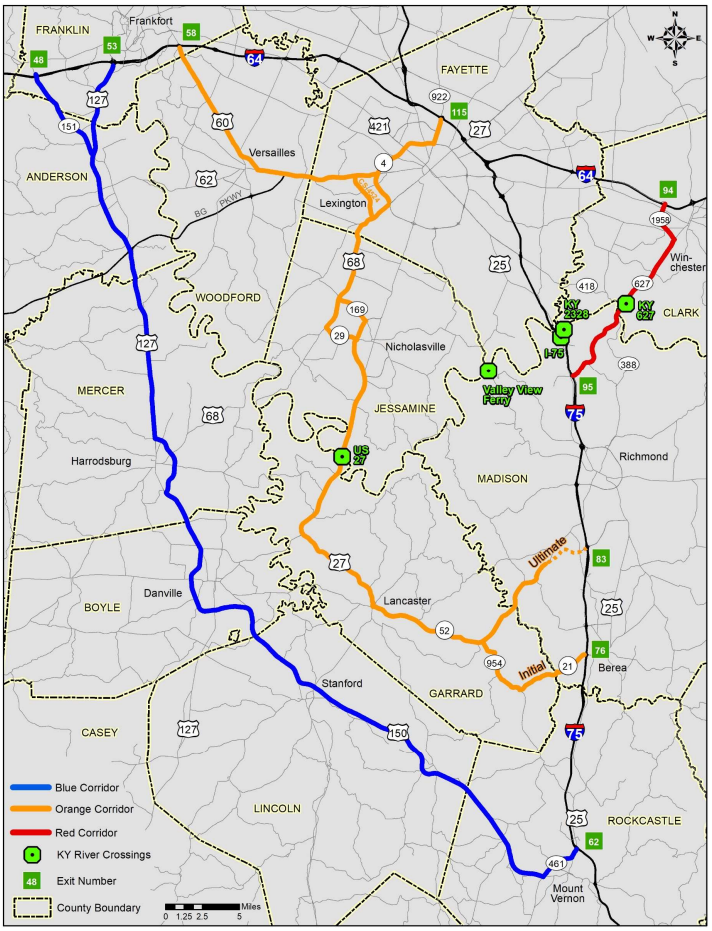
Clays Ferry Bridge Closure Detour Study

KYTC Item No. 7-264
Executive Summary | October 2024



Prepared for

TEAM KENTUCKY®
TRANSPORTATION CABINET

In Partnership with

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EXECUTIVE SUMMARY

Study Background

The Kentucky Transportation Cabinet (KYTC) initiated a planning study in fall 2022 to develop an operational detour plan in the event of a long-term closure of the Clays Ferry Bridge, carrying I-75 over the Kentucky River between Madison and Fayette counties. The structure combines portions of three distinct structures constructed over three different eras. The study was conducted in two phases:

- Phase 1, present day detour options, optimizing operations within the existing network in the event of an unplanned, long-term closure
- Phase 2, representative new alignments for a potential river crossing in the future

Three primary detour corridors were identified for this study (**Figure ES-1**), defined around other regional river-crossing opportunities. **Table ES-1** compares key information for the three detour study corridors. KY 418 (Athens-Boonesboro Road) south of I-75 and the one-lane KY 2328 truss just east (upstream) of the Clays Ferry Bridge are assumed to be closed to thru traffic in any detour scenario.

Table ES-1: Detour Study Corridor Comparison

	Red Corridor	Orange Corridor	Blue Corridor
Southern Terminal	I-75 Exit 95 Madison County	I-75 Exit 76/Berea or I-75 Exit 83/Madison Co	I-75 Exit 62 Mount Vernon
Northern Terminal	I-64 Exit 94 Winchester	I-75 Exit 115/Lexington or I-64 Exit 58/Frankfort	I-64 Exit 53/Frankfort or I-64 Exit 48/ Franklin County
Primary Highways	KY 627, KY 1958	KY 52, US 27, US 68 US 60 or KY 4	US 150, US 127
Length (Interstate)	29 miles/25 min.	32-59 miles/28-50 min.	80-85 miles/65-70 min.
Length (Detour)	15 miles/22 min.	61-80 miles/75-90 min.	75 miles/90 min.
KY River Crossing	KY 627 Two Lanes 8,000 vpd	US 27 Four Lanes 20,000 vpd	N/A

