congestion along US 27 in Lincoln County just south of Stanford. The study includes an examination of US 27 between KY 1247 and Education Way, milepoint (MP) 11.169 and MP 15.881, respectively, a distance of approximately 4.7 miles. **Figures 1** and **2** show the US 27 study area context in Lincoln County and its location in relation to Stanford, respectively.

This planning study represents the KYTC's first step towards identifying the costs and impacts associated with US 27 improvements within the study area. A $2.1 million allocation of Federal National Highway System (NHS) funds was previously authorized for this project's Design phase through authority provided within the KYTC's FY 2014–FY 2020 Highway Plan. However, future right-of-way, utility, and construction phases are neither currently funded, nor included within the current Highway Plan.

One KYTC Project Identification Form (PIF) project exists within the Item No. 8-167.00 study area **(Figure 1)** but not listed in the 2016 Highway Plan:

- **PIF No. 08 069 B0027 1765.0:** Improve safety and reduce congestion along US 27 from KY 1247 to Education Way (MP 11.169–MP 15.881). Estimated 2015 total project cost is $52.3 million.

1.1 Study Area

The study area begins at the intersection with KY 1247 and continues north along US 27 approximately 4.7 miles to the intersection of Education Way. It is nearly 5,600 feet wide in the south to accommodate potential improvement alternatives through and around Halls Gap, and narrows to 1,500 feet in the north.

The study area surrounding US 27 is predominantly rural and agricultural, with an abundance of prime farmland. This area has industrial and commercial development intermixed with rural residential and agricultural uses. Existing access control along the route is by permit.

1.2 Project History

US 27 in Kentucky is a north-south facility stretching nearly 191 miles from the Tennessee border to the Ohio border at Cincinnati, Ohio. It crosses into Kentucky in the Lake Cumberland area, passing near or through many towns, including Somerset, Stanford, and Nicholasville. The road then traverses straight through the heart of Lexington, including directly past Fayette Mall, Central Baptist Hospital, UK Medical Center, University of Kentucky, and Transylvania University. The need to improve 92 miles of US 27, study area included, was first identified nearly 20 years ago in a 1998 US 27 Corridor Feasibility Study. US 27 is part of the National Highway System, the Kentucky Freight Highway System, and the National Truck Network. US 27 serves as an alternate detour route to US 25 for motorists traveling I-75.

The 1998 US 27 Corridor Feasibility Study identified and prioritized transportation improvement options along nearly 92 miles of US 27 from the Tennessee state line north to Camp Nelson in

Jessamine County. Many of that study's recommended improvements have been implemented. In fact, this project is a part of only 16.5 miles of US 27 remaining from Somerset to Lexington that have not either been previously widened or are currently in some stage of highway design.

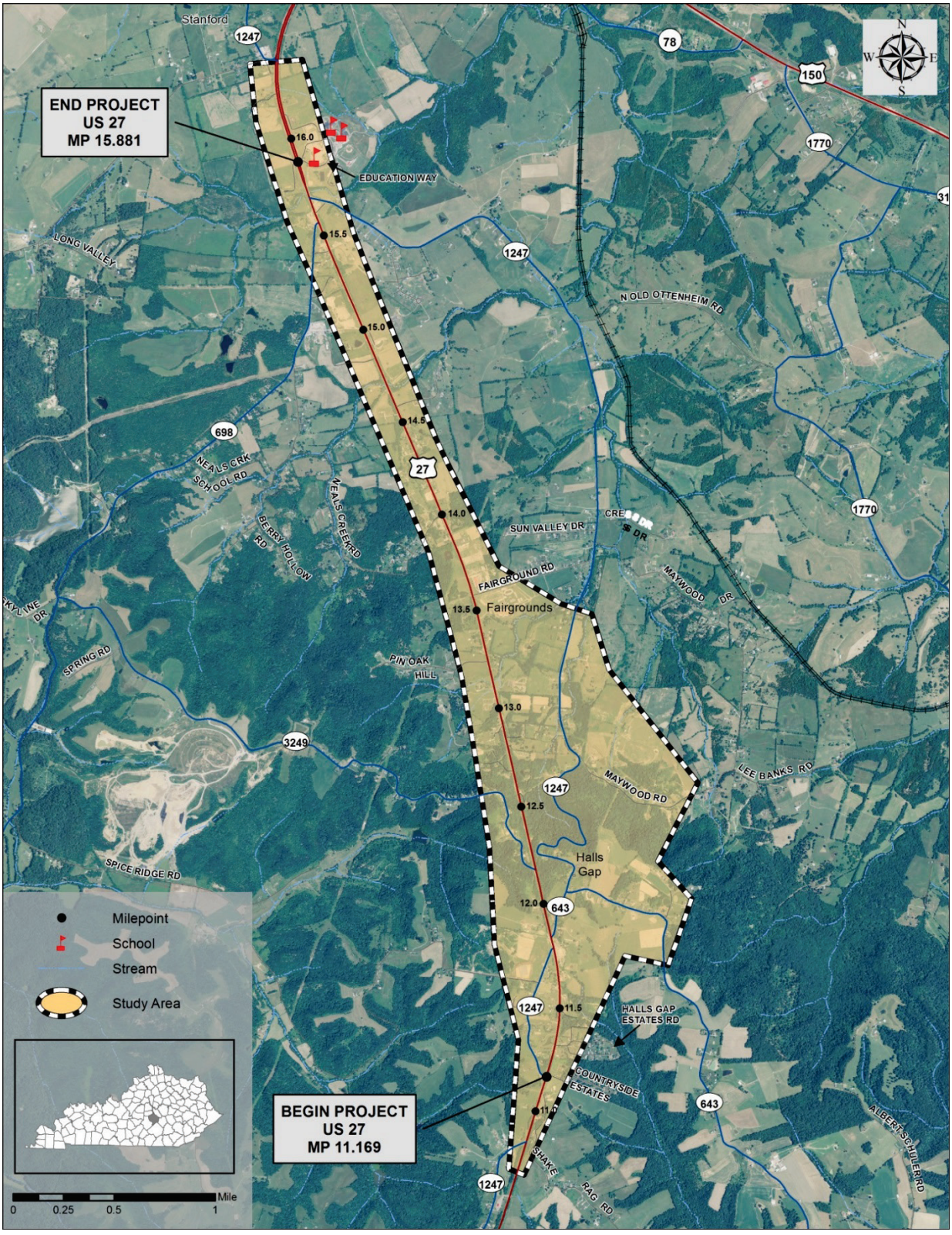


Figure 1: Study Area

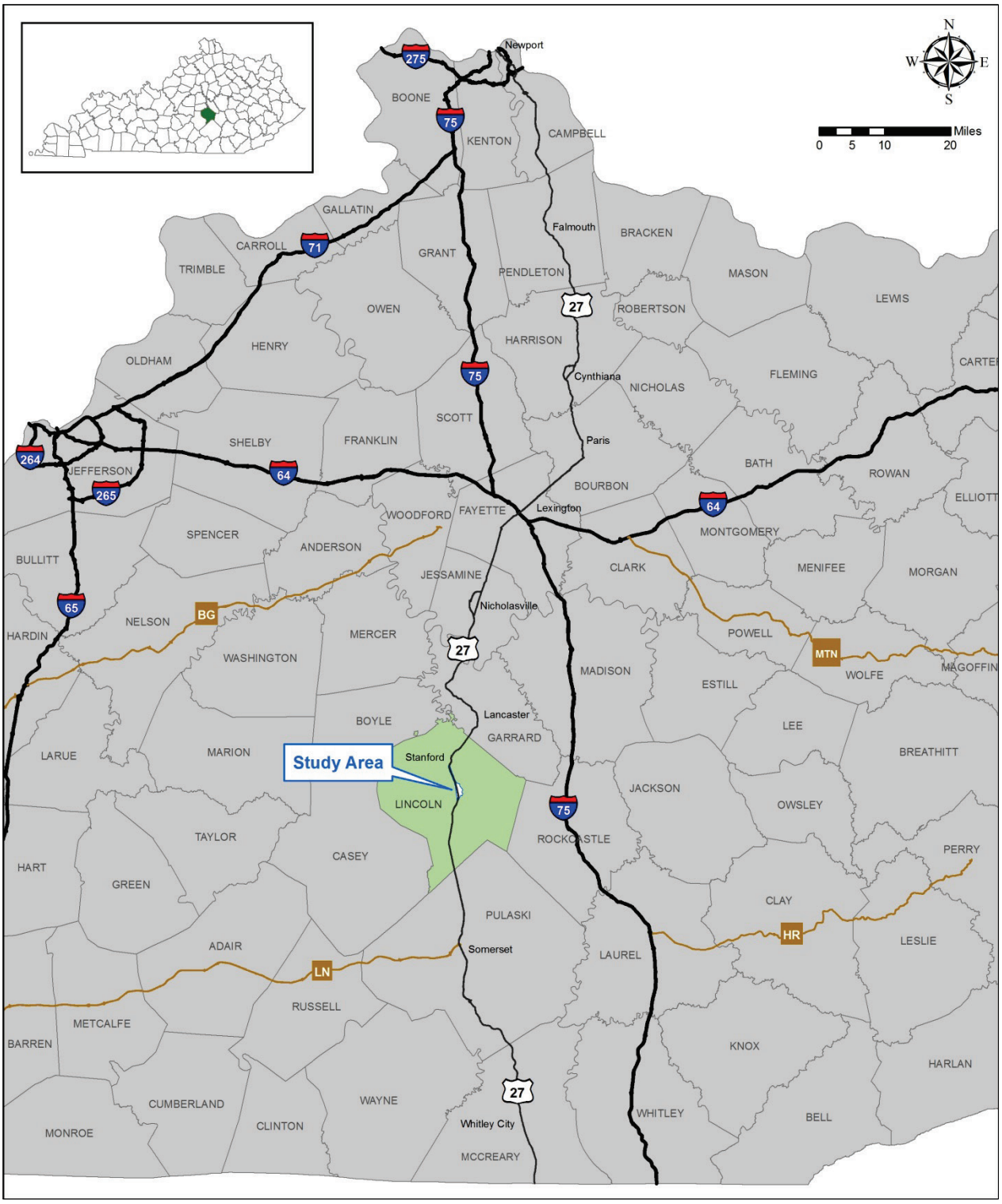


Figure 2: Project Location

2.0 EXISTING CONDITIONS

US 27 **(Figure 3)** roadway characteristics are identified in the following sections. Information is included on highway systems, geometric characteristics, structures, traffic conditions, and crash history. Applicable features are summarized from the KYTC Highway Information System (HIS) database, existing plans, and field reviews.

Figure 3: US 27 South Near Northern Terminus

2.1 Highway Systems

US 27 major highway systems are in **Table 1**.

Table 1: Highway Systems

Route	US 27
State Primary System	**State Primary:** One of five categories of state-maintained roads under the State System. Ranging from highest to lowest classification order: Interstates, Parkways, Other State Primary roads, Rural Secondary roads, and Supplemental roads.
Functional Classification	**Rural Principal Arterial:** One of 13 functional classification categories assigned to each state-maintained road based on the function it provides and urban or rural location.
National Truck Network (NN)	**Yes:** Includes roads designated for use by commercial trucks with increased dimensions (102 inches wide; 13 feet, six inches high; semi-trailers up to 53 feet long; and trailers up to 28 feet long – not to exceed two trailers per truck).
National Highway System (NHS)	**Yes:** Includes Interstate Highways and other significant Principal Arterials important to the nation's economy, defense, and mobility.
Kentucky Freight Highway System	**Yes—Tier 3:** A four-tiered roadway network representing critical freight corridors. • Tier 1 – National Regional Significance, annual average daily truck traffic (AADTT) ≥ 7,000. • Tier 2 – Statewide Significance; AADTT of 4,000 to 7,000. • **Tier 3 – Statewide Regional Significance, AADTT of 500 to 4,000**. • Tier 4 – Local Access Significance.
Truck Weight Class	**Yes—AAA:** Kentucky Revised Statutes require weight limits on state-maintained highway system. Weight classification limits in maximum gross vehicle weights are: • **AAA–80,000 pounds** • AA–62,000 pounds • A–44,000 pounds Occasional exceptions are granted.
Forest Highway System	Not on system
Scenic Byway System	Not on system
Bike Route	Not a bike route
Coal Haul (annual tons)	Not a coal haul route
Extended Weight System	Not on system

2.2 Roadway Geometrics

As part of the study effort, US 27 roadway geometrics were compared to common geometric practices for Rural Arterial Roads.[1] Roadway characteristic data discussed in this section are taken from the KYTC Highway Information System (HIS) database or existing highway plans.

- 2017 average daily traffic (ADT) volumes range from 10,000 – 12,000 vpd.
- At the southern terminus, US 27 begins as two lanes, then widens to three through Halls Gap for approximately 1.25 miles, where it narrows back to two lanes before transitioning to three lanes for approximately 0.7 mile and finally four lanes at the northern terminus near Education Way.
- Southbound truck climbing lanes are located on two occasions at Halls Gap and KY 643; northbound one instance at Trinity Lane.
- Driving lanes are consistently 12 feet wide, meeting current design guidelines. KYTC's 2017 design guidelines recommend minimum 12-foot-wide lanes on roads with an ADT greater than 2,000 vpd.
- Shoulders are between four and 10 feet wide, two feet of which are paved. Minimum recommended shoulder widths are eight feet for roadways with an ADT greater than 2,000 vpd.
- The posted speed limit is 55 MPH. Average travel speeds are 42 to 43 MPH, well below the posted speed limit.
- Horizontal curves and all but one vertical curve (sag vertical at MP 13.06) meet current KYTC design criteria. However, with a vertical grade of 6.0 and 6.4%, Halls Gap (MP 11.840-13.100) exceeds the recommended five percent maximum grade. **(Figure 4)**.

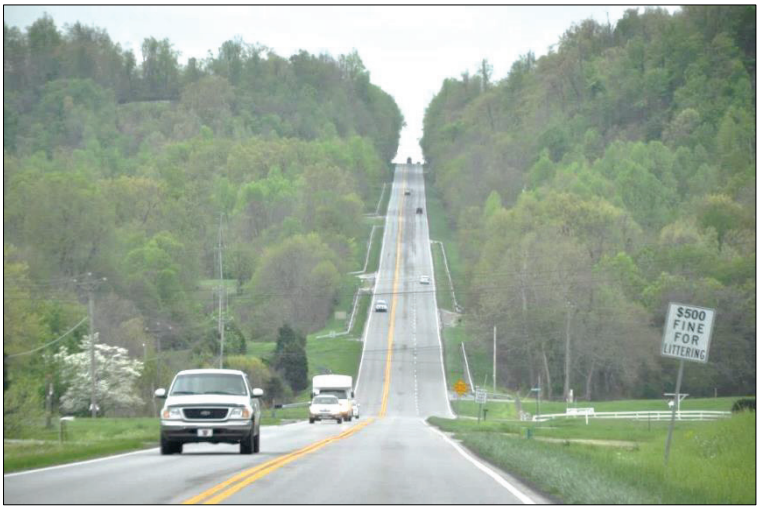


Figure 4: Halls Gap Hill Southbound

- Passing opportunities predominately favor southbound traffic, having 3.6 miles or 77 percent of the total available passing opportunities (shared and dedicated passing combined), and two miles or 43 percent dedicated passing.

[1] 2017 KYTC Highway Design Manual, Exhibit 700-03.

- Northbound travelers have approximately 1.5 miles or 32 percent of total passing opportunities, of which 0.4 mile or nine percent is dedicated passing for northbound drivers only.

Table 2 summarizes these geometric characteristics of US 27 including terrain, number of lanes, lane width, shoulder width, posted speed limit, horizontal and vertical alignments, and passing opportunities.

Table 2: Geometric Characteristics

Terrain	Rolling
Number of Lanes	2-Lanes (MP 11.169 – 11.840) 3-Lanes (MP 11.840 – 13.100) 2-Lanes (MP 13.100 – 14.710) 3-Lanes (MP 14.710 – 15.794) 4-Lanes (MP 15.794 – 15.881)
Lane Width	12 feet
Shoulder Width	4–10 feet
Posted Speed Limit	55 MPH
Horizontal Alignment	All meet/exceed current guidelines
Vertical Alignment Deficiencies	Halls Gap Hill (MP 11.840 – 13.100) 6.00 and 6.48% (exceeds 5% maximum grade) Sag Vertical Curve at MP 13.0
Passing Opportunities	
Southbound Total	3.6 miles (77%)
Southbound Dedicated	2.0 miles (43%)
Northbound Total	1.5 miles (32%)
Northbound Dedicated	0.4 mile (9%)

2.3 Bicycle and Pedestrian Review

Lincoln County and the City of Stanford do not currently have a bicycle or pedestrian master plan. No proposed plans for bicycle or pedestrian travel or improvements exist from the local government within the project area. Strava Heat Map[2] only shows pedestrian activity along KY 1247 east of US 27 and on Fairground Road. However, pedestrians have been observed walking the corridor **(Figure 5)**. Strava Bicycle use is shown along US 27 throughout the study area.

Figure 5: Pedestrian Walking Along US 27

[2] Strava is a data service locating where people ride and run. Strava users track rides and runs with a smartphone or with a GPS device. https://labs.strava.com/heatmap

2.4 Structures

Two 1958 three-span structures are located in the study area: the structure (069B00049N) at MP 14.140 spans Neals Creek, and the structure (069B00048N) at MP 15.720 spans Logan Creek.

In accordance with federal standards, bridges are inspected every two years to evaluate their conditions and other elements. A sufficiency rating—a numeric score from 0 to 100 describing the sufficiency of the bridge to remain in service—is calculated during each inspection. Higher sufficiency ratings generally correlate to better bridge conditions. A bridge considered functionally obsolete indicates the bridge has older features not meeting today's design standards. For example, a functionally obsolete bridge may not be wide enough to accommodate current vehicle sizes, weights, and traffic volumes.

Bridges are considered structurally deficient if significant load carrying elements are found to be in poor condition due to deterioration and/or damage, or the adequacy of the waterway opening provided by the bridge is determined to be extremely insufficient to the point of causing overtopping with intolerable traffic interruptions. Bridges considered structurally deficient or functionally obsolete with a sufficiency rating of less than 50.0 are considered for funding to replace or rehabilitate. Those with a sufficiency rating of 80.0 or less are regularly considered for funding to rehabilitate.

Neither structure in the project area is structurally deficient or functionally obsolete, nor has a sufficiency rating below 50.0. However, with a current sufficiency rating of 50.4, structure 069B00048N (MP 15.720) is nearing the KYTC's 50.0 threshold, and could therefore become eligible for the Federal Highway Administration's (FHWA) Highway Bridge Replacement and Rehabilitation Program (HBRRP) funding in upcoming years. **Table 3** shows structure details.

Table 3: Structures

Bridge No.	069B00049N	069B00048N
Route	US 27	US 27
MP	14.140	15.720
Features Intersected	Neals Creek	Logan Creek
Description	0.85 mile south of Junction of KY 698	0.20 mile north of Junction of KY 698
Year Built	1958	1958
Description	3-span Concrete Culvert	3-span Concrete Culvert
Length (feet)	41.01	41.01
Sufficiency Rating	65.4	50.4
Last Inspection Date	15-Apr-16	15-Apr-16
Approach Roadway (feet)	23.95	36.09
Skew (degrees)	15	0
Structurally Deficient	No	No
Functionally Obsolete	No	No
Inventory Rating	HS 24.4 44 tons	HS 11.1 20 tons
Operating Rating	HS 33.3-60 tons	HS 22.2-40 tons
Posting	No Restrictions	No Restrictions

2.5 Crash History

Kentucky State Police traffic collision data were collected and analyzed for the five-year period between July 1, 2011, and June 30, 2016 **(Appendix A)**. During the review period, 122 crashes were reported on US 27 between MP 11.169 and MP 15.881.

2.5.1 Crash History by Crash Type

Crashes by type—fatality, injury, and property damage only (PDO) are shown on **Figure 6. Figure 9** depicts crashes during the five-year period in which 32 injury and 88 PDO crashes were reported. Two fatal rear-end crashes occurred during this period: one at Shake Rag Road, US 27 MP 11.100; and one 0.2 mile north of Yates Road, US 27 MP 15.184. The following describes each fatal crash.

