



# **KY 9 Scoping Study**

**KTYC Item No. 6-448.00**

**FINAL REPORT**

**Campbell County, Kentucky**

**July 2022**



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Kentucky Transportation Cabinet

In partnership with:  
HMB Professional Engineers, Inc.



In association with:  
Qk4  
Corn Island Archaeology





# KY 9 Scoping Study

## KYTC Item No. 6-448.00

**FINAL EXECUTIVE SUMMARY**

**Campbell County, Kentucky**

**July 2022**



# Executive Summary

The KY 9 Scoping Study was initiated in 2021 by the Kentucky Transportation Cabinet (KYTC) to evaluate potential improvement options to address safety and operational performance in the vicinity of the KY 9 and I-275 interchange in Wilder, KY. As part of the study, improvement options were developed to address identified issues. They were further evaluated in terms of performance and cost to determine priority. The study was conducted in coordination with KYTC, the Ohio – Kentucky – Indiana Regional Council of Governments (OKI), and the Northern Kentucky Area Development District (NKADD).

Illustrated in **Figure ES-1**, the study area includes KY 9 from MP 16.5 (KY 1998/Pooles Creek Road) to MP 18.2 (Hampton Lane) and I-275 from MP 76.8 to 77.6. A total of eight intersections are included in the study area.

The objective of the KY 9 Scoping Study was to evaluate transportation needs related to safety and congestion in the vicinity of the I-275 interchange with KY 9 and to identify and prioritize any proposed improvement options. To accomplish this objective, study goals include the following:

- Identify Locations for Possible Projects Through Safety and Traffic Analysis
- Develop / Evaluate Improvement Options
- Prioritize a List of Short- and Long-Term Improvement Options

Based on the detailed traffic and crash analysis, roadway deficiencies, and consultation with the project team, a preliminary list of potential improvement options were developed and presented at Project Team Meeting #1 on May 26, 2021. Representatives included KYTC Division of Planning staff, KYTC District 6 staff, NKADD staff, OKI staff, and the consultant team. Study information was shared through use of an ArcGIS StoryMap including the study area, objective and goals, schedule, existing traffic conditions, crash analysis, environmental conditions, and high-level improvement options.

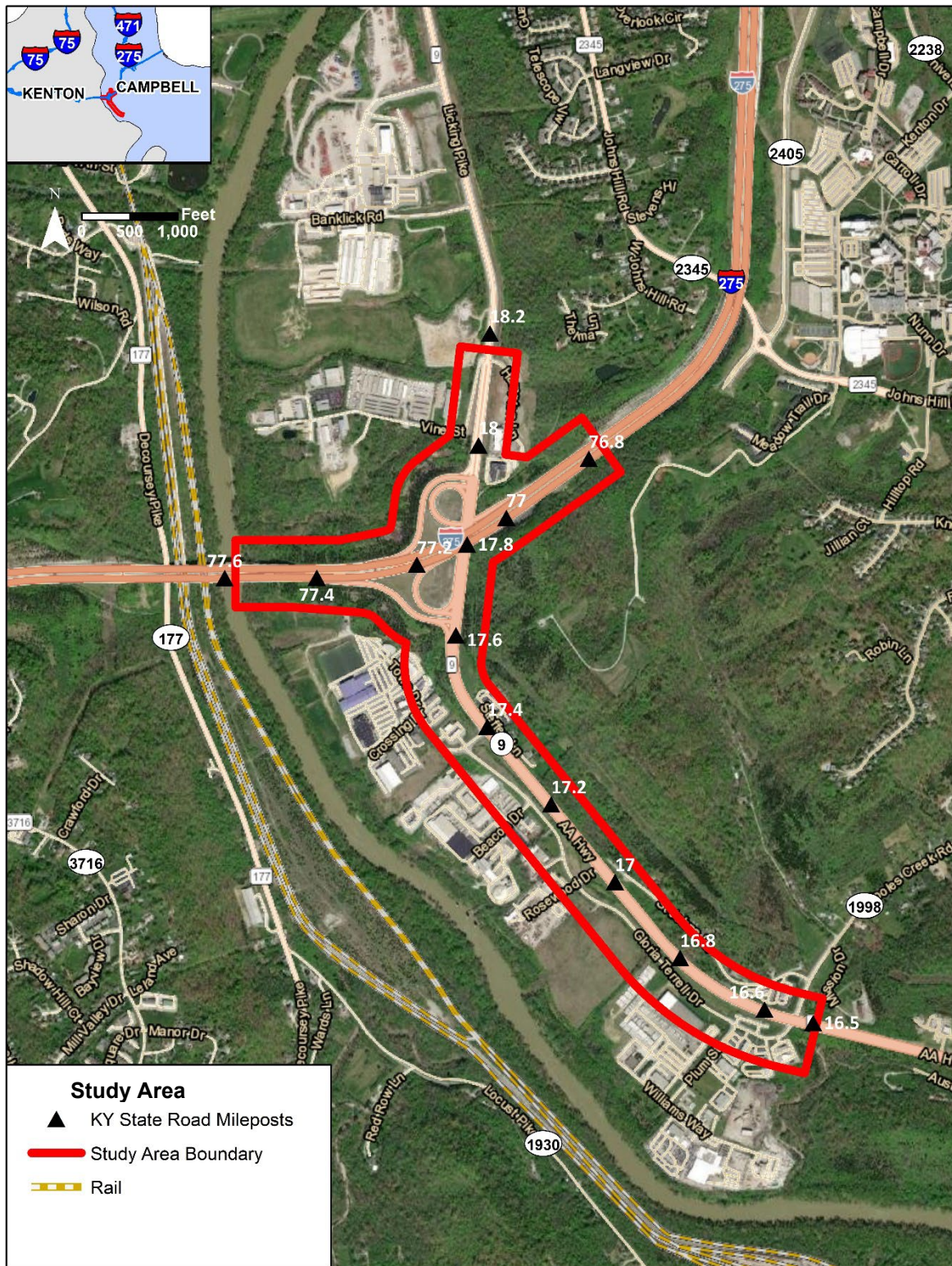
With feedback from the project team on the initial list of possible improvement options, the next step was to further refine the list. Sixteen improvement options were developed at varying levels of detail. The primary goal of this preliminary analysis was to analyze each option to determine overall feasibility and determine if more detailed analysis was warranted. Considerations included traffic analysis, geometric design, and environmental impacts.

The second Project Team meeting was held on September 29, 2021. The consultant team updated the ArcGIS StoryMap, which included updated traffic analysis and improvement options. KYTC provided valuable input on each of the improvement options and made suggestions for additional modifications. Utilizing the project team input, the number of improvement options was reduced from sixteen to eleven for detailed consideration. This process included modifying and consolidating multiple initial improvement options.

For each of the eleven improvement options, a conceptual design was completed, traffic analysis was conducted for the future year 2045, planning-level cost estimates were developed and refined, and a high-level benefit-cost analysis was completed.



Figure ES-1. Study Area



The emphasis for this study was improving safety and operational performance of the I-275 / KY 9 interchange. The benefit-cost analysis focused on identifying the traffic benefits and comparing to the investment cost to determine a benefit-cost ratio. To translate the traffic benefits associated with an improvement, travel time savings were calculated for each improvement option based on the 2045 No Build and Build VISSIM-derived average delay per vehicle. This was translated to a 20-year travel savings and compared to total capital cost yielding a benefit-cost ratio.

The KY 9 Scoping Study resulted in a range of conceptual improvements for future consideration. Improvement options primarily focused on addressing four areas where congestion and safety concerns were identified through examination of documented crash records and traffic analysis. Utilizing additional tools including operations analysis, traffic forecasting, and project team input, four improvement options were prioritized. Seven other improvement options were considered but not recommended at this time and more information can be found in Sections 4.4 and 4.5. The prioritization is broken down by the following categories:

- **Short-Term** projects include those that are relatively low-cost and have minimal impacts. Due to their cost, these projects may still need to go through the SHIFT process to be constructed.
- **Long-Term** projects are higher-cost and may have additional impacts. While they are anticipated to take longer to fund and construct, they will help to meet the future transportation needs of the KY 9 and I-275 corridors in terms of operations and safety. These projects would go through the SHIFT process to be constructed.

**Table ES-1** lists the recommended improvement options, total project costs, benefit-cost ratio, and priority as assigned by the project team.

At this time, no additional funding is programmed to further study this interchange or for future phases of specific improvement options presented in this study. Improvement Options 1 and 5C are proposed as short-term options. It should be noted that Improvement Option 5C includes all components of Option 5A; therefore, both are not required to be completed. Improvement Option 3A is recommended as a long-term option.

The next phase in the project development process is Preliminary Engineering and Environmental Analysis (commonly referred to as Phase I Design). If federal funds are used and/or permits will be required, additional environmental analyses will be needed to satisfy the National Environmental Policy Act (NEPA). Improvement options will need to be incorporated into OKI's Metropolitan Transportation Plan and Transportation Improvement Program (TIP), and KYTC's Statewide Transportation Improvement Plan (STIP). Furthermore, Improvement Option 3A would require an Interchange Modification Report (IMR) to analyze the impacts to the interstate in more detail. This would include analyzing each interchange east and west of the KY 9 interchange.

The Improvement Options recommended for further development are detailed in **Figures ES-2, ES-3, ES-4, and ES-5**.



**Table ES-1. Recommended Improvement Options**

Improvement Option	Description	Total Project Cost (DRUC*)	Priority
Option 1	Extend Left Turn Lane for I-275 Westbound Ramp from KY 9 Northbound.	\$ 3,070,000	Short-Term
Option 3A	Flyover Ramp with Separated Movement Starting North of I-275 Bridge over KY 9. Provide Dual Lane Entry Onto I-275.	\$ 46,260,000	Long-Term
Option 5A	Provide Three KY 9 Southbound Lanes between Eastbound Ramps and just south of Town Drive. No Lane Drop at I-275 Eastbound Exit Ramp for KY 9 Southbound, Additional Continuous Lane from I-275 Eastbound Exit Ramp to Town Drive and Extend the Extra Lane past Town Drive.	\$ 5,560,000	Short-Term
Option 5C	Improvement Option 5A Plus: Remove Town Drive Signal, Convert Town Drive and Steffen Lane to Right-In / Right-Out. Permit U-Turns south of Town Drive and at the I-275 Eastbound Ramp intersection. Realign Rosewood Drive and Gloria Terrell Drive Intersection and Provide Dual Lefts from Rosewood Drive onto KY 9.	\$ 6,440,000	Short-Term

