US 27
EXECUTIVE SUMMARY

FINAL

Lincoln County | Item No. 8-167.00
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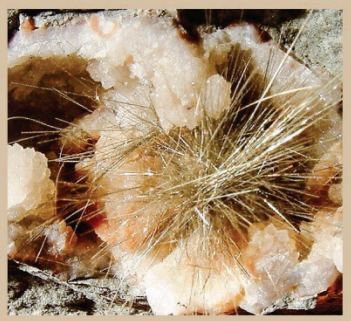
KENTUCKY TRANSPORTATION CABINET









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

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

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.

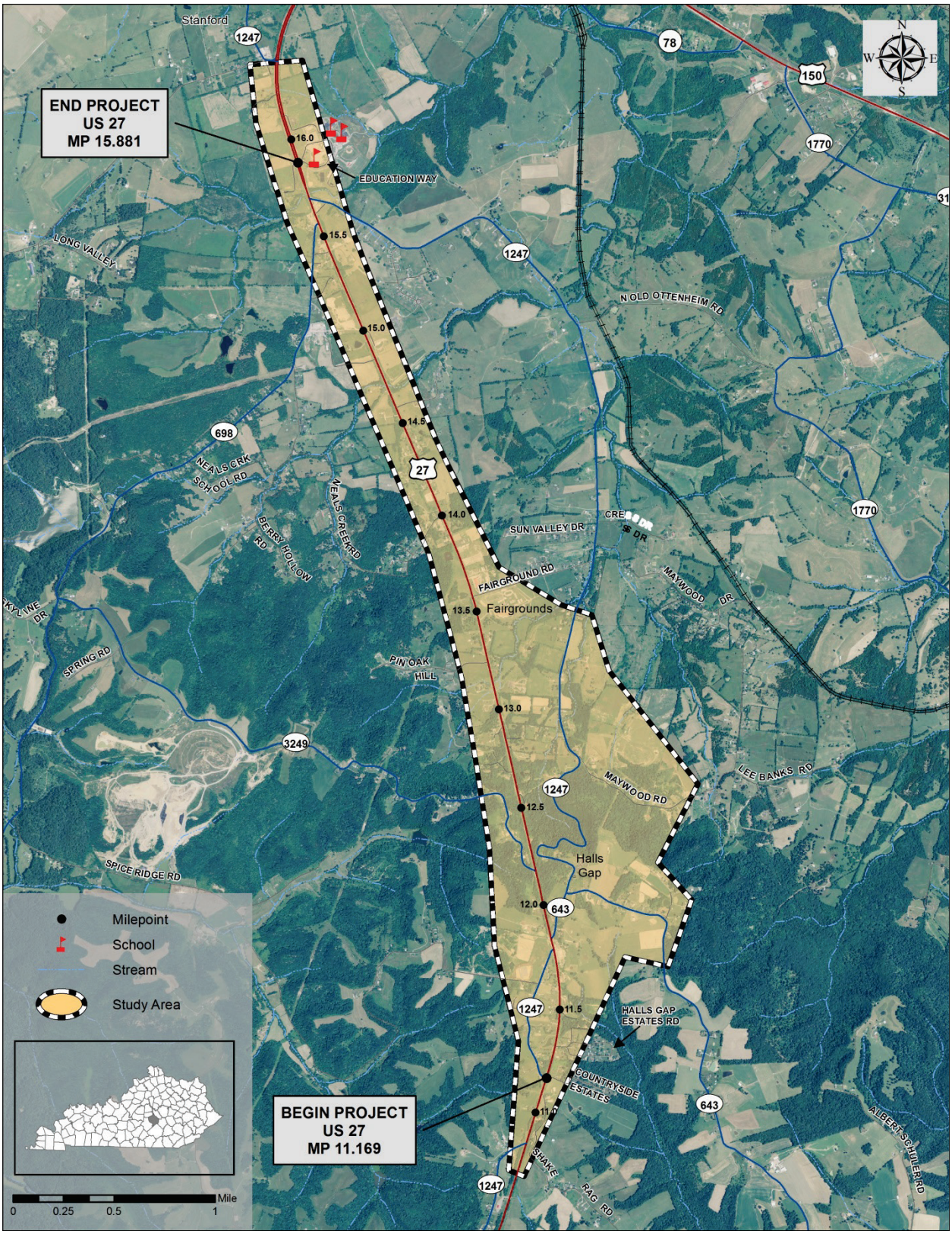


Figure ES 1: Study Area

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.