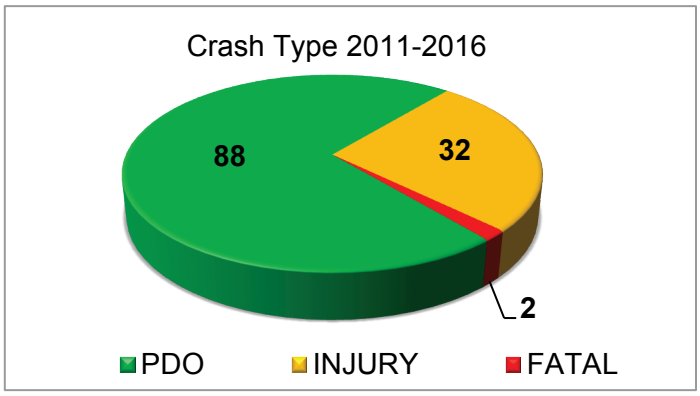


Figure 6: Crashes by Crash Type

1) **US 27, MP 11.100 at Shake Rag Road:** A southbound vehicle stopped to turn left onto Shake Rag Road was rear-ended under dry, clear daylight conditions. Driver inattention was cited as a contributing human factor.

2) **US 27, MP 15.184, 0.2 mile north of Yates Road:** A southbound vehicle stopped on US 27 was rear-ended under dark, dry conditions. Lack of working tail lights was cited as a contributing factor.

2.5.2 Crash History by Vehicle Type

Figure 7 shows the breakdown of crashes by vehicle type. Passenger vehicles accounted for eighty percent of crashes occurring in the study area. Passenger vehicles are defined as motor vehicles weighing less than 10,000 pounds and include passenger cars and light trucks (SUVs, pickup trucks, vans, and other light trucks). Four percent involved semi-trucks and two

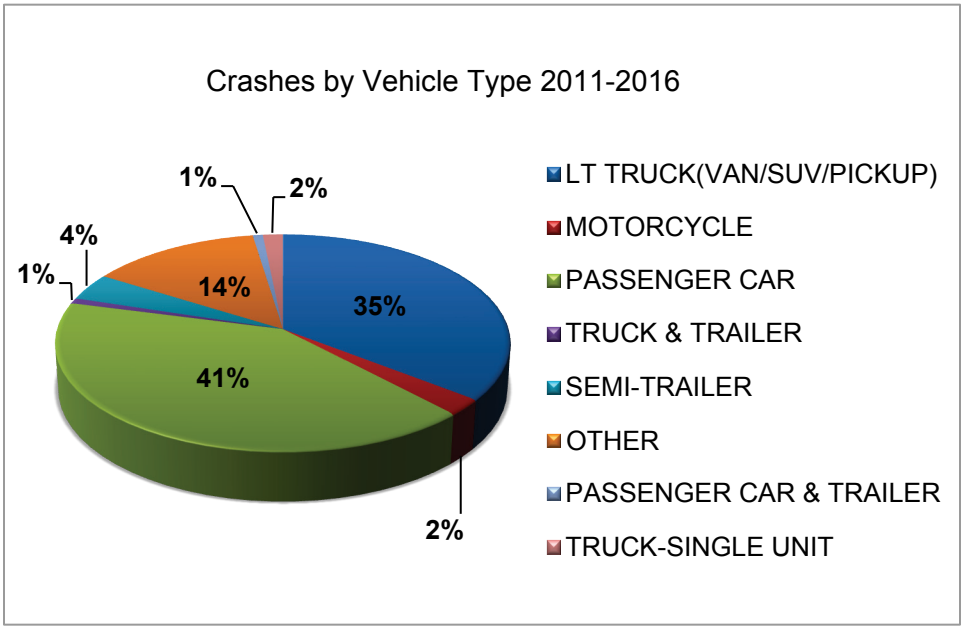


Figure 7: Crashes by Vehicle Type

percent, single-unit trucks.

2.5.3 Crash History by Manner of Collision

A breakdown of crashes by the manner of collision is shown on **Figure 8.** Of 122 total crashes, the predominant manners of collision reported were rear-end (35 percent) and single-vehicle crashes (34 percent). Crash locations by manner of collision are on **Figure 10**.

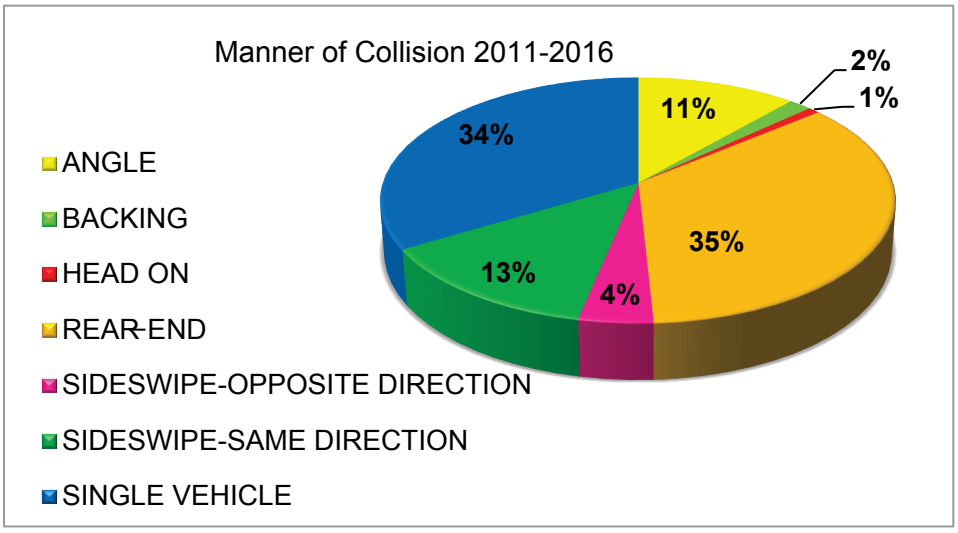


Figure 8: Manner of Collision

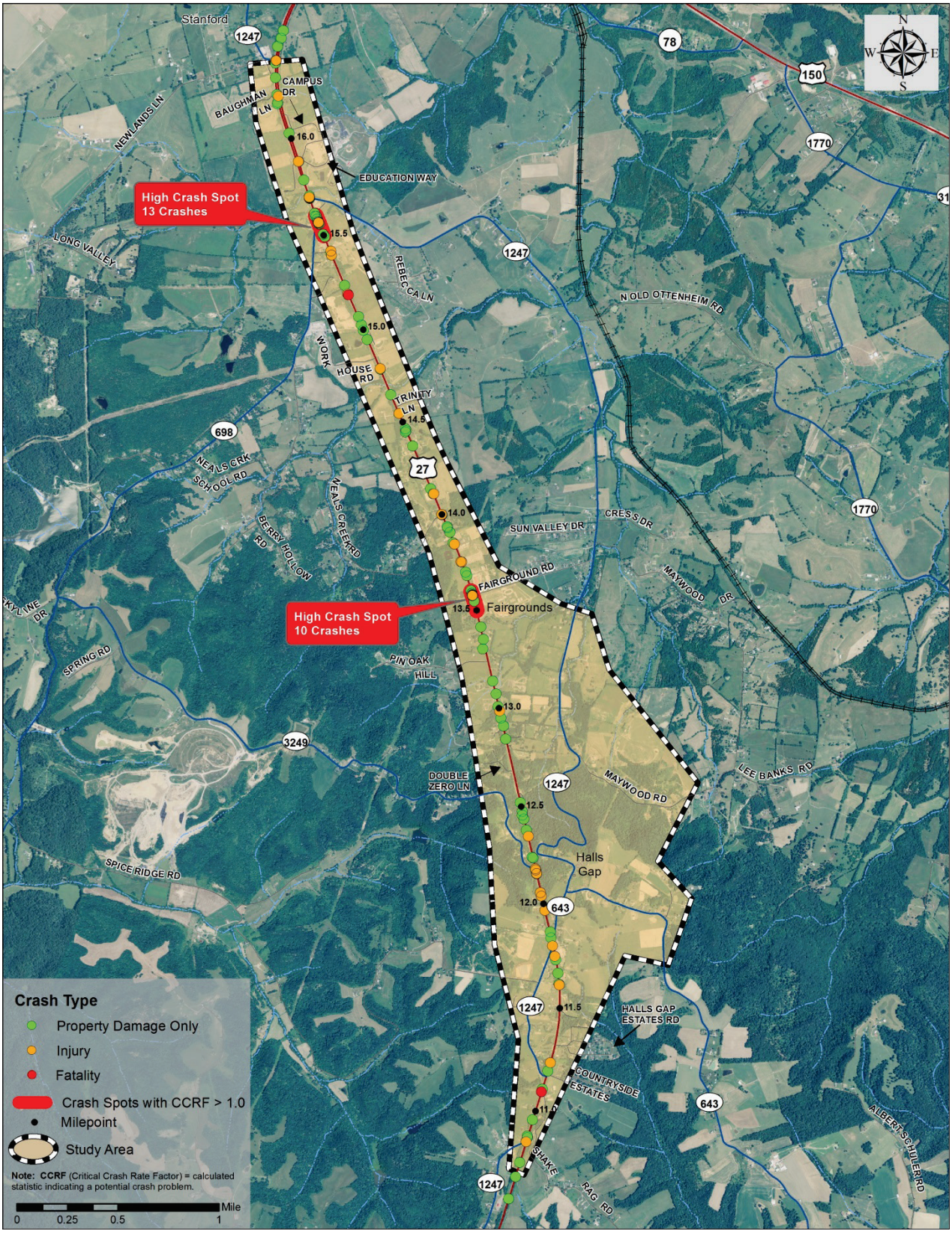


Figure 9: Crash History by Type

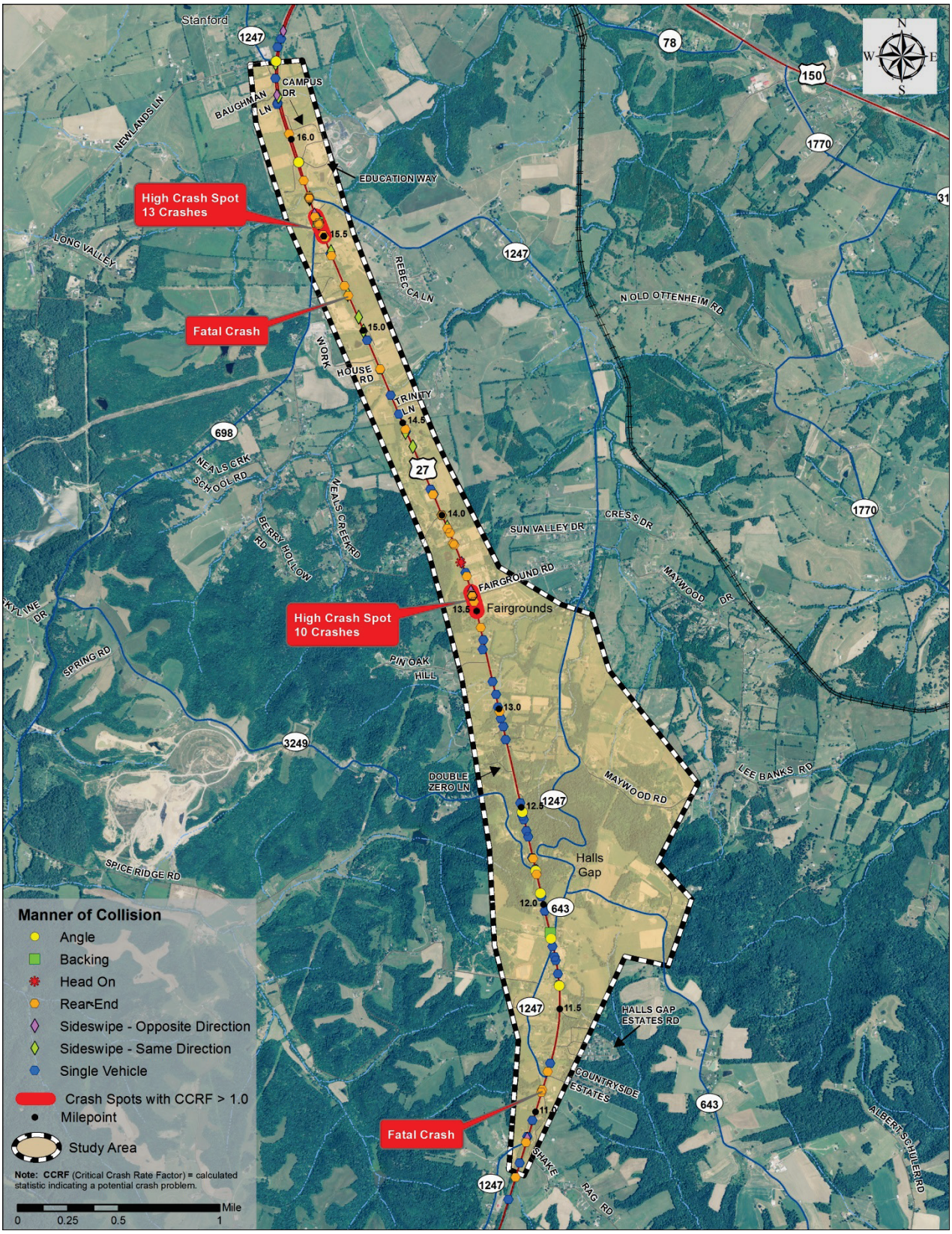


Figure 10: Manner of Collision with Critical Crash Rates (CCRF) and High Crash Spots

2.5.4 0.1-Mile High Crash Spots

Using the Kentucky Transportation Center's methodology[3], two high crash 0.1-mile spots **(Figure 10)** were identified with critical crash rate factors (CCRF) greater than 1.0 during the five-year study period, as listed in **Table 4**. The CCRF is one measure of the safety of a road, expressed as a ratio of the crash rate at the location compared to the average crash rate for roadways of the same functional classification throughout the state. A CCRF of 1.00 or greater indicates crashes may be occurring due to circumstances that cannot be attributed to random occurrence.

Table 4: High Crash Spots

High Crash Spot		US 27 Milepoint		Crashes				
		Begin	End	Fatal	Injury	PDO	Total	CCRF
1	Fairground Road	13.5	13.6	0	3	7	10	**1.23**
2	KY 698	15.5	15.6	0	2	11	13	**1.57**

1. Ten crashes (three injury, seven PDOs) occurred. The CCRF is 1.23. Ninety percent were rear-end collisions. Three of the 10 crashes occurred when roads were wet or icy.

2. Thirteen crashes (two injury, 11 PDO) occurred. Five of the 13 collisions were rear-end, four were angle crashes.

Table 5 compares the two 0.1-mile high crash spots with statewide averages[4]. Where comparisons could be made, the percent of crashes reported on US 27 was higher in wet road conditions, angle, rear-end, backing up, injury, and property damage only (gray shading). Most significant were rear-end crashes on US 27 at Fairground Road and KY 698, with 90.0 and 38.5 percent, respectively, compared with 23.7 percent statewide.

Table 5: Crash Comparison to 2016 Statewide Averages

Percent of Crashes	US 27 MP 13.5 – 13.6 Fairground Road	US 27 MP 15.5 – 15.6 KY 698	2016 Statewide Average*
Occurring In Darkness	10.0%	0.0%	27.9%
Occurring On Wet Roads	30.0%	15.4%	20.2%
Single Vehicle	0.0%	15.4%	38.0%
Angle	0.0%	30.8%	17.6%
Sideswipe	10.0%	7.7%	11.8%
Rear-End	90.0%	38.5%	23.7%
Backing Up	0.0%	7.7%	2.4%
Fatality	0.0%	0.0%	0.5%
Injury, Not Including Fatalities	30.0%	15.4%	17.8%
Property Damage Only	70.0%	84.6%	81.6%

*Updated following all study meetings.

[3] *Analysis of Traffic Crash Data in Kentucky (2011-2015)*
[4] *Kentucky Traffic Collision Facts 2016*

3.0 TRAFFIC ANALYSIS – EXISTING (2016/2017) AND FUTURE (2040)

The KYTC Division of Planning prepared the *Traffic Forecast Report and Bike/Ped Recommendations* November 2016. A *Traffic Forecast Report Addendum #1* issued in March 2017 used a new traffic count mid-corridor. Both reports are in **Appendix B.**

3.1 2016/2017 Traffic Counts

The KYTC provided historical traffic volume counts for three stations, two with classification counts. The 2016 average daily traffic (ADT) volume was based on the 2014 volume count at count station 069022. The 2017 ADT volume is based on the 2017 vehicle classification count at count station 069306 **(Figure 11).** Peak hour turning movements did not change with the updated count.

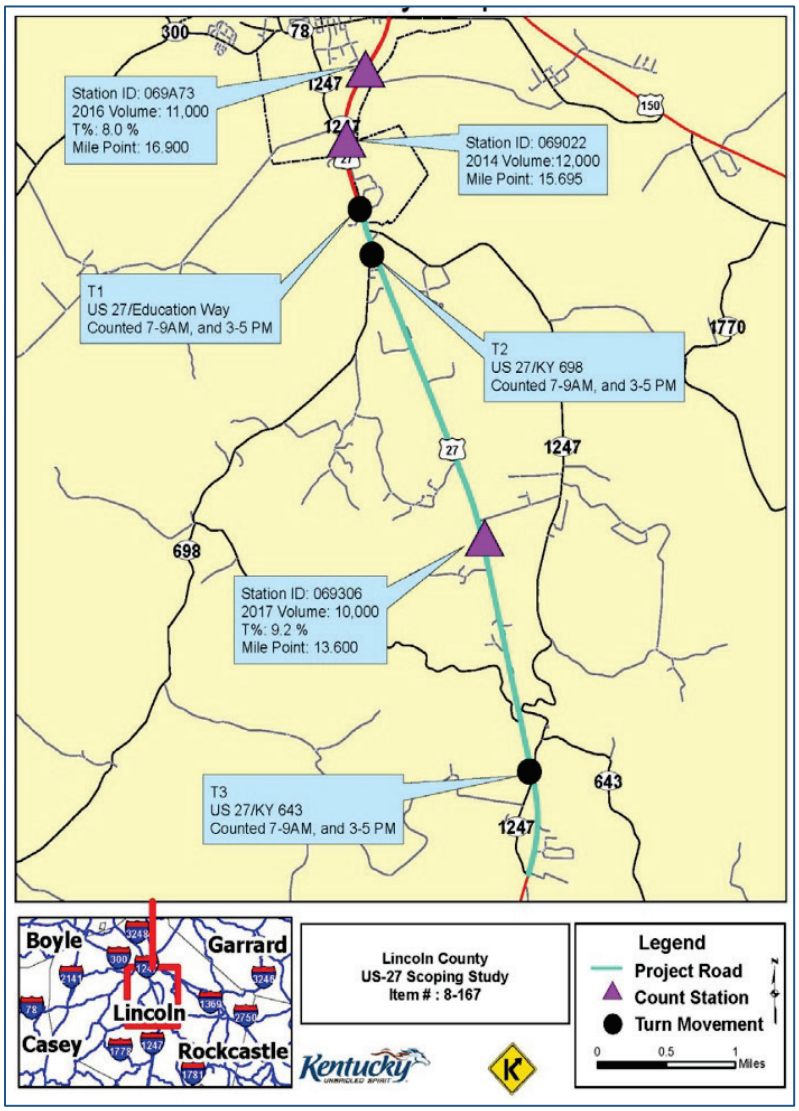


Figure 11: 2016/2017 Traffic Count Locations

Based on the 2017 traffic count, ADT volumes along US 27 are 10,000 vehicles per day (vpd) mid-corridor and 12,000 vpd closer to Stanford, with truck percentages ("T%" on **Figure 12**) between 8.0 and 9.2 percent, or 800 to 1,100 trucks.

3.2 2040 Design Year Growth Factors

The KYTC performed a growth analysis using historical data at traffic stations 069022 and 069306 and estimated a 1.0 percent growth rate compounded annually; however, a 0.25 percent growth rate was used at the Lincoln County High School entrance in accordance with the annual county growth rate over the next 20 years.