\*DRUC – Design, Right-of-Way, Utilities, Construction in 2021 Dollars

**Figure ES-2. Improvement Option 1 – Extend Northbound Left Turn Lane on KY 9**


LOCATION INFORMATION												
<p><b>Location</b></p> <p>County: Campbell</p> <p>Route: KY 9 (MP:17.6 to 18.0)</p> <p>Northbound KY 9 to I-275 Westbound</p>		<div>1</div>										
EXISTING CONDITIONS												
<p><b>Existing Features</b></p> <ul style="list-style-type: none"><li>• 170' of storage for existing left turn lane</li><li>• 12' lane widths and outside paved shoulder width of 10' along KY 9</li><li>• I-275 - 65 mph; KY 9 - 45 mph to the south, 55 mph to the north</li></ul> <p><b>Issues</b></p> <p>The left turn from KY 9 to the on-ramp for westbound I-275 is a heavy turning movement. Currently, there is a large concentration of rear end crashes between the ramp intersections on KY 9 in the northbound direction where queue spillover occurs. There were 107 northbound crashes between the ramp intersections and 91% were rear end crashes, while 6% were sideswipes.</p>	<p><b>TRAFFIC DATA</b></p> <p>KY 9 No Build (AADT):</p> <p>2021: 24,400</p> <p>2045: 31,000</p> <p><b>CRASH DATA</b></p> <p>KY 9 NB Crashes:</p> <p>Total: 107</p> <p>Rear End: 97</p> <p>Serious Injury: 1</p>											
IMPROVEMENT CONCEPT												
<p><b>Description</b></p> <p>Improve left turn onto I-275 westbound on-ramp by converting left most thru lane to a left turn lane. Existing two thru lanes will be maintained by developing another lane right of the existing lanes. In the short-term, extending the left turn storage should reduce queue spillback into the KY 9 northbound thru lanes and provide a safety benefit. Possible constraints with this option are the utilities below the northbound shoulder on KY 9 and future capacity constraints.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"><li>• AM Peak: 54 sec/veh delay reduction / 5.5 mph speed increase</li><li>• PM Peak: 17 sec/veh delay reduction / 0.9 mph speed increase</li></ul>	<p><b>COST ESTIMATE</b></p> <p>2021 Dollars</p> <table><tr><td>Design:</td><td>\$230,000</td></tr><tr><td>ROW:</td><td>\$100,000</td></tr><tr><td>Utilities:</td><td>\$500,000</td></tr><tr><td>Const.:</td><td>\$2,240,000</td></tr><tr><td>Total:</td><td>\$3,070,000</td></tr></table> <p><b>BENEFIT-COST RATIO</b></p> <p>2.9</p> <p><b>PROJECT PRIORITY</b></p> <p>Short-Term</p>	Design:	\$230,000	ROW:	\$100,000	Utilities:	\$500,000	Const.:	\$2,240,000	Total:	\$3,070,000	
Design:	\$230,000											
ROW:	\$100,000											
Utilities:	\$500,000											
Const.:	\$2,240,000											
Total:	\$3,070,000											

Figure ES-2. Improvement Option 1 – Extend Northbound Left Turn Lane on KY 9 (continued)





**Figure ES-3. Improvement Option 3A – Flyover Ramp to I-275 WB On-Ramp (Dual Lane Entry)**



LOCATION INFORMATION		
<p><b>Location</b></p> <p>County: Campbell</p> <p>Route: I-275 (MP 77.2 to 77.9); I-275 Ramp (MP: 0.0 to 0.3); KY 9: (MP 17.4 to 18.0)</p> <p>Northbound KY 9 to I-275 Westbound</p>		
EXISTING CONDITIONS		
<p><b>Existing Features</b></p> <ul style="list-style-type: none"> <li>• 170' of storage for existing left turn lane</li> <li>• 12' lane widths and outside paved shoulder width of 10' along KY 9</li> <li>• I-275 - 65 mph; KY 9 - 45 mph to the south, 55 mph to the north</li> </ul> <p><b>Issues</b></p> <p>The left turn from KY 9 to the on-ramp for westbound I-275 is a heavy turning movement. Currently, there is a large concentration of rear end crashes between the ramp intersections on KY 9 in the northbound direction where queue spillover occurs. There were 107 crashes between the ramp intersections and 91% were rear end crashes, while 6% were sideswipes. 39 crashes occurred at I-275 ramp merge with mainline with 21% being sideswipes.</p>	<p><b>TRAFFIC DATA</b></p> <p>KY 9 No Build (AADT):</p> <p>2021: 24,400</p> <p>2045: 31,000</p> <p><b>CRASH DATA</b></p> <p>KY 9 NB Crashes:</p> <p>Total: 107</p> <p>Rear End: 97</p> <p>KY 9/I-275 WB Ramp: 2 Fatalities</p>	
IMPROVEMENT CONCEPT		
<p><b>Description</b></p> <p>Relocate left turn for I-275 westbound on-ramp by separating movement at the KY 9 and I-275 eastbound ramps intersection and bridging over KY 9 to tie into the existing I-275 westbound on-ramp. A dual lane entry to I-275 would be provided which will address the short ramp acceleration length. Removing the left turn traffic from KY 9 would provide a safety benefit at the intersection. Constraints with this option are the utilities under the northbound KY 9 shoulder and the impact to the Licking River Bridge due to the dual lane entry. A design exception would be required for the entry curve for the flyover bridge which has a 30 mph design speed. The entry curve to the interstate is a 50 mph curve. The new ramp will require significant fill increasing overall cost.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"> <li>• AM Peak: 83 sec/veh delay reduction / 11.5 mph speed increase</li> <li>• PM Peak: 67 sec/veh delay reduction / 7.0 mph speed increase</li> </ul>	<p><b>COST ESTIMATE</b></p> <p>2021 Dollars</p> <p>Design: \$4,050,000</p> <p>ROW: \$250,000</p> <p>Utilities: \$1,500,000</p> <p>Const.: \$40,460,000</p> <p>Total: \$46,260,000</p> <p><b>BENEFIT-COST RATIO</b></p> <p>0.4</p> <p><b>PROJECT PRIORITY</b></p> <p>Long-Term</p>	



Figure ES-3. Improvement Option 3A – Flyover Ramp to I-275 WB On-Ramp (Dual Lane Entry)  
(continued)





**Figure ES-4. Improvement Option 5A – Third Southbound Lane on KY 9**

LOCATION INFORMATION											
<p><b>Location</b></p> <p>County: Campbell</p> <p>Route: KY 9 (MP: 17.1 to 17.6)</p> <p>KY 9 Southbound at I-275 Eastbound Off-Ramp</p>											
EXISTING CONDITIONS											
<p><b>KY 9 Existing Features</b></p> <ul style="list-style-type: none"><li>Two lanes each direction with mountable median</li><li>12' lane width; 10' outside paved shoulder width</li><li>45 mph Posted Speed Limit</li></ul> <p><b>Issues</b></p> <p>At the I-275 EB off-ramp, KY 9 drops to a single lane while the channelized right turn from the ramp merges with KY 9 reforming two southbound lanes. This lane drop results in a lane imbalance for the southbound direction and is observable at both the eastbound and westbound ramp intersections. 16 southbound crashes occur at the ramp merge with KY 9 and 12 are sideswipe crashes. Existing LOS during the PM Peak is D, F, and E at the KY 9 intersections with Town Drive, I-275 Eastbound Ramps, and I-275 Westbound Ramps, respectively.</p>	<p><b>TRAFFIC DATA</b></p> <p>KY 9 No Build (AADT):</p> <p>2021: 24,400</p> <p>2045: 31,000</p> <p><b>CRASH DATA</b></p> <p>KY 9 SB Crashes at Ramp Merge:</p> <p>Total: 16</p> <p>Sideswipe: 12</p> <p>Fatality: 1</p>										
IMPROVEMENT CONCEPT											
<p><b>Description</b></p> <p>Keep both southbound lanes on KY 9 at the I-275 eastbound of-ramp and add another lane for ramp traffic. Tie in the channelized right turn from the I-275 ramp as a third lane. All three lanes will extend past Town Drive and be dropped before Rosewood Drive. Significant fill is needed along KY 9. It is recommended to be rock rill in order to achieve a 2:1 slope and minimize ROW impacts to businesses along Town Drive. Removing the lane drop at the intersection would improve the lane utilization and improve safety, specifically the high percentage of sideswipe crashes.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"><li>AM Peak: 8 sec/veh delay increase / 0.6 mph speed reduction</li><li>PM Peak: 121 sec/veh delay reduction / 8.9 mph delay increase</li></ul>	<p><b>COST ESTIMATE</b></p> <p>2021 Dollars</p> <table><tr><td>Design:</td><td>\$350,000</td></tr><tr><td>ROW:</td><td>\$250,000</td></tr><tr><td>Utilities:</td><td>\$1,500,000</td></tr><tr><td>Const.:</td><td>\$3,460,000</td></tr><tr><td>Total:</td><td>\$5,560,000</td></tr></table> <p><b>BENEFIT-COST RATIO</b></p> <p>3.3</p> <p><b>PROJECT PRIORITY</b></p> <p>Short Term</p>	Design:	\$350,000	ROW:	\$250,000	Utilities:	\$1,500,000	Const.:	\$3,460,000	Total:	\$5,560,000
Design:	\$350,000										
ROW:	\$250,000										
Utilities:	\$1,500,000										
Const.:	\$3,460,000										
Total:	\$5,560,000										

Figure ES-4. Improvement Option 5A – Third Southbound Lane on KY 9 (continued)





**Figure ES-5. Improvement Option 5C – Widen KY 9 and Convert Town Drive and Steffen Lane to a Right-In/Right-Out**

LOCATION INFORMATION		
<p><b>Location</b> County: Campbell Route: KY 9; Town Drive; Steffen Lane MP: 17.05 to 17.60</p> <p>KY 9 Southbound at I-275 Eastbound Off- Ramp and Town Drive</p>		
EXISTING CONDITIONS		
<p><b>Town Drive Existing Features</b></p> <ul style="list-style-type: none"> <li>• Four lanes at KY 9</li> <li>• 12' lane width</li> <li>• No paved shoulder width</li> <li>• 20 mph Posted Speed Limit</li> <li>• Two lanes south of intersection</li> </ul>	<p><b>KY 9 Existing Features</b></p> <ul style="list-style-type: none"> <li>• Two lanes each direction with mount-able median</li> <li>• 12' lane width; 10' outside paved shoulder width</li> <li>• 45 mph Posted Speed Limit</li> </ul>	<p><b>TRAFFIC DATA</b> KY 9 No Build (AADT): 2021: 24,400 2045: 31,000</p> <p><b>CRASH DATA</b> KY 9 Crashes at Town Drive Total: 101 Rear End: 73 Angle: 12 Severe Injury: 1</p>
<p><b>Issues</b> The lane drop along KY 9 and the proximity of the Town Drive intersection to the I-275 Eastbound Ramps results in congestion and safety concerns. LOS at Town Drive is currently D in the PM Peak. Systemwide delay is worse during the PM Peak, when traffic is predominantly heading southbound on KY 9. It is currently 122 sec/veh and expected nearly double to 208 sec/veh by 2045. Over 100 crashes were identified near the Town Drive intersection, with 72% being rear end crashes and 21% being either angle or sideswipe crashes.</p>		
IMPROVEMENT CONCEPT		
<p><b>Description</b> Keep both southbound lanes on KY 9 at the I-275 eastbound off-ramp and add another lane for ramp traffic. Tie in the channelized right turn from the I-275 ramp as a third lane. Convert Town Drive and Steffen Lane to a right-in / right-out and provide a U-turn loon for both directions of KY 9 traffic. A crash reduction would be anticipated from the removal of the signal at Town Drive. Reconfigure the Gloria Terrell Drive/Rosewood Drive intersection. Significant fill is needed along KY 9. It is recommended to be rock fill in order to achieve a 2:1 slope and minimize ROW impacts to businesses along Town Drive.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"> <li>• AM Peak: 33 sec/veh delay increase / 2.4 mph speed reduction</li> <li>• PM Peak: 144 sec/veh delay reduction / 12.3 mph speed increase</li> </ul>	<p><b>COST ESTIMATE</b> 2021 Dollars</p> <p>Design: \$430,000 ROW: \$250,000 Utilities: \$1,500,000 Const.: \$4,260,000 Total: \$6,440,000</p> <p><b>BENEFIT-COST RATIO</b> 3.0</p> <p><b>PROJECT PRIORITY</b> Short-Term</p>	