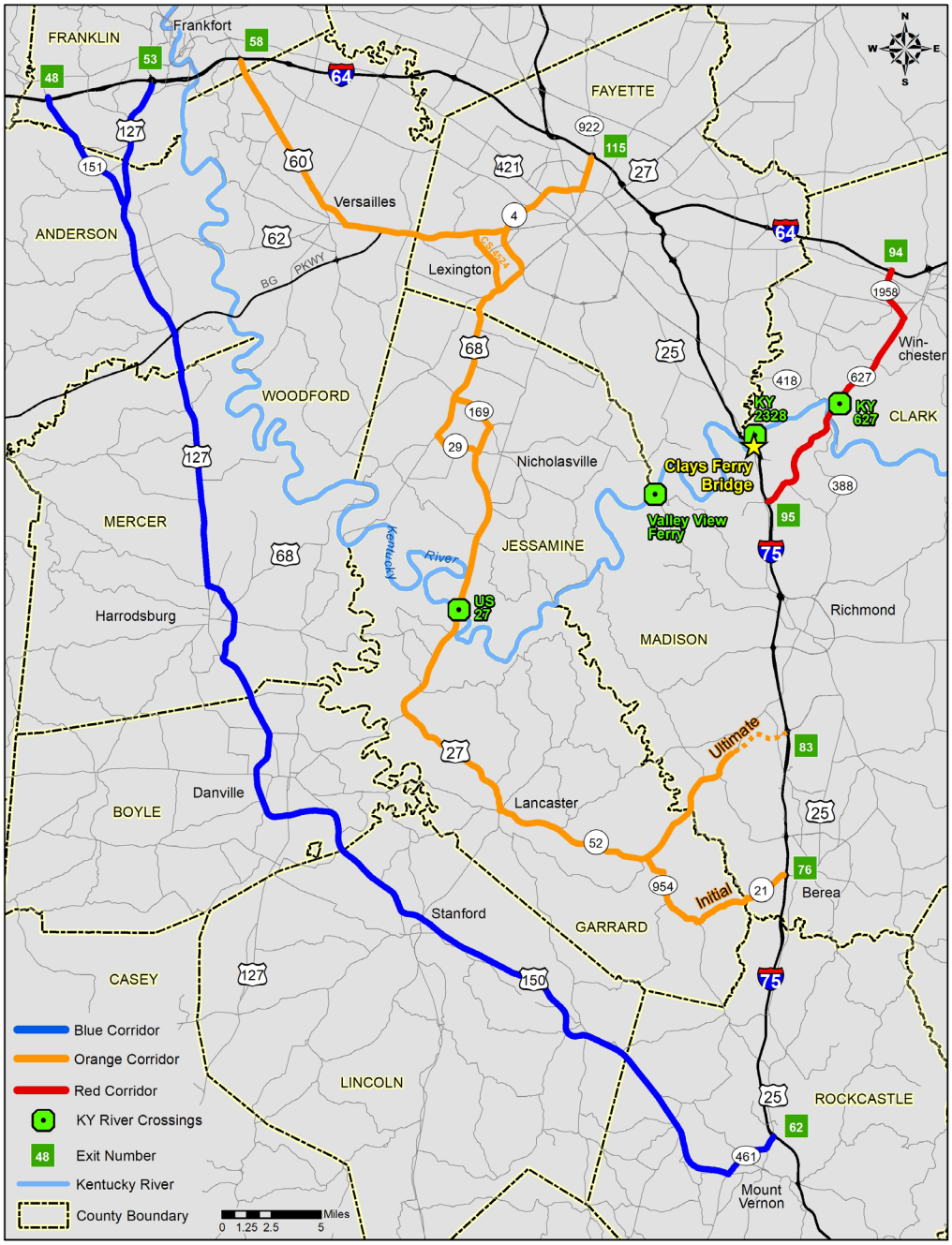

Figure ES-1: Detour Study Corridors

Analysts evaluated existing roadway conditions and traffic trends to understand constraints.

Geometric Constraints. Most detour corridors satisfy KYTC *Highway Design Manual* guidelines for pavement widths, alignment elements, and clearances, with the exceptions shown in **Figure ES-2** and noted below:

A. KY 21 (Paint Lick Road) and KY 954 (Cartersville Road) on the initial Orange routing both have two 10-foot-wide lanes with 1- to 3-foot paved shoulders. This 9.6-mile stretch also contains a high concentration of both steep and curvy sections, associated with rugged terrain and the low volume rural nature of the roadways.

B. Two route options link US 27 to US 68 west of Nicholasville along the Orange detour: KY 29 (Wilmore Road) or KY 169 (Keene Road). Both have two 10-foot-wide lanes with minimal shoulders. KY 29 meets US 27 at a grade-separated interchange, funneling traffic using these legs onto one-lane ramps.