Truck percentage calculations were based on classification counts taken at traffic stations 069A73 and 069306. Truck volumes were obtained using the 1.0 percent growth rate calculated from the aforementioned historical data.

3.3 Turn Movements

The KYTC conducted three peak hour turn movement counts. Peak hour counts were obtained during 7 – 9 AM and 3 – 6 PM for three US 27 intersections: Education Way, KY 698 and KY 643.A summary of current and design year 2040 traffic data and road segment limits are shown in **Figure 12**.

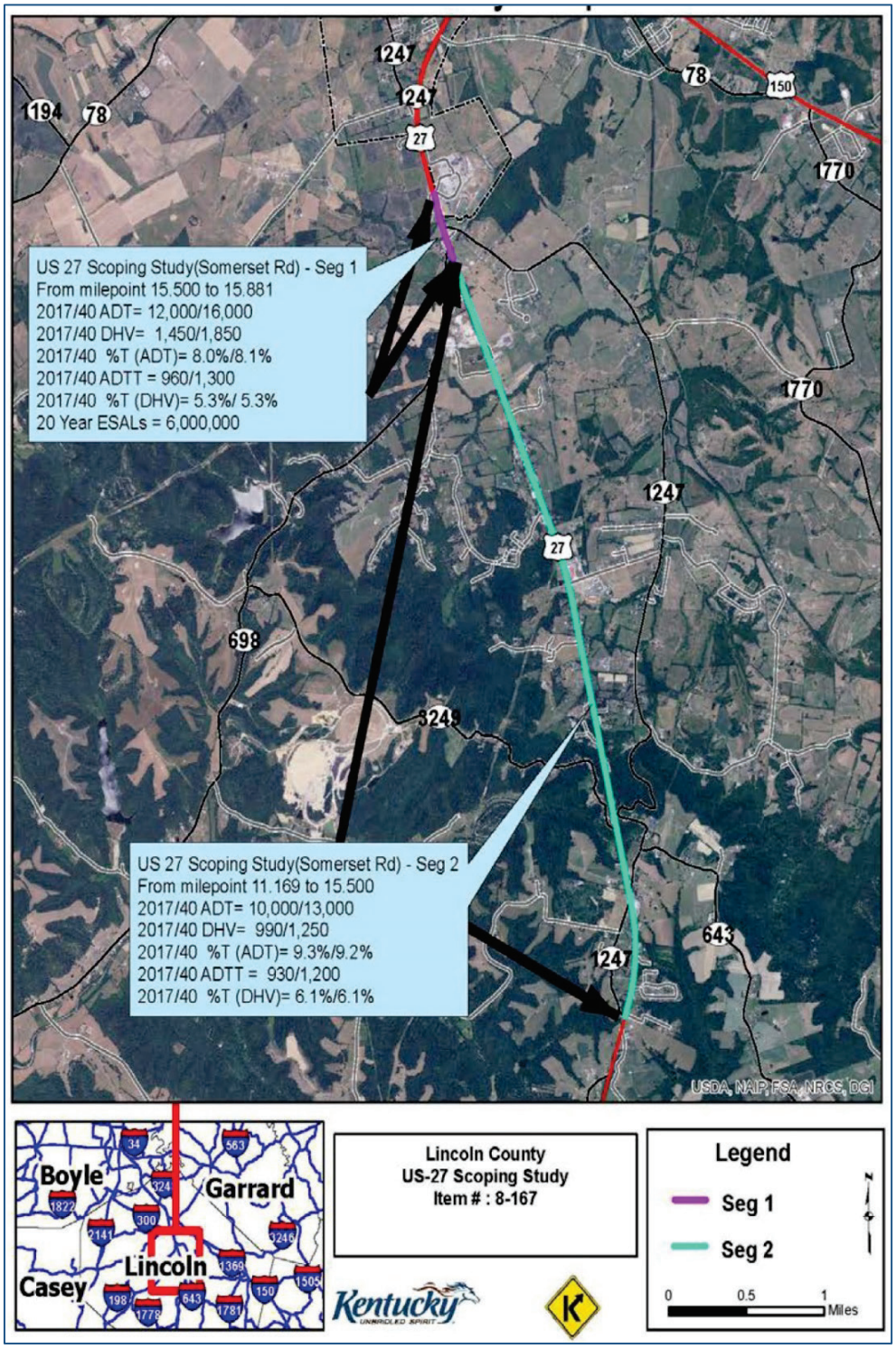


Figure 12: Traffic Segments 1 and 2

ADT = Average Daily Traffic **DHV** = Design Hour Volume **%T** = Truck Percentage
ADTT = Average Daily Truck Traffic **ESAL** = Equivalent Single Axle Load

3.4 2017 Existing Traffic Operations

To evaluate congestion, 2017 traffic volumes ("v") were compared to area roadways' theoretical capacity ("c"). A v/c ratio greater than 0.9 in rural areas indicates congestion in the design year. The 2017 v/c ratios developed for US 27 show no segments with a v/c ratio greater than 0.75.

Level of service (LOS) is a qualitative performance measure used to evaluate a roadway or intersection congestion **(Figure 13)**. Levels of service are described according to a letter rating system ranging from LOS "A" (free flow, minimal or no delays—best conditions) to LOS "F" (severe congestion, long delays—worst conditions). LOS C or better is desirable in rural areas.

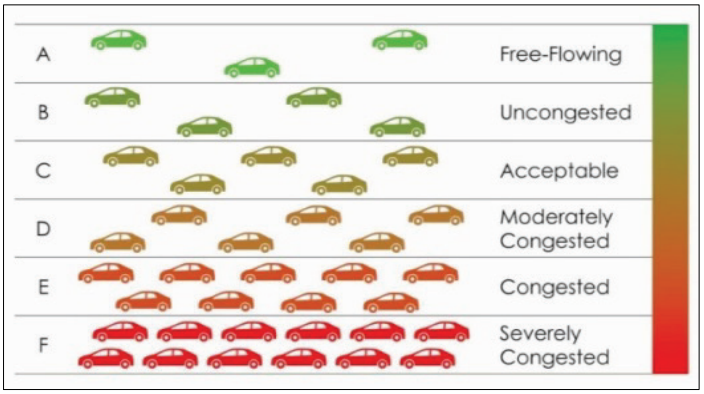


Figure 13: LOS Definition

Using 2010 Highway Capacity Manual (HCM) classifications and methodology, US 27 rural two-lane, 55 MPH sections were analyzed as Class I highways.

Class I highways function as primary connectors of major traffic generators where motorists expect to travel at high speeds and serve as daily commuter routes. LOS criteria for Class I two-lane highways are measured by Average Travel Speed (ATS) and Percent Time Spent Following (PTSF).

3.4.1 2017 US 27 Segment Analysis

The 2017 segment traffic analysis **(Table 6)** indicates US 27 averages LOS D or is moderately congested in the AM and PM peak hours. Average travel speeds in all two-lane segments range from 42 to 43 MPH, below the posted 55 MPH speed limit. Drivers spend nearly 80 percent of travel time following other vehicles. AM and PM traffic in the four-lane section of US 27 operates freely (LOS A or B), average speeds meet or exceed the posted speed limit, and motorists spend only four to 11 percent of the time following others.

Table 6: 2017 Segment Traffic Analysis

SECTION	US 27 SEGMENT				ADT	% Trucks	No. Lanes	2017 EXISTING							
								LOS		Average Speed (mph)		% Time Following		v/c Ratio	
	FROM	MP	TO	MP	2017 2040			AM	PM	AM	PM	AM	PM	AM	PM
1	KY 1247	11.169	KY 643	11.820	10,000 13,000	9.3 9.2	2	D	D	43	42	80	77	0.50	0.75
	KY 643	11.820	BEGIN SB TL	13.107											
	END SB TL	13.107	TRINITY LN	14.583										0.51	0.48
	TRINITY LN	14.583	END NB TL	15.133											
2	END NB TL	15.133	KY 698	15.568	12,000 16,000	8.0 8.1									
	KY 698	15.568	4-LANE	15.794			3							0.60	0.54
	4-LANE	15.794	ED. WAY	15.881			4	B	A	60	60	11	4	0.21	0.20

SB=southbound NB=northbound TL=turn lane

3.4.2 2017 US 27 Intersection Analysis

2017 traffic analysis at three intersections **(Table 7)** along US 27 shows acceptable traffic flow in AM and PM hours at Education Way (LOS C or B), and severe congestion at KY 698 (LOS F or E) and KY 643 (LOS F or C).

Table 7: 2017 Intersection Traffic Analysis

US 27 Intersections	2017 EXISTING LOS		Worst Movement
	AM	PM	
KY 643	F	C	WB-LR
KY 698	F	E	EB-LR
Education Way	C	B	WB-LR

WB=westbound EB=eastbound L=left lane R=right lane

2017 Traffic operations are shown in **Figures 14 and 15**.

3.5 No Build Year 2040 ADT and LOS

The projected 2040 No Build traffic volumes and operations analysis compared to existing traffic operations are summarized in **Tables 8 and 9** and **Figures 14 and 15**.

3.5.1 No Build Year 2040 US 27 Segment Analysis

Using a 1.0 percent growth rate, 2040 design year ADT on US 27 is expected to reach 13,000 vpd on Segment 1, the southernmost, two-lane section. Design year ADT on Segment 2, the northern, multi-lane section near Lincoln County High School, is projected to reach 16,000 vpd. Truck percentages for roadway segments are anticipated to remain nearly the same as traffic grows.

In 2040, unimproved US 27 is anticipated to decline from LOS D to E. Average travel speeds slow to 40 MPH and the time drivers spend following other vehicles increases as high as 88 percent in design year 2040. The existing four-lane section will remain uncongested, operating at LOS A and B.

Two segments in Section 1 (MP 11.169 – MP 13.107) show 2040 v/c ratios of 0.91. A v/c ratio greater than 0.9 in rural areas indicates congestion in the design year.

Table 8: Averaged 2017/2040 Existing and No Build Segment Analysis

SECTION	US 27 SEGMENT				ADT	% Trucks	No. Lanes	2017 EXISTING								2040 NO BUILD							
								LOS		Speed		% Time Following		v/c Ratio		LOS		Speed		% Time Following		v/c Ratio	
	FROM	MP	TO	MP	2017 2040			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	KY 1247	11.169	KY 643	11.820	10,000 13,000	9.3 9.2	2	D	D	43	42	80	77	0.50	0.75	E	E	40	40	88	83	0.61	0.91
	KY 643	11.820	BEGIN SB TL	13.107																			
	END SB TL	13.107	TRINITY LN	14.583										0.51	0.48							0.63	0.58
	TRINITY LN	14.583	END NB TL	15.133																			
2	END NB TL	15.133	KY 698	15.568	12,000 16,000	8.0 8.1																	
	KY 698	15.568	4-LANE	15.794			3							0.60	0.54							0.74	0.70
	4-LANE	15.794	ED. WAY	15.881			4	B	A	60	60	11	4	0.21	0.20	B	A	60	60	11	6	0.27	0.25

3.5.2 No Build Year 2040 US 27 Intersection Analysis

Left unimproved, all intersections will have approaches projected to operate at LOS D or F in the 2040 AM peak hour.

Table 9: 2017/2040 Existing and No Build Intersection Traffic Analysis

US 27 Intersections	2017 EXISTING		2040 NO BUILD		Worst Movement
	LOS		LOS		
	AM	PM	AM	PM	
KY 643	F	C	F	C	WB-LR
KY 698	F	E	F	F	EB-LR
Education Way	C	B	D	C	WB-LR

WB=westbound EB=eastbound L=left lane R=right lane

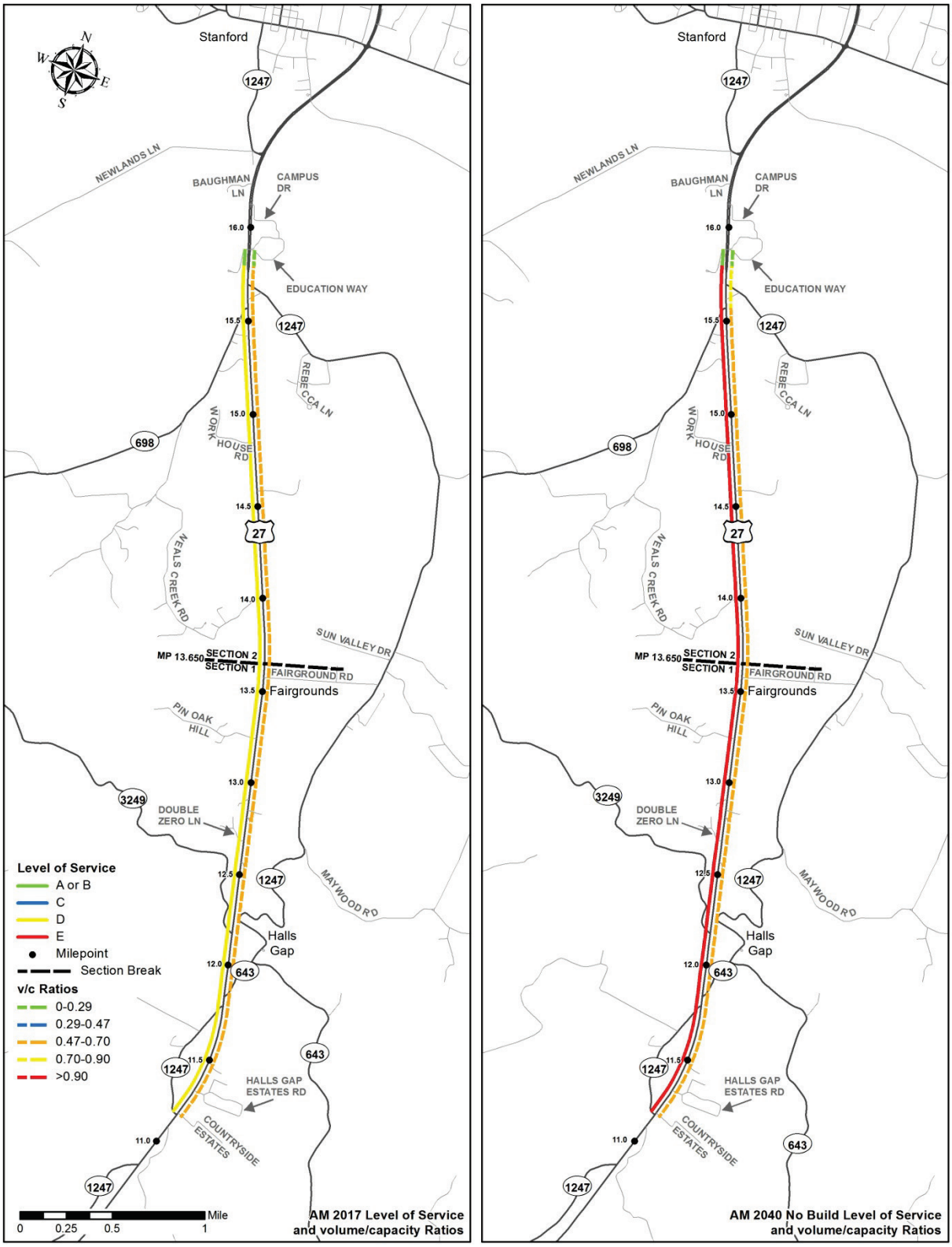


Figure 14: AM Peak Hour 2017/2040 No Build LOS

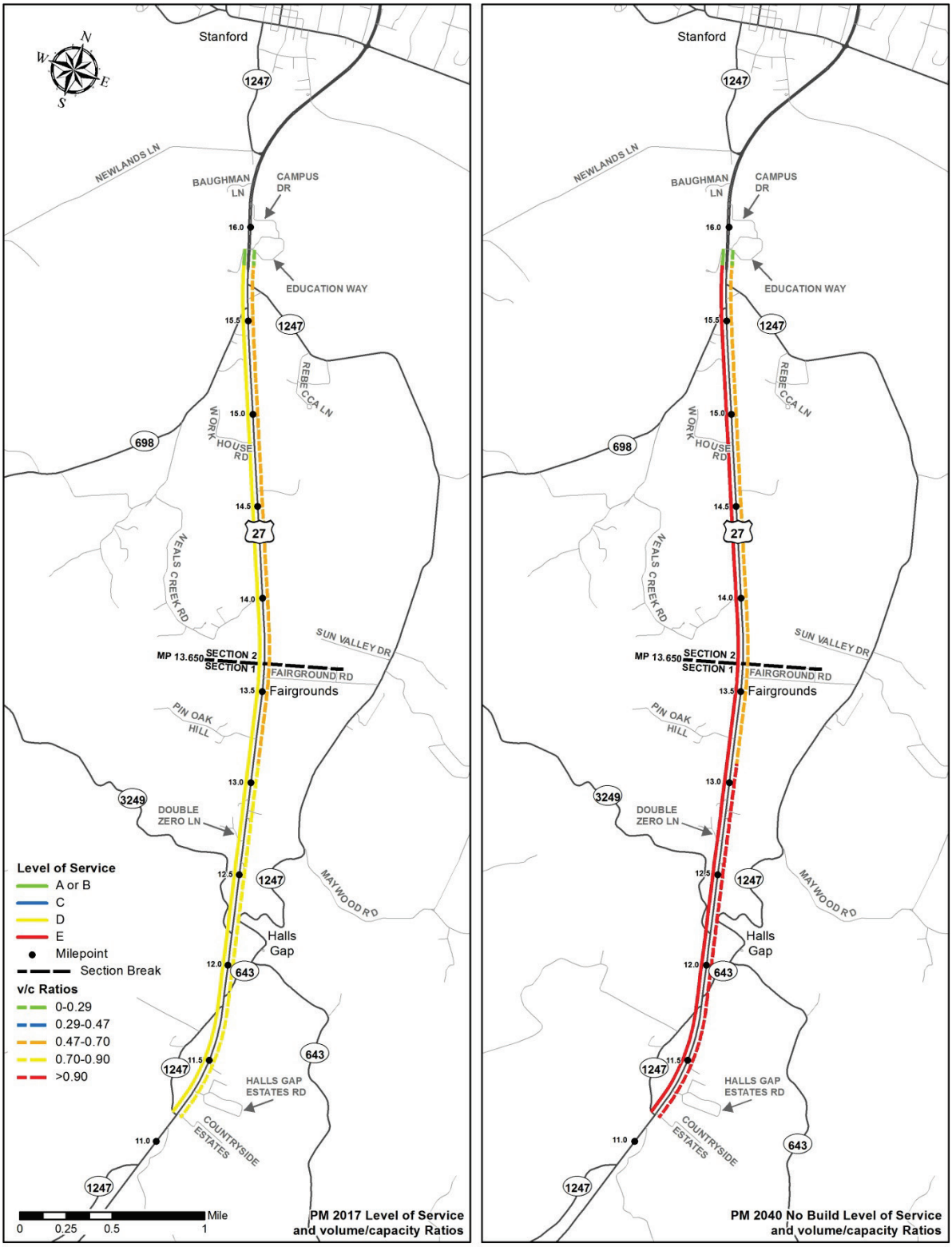


Figure 15: PM Peak Hour 2017/2040 No Build LOS

4.0 ENVIRONMENTAL OVERVIEW

An abbreviated environmental overview was conducted to identify human and natural environmental resources in the study area. These resources were identified through literature searches, readily available GIS information, and windshield surveys. If projects advanced from this study receive federal funds, National Environmental Policy Act (NEPA) documentation will be required to address resources, impacts, and commitments to minimize and mitigate impacts, as described in Section 7.4

4.1 Natural Environment

The overview study area encompasses an approximately 1,740-acre study area. Streams, wetlands, ponds, floodplains, geological features, and ecological resources, including habitat for threatened and endangered species, comprise the natural resources summarized in the following sections.

4.1.1 Water Resources

A review of available mapping identified water resources potentially in the study area. Those resources are illustrated on **Figure 16** and listed in **Table 10**. According to the Kentucky Division of Water (KDOW) online Kentucky Watershed Viewer none of the following exist in the study area: public water supply sources, wellhead protection areas (WHPA), source water assessment and protection programs (SWAPP), or KDOW priority watersheds. The northern portion of the study area is within the Neals Creek drainage basin, and the southern portion is generally along the divide between the Upper Cumberland basin to the east and the Green River basin to the west.