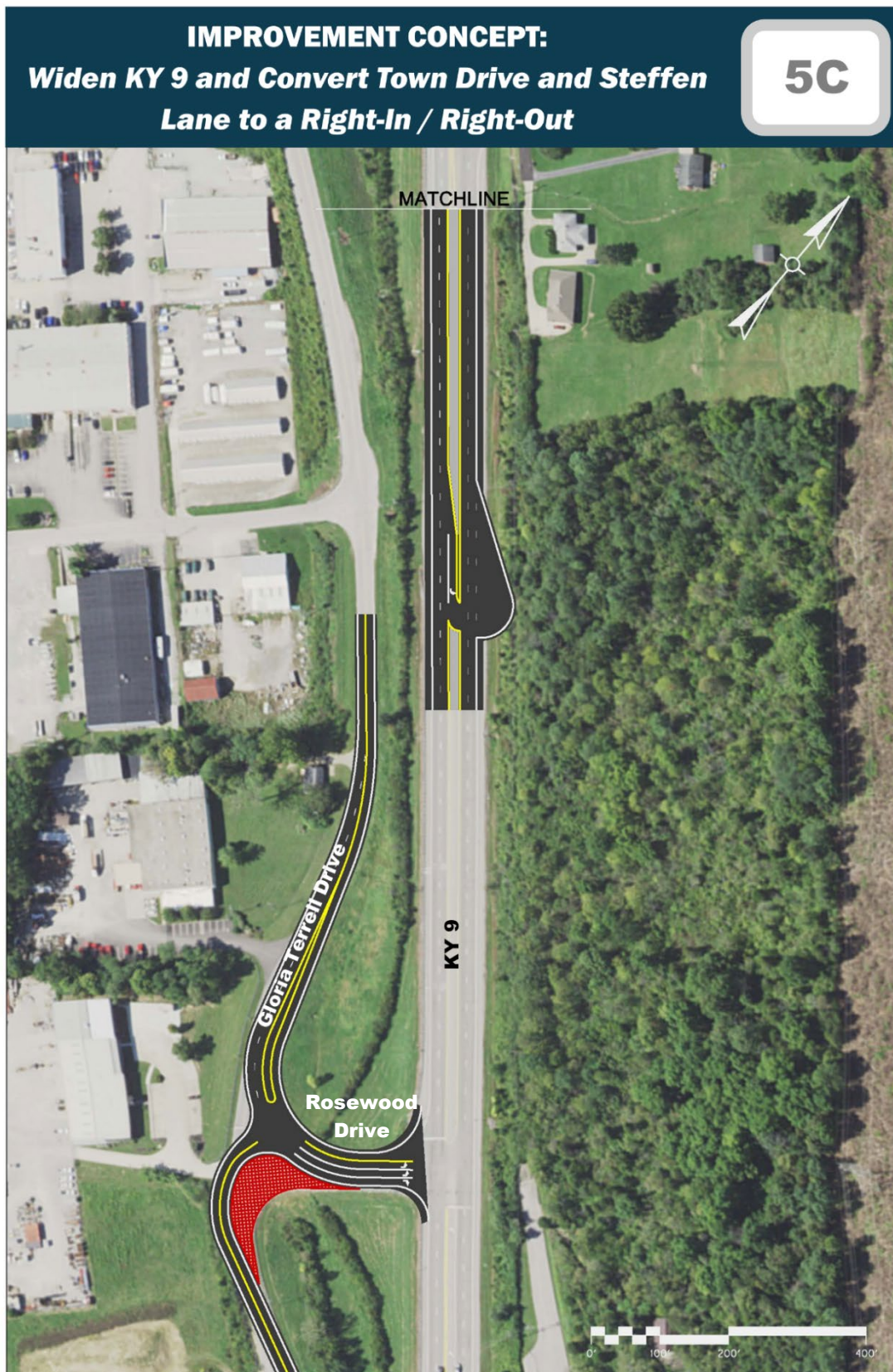


Figure ES-5. Improvement Option 5C – Widen KY 9 and Convert Town Drive and Steffen Lane to a Right-In/Right-Out (continued)





Figure ES-5. Improvement Option 5C – Widen KY 9 and Convert Town Drive and Steffen Lane to a Right-In/Right-Out (continued)



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## Abbreviations and Descriptions

<b>USDOT</b>	United States Department of Transportation
<b>KYTC</b>	Kentucky Transportation Cabinet
<b>FWHA</b>	Federal Highway Administration
<b>KTC</b>	Kentucky Transportation Center
<b>OKI</b>	Ohio Kentucky Indiana (OKI) Regional Council of Governments
<b>NKADD</b>	Northern Kentucky Area Development District
<b>TIP</b>	Transportation Improvement Program
<b>STIP</b>	Statewide Transportation Improvement Plan
<b>FY</b>	Fiscal Year
<b>CHAF</b>	Continuous Highway Analysis Framework
<b>SHIFT</b>	Strategic Highway Investment Formula for Tomorrow
<b>MP</b>	Mileposts / Milepoints
<b>HIS</b>	Highway Information System
<b>NBI</b>	National Bridge Inventory
<b>TANK</b>	Transit Authority of Northern Kentucky
<b>NHS</b>	National Highway System
<b>KHFN</b>	Kentucky Highway Freight Network
<b>PFN</b>	Primary Freight Network
<b>NN</b>	National Truck Network
<b>STAA</b>	Surface Transportation Assistance Act of 1982
<b>AASHTO</b>	American Association of State Highway and Transportation Officials
<b>NBI</b>	National Bridge Inventory
<b>No Build</b>	Traffic Conditions without Improvements
<b>AADT</b>	Annual Average Daily Traffic
<b>AADTT</b>	Annual Average Daily Truck Traffic
<b>T %</b>	Truck Percentage
<b>K %</b>	Design Hour Factor
<b>D %</b>	Directional Factor
<b>DHV</b>	Design Hourly Volume
<b>DHVT</b>	Design Hourly Truck Volume
<b>LOS</b>	Level of Service
<b>TMC</b>	Turning Movement Count
<b>HCM</b>	Highway Capacity Manual
<b>VHT</b>	Vehicle-Hours Traveled
<b>TWLTL</b>	Two-Way Left Turn Lane
<b>VISSIM</b>	Traffic simulation software that simulates modes of traffic and analyzes their interactions
<b>HSM</b>	Highway Safety Manual
<b>KSP</b>	Kentucky State Police
<b>CDAT</b>	Crash Data Analysis Tool
<b>SPF</b>	Safety Performance Function
<b>LOSS</b>	Level of Service of Safety
<b>EEC</b>	Excess Expected Crashes
<b>KABCO</b>	Crash Injury Severity Scale
<b>B/C</b>	Benefit-Cost Ratio
<b>NEPA</b>	National Environmental Protection Act
<b>USGS</b>	United States Geological Survey
<b>GQ</b>	Geologic Quadrangle
<b>HUC</b>	Hydrologic Unit Code
<b>KDOW</b>	Kentucky Division of Water
<b>FEMA</b>	Federal Emergency Management Agency
<b>NWI</b>	National Wetland Inventory
<b>KGS</b>	Kentucky Geological Survey
<b>USFWS</b>	U.S. Fish and Wildlife Service
<b>T&amp;E</b>	Threatened and Endangered species
<b>EPA</b>	U.S. Environmental Protection Agency

<b>NAAQS</b>	National Ambient Air Quality Standards
<b>KHC</b>	Kentucky Heritage Council
<b>OSA</b>	Office of State Archaeology
<b>NRHP</b>	National Register of Historic Places
<b>GIS</b>	Geographic Information System



# Chapter 1 – Introduction

The KY 9 Scoping Study was initiated in 2021 by the Kentucky Transportation Cabinet (KYTC) to evaluate potential improvement options to address safety and operational performance in the vicinity of the KY 9 and I-275 interchange in Wilder, KY. The potential improvement options were further evaluated in terms of performance and cost to determine priority.

The study was conducted in coordination with KYTC, Ohio-Kentucky-Indiana Regional Council of Governments (OKI), and the Northern Kentucky Area Development District (NKADD). These entities, along with the consultant team, made up the project team for this study.