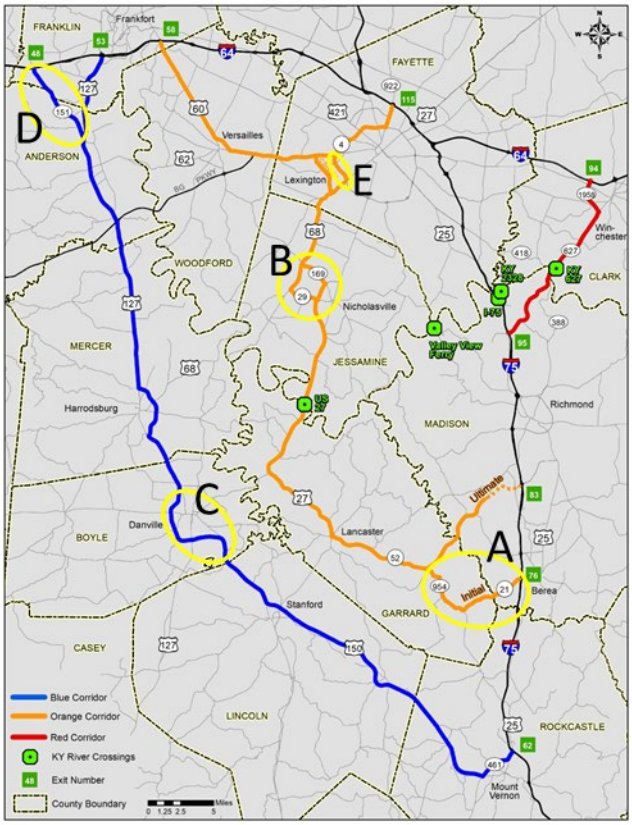

Figure ES-2: Substandard Geometrics

C. Along the Blue detour, US 150 and US 150B in southern Boyle County exhibit 7-9% grades for about two miles in either direction.

D. At the north end of the Blue route, KY 151 has a series of steep grades over its 6-mile length. Aging twin bridges carrying I-64 over KY 151 are being reconstructed concurrent with this study.

E. Two overpasses provide less than 16-foot vertical clearance for the detour corridors, the requirement for interstate routes. However, both are associated with KY 4 (New Circle Road) and routinely serve large truck traffic.

ITS Infrastructure. Several corridors—particularly within the more urban areas—have existing Intelligent Transportation Systems (ITS) infrastructure in place. Current sites with overhead variable message signs (VMS) or traffic cameras are shown in **Figure ES-3**.

Further north and south along I-75, there are also permanent overhead VMS south of Corbin (MP 23), south of London (MP 35), north of Georgetown (MP 127), and five in Boone County between the I-71 and I-275 interchanges.

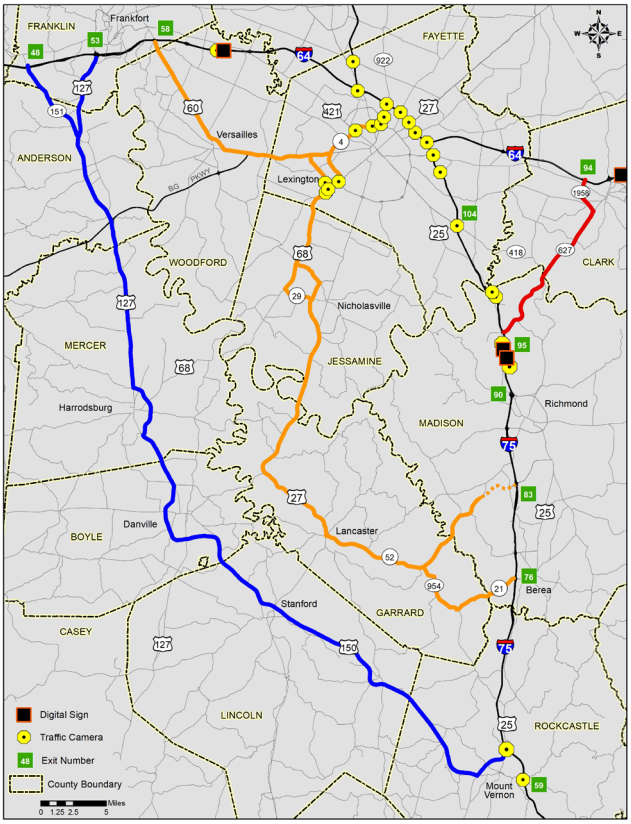

Figure ES-3: Existing ITS Infrastructure

2023 Traffic Flows

Phase I addresses two basic traffic scenarios, both built around existing (year 2023) traffic flows. The "Bridge Open" scenario follows current traffic patterns while the "Bridge Closed" scenario assumes the I-75 Clays Ferry Bridge is closed to traffic, which must divert to other highway links within the network.

An estimated 72,000 vehicles per day (vpd) travel the Clays Ferry Bridge today. About 20% of the daily volume is truck traffic. Hourly distributions show strong directional peaks: northbound in the morning and southbound in the afternoon. Peak hour traffic along the bridge is about 3,500 vehicles per hour (vph) in the AM and 4,000 vph in the PM.

Summarized in **Figure ES-5**, StreetLight™ origin-destination data illustrates the dispersion of Clays Ferry Bridge traffic through the larger interstate system.

- North of the river, 31% of daily Clays Ferry Bridge traffic enters/exits I-75 at Exit 104 (KY 418 Athens-Boonesboro). About 40% of traffic originates from or is heading to locations north or west of the northern I-64/I-75 split. Very few bridge trips use I-64 to/from the east as KY 627 provides a more direct connection.

South of the river, 48% of daily Clays Ferry Bridge trips originate from or are headed to areas south of Richmond, dropping to 31% past Mount Vernon, and 12% beyond Williamsburg.