Table 10: Water Resources

Resource	Quantity	Unit	Designation
Potential wetlands[5]	13	acres	
Potential streams – Intermittent[6]	23,977	linear feet	
Potential streams – Perennial[6]	3,530	linear feet	
100-Year Floodplain	20	acres	Logan's Creek, Neals Creek and Neals Creek tributary

No Wild and Scenic Rivers, Outstanding National Resource Waters, or Exceptional and Reference Reach Waters of Kentucky are in the study area.

Watersheds include Logan and Cedar Creeks and the headwaters to Buck Creek and Green River. Buck Creek south of the study area is a designated Outstanding State Resource Waters.

Best Management Practices are recommended during construction to prevent nonpoint source water pollution.

[5] KYGIS
[6] https://nhd.usgs.gov/

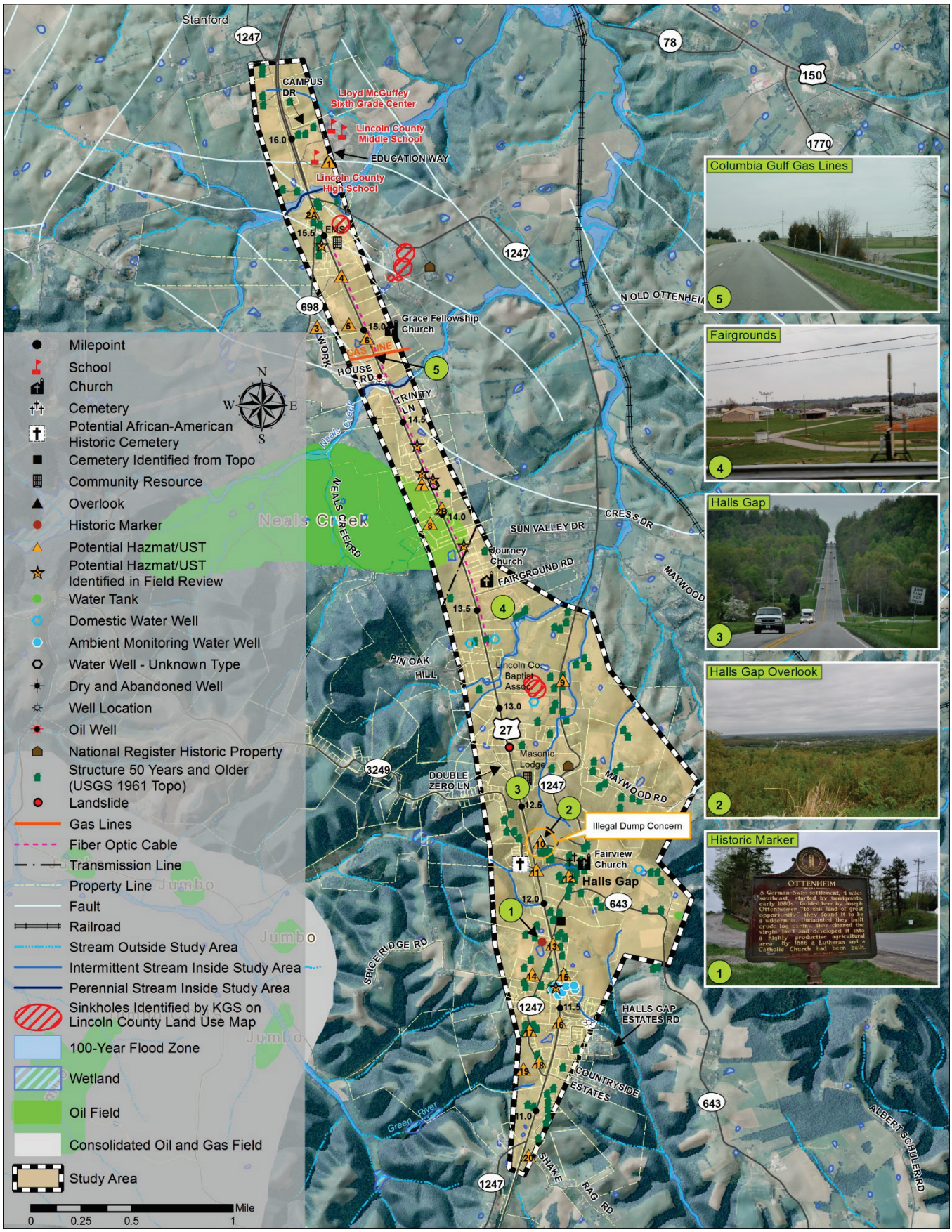


Figure 16: Environmental Overview

4.1.2 Threatened and Endangered Species

Databases of state and federally listed species from the U.S. Fish and Wildlife Service (USFWS), Kentucky Department of Fish and Wildlife Resources (KDFWR) and Kentucky State Nature Preserves Commission (KSNPC) in Lincoln County are listed in **Table 11 and Appendix C**. Regarding habitat for the listed species, the National Hydrography Dataset was accessed to identify the presence of wooded, intermittent and perennial streams, the preferred foraging habitat of gray bats. Indiana and northern long-eared bats hibernate during winter in caves, mines, rock shelters, and sinkholes, which also provide year-long roost habitat for gray bats. Mapping from the U.S. Geological Survey (USGS), the Kentucky Department for Natural Resources (KDNR), and the KGS, helped identify the presence of caves or karst features, i.e., winter habitat, in the vicinity of the study corridor. Summer habitat for these three bat species is located throughout the study area. The USFWS IPaC[7] listed no federally designated "critical habitats" for federally listed species.

No suitable habitat is present in the study area for the five mussel species. No information is available regarding habitat for the listed birds.

Table 11: Threatened and Endangered Species

	Scientific Name	Common Name	US Status	KY Status	Listing Agency
Birds	*Accipiter striatus*	sharp-shinned hawk	N	S	KDFWR
	Ammodramus henslowii	Henslow's sparrow	N	S	KDFWR
	Anas clypeata	northern shoveler	N	E	KDFWR
	Anas discors	blue-winged teal	N	T	KDFWR
	Circus cyaneus	northern harrier	N	T	KDFWR
	Fulica americana	American coot	N	E	KDFWR
	Haliaeetus leucocephalus	American bald eagle	N	T	KDFWR
	Tyto alba	barn owl	N	S	KDFWR
	Junco hyemalis	dark-eyed junco	N	S	KDFWR
	Pandion haliaetus	osprey	N	S	KDFWR
	Passerculus sandwichensis	Savannah sparrow	N	S	KDFWR
	Phalacrocorax auritus	double-crested	N	T	KDFWR
Mussels	*Lampsilis ovata*	pocketbook	N	E	KDFWR
	Simpsonaias ambigua	salamander mussel	N	T	KDFWR
	Toxolasma lividum	purple lilliput	N	E	KDFWR
	Villosa lienosa	little spectaclecase	N	S	KDFWR
	Villosa trabalis	Cumberland bean	E	E	KDFWR
Mammals	*Myotis sodalis*	Indiana bat	E	N	USFWS
	Myotis grisescens	gray bat	E	N	USFWS
	Myotis septentrionalis	northern long-eared bat	T*	N	USFWS

S – Special Concern T – Threatened E – Endangered N – Not Listed

* Threatened, with 4(d) rule, which allows USFWS to focus on protections necessary/advisable to conserve species listed as "threatened."

[7] IPaC: Project planning tool which streamlines the USFWS environmental review process located here: https://ecos.fws.gov/ipac/

4.1.3 Preliminary Geotechnical Assessment

The *Preliminary Geotechnical Assessment* conducted by the KYTC is found in **Appendix D**. The study area is in Outer Bluegrass and Knob physiographic region. Topographic mapping shows relief ranging from 915 to 1,420 feet above mean sea level. Limestone, dolomite, and shale are dominant rock types. Fault lines exist, but none are known to be active.

Geotechnical issues related to roadway construction include the following:

- Soils in this area are generally clay materials. Fill has been used throughout the corridor in roadway fill areas. Soils are generally suitable for embankment construction. Recommended cut slopes are found in the full assessment.
- New Albany Shale is located between Halls Gap and KY 698. This shale is acidic, and the required mitigation method of encapsulating this material in clay adds to project cost. In addition, New Albany and New Providence shales require flatter slopes, additional right-of-way, and slope treatment. This has caused increased construction costs on previous projects throughout Kentucky. Special consideration should be given where structure foundations encounter acid-producing shales.
- Limestone and dolomite are suitable for embankment foundation construction and rock roadbed; however, based on field reconnaissance, minimal amounts of durable rock may be available for construction use.
- Halls Gap cut area has been scavenged by rock collectors seeking millerite (geodes). Prospectors have opened up dangerous, hand-dug works into the hillside. These have been sealed, but measures may need to be considered to deter this activity for new cuts.
- Halls Gap (MPs 11.840 to 13.100) is characterized by steep vertical grades and a history of embankment failures. To address these embankment failures, in 2002 the KYTC authorized $560,000 to utilize state force and price contracts to drive an estimated 16,000 linear feet (LF) of railroad steel between MP 12.000 and MP 12.300 **(Figure 17)**. In addition, a $561,080 supplemental construction contract was let in 2003 to install approximately 8,000 LF of 12 x 84 H-piles. These efforts have helped stabilize the area, but are not intended to be a permanent solution, as noted by the Preliminary Geotechnical Assessment.

Figure 17: Railroad Steel

Signs of stability issues are still present as evidenced by eroding fill slopes and concrete cross drains with visibly separated joints and dropped headwalls. Further investigation is needed to determine if damage to these structures extends under existing embankments

- Future consideration should be given to excavating current embankment on Halls Gap and replacing it with new material. This issue will also need to be addressed during the project's design phase.
- During design, proper drainage should be proposed to keep water away from, and out of, Halls Gap embankments. Existing pipes located in roadway fill are broken and allow water to saturate embankment, causing instability.
- Ponds were noted in multiple areas and, if encountered, may require remediation. Springs will likely be present in the corridor, and will need to be addressed in design and construction pending an investigation. Numerous water wells, monitoring wells, and oil wells are in the vicinity of the project.

Existing geotechnical conditions are illustrated in **Figure 18**. Potential design recommendations are found in Alternatives Development, **Section 7.0**.

4.1.4 Prime Farmland

According to the U.S. Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) web soil survey[8], much of the study area **(Figure 19 and Appendix E)** is considered prime farmland. Approximately 48 percent of the study corridor is prime farmland and 32 percent is of statewide importance.

4.1.5 Agricultural Districts

The Kentucky Division of Conservation administers the Agricultural District Program, the goals of which are to protect Kentucky's best agricultural land for food and fiber production, and to prevent its conversion to nonagricultural usage. Land enrolled in the program cannot be annexed or condemned without mitigation, is taxed at the agricultural rate, and is eligible for deferred assessment costs when water lines are extended. No established agricultural districts are within or near the study area.

4.1.6 Karst Potential

Kentucky Geologic Survey (KGS) uses five classes to show tendency for sinkholes, springs, caves, or other solution features[9]—very high, high, medium, low, and non-karst. The study area has low[10] and medium potential for karst **(Figure 20)**.

4.1.7 Landslides

Landslide inventory from the KGS shows one previously reported landslide in the study area. It is located along the east side of US 27 at MP 12.8.

[8] https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm
[9] http://kgs.uky.edu
[10] Petroleum fields are named and identified by predominate fuel type by KGS geologists from oil and gas mapping in Kentucky (see footnote 9).

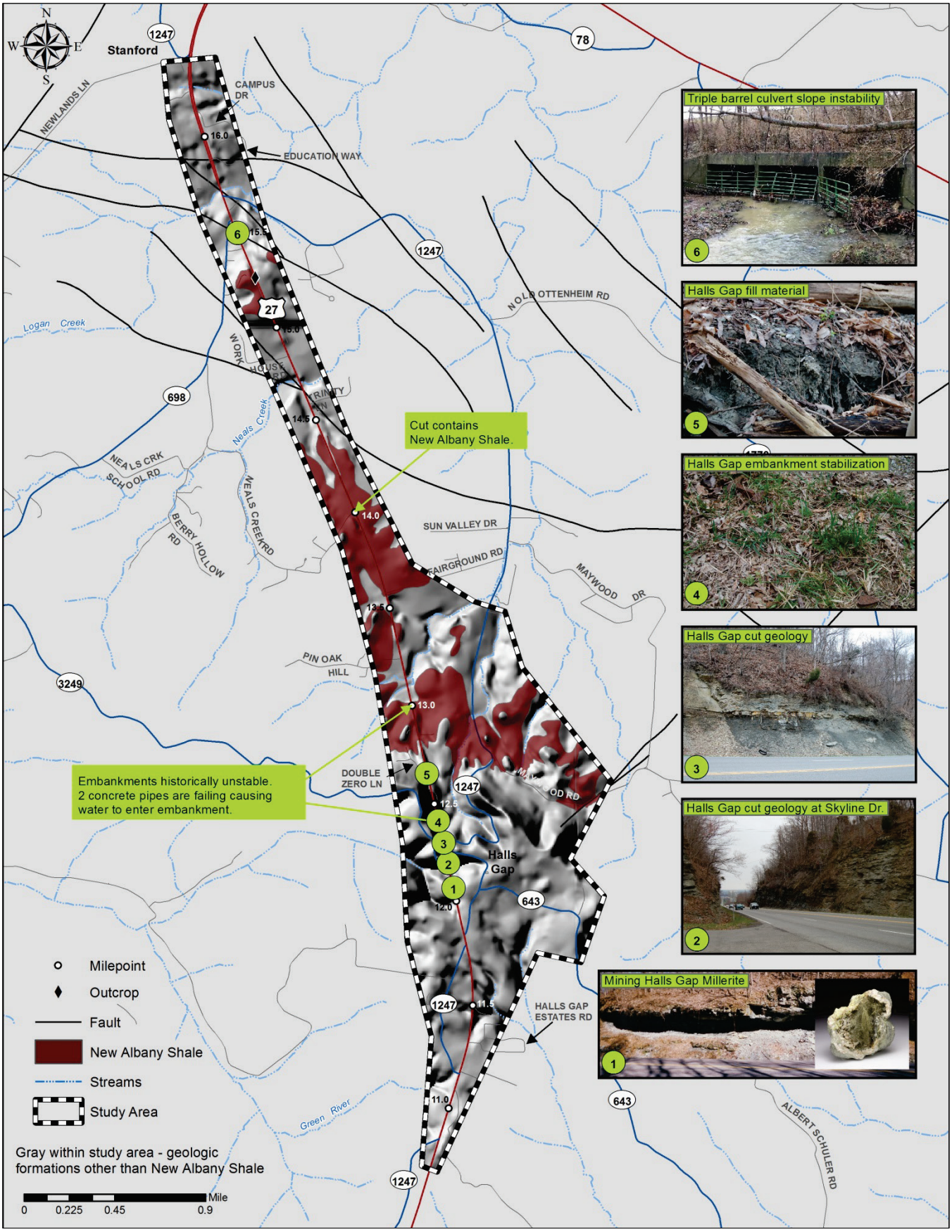


Figure 18: Geotechnical Issues

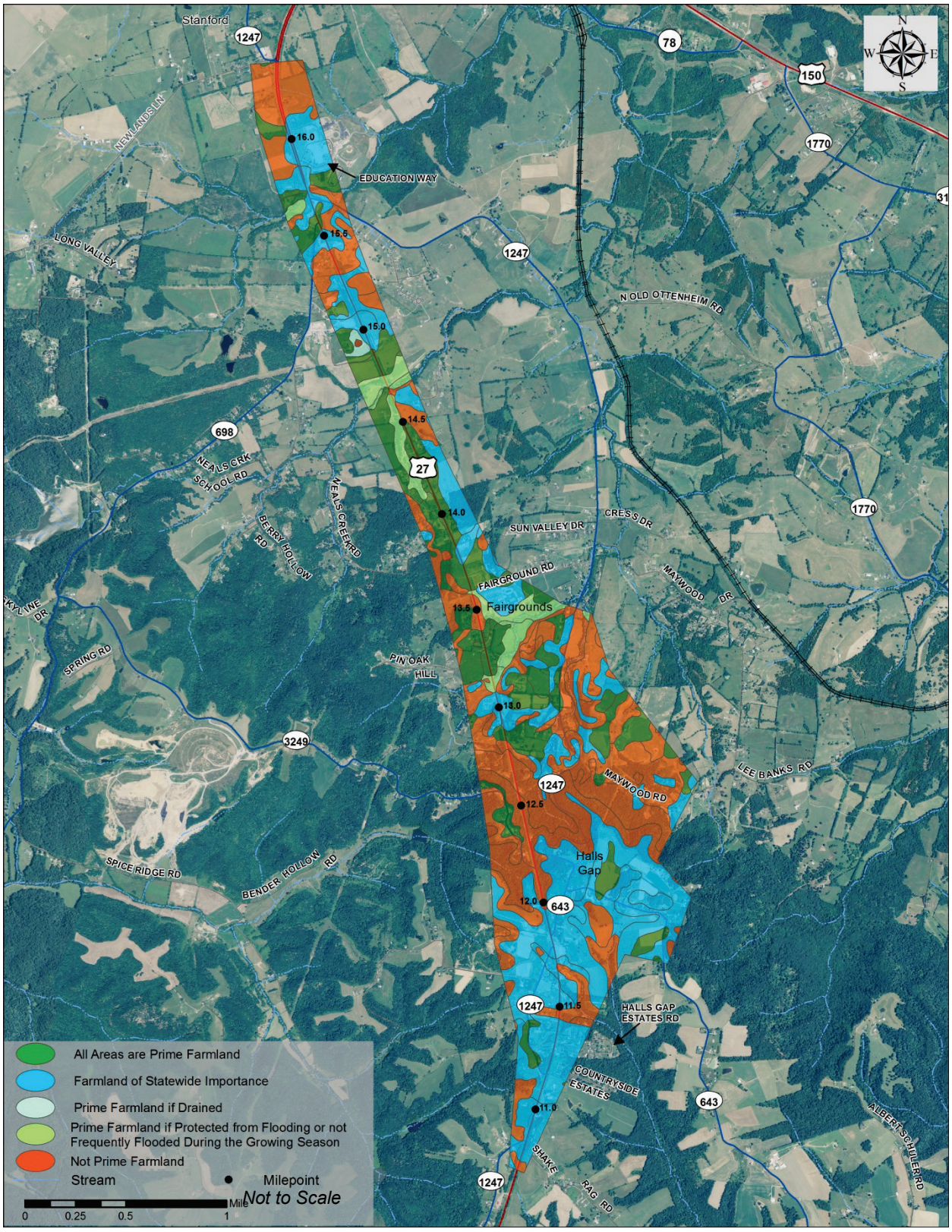


Figure 19: Farmland Classification

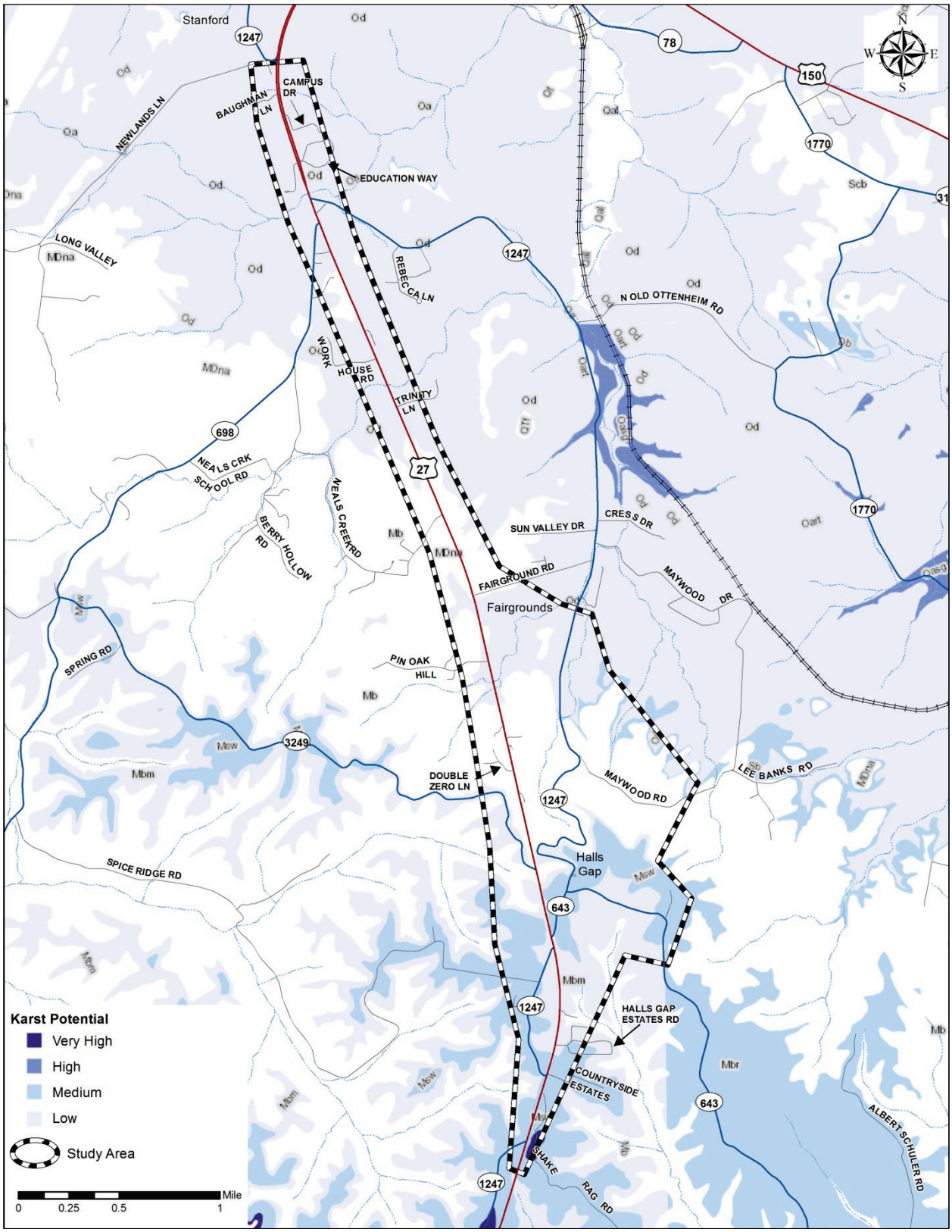


Figure 20: Karst Potential

4.2 Human Environment

The human environment is often defined as the "built" environment or can be described as what we live in and around and what we have built. Built-environment resources that may affect or be affected by improvements recommended in this corridor study are discussed in the following sections.