## 1.1 Study Area

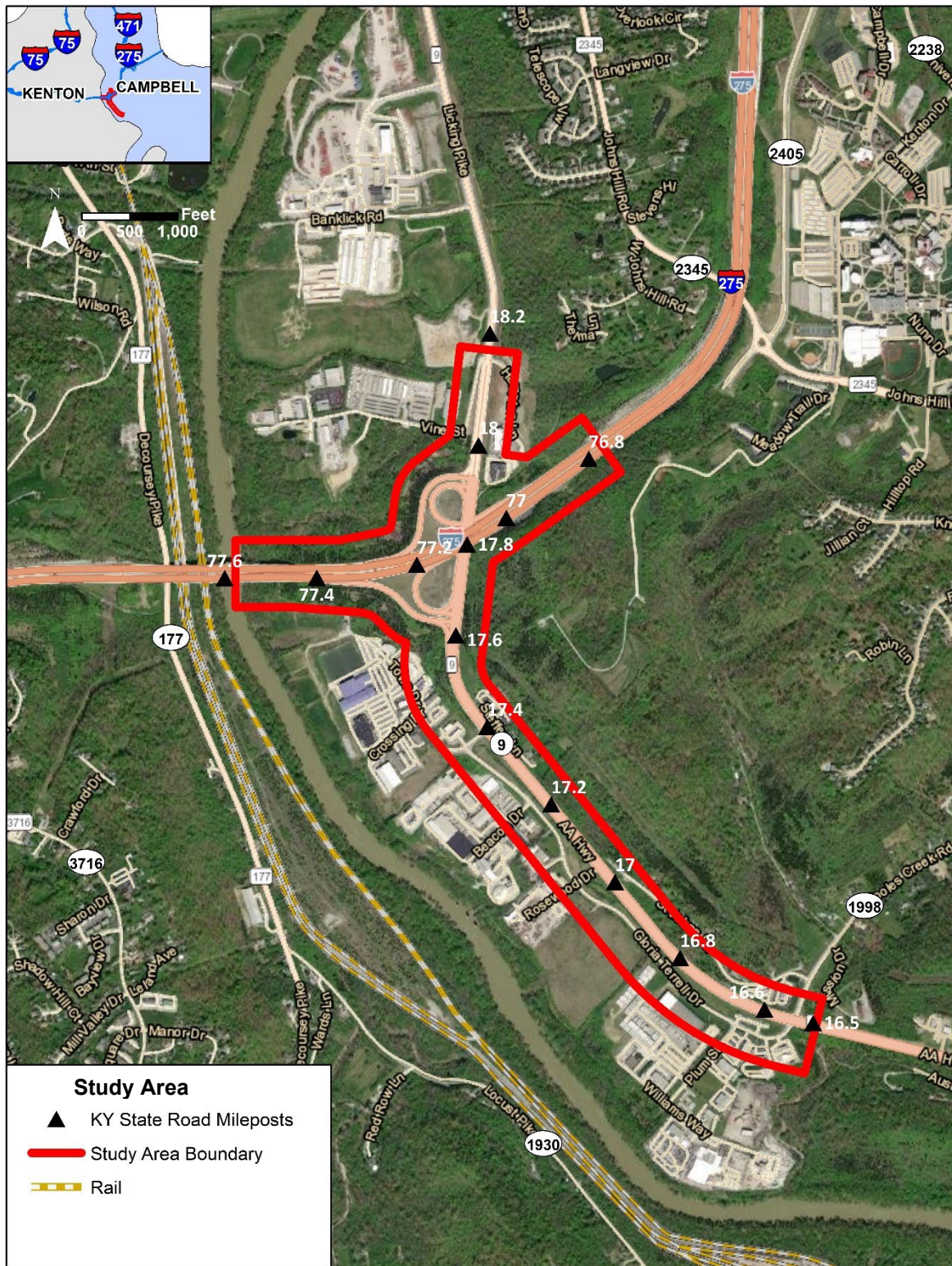
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## 1.2 Study Objective and Goals

The objective of the KY 9 Scoping Study is to evaluate transportation needs related to safety and congestion in the vicinity of the I-275 interchange with KY 9 and to identify and prioritize any proposed improvement options. To accomplish this objective, study goals include the following:

- Identify Locations for Possible Improvement Options Through Safety and Traffic Analysis
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- Prioritize a List of Short- and Long-Term Improvement Options

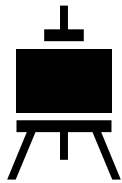
Figure 1. Study Area





## 1.3 Study Process

The process of this study is described in detail in the following five chapters. Additional resource / reference materials are included in the appendices.



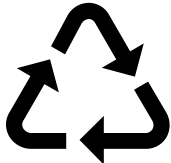
### **Chapter 1 – Introduction**

The first chapter provides background introductory information about the study and provides the framework for the remainder of the report.



### **Chapter 2 – Existing Conditions**

The second chapter encompasses collected data including geometrics, structures, existing traffic volumes and operations, and safety analysis.



### **Chapter 3 – Environmental Overview**

This chapter is devoted to a summary of the natural and human impacts within the study area.



### **Chapter 4 – Improvement Concept Development and Analysis**

Chapter four presents the process for which locations and potential improvement options were developed. It also includes a discussion on analysis procedures and improvement option refinement, including the benefit-cost analysis.



### **Chapter 5 – Study Outcomes**

The final chapter presents the outcomes of the study as a prioritized list of locations and improvement options.

## 1.4 Previous Studies, Identified and Highway Plan Projects

Locally identified projects and current highway plan transportation improvements that could impact the I-275/KY 9 interchange in the future were identified in the study area. During this study, *Kentucky's FY 2022 – 2028 Highway Plan* was proposed and enacted. In the enacted plan there is no additional funding allocated for Item No. 6-448.00 beyond what was previously allocated for this planning study.

### **Previous Studies**

The OKI Northern Kentucky Active Traffic Demand Management Study (Item No. 6-464.00) is expected to be completed in summer 2022. This study included I-275, throughout Boone, Kenton, and Campbell Counties among other northern Kentucky interstates and recommended a queue

warning system for the KY 9 interchange. No other recommendations specifically addressed the KY 9 interchange.

### Identified and Highway Plan Projects

Identified projects are transportation projects that have been identified from a variety of sources and have been created in KYTC's Continuous Highway Analysis Framework (CHAF) database. The database provides a means to track and analyze projects as well as a way to sponsor, score, and rank projects as part of the Strategic Highway Investment Formula for Tomorrow (SHIFT) prioritization process. Other sources for identified projects can come from regional transportation plans such as the OKI FY 2021-2024 Transportation Improvement Program (TIP). **Table 1** contains all identified projects in the study area.

**Table 1. Kentucky's Identified Projects Near the Study Area**

CHAF No.	Route	Description
IP20080295	KY 9	Improve mobility and reduce congestion at the I-275 interchange with KY 9 (AA Highway)
IP20190072	KY 9	Improve egress safety along KY 9 in the vicinity of intersections of Shadow Lake, Glenridge, KY 915
IP20080297	KY 1998	Reconstruct Pooles Creek #1 (KY 1998) from AA Highway to US 27
IP20000021	KY 915	Improve safety and mobility, and address geometric deficiencies along KY 915 from KY 9 (AA Highway) to KY 2924

Current highway plan projects are those that have been prioritized through SHIFT and have been included in *Kentucky's FY 2022 – 2028 Highway Plan*. **Table 2** contains additional information about the one current highway plan project within the study area.

**Table 2. Kentucky's FY 2022 – 2028 Highway Plan Projects in Study Area**

Item No.	Route	Begin Milepoint	End Milepoint	Project Type	Description	Construction Year	Construction Estimate
6-8105	New Route	N/A	N/A	New Connector	Construct a new connector road from KY 9 (AA Highway) to the end of new route just south of John's Hill Road.	2024	\$27,610,000



## Chapter 2 – Existing Conditions

In this chapter, the existing transportation network conditions are presented. This includes information on the roadway facility type and geometrics, structures, traffic volumes and operations, and crash history and analysis. Data for this chapter was collected from KYTC's Highway Information System (HIS) database, bridge inspection reports, National Bridge Inventory (NBI) forms, the KYTC Traffic Count Reporting System, site visits, and existing archive project plans.

Per the Federal Highway Administration's (FHWA) 2019 Bicycle and Pedestrian Planning, Program, and Project Development, guidance states that pedestrian and bicycle needs must be given "due consideration" under Federal transportation law. KY 9 does not have designated pedestrian or bicycle facilities nor is it currently part of a designated touring route. As specific improvement concepts were developed, opportunities for pedestrian and bicycle accommodations were considered.

Transit systems and opportunities is another area of consideration for corridor studies. The Transit Authority of Northern Kentucky (TANK) is the transit provider for Campbell County and the broader Northern Kentucky Area; however, KY 9 does not have designated or fixed transit routes currently served by TANK.

### 2.1 Functional Class and Roadway Systems

#### **Functional Class**

Functional classification is the process of grouping streets and highways by character of travel service and access to adjacent land uses. According to the HIS database, KY 9, south of I-275 is classified as an Urban Principal Arterial, while north of I-275 is classified as an Urban Minor Arterial. Principal Arterials are roadways that provide a high level of traffic mobility for substantial statewide travel and/or serve major activity centers and the longest trip demands within urban areas. Minor Arterials are roadways that serve trips of moderate length to smaller geographic areas and at a slightly lower level of traffic mobility than Principal Arterials. I-275 is classified as an Urban Interstate. These are roadways that comprise the Dwight D. Eisenhower National System of Interstate and Defense Highways and other Interstates as designated by the Secretary of Transportation.

#### **National Highway System**

The National Highway System (NHS) is a network of strategic highways within the United States that are important to the nation's economy, defense, and mobility. I-275 and KY 9 south of I-275 are both listed in the NHS. As such, they fall under the monitoring and performance for the FHWA Practices for Performance-Based Planning and Programming. Improvement concepts that are identified as part of this study should consider the impact on Kentucky's performance measures as these are reported to FHWA.

#### **Truck Routes**

Both I-275 and KY 9 are important links in Kentucky's freight network and are designated as Tier 2 and Tier 3, respectively, in the Kentucky Highway Freight Network (KHFN). The Tier 2 designation means I-275 is an interstate not on the Primary Freight Network (PFN) with a truck AADT (AADTT) between 4,000 and 7,000. The Tier 3 designation means KY 9 is an arterial with an AADTT of 500 to 4,000 trucks.

I-275 is a federal authorized route on the National Truck Network (NN). The NN was created by the federal Surface Transportation Assistance Act of 1982 (STAA) to require states to allow

conventional combination trucks on the designated system serving to support interstate commerce connecting principal cities and densely developed areas. KY 9, south of I-275, is a state authorized route on the NN. KY 9 carries between 10 to 14 percent trucks in the study area.

## 2.2 Roadway Geometric Characteristics

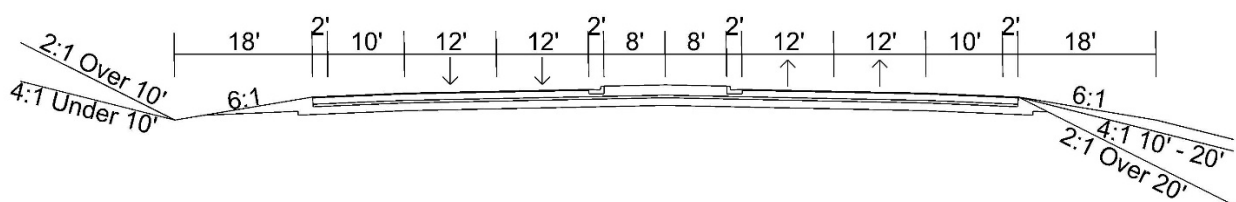
Current geometric characteristics of KY 9 and I-275 were identified through HIS queries and existing archive plans and compared with roadway design standards and common practices as set forth in AASHTO's *A Policy on Geometric Design of Highways and Streets, 7<sup>th</sup> Edition (2018)*, commonly referred to as the *Green Book*. Highway data assembled from HIS used in this study includes:

- Typical Sections
- Speed Limits
- Acceleration/Deceleration Lanes

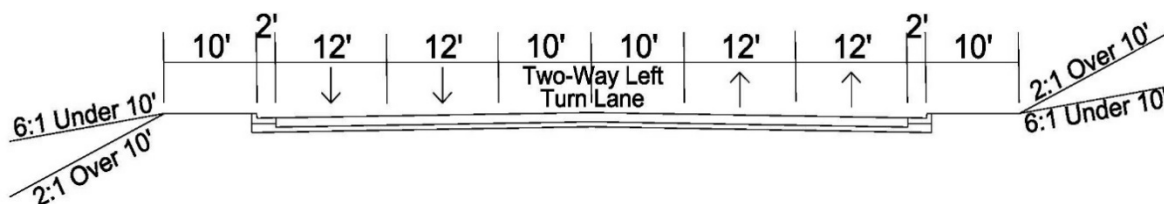
### Typical Sections

KY 9 is a four-lane divided highway with a mountable median and left turn lanes at intersections. This typical is carried through both the asphalt and concrete pavement sections of KY 9. The asphalt pavement section of KY 9 lies south of the I-275 eastbound off ramp merge with KY 9 and the concrete pavement section begins north of this merge and ends 250 feet north of the I-275 westbound on ramp. There is a small section in the study area where the raised median is replaced with a two-way left turn lane (TWLTL). The TWLTL typical section has both asphalt and concrete pavement sections north of the I-275 westbound on ramp to the end of the study area. Examples of typical sections for the asphalt and concrete pavement sections of KY 9 are in **Figure 2** and **Figure 3**.