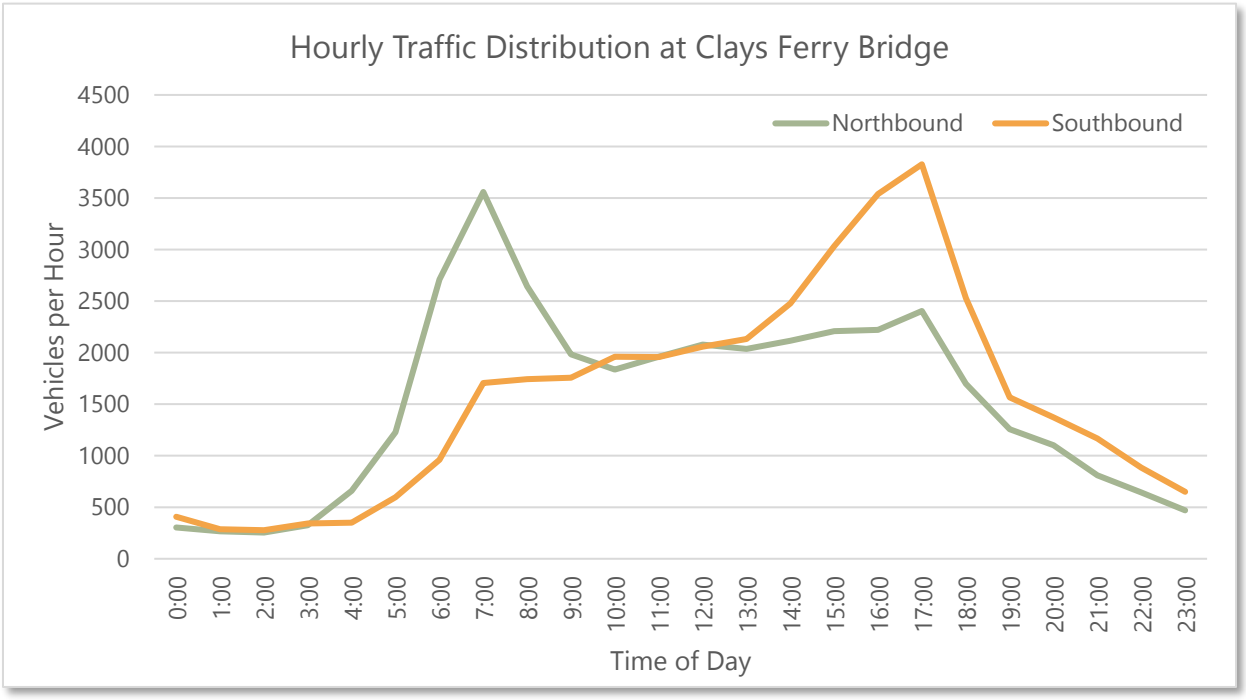

Figure ES-4: Hourly Traffic at Clays Ferry Bridge

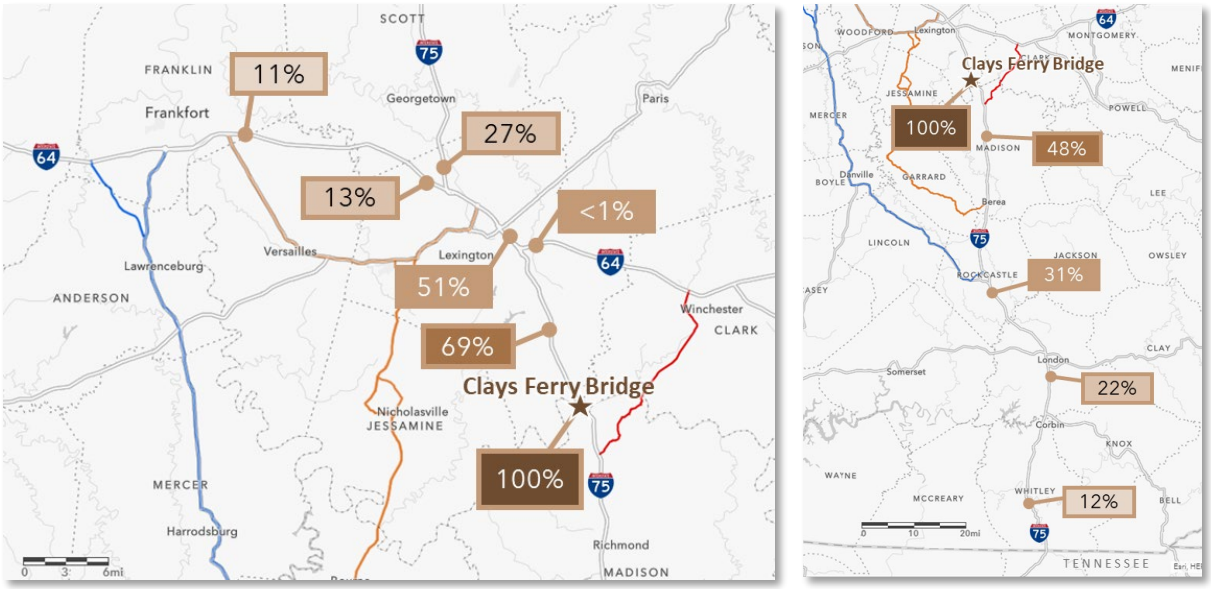

Figure ES-5: Origin-Destination Flows, North (left) and South (right)

Bridge Closed Detour Scenario. To approximate the "Bridge Closed" scenario from 2023 traffic flows, analysts used KYTC's statewide travel demand model to compare current traffic flows against a what-if scenario with both the I-75 and KY 2328 river bridges closed to traffic. KY 418 east of I-75 is also closed to thru trips. Diversion assumptions for the Bridge Closed scenario show:

- 50% of the Clays Ferry Bridge traffic diverting to the Red corridor
- 20% diverting to the Blue corridor
- 15% diverting to the Orange corridor
- 15% eliminated: not making the trip, adjusting the destination to avoid crossing the river, or finding further alternate routes.