4.2.1 Land Use

As mentioned previously, the study area surrounding US 27 is predominantly rural and agricultural, with an abundance of farmland. Land uses include small businesses and rural residential properties. Several churches, a large recycling center, an EMS station, and three Lincoln County schools are also located along US 27 in the study area.

4.2.1.1 Community Resources

Churches

Four churches are in the study area: Journey Community, Grace Fellowship, Lincoln County Baptist, and Fairview Baptist. In addition, LO/S identified property obtained for a future church adjacent to US 27 and Pin Oak Lane. The Lincoln County Baptist Association is located north of Neals Creek Road at MP 14.200.

Schools

Three schools—Lincoln County High School, Lloyd McGuffey Sixth Grade Center, and Lincoln County Middle School—are located on Education Way in a complex adjacent to US 27 near the project's northern terminus.

Other

- Lincoln County Fairgrounds (275 Fairground Road) hosts a county fair annually in July and other events throughout the year. Attendance for fair week is 25,000[11].
- Lincoln County Masonic Lodge #60 is located at 4680 US 27S. Relocating this facility, if necessary, may require more time than a typical relocation.

4.2.1.2 Cemeteries

Four known cemeteries are in the study area. Topographic mapping shows one cemetery on KY 643 approximately 0.1 mile from US 27/KY 643 intersection. A field-located cemetery is adjacent to Fairview Baptist Church at 6246 KY 1247. Two cemeteries, thought to be African-American Civil War burials, were identified by local officials: (1) Mount Zion Baptist Church Cemetery on KY 3249 (Skyline Drive) 0.1 mile from US 27, and (2) a cemetery near the Dollar General Store (3137 US 27S).

[11] http://www.lincolnfair.net/page2.html

4.2.1.3 Landfill

Tri-K Landfill is located on KY 3249 (Skyline Drive) near MP 1.0, but is primarily accessible via KY 698. Although outside the study area, the landfill is responsible for truck traffic through the project area.

4.2.1.4 Oil and Gas Wells/Fields

According to the KGS[12], four known wells are present within the study area **(Table 12)**. A gas field, "Neals Creek," is located near Neals Creek between Fairground Road and Trinity Lane.

Table 12: Oil and Gas Wells

MP	API Number	Notes	US 27 Description	Type	Latitude*	Longitude*
14.7	16137000440000	Completion Date 6/15/1981	Just west of US 27	Oil	37.496509	-84.650115
14.7	2044928**		Just west of US 27	Unknown	37.496303	-84.650100
14.5	16137000110000	Completion Date 9/27/1983	0.1 mile west of US 27	Dry and Abandoned	37.493433	-84.650632
11.5	2044978**		0.2 mile east of US 27	Unknown	37.449873	-84.631900

* NAD83

**KGS Record Number

4.2.1.5 Mines

According to the Kentucky Department of Natural Resources' Kentucky Coal Mine Maps[13], no mines exist in Lincoln County.

4.2.1.6 Water Resources

Three water companies (Eubank Water System, McKinney Water District, and Stanford Water Commission) provide service. Lines parallel and traverse US 27. The KGS also provided a database for known water wells and water tanks. The following points of interest are described south to north.

- A cluster of 11 ambient monitoring wells on both sides of US 27 near MP 11.5.
- One 100,000 gallon (maximum) water tank on Stillhouse Road near KY 643.
- One domestic well near MP 13.0 east of US 27.
- Two domestic wells near MP 13.3 on each side of US 27.

[12] kgs.uky.edu
[13] https://eppcgis.ky.gov/minemapping/

4.2.1.7 Major Utilities

Columbia Gulf has three major gas transmission pipelines (two-30" and one-36") that cross US 27 near Lincoln County Ready Mix at approximately MP 14.4 **(Figure 21)**. Impacting these facilities would result in a multimillion dollar expense, roughly approximated to be $3,000,000.

Figure 21: Gas Line Corridor East Side of US 27

ATT has a fiber optic telephone line along the east side of US 27, beginning at the north side of Halls Gap. ATT indicated impacts to this line would require replacement of two sections—approximately 18,000 LF. ATT's estimated relocation costs for this line is over $1.1 million, with potential to be "substantially more" if rock is encountered.

4.2.2 Socioeconomic Review

The *US 27 Alternatives Socioeconomic Study* (**Appendix F**) was prepared by the Bluegrass Area Development District (BGADD). This report relies on the U.S. Census Bureau's 2010–2014 American Community Survey (ACS) for demographic data about the study area's Census Tract (CT) 920101 [Block Groups (BG) 1 and 2] and 920300 (BG 1). It includes documentation of potential environmental justice populations, i.e., racial minorities and persons below poverty level.

Statistics are provided for minority, elderly (65 and over), below poverty level, disabled, and limited English proficiency (LEP) populations. Data is intended to identify populations that may have specific concerns/needs that may require additional analysis if projects are advanced to future phases from this study.

Table 13 highlights where Lincoln County exceeds Kentucky category percentages and where BGs surpasses Lincoln County percentages.

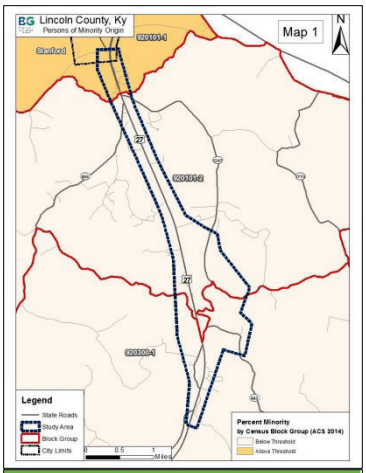
Table 13: Affected Populations in Study Area Census Tracts and Block Groups

		Total Population	Minority	Poverty	65 and Over	Disabled	Limited LEP*
United States		314,107,084	36.7%	15.5%	13.7%	10.1%	8.6%
Kentucky		4,383,272	13.9%	18.9%	14%	15.4%	2.1%
Lincoln County		24,546	5.5%	**25%**	**16%**	**19.3%**	0.4%
Census Tract	**Block Group**						
920101	1	460	**16.5%**	**34.3%**	11.7%	**19.8%**	0%
920101	2	1,526	3.2%	19%	**23.9%**	**25.4%**	0%
920300	1	1,439	2.9%	14.6%	7.7%	14.8%	0%

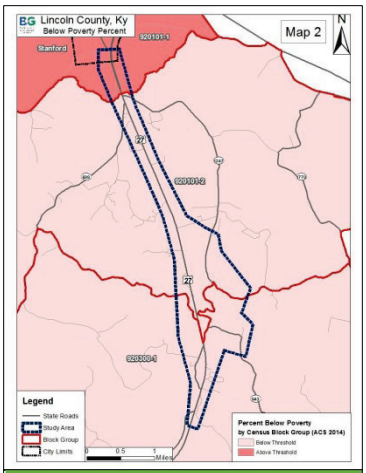
*Limited English Proficiency

The northernmost portion of the study area has a concentration of minorities and persons below poverty level. Disabled and persons over age 65 are in the middle and northern portions of the corridor. Limited English speaking proficiency is not a concern within study area census tracts or block groups. **Figure 22** illustrates each affected CT and BG percentage that exceeds Lincoln County statistics (darker colors). Larger maps are located in **Appendix F.**

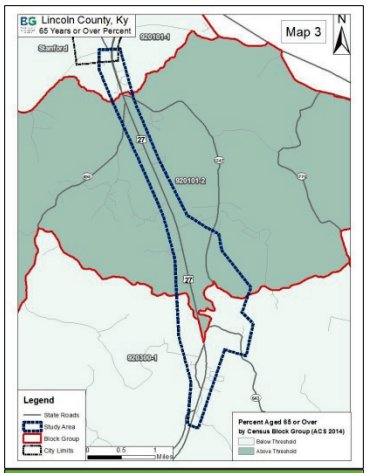
During future phases of project development, a more detailed analysis may be required for NEPA documentation, per Environmental Justice Executive Order 12898, to assess potential for adverse and disproportionate impacts to low-income and minority populations.



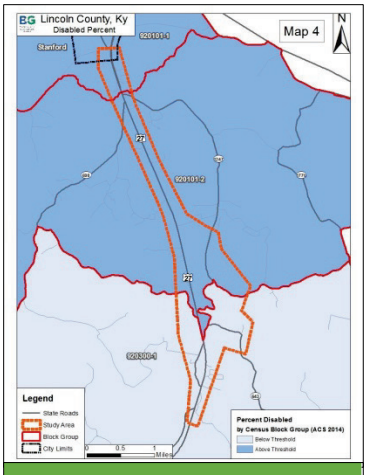
Area	Minorities
Kentucky	13.9 %
Lincoln	5.5 %
Study Area CT 920101, BG1	**16.5 %**



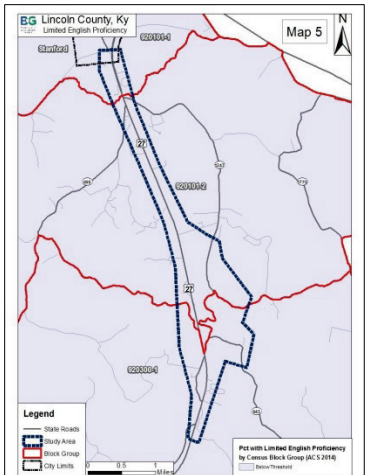
Area	< Poverty
Kentucky	18.9 %
Lincoln	25 %
Study Area CT 920101, BG1	**34.3 %**



Area	Age 65+
Kentucky	14 %
Lincoln	16 %
Study Area CT 920101, BG1	**23.9 %**



Area	Disabled
Kentucky	15.4 %
Lincoln	19.3 %
Study Area CT 920101 BG1, BG2	**19.8, 25.4 %**



Area	LEP
Kentucky	13.9 %
Lincoln	5.5 %
Study Area CT 920101, BG1	**16.5 %**

Figure 22: Thumbnail View of Affected Populations

4.2.3 Noise

The US 27 study corridor is located in a predominantly rural area **(Figure 15)**. A noise sensitive area (NSA) is generally defined as a geographical area covering multiple properties with similar land uses and noise environments that may benefit from a single noise abatement measure, such as a noise barrier wall. Noise sensitive sites typically represent property (owner occupied, rented, or leased) where frequent human outdoor activity would benefit from a lowered noise level. An NSA can represent a single isolated property or an entire neighborhood.

Several NSAs located adjacent to the corridor include clusters of single-family residences, approximately five churches/places of worship, and the Lincoln County Middle and High schools and athletic fields. If a project is advanced from this study and receives federal funds, additional noise impact analysis may be required. However, given existing and projected future traffic volumes, anticipated noise levels are not expected to approach or exceed FHWA Noise Abatement Criteria (NAC), and noise abatement measures are unlikely to be warranted.

4.2.4 Air Quality

Lincoln County is in attainment for all National Ambient Air Quality Standards (NAAQS) for six major air quality pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), lead (Pb), and particulate matter ($PM_{2.5}$) and (PM_{10}). Based on Kentucky CO screening criteria, projects resulting from this study will not require a CO project-level analysis and will not produce a projected violation of the CO standard.

Regarding mobile source air toxics (MSATs), the scenarios presented in this study are considered as a project with “Low Potential MSAT Effects”; therefore, only a qualitative (as opposed to a quantitative) assessment of emissions projections will be required.

4.2.5 Potential Hazardous Materials

Review of potential hazardous materials sites is based on Environmental Data Resources, Inc. (EDR) DataMap Area Overview and a limited field reconnaissance to identify additional potential sites of concern. An electronic review of applicable environmental database searches of 57 federal records, nine state and local records, and one EDR proprietary record was conducted. A database search reported by EDR identified 20 potential hazardous sites in the study area. **Table 14** lists these sites. Six additional potential sites were identified in the field. The EDR map and report are in **Appendix G.**

Table 14: Potential UST/Hazmat Sites

Report Map ID	Site Name	Date or Note	Database(s)	Address(es)	Occurrence
1	Lincoln Co. High School	6/13/1995[1] 12/8/1995	FINDS UST	60 Education Way	Tank Removal
2	Stanford Somerset Oil Cook's Mart, Inc. Everett's Grocery	(2002,2003,2004,2005) 1/19/2007[1] 5/28/2014[2] 11/6/2014[3] 11/18/1997[1]	EDR Hist Auto UST SPILLS UST SB193, UST	1589 US 27N 1589 US 27N 1509 US 27S+ 1560 US 27S 1580 Somerset Rd.	Tank removed + Benzene found above allowable limit from removed tank
3	Lincoln Co. HHP Fur goods		NPDES	698 Mason Gap Rd.	
4	Dixie Paving Inc.		FINDS	US 52W Lancaster	
5	Lincoln Co. Ready Mix	3/28/1995[3] 5/15/1995[2]	UST, NPDES, AIRS, ECHO, FINDS	2225 US 27S	
6	Tommy Owens	State Master	FINDS	Not Available	
7	Martins Ashland Service Station		EDR Hist Auto	3005 US 27S	
8	Stanford drinking water impacted McKinney Water District	6/28/2010[2] 7/1/2010 End Date	SPILLS	Stanford	Drinking Water tastes bad
9	Stanford spills 2/22/2006	11/2/2006[2]	SPILLS SPILLS	4000 Block of KY 1247 in Stanford KY 1247 Box 4900	Wastewater: Non-Permitted Discharge; Odor Stream Degradation
10	Halls Gap Overlook Dump Halls Gap Road Dump		FINDS FINDS	KY 1247	Dump Dump
11	Rural Kentucky truck incident	8/13/2014[2]	SPILLS FINDS	US 27 at Halls Gap Hill	Truck accident spilled diesel. Issue Notice of Violation. Impacted solid waste
12	Halls Gap	8/12/2009[2]	SPILLS	Waynesburg, KY Next door to 6401 KY 1247	Bulldozer clearing land near headwaters of Green River. Concern: Water Quality
13	Skytower Automotive	(1999, 2000, 2001, 2002, 2003)	EDR Hist Auto	5460 US 27S	
14	Fairview Baptist Church	Multiple dates	NPDES, FINDS, ECHO	Spice Ridge Rd.	Permit issued

Table 14: Potential UST/Hazmat Sites (continued)

Report Number	Site Name	Date	Database(s)	Address(es)	Occurrence
15	Shirley's Grocery	 3/12/1998 (possibly) 11/19/2007[2] 11/19/2007[2]	RCRA NonGen, NLR, FINDS, SB193, ECHO, UST SPILLS SPILLS	5675 US 27S, Stanford 5620 US 27S Halls Gap Hotel 5460 US 27S	Handler: Non-Generators do not presently generate hazardous waste Tank removed Straight Pipe Illegal Disposal-Sewage and Tires behind Sky Tower Automotive and Machine
16	Pepsi truck spill	11/26/2013	SPILLS	US 27S near Edgewood Ave. 300 yards from KY 1247	100 gallon diesel spill
17	Water bad taste, smell	11/3/2008	SPILLS	7290 KY 1247	Drinking Water: Water bad taste/ odor
18	Stanford open burning	1/24/2012[2]	SPILLS	KY 1247 Loop at top of hill	Air: Open Burning with garbage
19	Water quality inquiries	9/30/2004[2]	SPILLS	7255 KY 1247 Waynesburg	Drinking Water: Water Quality
20	Non-notifier Drinking Water Pressure	7/31/2006[2]	SPILLS	Shake Rag Road Area	Drinking Water Pressure
*	Priddys Car Sales	Note 4	*	3058 US 27	
*	Mickeys Automotive	Note 4	*	3005 US 27	
*	Hensleys Ag Center	Note 4	*	3418 US 27S	
*	Auto Sales	Note 4	*	5675 US 27S	
*	Sarabeths Signature Salon	Note 4	*	2867 US 27S	Appears possible former repair shop/garage (or car repair)
*	Service repair shop	Note 4	*	Just South of KY 698	

[1]Removed [2]Received Date [3]Closed in place [4]Identified in field review February 2017

4.2.6 Historic Architectural Resources (Section 106)

A review of National Park Services' online database[14] identified one architectural resource listed in the National Register of Historic Places (NRHP)— Adam Pence House, located just outside the northeast corner of the study area.

Neither an archival research at the Kentucky Heritage Council (KHC) to identify previously documented historic sites, nor a windshield reconnaissance to identify other architectural resources, was completed for this corridor study. Using data provided by Lincoln Property Valuation Administrator (PVA) and a 1961 USGS topographic map, 142 structures were found to be at least 50 years of age **(Figure 16)**. The majority of these structures are south of Fairground Road. If projects are advanced from this planning study and federal funds are used, a formal, more intensive survey under Section 106 of the National Historic Preservation Act will be necessary to assess these structures' eligibility for listing in the NRHP.

A historical marker along US 27 due west of KY 643 pays tribute to a Ottenheim German-Swiss early progressive farming settlement started by immigrants in the early 1880s four miles southeast of the marker location.

4.2.6.1 Halls Gap

Halls Gap Overlook, elevation 1,200 feet, is five miles south of Stanford and east of US 27 on KY 3249 (Skyline Drive). According to Lincoln County Chamber of Commerce, it is the highest point overlooking the Bluegrass Region, and was once a thriving tourist attraction, with a view that attracted the motoring public **(Figure 23)**. The most well-known businesses in the Halls Gap community were: Skytower Auto Station, Skytower Restaurant, and Halls Gap Motel.