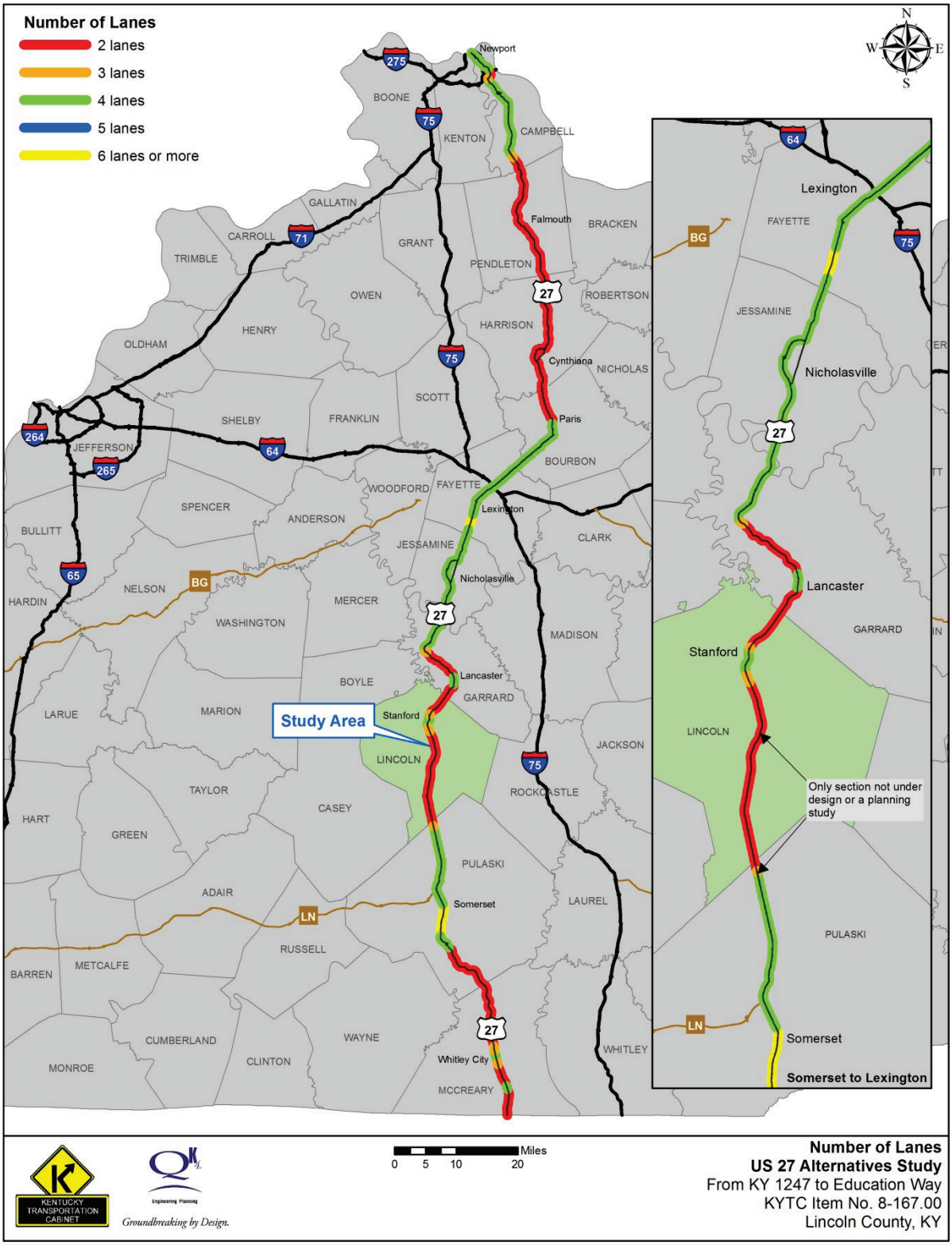


Figure ES 2: US 27 Number of Lanes Statewide

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.