To be conservative, the Bridge Closed scenario assumes 10% peak hour truck traffic (except along KY 151 where STAA trucks are prohibited) and does not account for peak period spreading.

Key Bottlenecks. Traffic analyses focused on key bottlenecks—points most likely to constrain capacity along each of the detour study corridors. Bottlenecks can include busy signalized intersections, lane drops, clearance limitations, etc. Intersections closest to corridor termini are a focus since traffic control at either end of the route are likely to carry the highest volumes and help meter flows for the remainder of the routes. There are 7 bottlenecks along the 15-mile Red corridor (6 with signals), 23 along 61- to 80-mile Orange corridor (17 signals), and 19 along the 75-mile Blue corridor (14 signals).

Phase 1 Detours

To accommodate expected increases in traffic during a long-term detour scenario, analysts looked at a series of small-scale and operational improvements at bottleneck locations and at larger communication needs to alert longer-distance trips. Measures were compared against the two most recent Highway Plans, "CHAF" project concepts, and legacy capacity projects in various stages of the project development process.

Project sheets in **Appendix E** provide additional details for recommended concepts to address detour capacity at bottlenecks that are not covered by other ongoing projects.

Red Corridor. The Red corridor follows KY 627, providing a 15-mile link from I-75 in northern Madison County to I-64 at Winchester. It crosses the KY River with a two-lane bridge and is expected to carry up to 2,900 vph more with the Clays Ferry Bridge closed. The shortest available detour option, the travel demand model suggests additional traffic would select this route if additional capacity were available. With the increased detour traffic diverting to Red in the Bridge Closed scenario, all seven bottleneck intersections are well over their current capacity. The US 60/KY 1958 intersection in Winchester carries the highest traffic volumes of bottlenecks along the Red corridor.

A wide range of improvement concepts were considered to improve detour throughput at bottleneck intersections: adding/optimizing signals, major widening, and reconfiguring intersections. Recommended measures include:

Table ES-2: Recommended Improvement Concepts, Red

Improvement Concept	Priority	Cost (DRUC)
2070 controllers/detour timing plans	High	$200,000
Temp. signal, striping, & widening at I-75 Exit 95	Short-Term	$3.8 M
Add northbound left turn lane to quarry	Low	$1.6 M
Add northbound left turn lane to Old Boonesboro Rd	Medium	$1.8 M
KY 627/KY 1958: construct Item No. 7-8401	High	Part of #7-8401
US 60/KY 1958: reconfigure intersection	Further Study	$500,000 Planning only

The team discussed the benefits of widening the corridor to increase capacity; none are recommended.

- A major widening project to create a four-lane highway over the 15-mile route would have relatively high costs and property impacts for a corridor that normally carries 7,000 to 10,000 vpd.
- Hard shoulder running reuses existing pavement but this results in narrower lanes and precludes the common practice to squeeze around a vehicle waiting to turn left by driving on the shoulder.
- A reversible lane system introduces additional costs and complexities, resulting in increased risks for crashes.

Table ES-3 compares before and after volume-to-capacity (v/c) ratios for the northbound and southbound detour moves at the seven bottlenecks along the Red detour, reporting the worst peak hour metric. The worst capacity constraint is at the KY 627/KY 1958 (Winchester Bypass) intersection; proposed improvements as part of the ongoing Item No. 7-8401 project provide substantial improvements compared to the existing configuration.

Table ES-3: Detour v/c along Red, with and without Improvements

ID	Intersection	Bridge Closed /Optimize Signals		Bridge Closed with Build Concepts		
		NB v/c	SB v/c	Concept	NB v/c	SB v/c
R0	SB Ramps @ KY 627	-	1.63	Signal/Dual WBL	-	0.83
R1	NB Ramps @ KY 627	0.76	1.07	-	0.76	1.07
R2	Simpson @ KY 627	1.69	1.69	Thru Lanes	0.86	0.86
R7	KY 1958 @ KY 627	16.57	Free	Bypass Thru Green-T	1.01 1.09	1.02 Free
R8	KY 1958 @ US 60	1.59	2.55	Bowtie MUT Displaced Lefts	1.10 0.96	1.42 1.15
R9	KY 1958 @ EB Ramps	0.61	0.94	-	0.61	0.94
R10	KY 1958 @ WB Ramps	1.18	-	-	1.18	-

Orange Corridor. The Orange corridor stretches between I-75 near Berea and one of two northern endpoints: I-75 at Lexington (61 miles) or I-64 at Frankfort (80 miles). It relies on US 27 to cross the KY River with a four-lane bridge and is expected to carry up to 1,600 vph more traffic with the Clays Ferry Bridge closed. The initial routing for the Orange corridor is assumed to follow KY 21 and KY 954 from the southern Berea interchange (Exit 76) but will shift to the ultimate routing along KY 52 (Duncannon Lane, Exit 83) once an ongoing construction effort completes the connection.