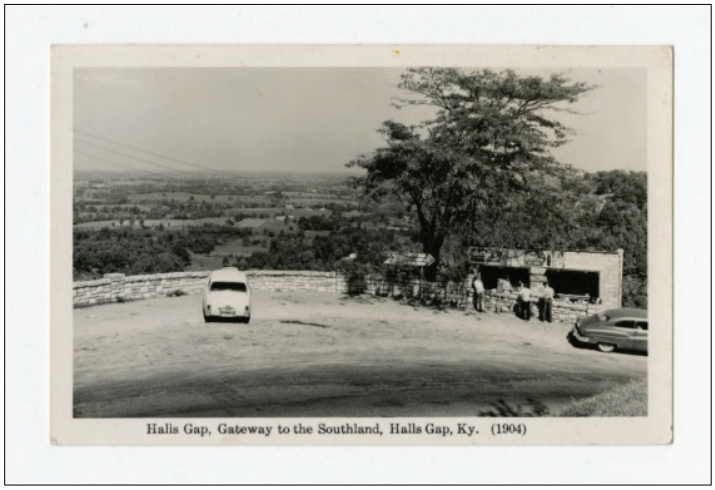


Figure 23: Halls Gap Overlook
Picture Source: Kentucky Historical Society, Ronald Morgan Kentucky Postcard Collection, Graphic 5.

According to a local newspaper, *Interior Journal,*[15] in 1995, 13 dump-truck loads of trash were hauled from the hillside below scenic Halls Gap Overlook. At the time, there was a joint effort to clean the hillside of trash, cut or trim trees, sandblast the rock wall, and recreate the popular overlook site that had fallen into a "disgraceful state over two decades." Illegal dumping remains a problem today, as evidenced by hazardous materials research noted herein.

[14] https://www.nps.gov/nr/research/index.htm
[15] https://www.newspapers.com/newspage/224104630/

4.2.7 Archaeological Resources

Neither an archival research nor field reconnaissance was conducted to identify prior archaeological surveys completed in the study area, or areas likely to contain archaeology sites. If projects are advanced from this planning study and federal funds are used, a Phase 1 archaeology study will be required prior to land disturbances.

4.2.8 Land and Water Conservation Fund (LWCF) Act—Section 6(f)

Parks using LWCF grants are afforded certain protections. If proposed roadway projects affect recreational land/facilities benefitted by LWCF grants, Section 6(f) issues may arise. Six grants were identified in Lincoln County (**Appendix H**). This list was researched by the Lincoln Judge Executive. From court meeting minutes, it was discovered grant ID 709 ($90,501.97) was spent during the 1981-1985 timeframe on tennis courts, a softball field, outdoor basketball courts, and a playground on Lincoln County High School property adjacent to US 27. Research at the Kentucky Department of Local Government, indicates grants were tied to a lease. Future research is required to determine exact Section 6(f) involvement. If eligible for protection, avoidance of this site by highway construction must be explored. If avoidance is not prudent or feasible, then mitigation would be required through coordination with the Kentucky Department for Local Government and the school district.

4.2.9 Conservation Easements

Kentucky's Farmland Preservation Program authorizes purchase of agricultural conservation easements through the Purchase of Agricultural Conservation Easements (PACE) program to ensure lands currently in agricultural use will remain available for agriculture and not be converted to other uses. The Kentucky Department of Agriculture data shows no PACE program properties are in or near the study area.

5.0 INITIAL PROJECT TEAM AND PUBLIC INVOLVEMENT

The project team held three project team meetings and two Local Officials/Stakeholders (LO/S) meetings to coordinate key issues, gather input and present alternatives. This section describes project team and public involvement that occurred as a result of these efforts. Project team members include the KYTC Central Office Division of Planning, KYTC Central Office Division of Highway Design, District 8 Planning and Design staffs, BGADD, and the consultant. All project team and LO/S meeting minutes are presented in **Appendices I and J**, respectively.

5.1 First Project Team Meeting

The first project team meeting was held the morning of March 1, 2017, at Lincoln County Public Library in Stanford. The meeting objective was to discuss existing roadway, traffic, and environmental conditions; present and revise the draft purpose and need statement; and discuss potential improvement alternatives, which included the following:

- Four-lane roadway with depressed median variations (including one “off alignment” alternative bypassing Halls Gap).
- Four-lane roadway with barrier median through Halls Gap (to narrow project’s footprint through this critical area).
- Three-lane roadway (2+1 design concept) with alternating passing lanes.

Partial access control (1200 foot spacing) was included in each improvement alternative, as was the case with US 27 projects either currently in various stages of design or previously constructed in Pulaski, Lincoln, Garrard, and Jessamine counties. The Lincoln County Planning and Zoning Board approved the access control method.

5.2 First Local Officials/Stakeholders Meeting

The first LO/S meeting was held the afternoon of March 1, 2017, at the Lincoln County Public Library. The project team met with public and county officials, including the Mayor of Stanford and the Lincoln County Judge-Executive; representatives from police, fire and emergency management; school officials; BGADD; and key stakeholders along the corridor. The meeting objective was to review existing roadway, traffic, and environmental conditions; and discuss potential improvement alternatives, as listed above.

The project team provided large maps showing sensitive resources. Meeting participants were asked to identify and locate future development, and existing conditions and environmental resources not designated. Overviews of potential improvement alternatives were discussed.

A group exercise encouraged participants to communicate issues, ideas, and comments related to the project area. Input was organized into similar categories and summarized for follow-up by the project team as follows:

- Additional Lanes/Shoulders
- Spot Problems
- EMS Concerns
- School Issues

- Landfill Road Issues
- Fairground Road Issues
- Halls Gap Issues
- Specific Issues

Further discussion revealed a consensus regarding the need to improve US 27 for better access to Somerset and for benefit of motorists traveling through the corridor to work and school. Meeting participants noted existence of three cemeteries, one of which may be an African-American Civil War burial ground.

6.0 PURPOSE AND NEED STATEMENT

As a result of the existing conditions analysis, traffic analysis, project team and local official/stakeholder input, and resource agency coordination, a draft purpose and need statement was crafted for future project development efforts, including design and environmental activities. The draft purpose and need statement establishes why the KYTC proposes to advance a transportation improvement and drives the decision-making process for alternative consideration, analysis, and selection.

Purpose: The purpose of the project is to improve safety and mobility, reduce congestion, and provide a consistent and more efficient roadway from Somerset to Lexington.

The **need** for an improvement project is based on the following:

Safety: A five-year crash history between 2011 and 2016 identified 122 crashes on US 27, including two fatal, 32 injury, and 88 property damage only. Seven crashes involved single unit trucks (one) and semi-trucks (six). Two 0.1-mile high- crash spots, at Fairground Road and KY 698, were identified along the study corridor, with critical crash rate factors (CCRF) of 1.23 and 1.57, respectively. CCRFs over 1.0 indicate crashes are occurring more frequently within these two spot locations than on similar facilities in Kentucky. Most intersections along US 27 do not have left-turn lanes that allow vehicles to exit the through driving lane when preparing to make a turning movement, creating potentially unsafe conditions. Rear-end crashes are of particular concern.

- Ninety percent of crashes on US 27 at KY 698 were rear-end collisions. KY 698 links a large landfill to US 27.
- Thirty-nine percent of crashes at Fairground Road were rear-end collisions. Fairground Road is home to traffic-producing events held year round. The approach is located in a tangent section of US 27, making it possible for motorists to travel at higher than average speeds. Left-turning vehicles must stop in the through lane, unprotected from high speed approaching traffic.
- Both fatalities occurring on US 27 were results of rear-end collisions.

Mobility and Congestion: 2017 traffic counts revealed this segment of US 27 serves 10,000 to 12,000 vpd. Year 2040 traffic is projected to be between 13,000 and 16,000 vpd. It is now a moderately congested route operating at an average level of service (LOS) D. Year 2040 analysis predicts worsening congestion and operating conditions degrading with LOS E. Volume to capacity (v/c) ratios increase from 0.75 to 0.91 from 2017 to 2040. Trucks on US 27 are projected to remain near current levels of 8.0 to 9.2 percent.

- Current travel speeds along the corridor average 43 MPH, well below the posted 55 MPH speed limit, slowing to 40 MPH in 2040. No existing traffic signals are located within project limits to affect average speeds.
- Two-lane US 27 has limited passing opportunities in the northbound lane. It shares approximately one mile of passing lanes with southbound traffic between MP 11.169-11.575 and 13.940-15.090. Northbound dedicated passing opportunities are limited to a

truck climbing lane at MP 14.710-15.120 or only 8.9 percent of the project length. This results in motorists following slower vehicles (platooning) nearly 80 percent of the time, which is forecasted to grow to 88 percent by 2040. In response to the KYTC's request for comments and through LO/S meeting discussions, the Kentucky State Police reported northbound vehicles routinely pass illegally through the Halls Gap area, possibly resulting from the combination of platooning and lack of dedicated passing opportunities.

- US 27 serves a host of users such as people traveling for work or school, trucks moving goods, recreation enthusiasts enjoying the area's attractions, consumers and clients making trips to Lexington for shopping and medical needs, and emergency responders performing their duties. A route operating at LOS D or E with a v/c ratio over 0.9 can hinder many of these activities.

Systems Connectivity: consistent and more efficient connection from Somerset to Lexington: Managing driver expectation is an important factor in creating a safe and efficient roadway. One way to accomplish this is providing a consistent design template throughout a corridor. For many years the KYTC has been pursuing widening US 27 between Somerset and Lexington, a distance of approximately 75.0 miles. To date, roughly 40.5 miles of this corridor have been widened to four lanes including: Somerset north, 13.0 miles; through Stanford, 2.5 miles; and from KY 34 in Garrard County north to Lexington, 25.0 miles. The 14.0 miles of unimproved US 27 from Stanford north to KY 34 are in design to widen to four lanes. The unimproved 17.0-mile section of US 27 from KY 70 in Pulaski County north to Stanford contains 14.7 miles that is the focus of this Alternatives Study. **Figure 24** shows US 27 lane configurations through Kentucky from Tennessee to Ohio.

Goals: In addition to the purpose and need to improve safety, reduce congestion and improve systems connectivity, three project goals are to:

- Avoid or minimize environmental impacts.
- Reconstruct the corridor to current design standards similar to other segments of US 27.
- Preserve or enhance scenic vistas in the Halls Gap area.

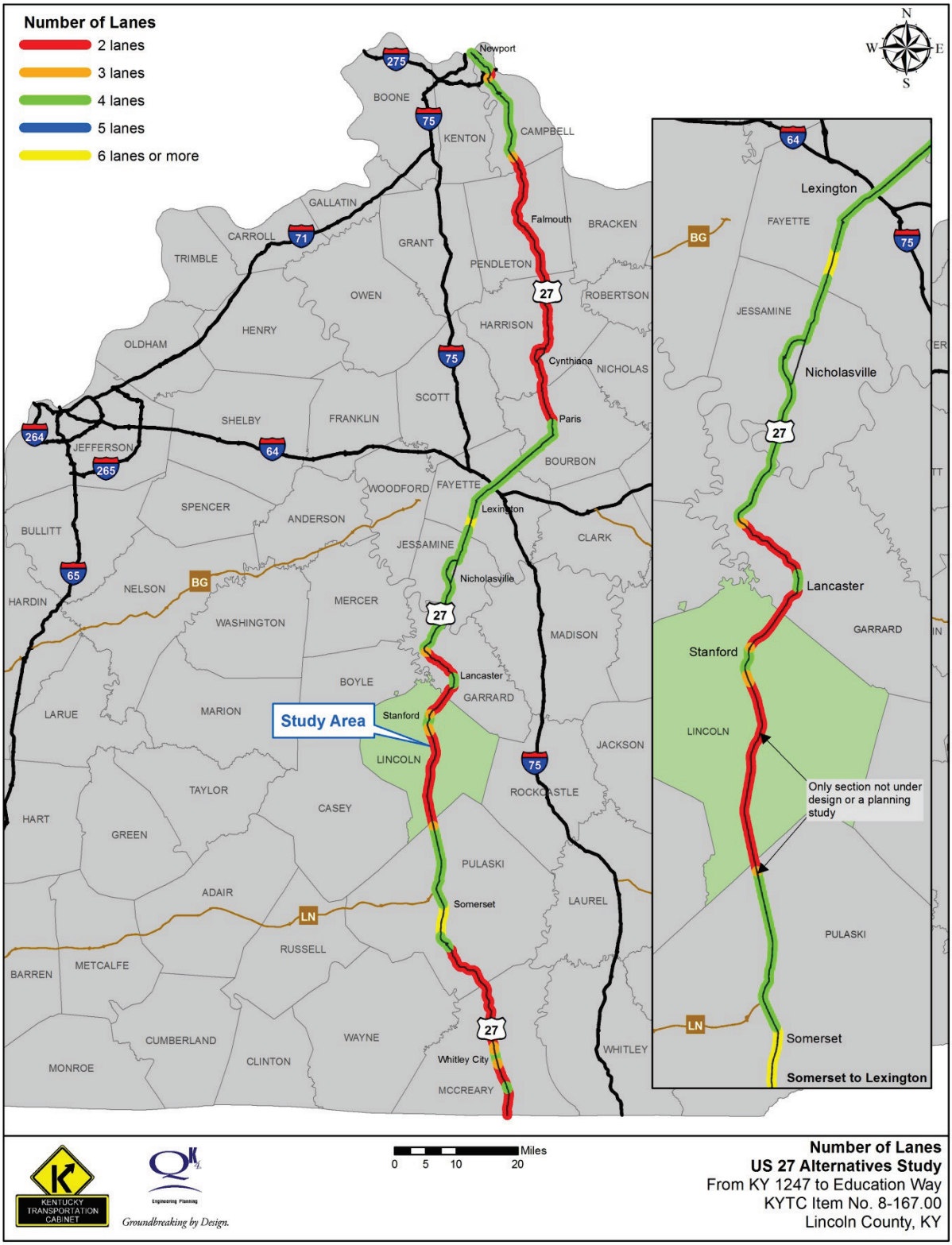


Figure 24: US 27 Number of Lanes Statewide

7.0 ALTERNATIVES DEVELOPMENT

Improvement alternatives were developed to meet existing and future transportation needs in the corridor, to current standards for a 55 MPH design, and partial control of access (driveway spacing a minimum of 1,200 feet). During development process, efforts were made to minimize costs and impacts to adjacent land uses. Alternatives were developed, evaluated, and compared based on environmental, right-of-way, utility, and traffic impacts. Cost estimates were generated for comparison. Alternatives presented are preliminary and subject to change in future project phases. Four-lane and three-lane (with 2+1 design) alternatives studied are summarized below and discussed in more detail in **Section 7.2**.

No Build/Do Nothing—This alternative provides a baseline comparison for other design options. Roadway improvements are not provided, and existing conditions and future maintenance costs remain.

Four-lane Roadway—This alternative would add two new travel lanes separated by a 40-foot-wide depressed median, and have partial access control.

- Widen Right (east)—widens east of existing US 27.
- Widen Left (west)—widens west of existing US 27.
- Widen Equally—widens equally east and west of existing US 27.
- Bifurcate and Bridge—A variation of Widen Left, but bifurcates (splits) southbound and northbound lanes, and provides a southbound bridge over the Columbia Gulf natural gas transmission line. Northbound lanes remain within the existing US 27 footprint.

Halls Gap Four-lane Roadway Alternatives—Because of the high costs and construction complexities of widening through Halls Gap, alternative concepts with partial access control were considered.

- Barrier Median—Utilizes a minimized typical section to reduce impacts through Halls Gap.
- Re-grade—Reconstructs US 27 through Halls Gap to lessen the roadway's steepness.
- New Eastern Alignment—Bypasses existing Halls Gap, meeting current design guidelines.

Three-lane Roadway with 2+1 Design—This alternative provides a continuous three-lane cross section with alternating northbound and southbound dedicated passing lanes. It can be developed with or without partial access control measures.

Five-lane with Two-Way-Left-Turn-Lane (TWLTL)—A TWLTL is a wide, painted center turning lane that also functions as a flush median. Opposing left-turn arrows are painted at regular intervals along the lane length, and left turning vehicles from both directions share this lane.

The five-lane TWLTL was eliminated from consideration at the project scoping meeting due to:

- Desire to increase mobility rather than access;

- Desire to implement partial control of access (1,200 minimum between access points), which decreases TWLTL effectiveness;
- Concerns the TWLTL could be misused as a passing lane;
- The project is located in a higher speed, rural area rather than lower speed urban area where TWLTL's are typically found to be effective;
- General KYTC concern that TWLTLs are not recommended for use on highways with speed limits of greater than 45 MPH.

7.1 South/North Segmented Corridor

As shown in **Figure 25**, the study area was segmented into south and north components, split just north of Fairground Road at MP 13.650, at the base of hilly terrain through Halls Gap. Section 1 is to the south and 2.48 miles in length. Section 2 is to the north and 2.25 miles in length. This break point allows for any southern alternative to be matched with any northern alternative, facilitating comparisons between various alternative combinations.

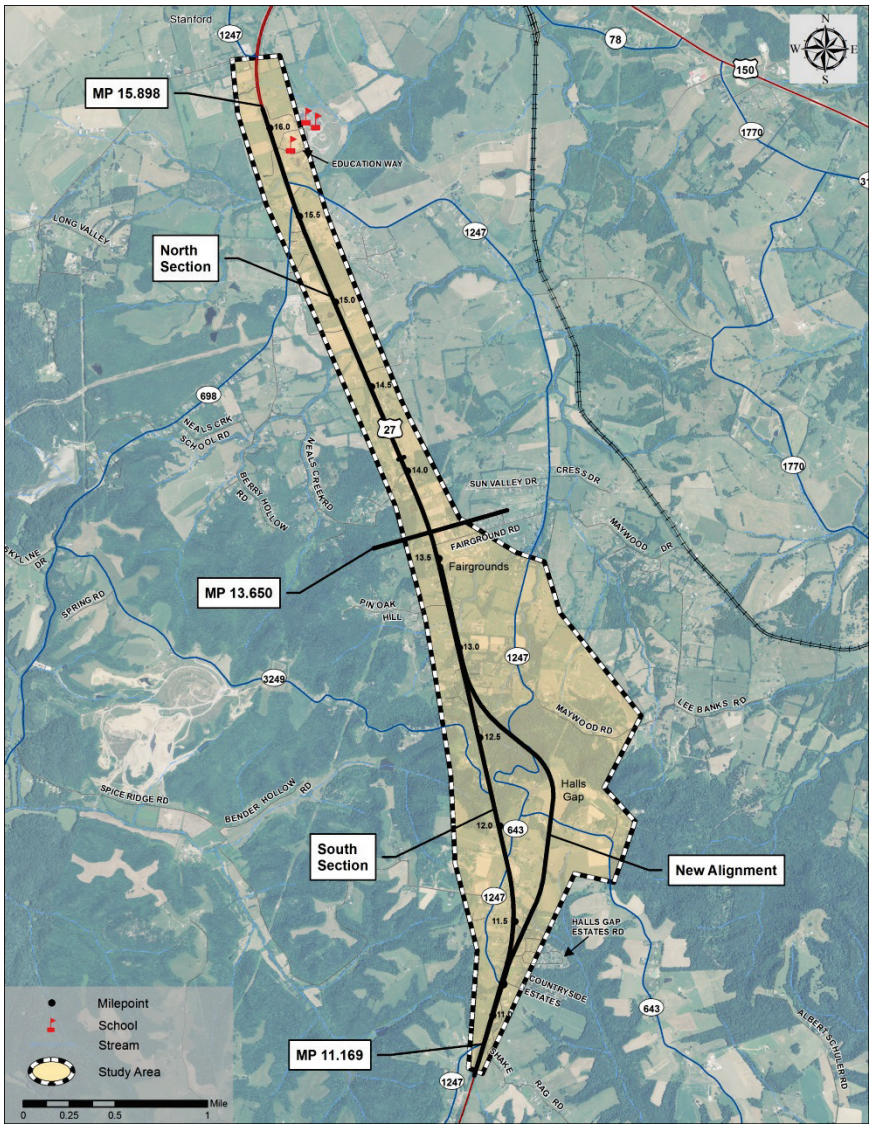


Figure 25: Section 1 (South) and Section 2 (North)

7.2 Alternative Discussion

The four-lane typical section is consistent with previously designed or constructed US 27 four-lane widening in Pulaski, Lincoln, and Garrard counties, including a 40-foot-wide depressed median. It is considered as a "worst case scenario" regarding impacts and costs. Typical sections may change during future project development phases. **Figures 26** and **27** show four-lane typical sections while **Figure 28** depicts a three-lane.