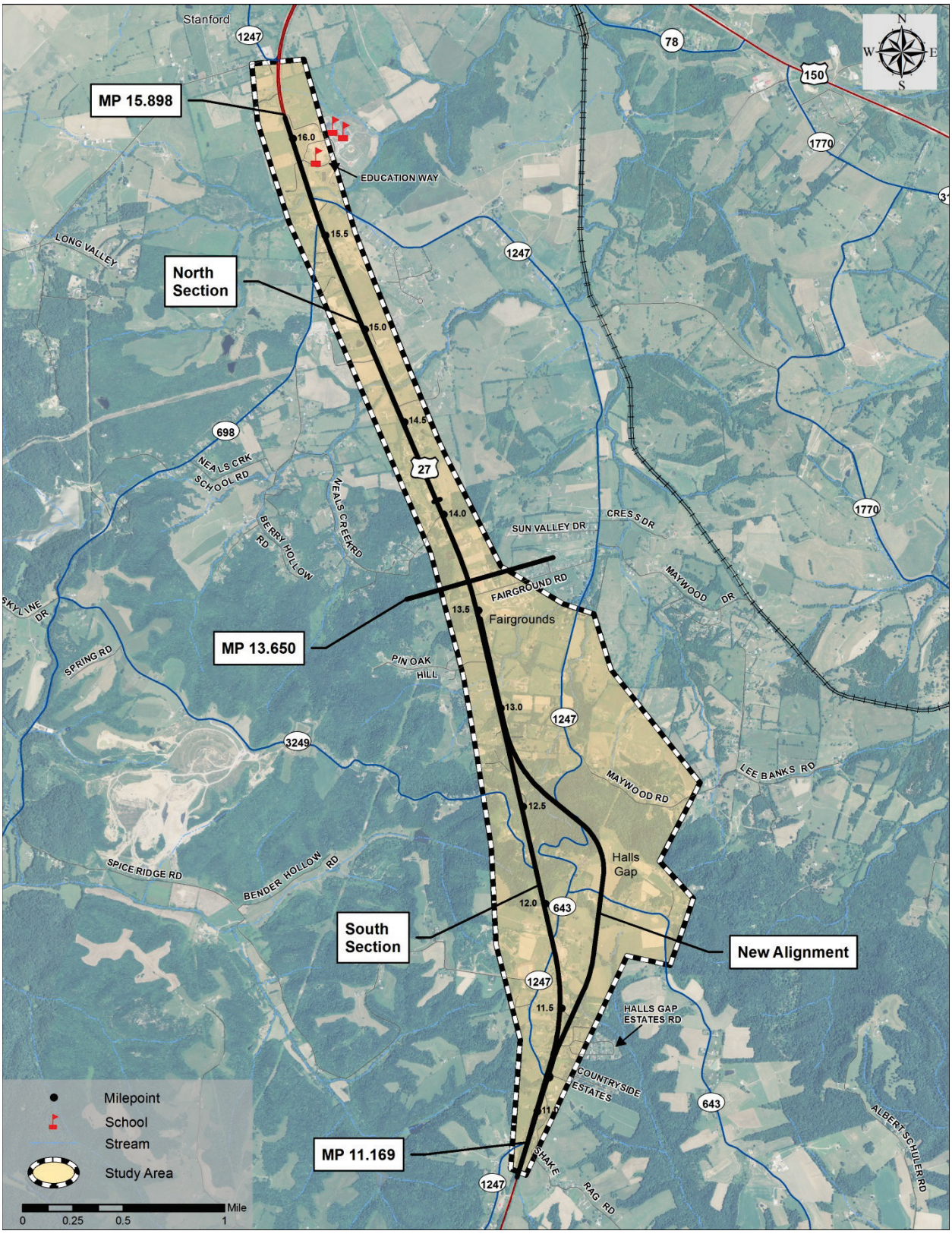


Figure ES 3: Section 1 (South) and Section 2 (North)

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