**Figure 2. KY 9 Asphalt Section with Raised Median Typical Section**



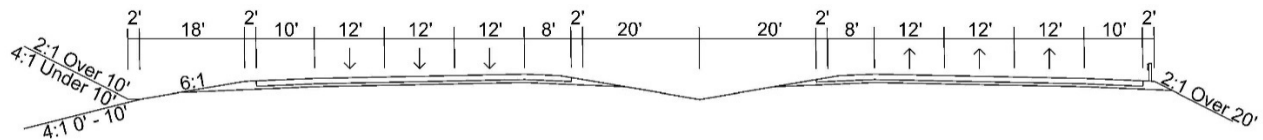
**Figure 3. KY 9 Concrete Section with TWLTL Typical Section**



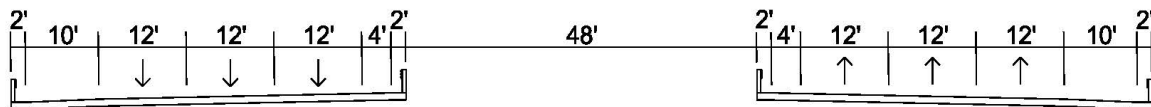
I-275 is a concrete pavement, six-lane divided highway with a 40-foot depressed median. This typical section is consistent throughout the study area except at the bridges. At the bridges the inside shoulder of I-275 narrows from 10 feet to 4 feet. The ramps for I-275 follow the KYTC Highway Design Manual for minimum traveled way and shoulder widths. Exhibits of the typical sections for I-275 are illustrated in **Figures 4, 5, and 6**.



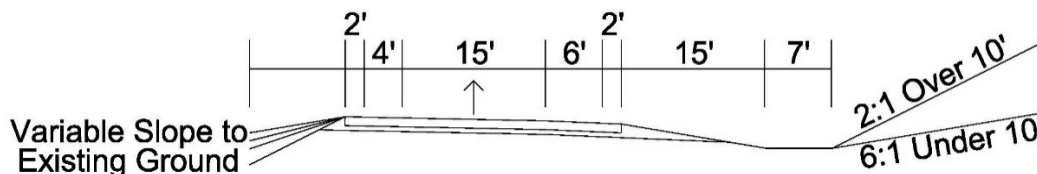
**Figure 4. I-275 Mainline Typical Section**



**Figure 5. I-275 Bridges Typical Section**



**Figure 6. I-275 Ramps Typical Section**



### Speed Limits

The posted speed limit along KY 9 is 45 mph between I-275 and Pooles Creek Road and 55 mph north and south of this segment. The speed limit along I-275 is 65 mph throughout the study area. Historical probe speed data was provided by KYTC for I-275 and KY 9 (by milepoint) for the years 2018 and 2019. The data was divided into hourly time periods during weekdays and includes various percentile speeds. It is also divided by passenger vehicles and truck traffic. The following observations can be made from the plotted data:

- During the AM Peak Period (7AM – 8AM) on I-275, traffic is consistently slower in the eastbound direction with 50<sup>th</sup> percentile speeds primarily ranging from 0 to 5 mph below the speed limit of 65 mph. In comparison, the 50<sup>th</sup> percentile speeds in the westbound direction are at or above the speed limit.
- During the PM Peak Period (5PM – 6PM) on I-275, 50<sup>th</sup> percentile speeds range between 37 mph and 63 mph in the eastbound direction, with the lowest speeds as traffic approaches I-471. For the westbound direction, 50<sup>th</sup> percentile speeds range from 0 to 5 mph below the speed limit.
- During both the AM and PM Peak Periods, speeds along northbound KY 9 steadily decrease from Pooles Creek Road to I-275, with 50<sup>th</sup> percentile speeds remaining below the speed limit ranging between 25 and 45 mph.
- During both the AM and PM Peak Periods, speeds along southbound KY 9 steadily increase as you travel south with speeds dipping below 20 mph north of I-275 and climbing to 50 mph or more south of Pooles Creek Road.

For additional detail on speed data, the plotted data is included in **Appendix A**.

### Acceleration/Deceleration Lanes

The length of a lane for entering and exiting a highway is governed by the design speed of the highway and the design speed of the entering/exiting curve of the ramp. The acceleration and deceleration lengths at the KY 9 interchange were compared to Table 10-4 and 10-6 in the Green Book, which provides minimum acceleration and deceleration lengths given the design speed of the highway being entered or exited and the design speed of the ramp's entering or exiting curve.

The existing acceleration and deceleration lengths through this section of I-275 were determined using statewide aerial imagery. Information regarding all acceleration and deceleration lanes for the KY 9 interchange is found in **Table 3**.

**Table 3. I-275/KY 9 Interchange Acceleration/Deceleration Lanes**

Acceleration/Deceleration Lanes					
Interchange	Entering / Exiting Curve Design Speed (mph)	Measured Length (ft)	AASHTO Minimum Length (ft)	Difference (ft)	Meets AASHTO Criteria
EB off ramp	45	400	340	60	YES
EB on ramp	35	1176	1000	176	YES
WB off ramp	45	610	340	270	YES
WB on ramp	35	600	1000	-400	NO

## 2.3 Structures

Structures identified through KYTC's Bridge Data Miner service can be seen in **Table 4**. A bridge is classified as structurally deficient if the deck, superstructure, substructure, or culvert is rated in "Poor" or worse condition (any with condition rating of four or less on the FHWA National Bridge Inventory (NBI) condition rating scale in accordance with the Pavement and Bridge Condition Performance Measures final rule). All five bridge structures are rated in Fair condition.

**Table 4. I-275 Existing Structures**

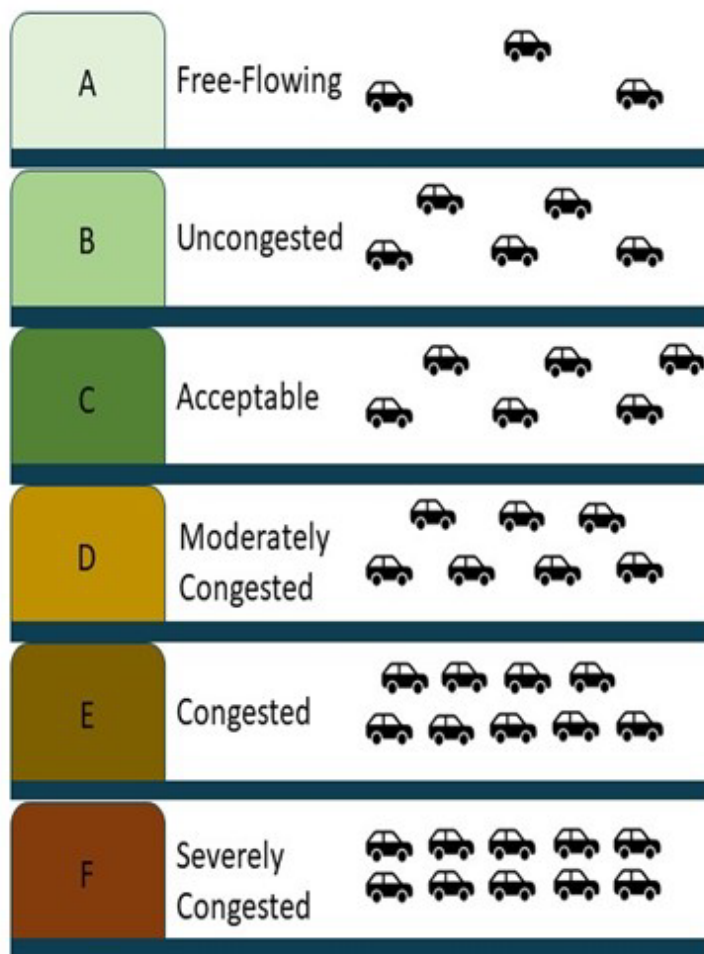
Description	Milepoint	Bridge ID	NBI Deck Rating	NBI Super-structure Rating	NBI Sub-structure Rating	Condition
I-275 WB Off-Ramp to KY 9	0.2	019B00047N	6	7	7	Fair
I-275 WB over KY 9	77.1	019B00048L	6	7	6	Fair
I-275 EB over KY 9	77.1	019B00048R	7	7	5	Fair
I-275 WB over Licking River	77.7	059B00052L	6	6	6	Fair
I-275 EB over Licking River	77.7	059B00052R	6	7	6	Fair



## 2.4 Existing Traffic Volumes and Operational Analysis

Existing year (2021) traffic volumes for I-275 and KY 9 are based on the most recent KYTC count stations, OKI traffic counts, and data collected for this study. The count years range from 2018 – 2021. Year 2021 volumes were calculated from these counts and calibrated using traffic volumes from the OKI Regional Travel Demand Model. The 2021 AADT volumes were forecasted to year 2045, based on the OKI Travel Demand Model and historical growth on area roadways. For the Existing scenario (2021), the annual average daily traffic (AADT), annual average daily truck traffic (AADTT), and design hourly volume (DHV) for each segment of I-275 and KY 9 is shown in **Figure 8** on the following page. Intersection traffic was based on intersection turning movement counts (TMC) conducted in 2021 and grown to 2045 (Analysis Future Year). The traffic forecast is presented in **Appendix B** and provides more detail on the forecast and traffic modeling calibration.