7.2.1 Four-lane Alternatives—North and/or South Sections.

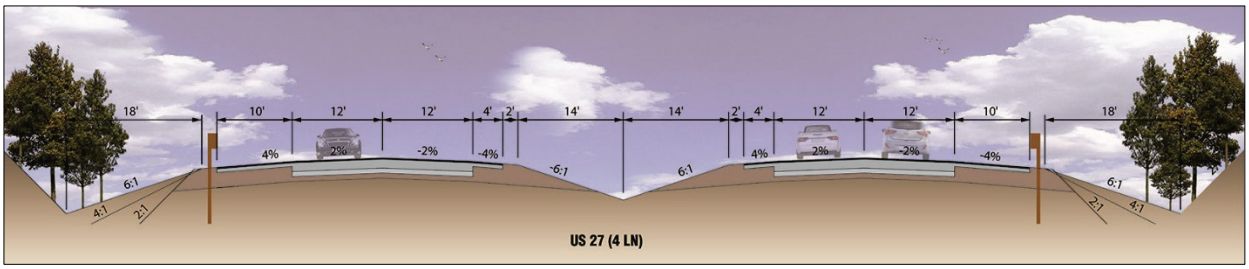


Figure 26: Typical Section 1: Four-lane (Alternatives A1–A4; A6–A7)

A1. Widen Right (east): Widen US 27 to four lanes on the east side of US 27. Traffic will be maintained along the existing roadway while new lanes are constructed to the east. Approximate impacts vary 150–200 feet east and 50–100 feet west of existing US 27, with impacts up to 600 feet through Halls Gap. This option does not improve the grade through Halls Gap.

A2. Widen Left (west): Widen US 27 to four lanes on the west side of US 27. Traffic will be maintained along the existing roadway while new lanes are constructed to the west. Approximate impacts vary 150–200 feet west and 50–100 feet east of existing US 27, with impacts up to 900 feet through Halls Gap. This option does not improve the grade through Halls Gap.

A3. Equal Widening (west and east): Widen US 27 to four lanes equally along both sides of US 27. Traffic will be maintained along the existing roadway while new lanes are constructed. Approximate impacts vary 100–150 feet east and west of existing US 27, with impacts up to 600 feet through Halls Gap. This option does not improve the grade through Halls Gap.

7.2.2 Four-lane Alternatives—North Section only.

A4. Bifurcate and Bridge: Bifurcate and construct southbound lanes farther west of existing US 27, allowing a bridge to be constructed over Columbia Gulf's natural gas transmission lines. Approximate impacts vary 100–300 feet west and 50–100 feet east of existing US 27. This option can be combined with any South Section alternative.

7.2.3 Four-lane Alternatives—South Section only.

A5. Halls Gap—Barrier Wall: Construct a barrier wall through Halls Gap to reduce the roadway footprint by approximately 25 feet through this steep highway section. Approximate impacts vary 100–300 feet east and up to 600 feet west of existing US 27 through Halls Gap. This option does not improve the grade through Halls Gap, and can be combined with any North Section alternative.

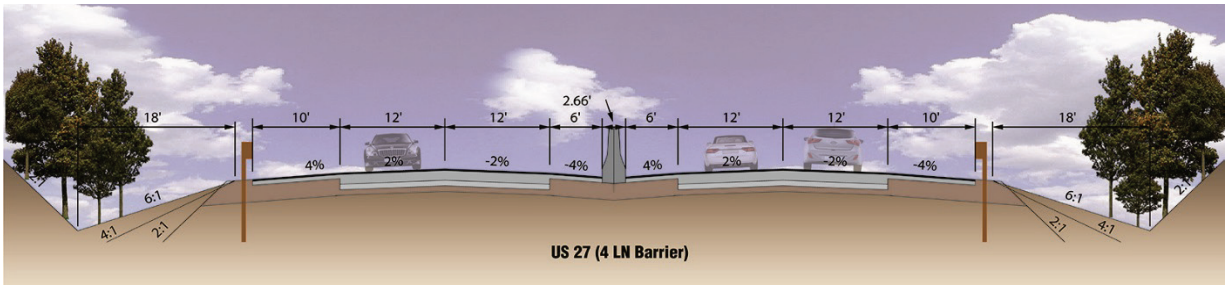


Figure 27: Typical Section 2 Four-lane with Barrier Wall (Alternative A5)

A6. Halls Gap—Re-grade: Reconstruct US 27 through Halls Gap to lessen the roadway's steepness and meet current design standards. Approximate impacts vary 200–600 feet east and west of existing US 27 through Halls Gap. This alternative can be combined with any North Section alternative.

A7. Halls Gap—New Eastern Alignment: Construct a roadway east of US 27 along a new alignment. Approximate impacts vary 300–700 feet. This new roadway will meet today's standards, and can be combined with any North Section alternative. Segments of existing US 27 will remain in use by local traffic requiring continued future maintenance.

7.2.4 Three-lane Alternative—South and North Sections.

B. 2+1: Add third lane to two-lane US 27 and stripe roadway to designate alternating southbound and northbound passing opportunities. Approximate impacts vary 50–150 feet east and west of existing US 27, with impacts up to 600 feet through Halls Gap. This option does not improve the grade through Halls Gap. **B1** has a modified shoulder width of 6-foot paved shoulders.

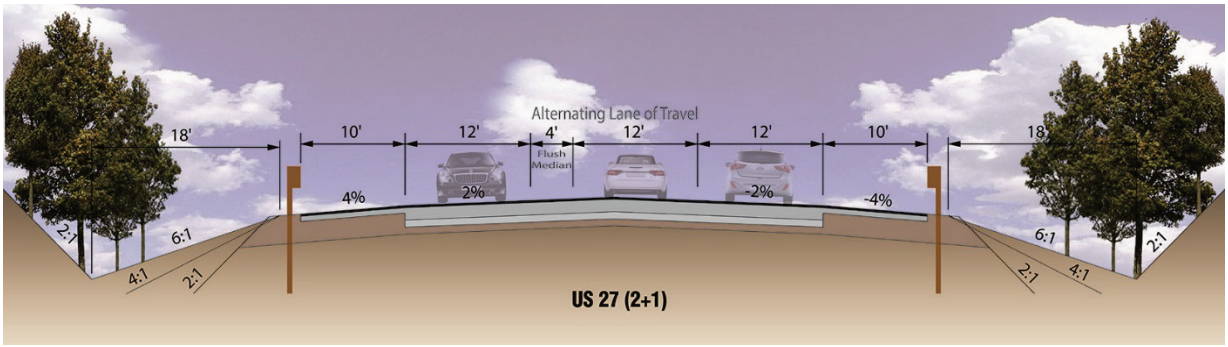


Figure 28: Typical Section 3: Three-lane (2+1) (Alternative B)

7.3 2040 Traffic Analysis Of Build Alternatives

Projected 2040 future year No Build and Build traffic volumes and an operations analysis are summarized in **Table 15** and **Figures 29** and **30.**

Table 15: Averaged US 27 Segment 2040 No Build/Build Traffic Data

SECTION	US 27 SEGMENT				ADT	% Trucks	No. Lanes	2040 NO BUILD								2040 BUILD													
																4-LANES								3-LANES (2+1)							
								LOS		Speed		% Time Following		v/c Ratio		LOS		Speed		% Time Following		v/c Ratio		LOS		Speed		% Time Following		v/c Ratio	
	FROM	MP	TO	MP	2040	2040	2040	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	KY 1247	11.169	KY643	11.820	13,000	9.2	2	E	E	40	40	88	83	0.61	0.91	A	A	55	55	10	11	0.22	0.21	D	C	47	48	72	58	0.63	0.58
	KY643	11.820	BEGIN SB TL	13.107																											0.91
	END SB TL	13.107	TRINITY LN	14.583										0.63	0.58																
	TRINITY LN	14.583	END NB TL	15.133																											0.58
2	END NB TL	15.133	KY698	15.568	16,000	8.1	3							0.74	0.70							0.27	0.25							0.27	0.25
	KY698	15.568	4-LANE	15.794																											
	4-LANE	15.794	ED. WAY	15.881			4	B	A	60	60	11	6	0.27	0.25	B	A	60	60	11	6			B	A	N/A	N/A	N/A	N/A		

SB=southbound NB=northbound TL=turn lane

Traffic data was averaged over US 27 segments for comparison purposes. Analyzing two-lane segments for 2040 No Build and Build alternatives identified the following:

2040 No Build LOS averages E in AM and PM peak hours and speeds slow to 40 MPH, suggesting congestion will likely occur as motorists spend over 83 percent of their time following slower vehicles. From KY 1247 (MP 11.169) to the southbound truck lane (MP 13.107), the 0.91 PM peak hour v/c ratio indicates congestion in the design year.

2040 Four-lane Build LOS averages A in AM and PM peak hours, indicating free-flowing traffic experiencing minimal or no delays. Average travel speeds increase to 55 MPH, and motorists will spend 10 to 11 percent of their time following slower vehicles. The low v/c ratios, all below 0.27, signify adequate lanes for the traffic volume.

2040 Three-lane (2+1) Build LOS average D and C in AM and PM peak hours, respectively, suggesting moderate congestion in the morning but becoming less congested in the evening. Travel speeds remain below the 55 MPH posted speed limit, at 47–48 MPH; and motorists will spend between 58 and 72 percent of their time following slower vehicles.

Table 16 presents a comparison of No Build and Build traffic performance measures for three intersections along the corridor—KY 643, KY 698, and Education Way. No significant LOS changes resulted for three intersections with respect to the No Build and Four-lane alternatives. The v/c ratios worsened for Education Way intersection movements and improved for KY 698 and KY 643.

Table 16: US 27 Intersections—2040 No Build/Build Traffic Data

US 27 Intersections	2040 NO BUILD		2040 BUILD				Worst Movement
			4-LANE		3-LANE (2+1)		
	LOS		LOS		LOS		
	AM	PM	AM	PM	AM	PM	
Education Way	F	C	F	C	N/A	N/A	WB-LR
KY 698	F	F	F	F	F	F	EB-LR
KY 643	D	C	C	C	D	C	WB-LR

WB=westbound EB=eastbound LR =-Left/Right

7.4 Potential Impacts

Potential impacts were estimated within disturb limits of mainline and proposed right-of-ways of new access control frontage roads.

An alternatives impact comparisons matrix **(Table 18)** was used to facilitate discussion of alternatives in project team and LO/S meetings. The matrix features environmental, historical, geotechnical, utility, and right-of-way impacts; project cost by phase; and LOS and v/c ratios. To calculate total four-lane alternative impacts, add Section 1 (South) to Section 2 (North). Total three-lane (2+1) impacts are shown.

Impacts for four-lane and 2+1 alternatives cannot be avoided. Notable impacts discussed at the project team and LO/S meetings are summarized in the following sections.

7.4.1 Utility Impacts

Columbia Gulf Gas Company owns 36-inch and double 30-inch transmission lines located in Section 2 (North). Disturbances to transmission lines will have major utility impacts on the project. Columbia Gulf requires a contractual agreement with the KYTC before providing cost estimates, however, a cost of $3,300 per linear foot was developed based on similar project impacts to transmission lines occurring in KYTC District 9.

AT&T owns a buried fiber optic cable located near US 27's east right-of-way line. The company provided a preliminary lump sum cost of $1.1 million for potential cable construction impacts.

Birch Communications, Spectrum, and AT&T maintain overhead fiber optic cables in the project area. The companies did not provide cost estimates for potential overhead cable impacts.

Three water companies service the project area: Eubank Water System, Stanford Water Commission, and McKinney Water District.

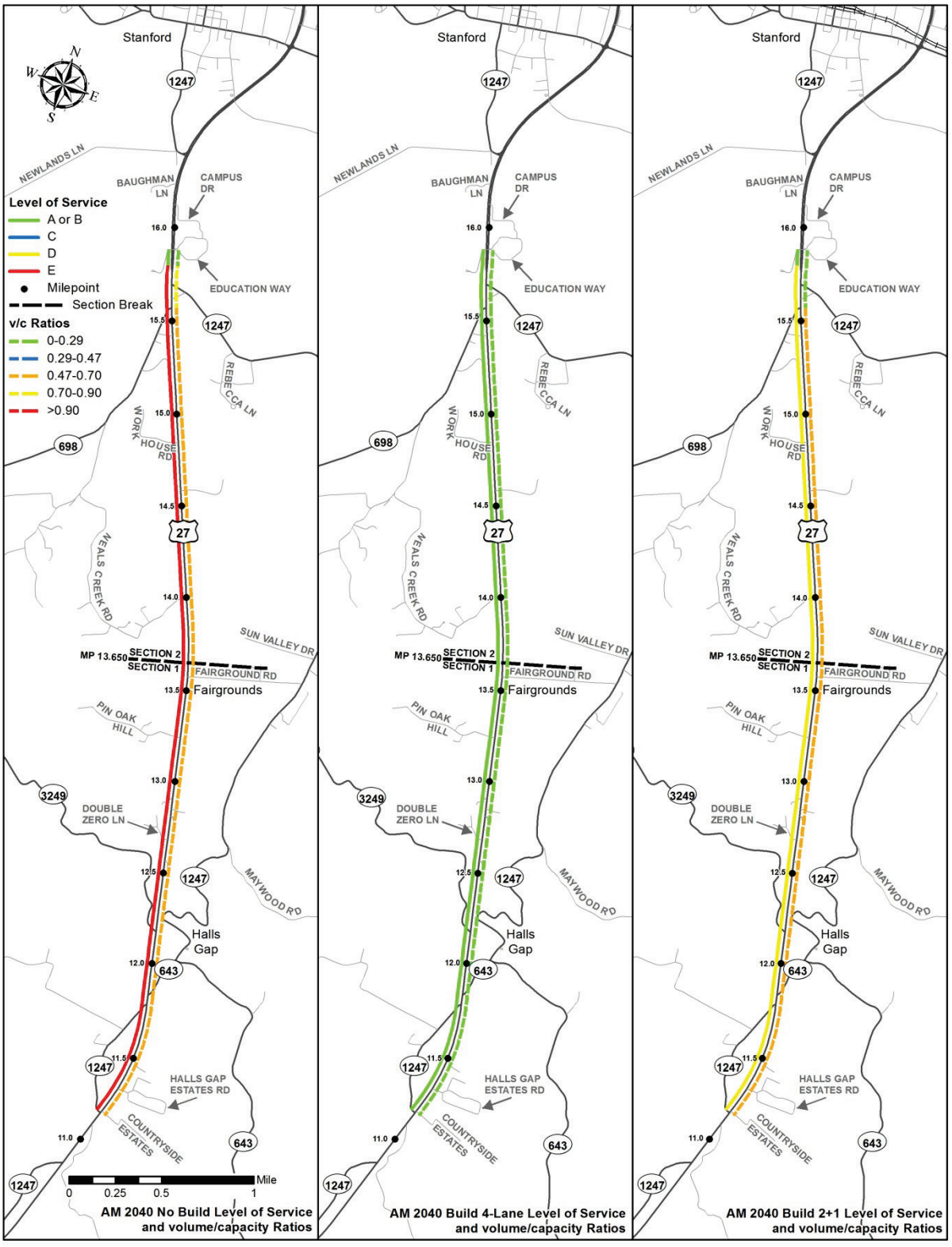


Figure 29: 2040 AM No Build/Build Traffic Operations

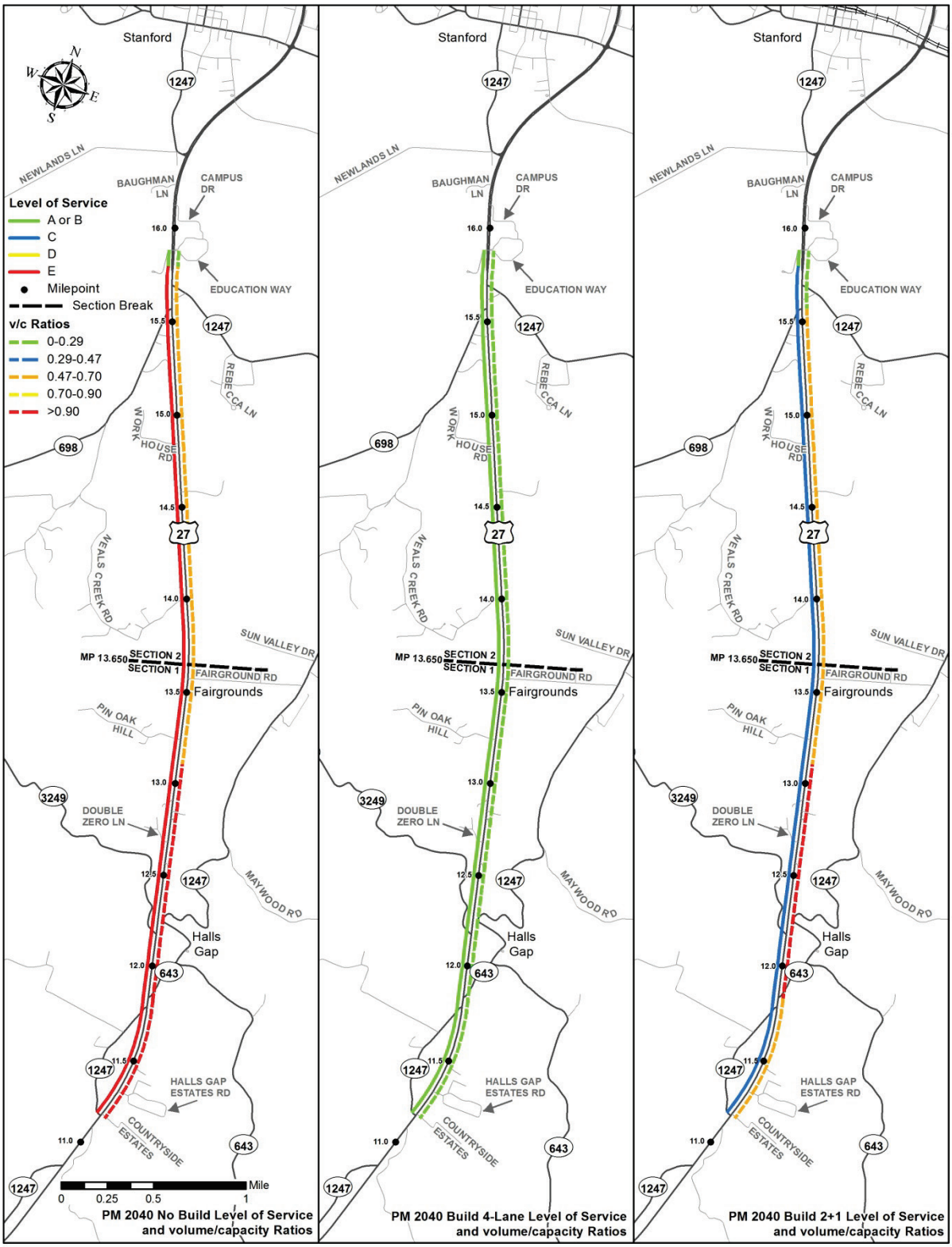


Figure 30: 2040 PM No Build/Build Traffic Operations

7.4.2 Environmental Impacts

Historic Properties: Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies to take into account effects of their undertakings on historic properties. Using available mapping, 142 structures over 50 years old were identified in the study area. Early evaluation of structures and resources, such as Hall Gap Overlook, is necessary to determine eligibility for listing in the National Register of Historic Places (NRHP) and potential impacts to eligible sites.

Environmental Justice is fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income. Findings in BGADD's socioeconomic report **(Appendix F)** indicate minority and low-income populations could be affected by all build alternatives. Age 65 and over residents positioned between KY 643 and KY 698, and disabled populations established from KY 643 north may also be affected. Further analysis may be required to determine potential impacts to these groups.