The Orange corridor passes through more urban areas with several signalized intersections at/over capacity today—especially along the south side of Lexington. Adding detour traffic in the Bridge Closed scenario exacerbates congestion. The Orange route was defined to avoid the busy US 27 (Nicholasville Road) corridor between Nicholasville and Lexington; however, US 68 (Harrodsburg Road) and Man O' War Boulevard are also congested during peak periods. While the Orange corridor shown represents the officially signed detour route, multiple routing options paired with personal GPS devices are likely to further disperse traffic than conservatively assumed for this analysis.

A wide range of improvement concepts were considered to improve detour throughput at bottleneck intersections. Recommended measures include:

Table ES-4: Recommended Improvement Concepts, Orange

Improvement Concept	Priority	Cost (DRUC)
Add signal at I-75 Exit 83	High	$350,000
Temp. striping solution at US 27/KY 52 in Lancaster	Short-Term	$350,000
US 27/KY 52: construct Item No. 7-196.2	High	Part of #7-196.2
Add signal at US 27/South Nicholasville Bypass	Medium	$350,000

Improvement Concept	Priority	Cost (DRUC)
Add signal at US 27/KY 29 northbound off-ramp	High	$350,000
US 27/KY 169: construct Items No. 7-458 & 7-459	High	Part of other projects
Extend US 60 northbound lefts onto Man O' War Blvd	Medium	$300,000

Geometric improvements along KY 954 were considered initially, but dismissed as the ultimate detour routing provides an improved typical section. Instead, the initial Orange detour could be signed as inadvisable for truck traffic until the ultimate KY 52 routing is available.

Blue Corridor. The Blue corridor stretches between I-75 at Mount Vernon and one of two northern endpoints along I-64 near Frankfort, for a total detour distance of 75 miles. The route is expected to carry up to 1,400 vph more traffic with the Clays Ferry Bridge closed.

The Blue corridor largely follows the US 127 corridor, which provides a four-lane divided section with bypass alignments around most cities. Several bottleneck intersections are approaching capacity today, but detour v/c ratios are generally lower along Blue than routes and exhibit less substantial changes in the Bridge Closed scenario. Recommended measures include:

Table ES-5: Recommended Improvement Concepts, Blue

Improvement Concept	Priority	Cost (DRUC)
Temp. striping solution at I-75 Exit 62	Short-Term	$250,000
US 25 & KY 461 Major Widening (Items No. 8-8952 & 8-80106)	High	Part of other projects
Danville bypass intersections	Further Study	$500,000 Planning only

The US 150/KY 461 intersection falls within the limits of the Item No. 8-8952 widening project. A traditional signalized intersection is proposed—with dedicated left and right turn lanes on each approach—but lead/lag signal timing, dual turn lanes, or a multi-lane roundabout should be evaluated with project-level traffic forecasts to provide adequate capacity for detour movements.

Detour routing at US 127/KY 151 conservatively assumes 80% of detour traffic will follow the KY 151 approach as it provides a more direct link to I-64 for areas to the west; however, US 127 provides a higher capacity connection and can handle anticipated volumes without intersection improvements evaluated.

Other ITS and Communications Measures. Beyond infrastructure improvements discussed above, another important aspect to manage detour traffic looks at ITS deployments and other communication measures to help manage traffic in real time. The Playbook in **Appendix D** contains recommendations for specific ITS deployments for field personnel.

Recommendations include:

- Messaging on overhead VMS
- Portable roadside message boards, 1-2 miles upstream of each detour route exit
- Additional CCTV installations at detour interchanges and two KY 1958 (Winchester Bypass) intersections to monitor queue lengths
- Real-time routing updates on GOKY.ky.gov
- Coordination with third-party GPS routing apps and FHWA's Work Zone Data Exchange
- Coordination with regional media outlets to rapidly publicize closures

Phase 2 New Cross-River Connections

In December 2023, the project team expand the original scope to examine additional measures to address capacity concerns during a bridge closure—including new cross-river connectors.

A new cross-river connection between I-75 and Jessamine County has been considered several times over the past decades. In 2008, KYTC completed the *US 27 to I-75 Corridor Scoping Study* (Item No. 7-249)[1] to examine a new highway connector from I-75 to US 27 south of Fayette County and north of Richmond. An extensive community engagement effort included meetings with local officials, the public, a Project Working Group, and resource agencies. As in the planning phase, Build options faced vocal opposition from local preservation and conservation advocacy groups. In 2016, the design effort was shelved due to statewide funding shortfalls and public opposition with five alignment options and three design scenarios recommended for future study should a Build concept advance.

Phase 2 of the current study examines a broader region to increase cross-river connection options. These can be organized into four geographic bands, each of which provides unique benefits and faces distinct constraints.

Unless otherwise noted, two typical sections were considered for comparison purposes: 1) 11-foot lanes with 4-foot paved shoulders and 2) 44 feet of full-depth pavement, which could be striped for two to four travel lanes. A 45-mph design speed is assumed as a means to reduce impacts to environmental features and private property.