**Figure 7. Level of Service (LOS) Designations**

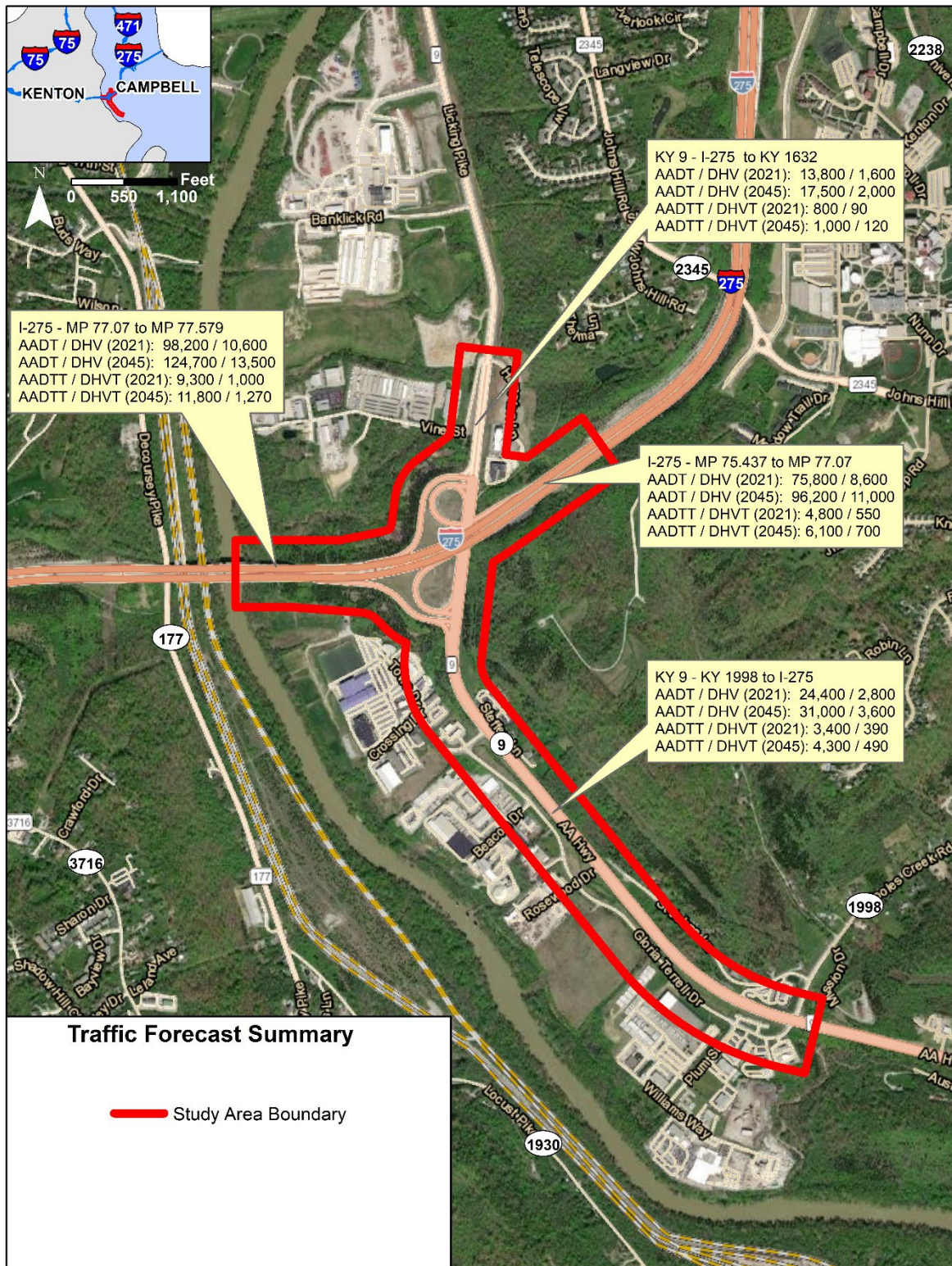


A level of service (LOS) analysis was performed using Highway Capacity Manual (HCM) methodologies for each of the eight intersections included within the study area using *Synchro Version 11*. LOS is a qualitative measure of determining the operational characteristics of a roadway facility. It is used to define the quality of traffic operations based on measures such as vehicle speed, travel time, comfort and convenience, maneuverability, congestion, and delay. There are six levels of service for each type of facility. The levels are designated by letters, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Acceptable operations for roadways in urban areas are LOS D or better. **Figure 7** presents a graphical depiction of LOS for reference. Existing (2021) conditions LOS is shown in **Table 5**.

In addition to providing the range of traffic flow according to letter grade, other reported performance measures are system-wide delay and average travel speed. The system-wide delay is a cumulative delay per

vehicle and is calculated using the calibrated VISSIM model and includes all eight study area intersections. Travel time is an overall average travel speed per vehicle. The VISSIM model was developed for both Existing (2021) conditions and future year (2045) for a No Build scenario in which no major widening or new construction would occur on either I-275 or KY 9. The results are shown in **Table 6**.

Figure 8. No Build Traffic Volumes





**Table 5. 2021 Existing KY 9 Peak Hour System-Wide Performance**

Intersection	AM Peak		PM Peak	
	LOS	Delay (seconds/vehicle)	LOS	Delay (seconds/vehicle)
<b>Signalized</b>				
KY 9 (AA Hwy) & KY 1998 (Pooles Creek Rd)				
Overall	D	35.1	D	53.0
KY 9 (AA Hwy) & Rosewood Dr				
Overall	A	2.5	A	7.4
KY 9 (AA Hwy) & Town Dr				
Overall	C	31.5	D	45.8
KY 9 (AA Hwy) & I-275 Eastbound Ramps				
Overall	B	12.7	F	276.8
KY 9 (AA Hwy) & I-275 Westbound Ramps				
Overall	B	14.4	E	75.2
KY 9 (AA Hwy) & Hampton Ln				
Overall	B	14.4	A	1.2
<b>Unsignalized</b>				
Town Dr & Gloria Terrell Dr				
Overall	B	14.4	B	13.6
Gloria Terrell Dr & Rosewood Dr				
Overall	A	8.1	A	8.8

**Table 6. No Build Peak Hour System-Wide Performance**

Period	Performance Measure	2021 Existing	2045 No Build
AM Peak	Delay (seconds/vehicle)	31.1	115.0
	Average Travel Speed (mph)	31.7	21.6
PM Peak	Delay (seconds/vehicle)	121.9	208.0
	Average Travel Speed (mph)	20.4	15.1



## 2.5 Crash Analysis

As part of this study, historical crash data was analyzed to identify locations along I-275 and KY 9 in the study area that could be considered high crash locations.

### High-Level Crash Analysis

Historical crash records were extracted from the Kentucky State Police's (KSP) *Collision Database* for a five-year period (April 2016 – April 2021). A high-level crash analysis was performed by analyzing the historical crash information provided by the KSP Collision Database and plotting all crashes along the corridor during the 5-year time period by their geographic coordinates. This involved analyzing statistics such as manner of collision, collision severity, daylight versus dark conditions, weather conditions, directional analysis, and others to find trends or help determine potential contributing factors to crashes along the corridor. The collected crash data was extended to outside the study area on I-275 to MP 78.0 in Kenton County after the development of improvement options showed that improvements may extend to this location.

Overall, there were 947 crashes within the 5-year timeframe in the study area. Summary statistics are provided in **Figure 9**. An overview map of the crash by manner of collision is presented in **Figure 10**. A more in-depth list of all crashes can be found in **Appendix C**.

Figure 9. Crash Statistics Infographic

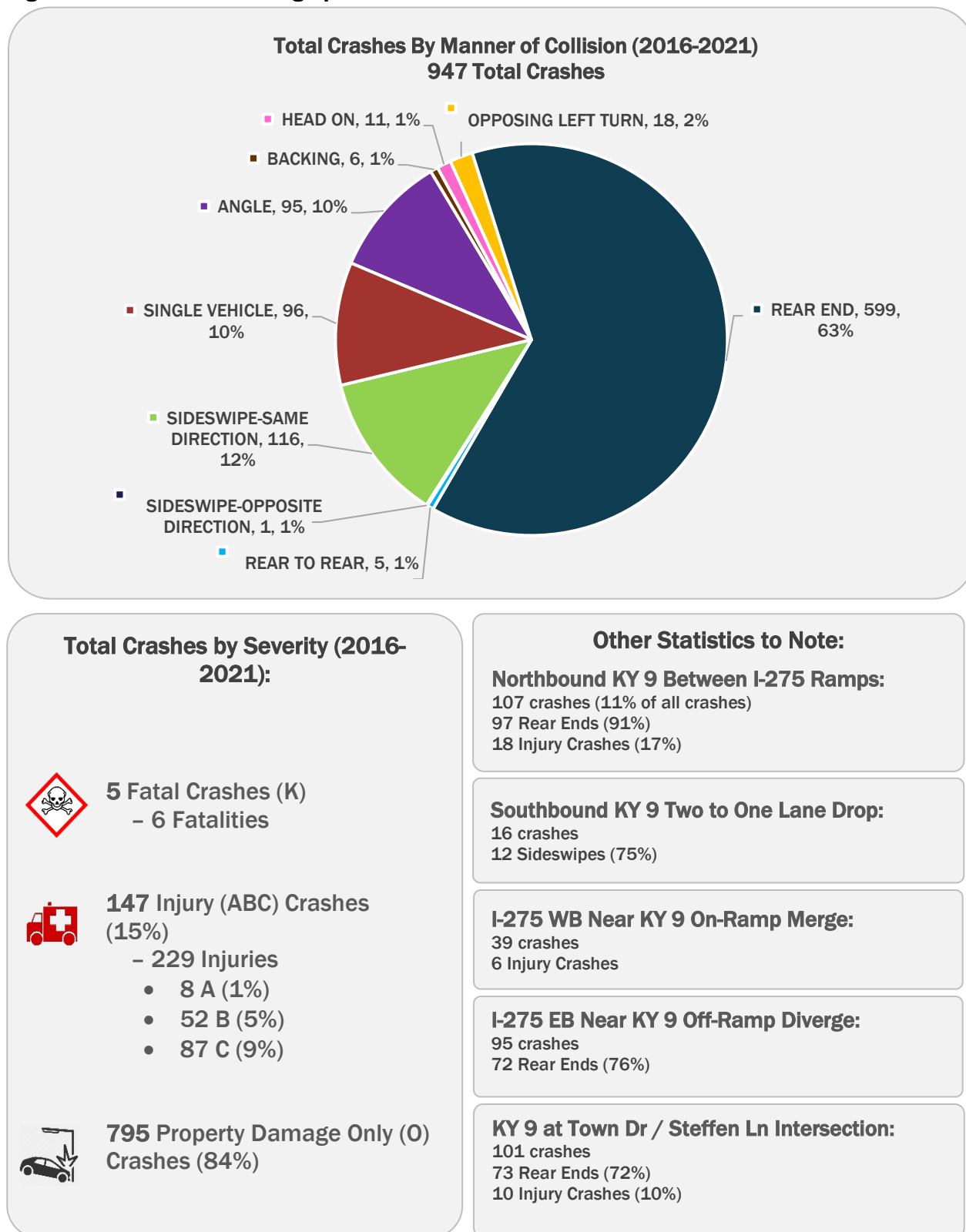
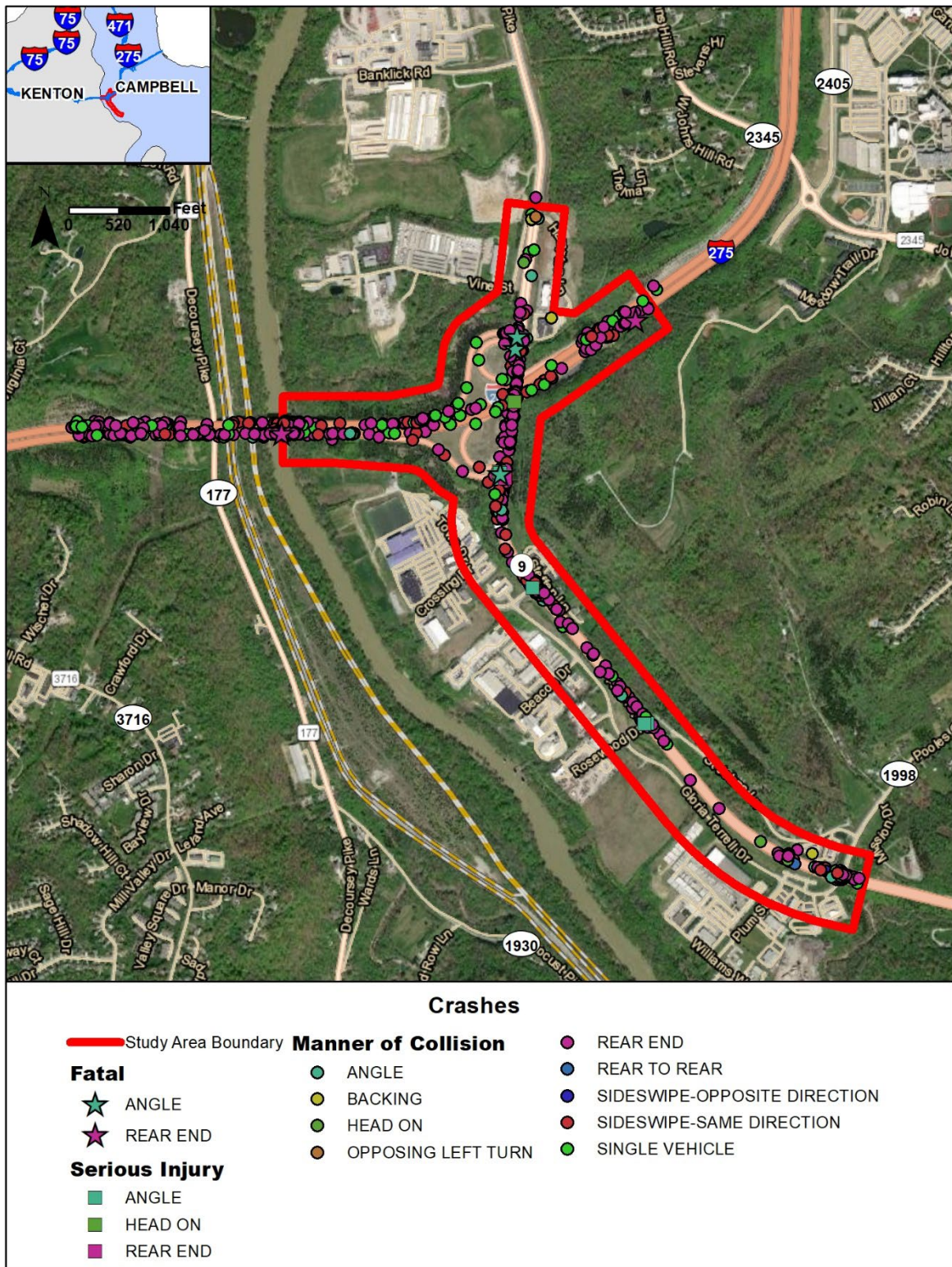