Section 4(f) of the U.S. Department of Transportation Act of 1966 requires consideration of publicly owned park and recreational lands, wildlife and waterfowl refuges, and historic sites in transportation project development. Alternatives east of US 27 could affect publicly owned recreational, fairgrounds property located on Fairground Road.

Section 6(f) of the Land and Water Conservation Act requires coordination with the Department of Interior on lands or facilities acquired with Land and Water Conservation Act funds (LWCF). Lincoln County High School, Lloyd McGuffey Sixth Grade Center, and Lincoln County Middle School are located on Education Way in a complex adjacent to US 27. The schools' softball fields, modified using LWCF, could be impacted; however, constructing a retaining wall through the property may be an avoidance solution. Should a build alternative be selected that would affect the soccer fields, measures to minimize/avoid impacts will be evaluated during Phase 1 design.

7.4.3 Geotechnical Impacts

Halls Gap—Alternative impacts through Halls Gap are based on conservative 2H:1V (typical) excavation and embankment slopes. Multiple rock formations are visible in existing rock cuts through this area and geotechnical investigation should take place early in the next project phase to determine feasibility of incorporating steeper slopes into design. Potential impacts to Halls Gap Overlook can be minimized and project costs reduced if this is possible.

Formations—New Albany Shale, a silty, pyritic shale that can produce acidic runoff is present in the area. Encapsulation with an impermeable material (typically clay) is required to prevent acidic runoff, when placed in roadway embankments.

Halls Gap embankment stability issues—Halls Gap has a history of embankment failures. To address these embankment failures, in 2002 and 2003 the KYTC authorized over $1.1 million an estimated 24,000 linear feet (LF) of railroad steel and H-piles. These efforts have helped stabilize the area, but are not intended to be a permanent solution, as noted by the Preliminary Geotechnical Assessment's recommending these retaining structures (H-piles and railroad rails) be removed as part of the reconstruction.

Signs of stability issues are still present as evidenced by eroding fill slopes and concrete cross drains with visibly separated joints and dropped headwalls. Further investigation is needed to determine if damage to these structures extends under existing embankments. A possible permanent stabilization solution includes removal of existing embankment material, installing pipe underdrains, and reconstructing embankment with suitable material. The estimated $2.5 million construction costs for this remediation are not included in estimates presented in this study.

7.4.4 Traffic Impacts

Left-turn lanes may improve traffic operations when placed at warranted locations in four-lane alternatives. However, they will decrease passing opportunities through turn-lane and transition areas in 2+1 alternatives, adversely affecting traffic flow.

7.5 Cost Estimates

Phased cost estimates for improvement alternatives are shown in **Table 17**. Conceptual design models generated quantities of high-cost construction items including earthwork, pavement, and structures. Construction costs were tabulated using the KYTC District 8 average unit bid prices. The KYTC District 8 provided right-of-way and utility cost estimates based on right-of-way limits.

Total project and phase costs for a four-lane alternative are determined by adding a cost from Section 1 (South) to a cost from Section 2 (North). Total project phase costs for the three-lane (2+1) option are shown.

Four-lane project costs range from **$49.3M** (South A1 + North A4) to **$70.9M** (South A7 + North A3). Three-lane (2+1) project costs range from **$37.2M** to **$40.7M.**

Table 17: Improvement Alternative Phase Cost Estimates

Project Phase	4-LANE ALTERNATIVES											3-LANE	
	Section 1 - South (2.48 Miles)							Section 2 - North (2.25 Miles)				4.7 Miles 4' Flush Median	
Cost Estimate ($ Million)	Widen RT (East)	Widen LT (West)	Equal Widen	Halls Gap Barrier Wall	Halls Gap Regrade	Halls Gap New Eastern Alignment		Widen RT (East)	Widen LT (West)	Equal Widen	Bifurcate & Bridge	6' paved shoulders	10' paved shoulders
Design	$ 1.8	$ 2.4	$ 2.3	$ 2.2	$ 2.8	$ 3.3		$ 1.2	$ 1.3	$ 1.4	$ 1.4	$2.2	$2.4
Right-of-Way	$ 6.3	$ 5.2	$ 5.6	$ 7.8	$ 7.5	$ 5.6		$ 7.0	$ 4.5	$ 6.7	$ 4.5	$8.0	$8.8
Utility	$ 2.2	$ 1.1	$ 2.7	$ 2.5	$ 2.3	$ 1.8		$ 5.4	$ 4.0	$ 4.9	$ 0.6	$5.5	$5.7
Construction	$ 18.4	$ 24.4	$ 23.0	$ 21.5	$ 27.5	$ 33.2		$ 12.4	$ 12.6	$ 14.0	$ 14.1	$21.5	$23.8
Section Total	**$ 28.7**	**$ 33.1**	**$ 33.6**	**$ 33.9**	**$ 40.1**	**$ 43.9**		**$ 26.0**	**$ 22.3**	**$ 27.0**	**$ 20.6**	**$37.2**	**$40.7**
Alternative	A1	A2	A3	A5	A6	A7	+	A1	A2	A3	A4	B1	B2

Table 18: Alternative Impact Comparison Matrix

LINCOLN COUNTY US 27: ALTERNATIVE IMPACT COMPARISIONS														
KENTUCKY TRANSPORTATION CABINET			4-LANE ALTERNATIVES										3-LANE	
			Section 1 - South (2.48 Miles)						Section 2 - North (2.25 Miles)				With Access Control	
			Widen RT (East)	Widen LT (West)	Equal Widen	Halls Gap Barrier Wall	Halls Gap Regrade	Halls Gap New Eastern Alignment	Widen RT (East)	Widen LT (West)	Equal Widen	Bifurcate (Bridge over Nat. Gas Lines)	4' Median 6' paved shoulders	4' Median 10' paved shoulders
Feature			A1	A2	A3	A5	A6	A7	A1	A2	A3	A4		
ENVIRONMENTAL	COMMUNITY	Cemeteries	1	1	1	1	1	0	0	0	0	0	1	1
		Churches	0	0	0	0	0	0	0	0	0	0	0	0
		Schools & Ball Fields	0	0	0	0	0	0	0	0	0	0	0	0
	HISTORICAL	Historic Marker	1	1	1	1	1	0	0	0	0	0	1	1
		NRHP	0	0	0	0	0	0	0	0	0	0	0	0
		Overlook	1	0	1	1	1	0	0	0	0	0	0	0
		Structure 50 yrs. old	13	19	13	14	15	4	0	0	0	0	14	14
	UST	Oil/Gas Wells	0	0	0	0	0	0	0	0	1	1	0	0
		UST/Hazmat (Potential)	4	5	4	4	5	0	4	4	3	3	7	7
		UST (Field Review)	0	0	1	1	0	0	2	4	3	1	1	1
	STREAMS WETLANDS	100 YR Flood (ACS)	0	0	0	0	0	0	0.94	1	0.92	1.5	0.5	0.5
		Wetlands (ACS)	1.4	2.5	1.7	1.7	1.4	1.4	0	0.9	0.9	0.9	1.9	1.9
		Intermittent (LF)	1,380	1,160	1,230	1,130	1,430	1,570	0	70	0	100	1,030	1,030
		Perennial (LF)	0	0	0	0	0	0	500	350	460	440	230	230
		Water Wells	6	7	6	6	3	0	0	0	0	0	6	6
	FARM	Prime Farmland	9	9	9	9	9	14	23	23	23	25	20	20
		Farmland of Statewide Importance	39	39	39	39	51	43	22	22	23	23	50	50
GEOTECH		Fault (LF)	0	0	0	0	0	0	1,940	1,470	1,440	1,760	1,200	1,200
		New Albany Shale (Acres)	8	8	8	8	11	6	18	18	18	18	16	16
UTILITIES		Sewer Line (LF)	0	0	0	0	0	0	650	650	650	660	700	700
		Columbia Gulf Natural Gas Transmission Lines (2-30" & 1-36") (LF)	0	0	0	0	0	0	350	350	300	0	300	300
		ATT Fiber Optic (LF)	1,900	0	1,900	730	1,880	1,830	9,200	0	9,260	0	11,200	11,200
		Water Lines (LF)	3,180	3,090	4,810	4,810	3,910	2,840	4,330	4,730	4,600	5,030	11,400	11,400
		Overhead Utility Lines - 1 Line (LF)	17,390	16,500	23,900	20,620	17,960	10,870	11,760	6,570	11,850	7,190	17,600	20,500
RIGHT OF WAY		R/W (Acres)	59.9	75.7	71.1	69.4	71.5	102.1	43.3	40.8	45.2	50.1	78	80
		Commercial Relocations (each)	2	2	2	1	2	1	2	2	2	2	0	0
		Residential Relocations (each)	21	18	20	29	22	12	24	16	25	15	26	27
PROJECT COSTS		Design Costs (10% of Construction; $ Millions)	$1.84	$2.44	$2.30	$2.15	$2.75	$3.32	$1.24	$1.26	$1.40	$1.41	$2.15	$2.38
		Right of Way Costs ($ Millions)	$6.28	$5.16	$5.63	$7.78	$7.50	$5.60	$7.00	$4.48	$6.70	$4.48	$8.00	$8.80
		Utility Costs ($ Millions)	$2.20	$1.10	$2.70	$2.50	$2.30	$1.80	$5.40	$4.00	$4.90	$0.60	$5.50	$5.70
		Construction Costs ($ Millions)	$18.40	$24.40	$23.00	$21.50	$27.50	$33.20	$12.40	$12.60	$14.00	$14.10	$21.50	$23.80
		TOTAL COSTS ($ Millions)	$28.72	$33.10	$33.63	$33.93	$40.05	$43.92	$26.04	$22.34	$27.00	$20.59	$37.15	$40.68
*LOS		CURRENT YEAR LOS	D										D	
		NO BUILD DESIGN YEAR LOS	E										E	
		BUILD DESIGN YEAR LOS	A						A-B				D (AM) / C (PM)	
v/c ratio		CURRENT YEAR v/c ratio	0.48-0.75						0.48-0.60				0.48-0.75	
		NO BUILD DESIGN YEAR v/c ratio	0.58-0.91						0.58-0.74				0.58-0.91	
		BUILD DESIGN YEAR v/c ratio	0.25-0.28						0.25-0.32				0.58-0.91	

*LOS Averaged over all project segments.

Category Impacts

Least — Most

8.0 RESOURCE AGENCY COORDINATION

Resource agency coordination was conducted to help identify potential environmental resources, development plans, or other potential issues. The KYTC Division of Planning mailed applicable resource agencies a packet of project-related information including purpose and need, existing conditions, an environmental overview, crash data, alternatives, and No Build and Build traffic data and maps. Resource agencies were provided a link to view potential improvement alternatives. Responses are summarized in **Table 19**, and provided in full in **Appendix K.**

Table 19: Resource Agency Comments Summary

Representing	Summary of Comments
U.S. Environmental Protection Agency (USEPA)	➲ The USEPA is unaware of known conservation or development plans ongoing within the project area. ➲ Identify waters, including aquatic ecosystems, of special significance such as designated special use waters and impaired streams. ➲ Address impacts to environmental justice communities consistent with FHWA Environmental Justice Policy and Guidance. ➲ Address impacts to existing groundwater conditions, including karst topography, and assess potential impacts to groundwater quality associated with the proposed project. ➲ Identify mitigation measures to prevent or reduce adverse impacts to groundwater quality. ➲ Consider providing a map depicting the proposed "bifurcate and bridge" alternative for the "north section." A map was provided to depict the proposed "Halls Gap" new eastern alignment. Neither proposed new alignment appears to address congestion associated with county fairgrounds. ➲ Consider lowering the posted speed limit and address whether time delays indicate a need for the proposed action as described. ➲ Consider installing traffic lights and turn lanes or roundabouts at two high crash intersections.
U.S. Fish and Wildlife Service (USFWS)	➲ The USFWS's Information for Planning and Conservation (IPaC) system lists the gray/Indiana/northern long-eared bats and Cumberland bean clam as endangered species. No critical habitats were identified in the study area. Seven migratory/breeding birds were listed: ▪ Blue-winged warbler. Breeds May 1 to June 30. ▪ Eastern whip-poor-will. Breeds May 1 to August 20. ▪ Kentucky warbler. Breeds Apr 20 to August 20. ▪ Prairie warbler. Breeds May 1 to July 31. ▪ Red-headed woodpecker. Breeds May 10 to September 10. ▪ Rusty blackbird. Breeds elsewhere. ▪ Wood thrush. Breeds May 10 to August 31.
Federal Highway Administration (FHWA)	➲ Purpose and Need ▪ Purpose - Statement should include addressing geometric deficiencies. ▪ Need - Bullet 1 doesn't indicate a need. ▪ Need - Please describe the need that goes along with Bullet 7 - US 27 be the primary detour route. Is it insufficient as a detour route? What are the required parameters? ▪ Need - Bullet 6 mentions 2 high crash locations are above the statewide average, but doesn't provide data – please include those numbers. ▪ Need - Bullet 6 mentions 2 high crash locations are above the statewide average. Provide data. ➲ Alternatives ▪ It is unclear how many alternatives exist. ▪ Seems like it should be 3-lane alternative (not a 2 + 1 – what is that?) and 4-lane alternative. ▪ Doesn't address EJ, Parks, Rec Land, 6(f) properties. ▪ Traffic Volume data is from which year? Please indicate.
U.S. Department of Agriculture – Natural Resources Conservation Agency (USDA-NRCS)	➲ If project may convert farmland to non-agricultural use and is anticipated to receive federal dollars, and AD-1006 Farmland Conversion Impact Rating must be initiated and forwarded to the NRCS for completion in accordance with the Farmland Policy Protection Act.

Table 19: Resource Agency Comments Summary (Continued)

KY Airport Zoning Commission (KAZC)	➲ Construction equipment or permanent structures greater than 200 feet above ground level require a permit from the KAZC.
KY Cabinet for Health and Family Services	➲ Does not lease or own property within the area; therefore, does not anticipate or have issues or concerns with the proposed project.
KY Tourism, Arts and Heritage Cabinet	➲ KY Heritage Council: No comment on draft purpose and need statement or mitigation strategies. No conservation or development plans in project area. ➲ Most of project area has not been surveyed for archaeological resources, however an adjacent narrow corridor has. At least three known archaeological sites are within the project area, which remain unassessed for eligibility on the National Register of Historic Places. ➲ KY Department of Fish and Wildlife Resources (KDFWR): No federally listed species are known to occur within 10 miles of project site. State-listed American black bear and Savannah sparrow are known to occur within one mile of project site. ➲ No caves, critical habitats, trout streams/fish spawning areas, or other unique natural areas are known to occur within close proximity to project site. To minimize indirect impacts to the aquatic environment KDFWR recommends implementing erosion control measures prior to construction. ➲ Project has potential to impact wetland habitats. KDFWR recommends reviewing NWI maps and county soil surveys to determine location of potential wetland impacts. Include measures to eliminate or reduce wetland impacts. If impacts are unavoidable, design mitigation measures at a 2:1 mitigation ratio for permanent loss or degradation of wetland habitats. KDFWR recommends contacting the USACE and KY Division of Water (KDOW) prior to beginning work within the waterways or wetland habitats of Kentucky. ➲ KDFWR listed eight recommendations for mitigating/minimizing stream impacts. ➲ To minimize impacts to the aquatic environment, the KDFWR recommends erosion control measures be developed and implemented prior to construction to reduce siltation into waterways and/or karst features.
KY Division of Waste Management (KDWM)	➲ Information provided is based on those facilities that the KDWM currently has in its database. Additional location of releases, potential contamination, or waste facilities may be present or unknown to the agency. ➲ Hazardous Waste Branch: No treatment, storage, and disposal (TSD) facilities in area, TEMPO database search revealed numerous underground storage tanks (USTs), Hazardous Waste generators, etc. The Hazardous Waste generators shouldn't be issues. ➲ Underground Storage Tank Branch: No active USTs in study area. ➲ Landfills: No landfills in project area. Stanford Historic City Dump is approximately 1.5 miles away and Tri-K is in the vicinity. ➲ Dump Sites: Open dump sites AI 72696 and 109790 were remediated in 2012. AI 105496 is a KDOW site; work log indicates the site was closed 9-23-09. ➲ Superfund Branch: No superfund sites in project area.
KY Division of Forestry (KDOF)	➲ The KDOF found no forest resources of significant importance also the US 27 corridor that would be affected by the project.
KY Energy and Environment Cabinet – Department for Natural Resources	➲ KY Division of Conservation: No PACE (Purchase of Agricultural Conservation Easements) or established agricultural districts within or near study area. Best Management Practices recommended during construction to prevent nonpoint source water pollution.
KY Department of Agriculture	➲ PACE program has no easements in/ near the study area.
KY State Police (KSP)	➲ The KSP considers widening US 27 a much needed project and described six issues in the area: A. Vehicles traveling below the posted speed limit are dangerous, especially at night. B. An additional travel lane is needed on northbound Halls Gap hill to prevent travelers from passing on a double yellow line. C. Slow travelling speeds and quick stops for turning movements cause a high number of rear-end collisions. D. High traffic volume on the existing two-lane roadway is a cause of drivers passing vehicles when they should not and following other vehicles too closely, resulting in a high number of collisions. E. High traffic volume on US 27 creates unsafe conditions for vehicles entering and exiting many businesses, residences, and churches located along the route.
David Meade State Representative Majority Caucus Chair 80th District	➲ In full support with the project. ➲ Project will improve known safety issues, help with traffic, and provide a more efficient connection from Somerset to Lexington.

Color Key: *Federal* *State* *Study Area*

9.0 FINAL MEETINGS

The project team held three project team meetings and two LO/S meetings to coordinate key issues, gather input and present alternatives. This section describes final project team and public involvement that occurred. Individual meeting minutes are presented in **Appendices I and J, respectively.**

9.1 Second LO/S Meeting

The project team met with local officials and stakeholders the morning of September 6, 2017, at the Lincoln County Public Library in Stanford. The meeting purpose was to present improvement alternatives with projected future traffic and impacts, and gather feedback. Attendees were distributed handouts, including an agenda; a location map with brief descriptions of improvement concepts; traffic operations comparisons for 2017 existing, 2040 No Build, 2040 Build 2+1, and 2040 Build four-lane alternatives; a summary of feedback from the first LO/S meeting; alternative descriptions; an alternative comparison matrix; and a survey. The meeting proceeded as follows:

- Improvement alternatives and impacts were presented and discussed including 2017 existing, 2040 No Build, and 2040 Build traffic data.
- LO/S were satisfied all issues were captured in a summary of comments received from the first meeting.
- LO/S identified property for future church development and a cemetery near Dollar General.
- LO/S reviewed alternatives during a breakout session at which project team members were available for individual discussion.
- The group reconvened from break to complete project surveys and participate in a question and answer session.

A total of five surveys were completed and returned. Survey results revealed all responders favored improving US 27, all preferred a four-lane alternative, and three of five preferred the equal widening alignment through the south and north sections.

9.2 Final Project Team Meeting

The project team met a third time the morning of October 16, 2017, at the KYTC District 8 Office in Somerset to discuss survey results received from the second LO/S meeting, review resource agency comments, finalize improvement alternatives, and refine the project's draft Purpose and Need (P&N) Statement. The project team discussed the following:

- Low participation in the LO/S survey may indicate need for a more in-depth public involvement campaign in future project phases.
- Further action was needed to address the FHWA's comments on the project's draft P&N Statement.
- LO/S made no comments or raised no objections in the second LO/S meeting to warrant revisions or elimination of improvement alternatives.

- The study will not recommend a preferred alternative, but will present all improvement alternatives, cost estimates, and potential impacts to help the KYTC in Highway Plan project selection

Following the meeting, a revised Purpose and Need was electronically submitted and accepted by the FHWA.

10.0 STUDY CONCLUSIONS

The US 27 Alternatives Study describes the process used to evaluate and compare environmental, right-of-way, utility, traffic impacts, and costs of each alternative relative to the others.

This report is intended to provide decision-makers with relevant information to facilitate logical, sound, and informed decision making in the KYTC Highway Plan process.

11.0 CONTACTS / ADDITIONAL INFORMATION

Written requests for additional information regarding the US 27 Alternative Study should be sent to:

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