[1] Online at https://transportation.ky.gov/Planning/Pages/Planning-Studies-and-Reports.aspx

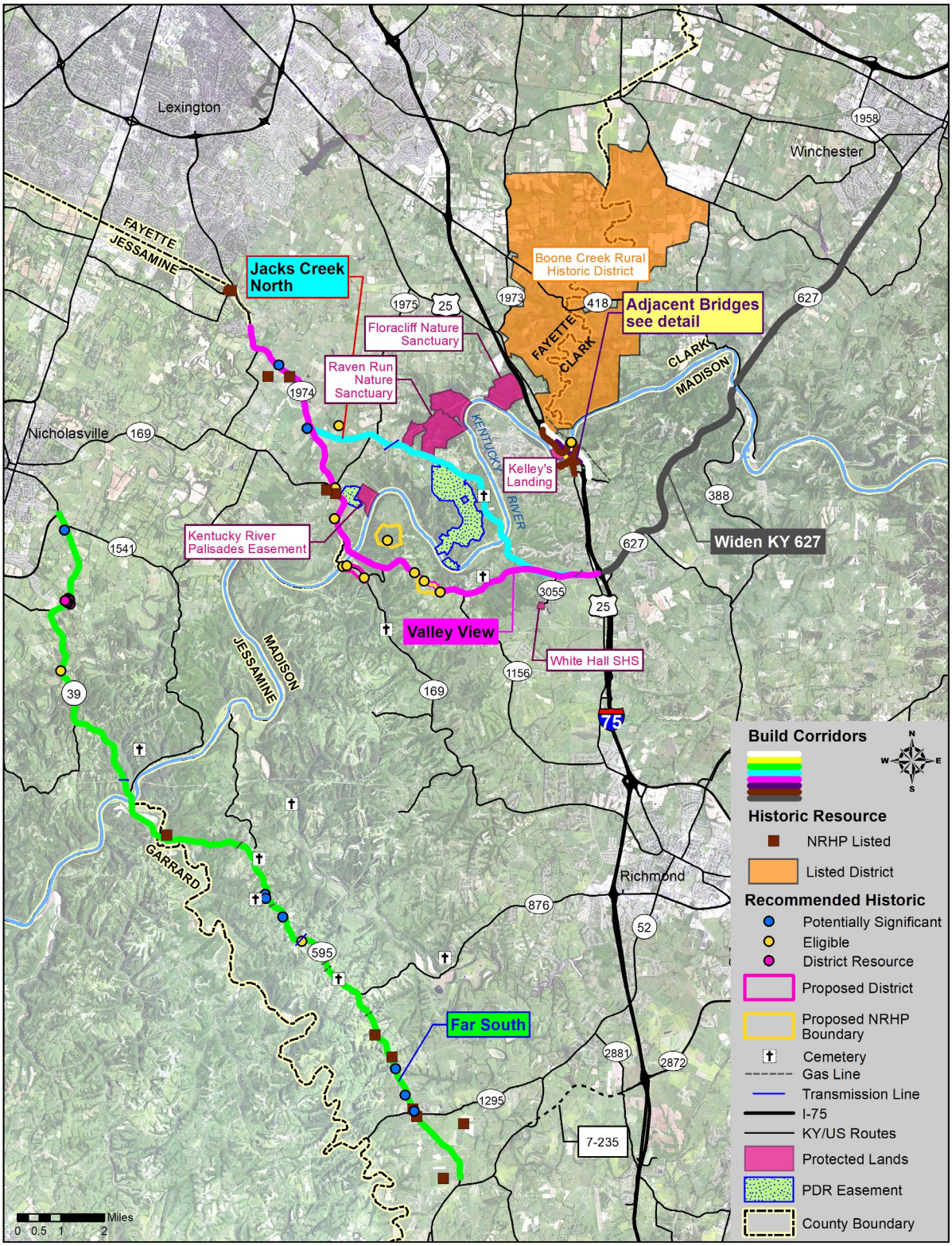

Figure ES-6: Phase 2 Build Concepts

Adjacent Bridges. Four Build concepts run alongside the existing I-75 Clays Ferry Bridge, representing the shortest path and most direct link for detour traffic. New Bridge West (yellow in **Figure ES-6**) and New Bridge East (white) stretch between I-75 Exits 97 and 99, west and east of the existing alignment, respectively. New Bridge Low (brown) follows the existing KY 2328 alignment between Exits 97 and 99, widening shoulders and creating a new two-lane bridge—close in size to the historic truss. The MOT Half Bridge concept creates a new, free-standing three-lane structure just west of the existing bridge with transitions and removable barrier at either end, intended to maintain three lanes of traffic in each direction at 55+ mph should one half of the existing interstate facility be closed. Steep terrain, an adjacent historic district, and a planned park/boat launch constrain the corridor.

With I-75 open to normal traffic, New Bridge East or West would carry minimal traffic in 2045: around 2,000 vpd as the existing interstate provides a more direct, higher speed connection. With the I-75 Clays Ferry Bridge closed, either Adjacent Bridge corridor is constrained by its assumed capacity—up to 25,000 vpd with two lanes or up to 40,000 vpd with four lanes.