Figure 10. Crashes by Manner of Collision





### **Excess Expected Crashes**

The statistical crash analysis was performed based on the Excess Expected Crashes (EEC) method that compares existing crashes with the predicted crashes and is based on crash data from similar types of facilities. KYTC crash analysis methodology has been evolving, transitioning from the Critical Crash Rate method and progressing toward the EEC methodology based on the AASHTO Highway Safety Manual (HSM) procedures. HSM methods allow for the ability to estimate the frequency of crashes on roadways and intersections based on differences in roadway characteristics such as geometry, lane/shoulder/median configurations, AADT, length, functional classification, and traffic control. If the EEC is positive, it indicates more crashes have occurred than expected in the segment. If the EEC is negative, it indicates that there are fewer crashes than expected. EEC analysis uses historical observed crash data for a specified time period and segment length. The segments used for this study are based on KYTC's traffic count segments, and those typically change when there is a change in roadway characteristic or breakpoint such as an intersecting road. EECs were collected for the study area roadway segments using the Kentucky Transportation Center (KTC) at the University of Kentucky Crash Data Analysis Tool (CDAT).

CDAT also reports a Level of Service of Safety (LOSS) which is a semi-quantitative measure used to identify potential safety issues by comparing the number of crashes that occur on a roadway segment or at an intersection to the number of crashes predicted. It ranges from LOSS 1 to LOSS 4. LOSS 1 indicates a substantially better safety performance and a low potential for crash reduction. LOSS 4 indicates a substantially worse than expected safety performance and a high potential for crash reduction.

The CDAT analysis was based on 5 years of crashes from 2016 to 2021. CDAT breaks down the historical crashes by severity as fatal injury (K), suspected serious injury (A), suspected minor injury (B), possible injury (C), and no apparent injury (O) crashes. Crash severities are classified based on the 4th Edition of the Model Minimum Uniform Crash Criteria (MMUCC 4th Edition) KABCO Injury Classification Scale which Kentucky adopted in 2017 and was required to be adopted by all states on or before April 15, 2019.

An overview of the EEC by segment is presented in **Table 7**.

**Table 7. CDAT Excess Expected Crashes and LOSS by Segment (2016 - 2021)**

Route	Begin Milepoint	End Milepoint	Number of Crashes						EEC	LOSS
			K	A	B	C	O	Total		
KY 9	17.20	17.82	0	0	9	17	135	161	133.0	4
KY 9	17.82	18.30	0	0	0	1	37	38	15.3	3
I-275	76.50	77.58	2	5	12	19	191	229	140.7	4
I-275	77.58	78.00	1	2	8	17	121	149	109.6	4

## Chapter 3 – Environmental Overview

The goal of the environmental overview is to identify potential red-flag environmental data that may affect the design, development, and implementation of any proposed improvements.

The overview was completed for the study area encompassing approximately 220 acres. On KY 9, the study area is an approximately 820-foot wide area beginning 2,000 feet north of the existing I-275 interchange and ending at the intersection with Pooles Creek Road. For I-275, the study area is an approximately 215-foot wide area beginning at the bridge over Licking River to the west of the existing interchange and ending just beyond the ramps to the east. Environmental resources were identified through a combination of reviewing online databases and mapping and a windshield survey of the project area.

### 3.1 Natural Environment

The natural environment includes all things that are not man-made, such as air, land, water, vegetation, and animal life.

#### **Physiography/Topography**

The project area is in Campbell County, which is within the Outer Bluegrass Physiographic Region in northern Kentucky. The county is bounded by streams on three sides – the Ohio River on the east and north, and the Licking River on the west. The project area is immediately east of the Licking River within and immediately south of the Wilder community, in the west-central area of the county.

Campbell County is well dissected by numerous small streams that flow into the Ohio and Licking Rivers. Flat areas are relatively scarce and generally small. Valley flats along the Ohio River are narrow or nonexistent; however, flat areas along the Licking River, where present, may be wider than those along the Ohio, and the project area is primarily within one such flat area. The higher elevations in the county range from approximately 900 feet mean sea level (msl) in the southern part of the county to less than 500 feet msl at the confluence of the Ohio and Licking Rivers in the northern part of the county. The project area is bounded on the west by a relatively and mostly flat area from KY 9 to the Licking River, and by a hill and ridgetop immediately to the east. The average elevation in the project area is approximately 500 feet msl, with that of the ridgetop to the east being more than 850 feet msl.

#### **Geology/Hydrogeology**

The geologic formations of Campbell County are the interbedded limestones and shales of the Kope Formation, the Grant Lake Limestone/Fairview Formation, and the Bull Fork Formation. The bedrock underlying the project area is the Kope Formation. The sediments that became these rock formations were deposited in shallow seas 490 million years ago during the Early Ordovician Period. In the Late Ordovician, the seas became relatively shallow, as indicated by the amounts of mud (shale) in the sediments. When the waters were clear and warm, a profusion of animal life developed, particularly brachiopods and Bryozoa. Over the last million years, unconsolidated Quaternary alluvium and glacial sediments have been deposited along the larger streams and rivers in the county. Groundwater can primarily be obtained from fractures in the Ordovician bedrock and from the unconsolidated Quaternary age sediments, especially in low-lying areas near surface water features. The project area is within the United States Geological Survey (USGS) Newport Topographic and Geologic Quadrangle (GQ) map areas.



A Geotechnical Overview Report was prepared by KYTC and is presented in **Appendix D**. Key items outlined in the overview report include:

- The project area is notorious for cut and fill slope stability failures. Cut slope configurations of 2H:1V or flatter and fill side slopes no steeper than 3H:1V should be anticipated.
- There will not be enough durable rock to construct a roadbed for the entire project. Chemical modifications may not be feasible so a granula subgrade could be utilized.
- There was a landslide in 1973 on the downhill slope of KY 9 on the south side of the I-275 interchange. Corrective action occurred following the landslide, and future work in this area should exercise caution and any work should avoid disturbing the granular material or underdrain system.
- Geotechnical drilling will be needed for roadway cut/fills and structures. Sampling of foundation soils should be performed for embankment situations.

### **Watersheds & Streams**

The study area is in the Licking River watershed, designated as 8-digit Hydrologic Unit Code (HUC) 05100101. This watershed is subdivided into the Banklink Creek-Licking River (0510010113) 10-digit HUC, and then the Decoursey Creek-Licking River 12-digit HUC.

As illustrated in **Figure 11**, the Licking River is the primary water resource in the area. It runs parallel to KY 9, is the boundary of the study area along I-275, and it serves as the county line between Campbell County and Kenton County. The blueline streams located within the study area include Pooles Creek and three unnamed tributaries of Licking River. Pooles Creek runs parallel to KY 1998 (Pooles Creek Road) at the southern limits of the study area. The unnamed tributaries surround the existing interchange and flow directly into Licking River.

None of the streams in the study area are listed on the Kentucky Division of Water's (KDOW) 303(d) list of impaired streams, and none of the streams are designated as a Special Use Waters.

### **Floodplains and Floodways**

Federal Emergency Management Agency (FEMA) Flood Maps show a regulatory floodway and 1% Annual Chance Flood Hazard surrounding Licking River. These areas overlap the western limits of the study area where I-275 bridges the Licking River. There are also minor encroachments on the 1% Annual Chance Flood Hazard area surrounding Poole's Creek at the study area's southern limits.

### **Wetlands**

The National Wetland Inventory (NWI) identified sixteen (16) wetlands, including twelve (12) designated as riverine wetlands (streams and roadside ditches) and four as freshwater ponds within the study area. A review of aerial photography, however, shows that most of the freshwater ponds are no longer present. The wetlands are illustrated on **Figure 11**.