Eastern Option. Another Build concept considers major widening for the KY 627 corridor to provide 44 feet of full-depth pavement along the Red detour corridor from Phase 1. With I-75 open, KY 627 carries 7,000-10,000 vpd today; with the I-75 Clays Ferry Bridge closed, the four-lane corridor could divert up to 40,000 vpd.

Central Build Options. A third set of Build concepts stretch between the I-75/KY 627 interchange (Exit 95) and the Fayette/Jessamine county boundary—overlapping part of the 2008 recommended corridor. Shown in cyan in **Figure ES-6**, Jacks Creek North is 11.3 miles long, running along sections of KY 3055 (White Hall Shrine Road), KY 1976 (Jacks Creek Pike), and KY 1974 (Tates Creek Road). Shown in pink, Valley View is 12.5 miles long and runs along sections of KY 3055 (White Hall Shrine Road), KY 1156 (Jacks Creek Road), and KY 1974 (Tates Creek Road).

Moderate in length, these serve relatively high traffic volumes whether the I-75 bridge is open to traffic or closed. This area is rich in natural resources, historic properties, and protected easements—and is likely to garner strong public opposition. Raven Run Nature Sanctuary abuts one of the concepts; large swaths of farmlands are protected in perpetuity via local "Purchase of Development Rights" (PDR) conservation easements.

With I-75 open to normal traffic, either Central Build corridor would carry an estimated 14,500 vpd based on land use and development patterns in the regional "LAMPO" travel demand model. The new link also diverts some traffic from congested facilities: 8,000 vpd shifting from the I-75 Clays Ferry Bridge to the new route and 6,000 vpd from Man O' War Boulevard near Hamburg. With I-75 closed, either corridor is constrained by its assumed capacity—up to 25,000 vpd with two lanes or up to 40,000 vpd with four lanes.

South Connector. The Far South concept (green in **Figure ES-6**) lies near the Madison/Garrard county line and follows existing KY 39 and KY 595 for much of its length. End to end, the concept is 20.7 miles long. It would result in the highest costs and most impacts. The model projects up to 6,100 vpd using the new route with I-75 open to traffic or 11,400 vpd with I-75 closed.

Beyond projected volumes on individual highways, another metric compares cumulative mileage (vehicle-miles traveled or "VMT") and cumulative travel time (vehicle hours traveled or "VHT") across the nine-county model region. Two-lane Build connections have relatively low impacts on everyday traffic volumes, assuming the I-75 Clays Ferry Bridge is open. However, each Build scenario reduces delay compared to the No-Build/Bridge Closed scenario. The central corridors (Jacks Creek North and Valley View) provide the best regional performance of the Bridge Closed scenarios.

Planning-level cost estimates by phase are presented in **Table ES-6** and

Concept	Total Cost	D	R	U	C
Adjacent West	**$85M**	$10M	$3.3M	$1.2M	$70M
Adjacent East	**$115M**	$10M	$3.4M	$1.2M	$100M
Adjacent Low	**$33M**	$2M	$4.5M	$1.9M	$25M
Jacks Creek North	**$160M**	$15M	$13M	$3.7M	$130M
Valley View	**$220M**	$20M	$16M	$5.8M	$180M
Far South	-	-	-	-	$480M*

* Dismissed from further consideration before phased costs estimated

Table ES-7**.** Costs are presented in 2023 dollars. While preliminary design and environmental analyses should consider the full project as a single entity, either of the Central options could be constructed in phases, spreading costs and construction work over multiple years.

Table ES-6: Costs by Phase, 30-foot Typical

Concept	Total Cost	D	R	U	C
Adjacent West	**$85M**	$10M	$3.3M	$1.2M	$70M
Adjacent East	**$115M**	$10M	$3.4M	$1.2M	$100M
Adjacent Low	**$33M**	$2M	$4.5M	$1.9M	$25M
Jacks Creek North	**$160M**	$15M	$13M	$3.7M	$130M
Valley View	**$220M**	$20M	$16M	$5.8M	$180M
Far South	-	-	-	-	$480M*

* Dismissed from further consideration before phased costs estimated

Table ES-7: Costs by Phase, 44-foot Typical

Concept	Total Cost	D	R	U	C
Adjacent West	**$110M**	$10M	$3.3M	$1.2M	$95M
Adjacent East	**$135M**	$10M	$3.4M	$1.2M	$120M
MOT Half Bridge*	**$100M**	$10M	$0.2M	-	$90M
Widen KY 627	**$33M**	$2M	$1.1M	$4.0M	$26M
Jacks Creek North	**$190M**	$15M	$13M	$3.7M	$160M
Valley View	**$260M**	$20M	$16M	$5.8M	$220M

* Assumes 48-foot width across bridge

Planning-level estimates shown are conservative, but larger projects on longer implementation timelines are likely to escalate. Based on the scale of the Phase 2 corridors and likelihood to encounter public opposition, the timeline to implement a future project is inherently uncertain. Risks abound at each stage of the project development process, with each layer of complexity potentially extending schedules and escalating costs.