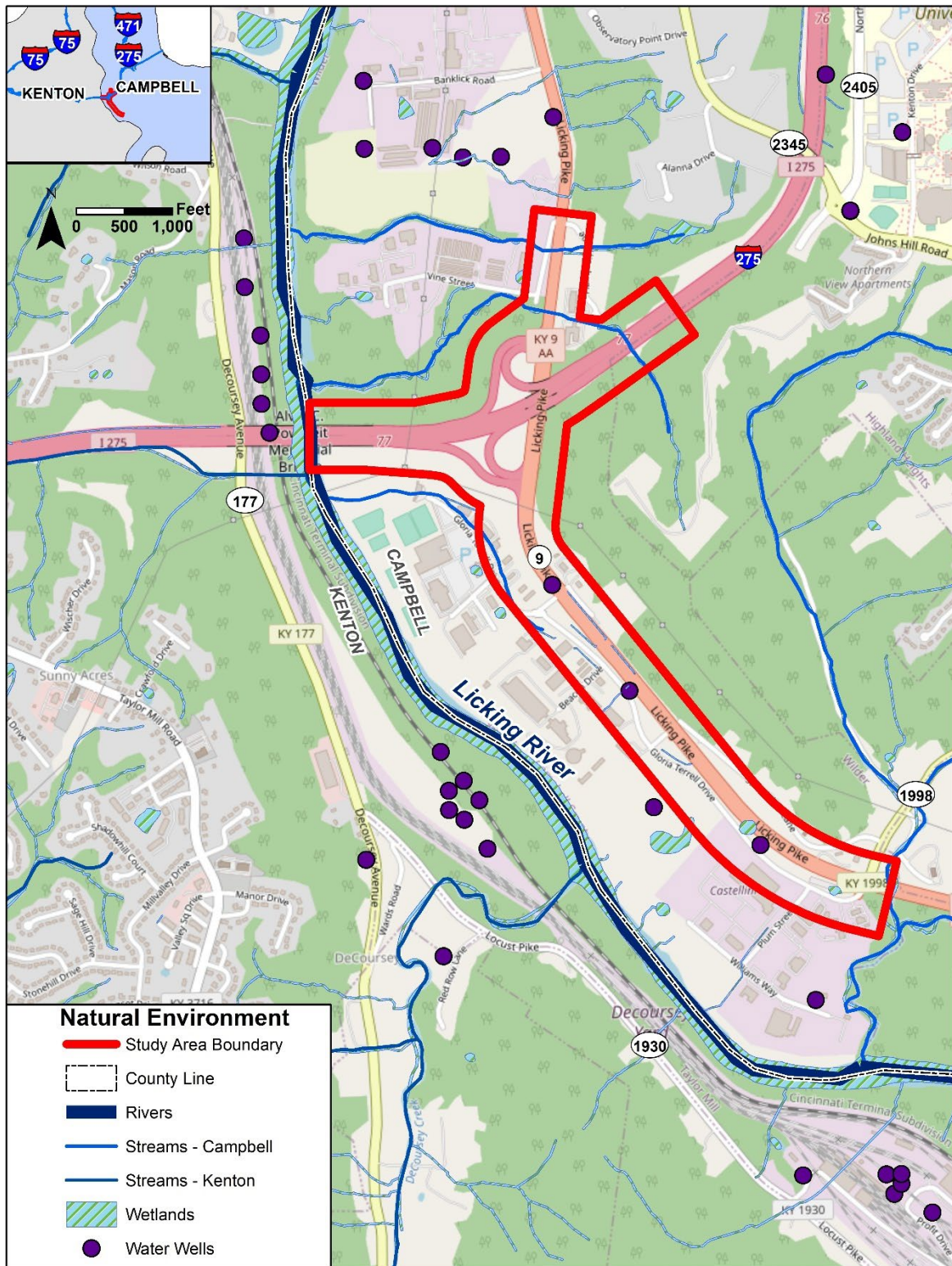
### **Springs and Water Wells**

According to the Kentucky Geological Survey (KGS), there are three plugged water wells within the study area. All three water wells are within KYTC right-of-way. The KGS database did not identify any springs within the study area.

### **Listed Species**

The U.S. Fish and Wildlife Service (USFWS) lists three bats and 11 mussels as Threatened and Endangered (T&E) species with the potential to be located in the study area, as well as the monarch butterfly as a candidate species for listing. No critical habitat for the listed species is noted within the study area. The listed species are included in **Table 8**.

Figure 11. Natural Environment



**Table 8. List of Threatened / Endangered Species**

Common Name	Scientific Name	Status
Bats		
Gray bat	<i>Myotis grisescens</i>	Endangered
Indiana bat	<i>Myotis sodalist</i>	Endangered
Northern long-eared bat	<i>Myotis septentrionalis</i>	Threatened with 4d Rule
Mussels		
Clubshell	<i>Pleurobema clava</i>	Endangered
Fanshell	<i>Cyprogenia stegaria</i>	Endangered
Northern Riffleshell	<i>Epioblasma torulosa rangiana</i>	Endangered
Orangefoot Pimpleback	<i>Plethobasus cooperianus</i>	Endangered
Pink Mucket	<i>Lampsilis abrupta</i>	Endangered
Purple Cat's Paw	<i>Epioblasma obliquata obliquata</i>	Endangered
Rabbitsfoot	<i>Quadrula cylindrica cylindrica</i>	Threatened
Ring Pink	<i>Obovaria retusa</i>	Endangered
Rough Pigtoe	<i>Pleurobema pium</i>	Endangered
Sheepnose	<i>Plethobasus cyphus</i>	Endangered
Spectaclecase	<i>Cumberlandia monodonta</i>	Endangered
Insect		
Monarch Butterfly	<i>Danaus plexippus</i>	Candidate

Preferred habitat for the Indiana bat and northern-long eared bat includes caves during the winter months and forested areas during the summer months. The gray bat is primarily found within caves year-round, although it too uses riparian forested habitat for foraging. All three bat species can also be found within bridge crevices. Within the study area, forested habitat surrounds the existing interchange and is on the eastern side of KY 9. KYTC typically mitigates for take associated with the habitat loss of these species through usage of the *Programmatic Biological Opinion on the Effects of Transportation Projects in Kentucky on the Indiana Bat and Gray Bat*. Per this programmatic agreement, the study area would be considered “Unsurveyed” habitat for the Indiana bat, which means the project is not within a known hibernaculum. The programmatic agreement also outlines mitigation efforts to reduce impacts to the Indiana and gray bats. The northern-long eared bat qualifies for use of USFWS’s Final 4(d) Rule, so no additional mitigation should be required for clearing of the forested habitat. As for caves, the study area is in an area considered as limited or no potential for karst development.

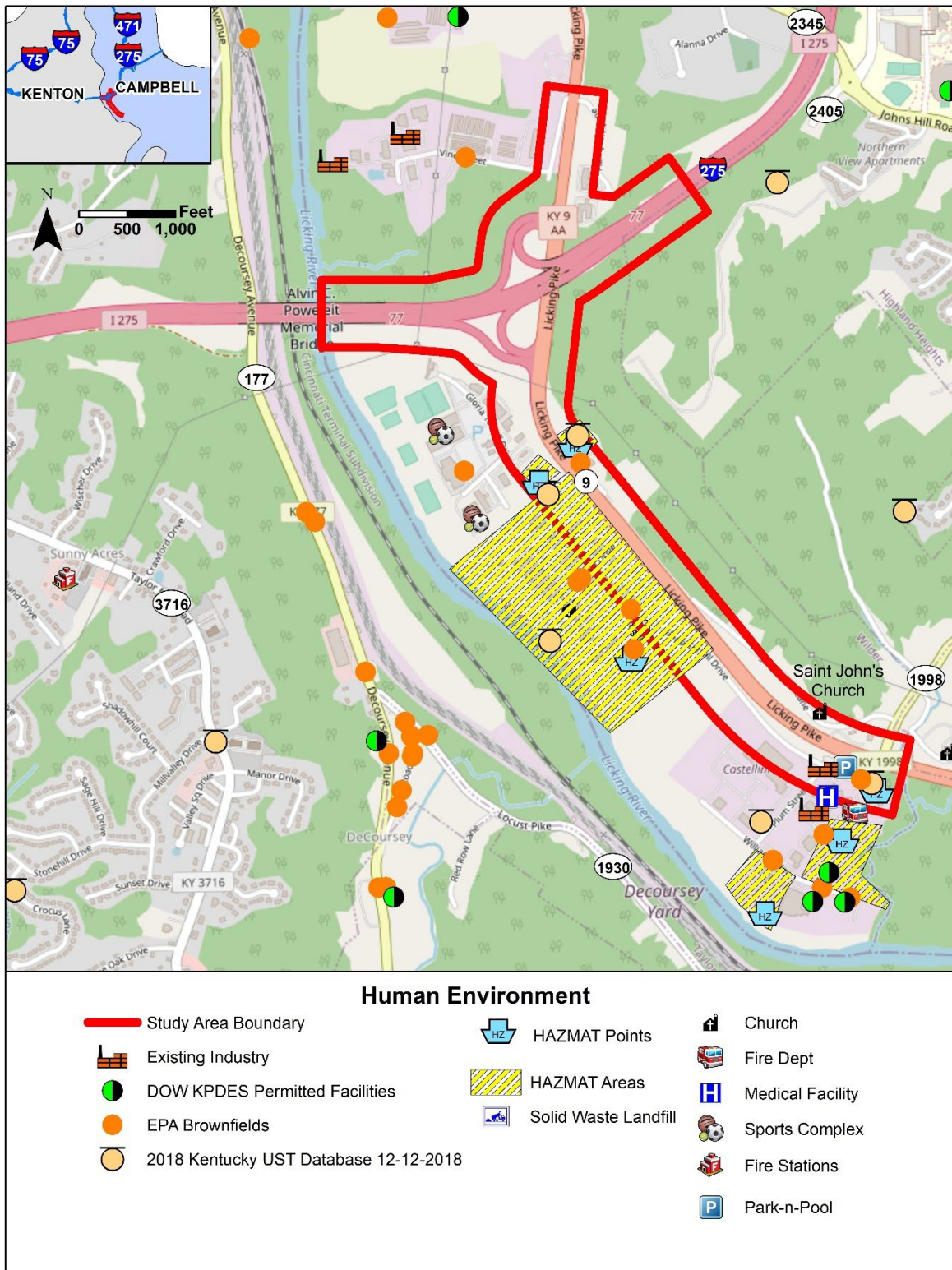
For the listed mussel species, no stream in the study area is expected to have suitable habitat. The Licking River does have suitable habitat for the listed mussel species, so if impacted, a mussel survey would be required.

## 3.2 Human Environment

The human environment deals with the man-made environment. It describes the overall land use and demographics as well as individual features such as historic sites, parks, potentially hazardous materials, and more. Key features are shown in **Figure 12**.



Figure 12. Human Environment



### **Land Use**

The areas adjacent to the study area are primarily commercial and industrial, with smaller areas of residential and open land. This correlates with the county's zoning of the area. West of KY 9 is zoned for Industrial Park or Highway Commercial, while the area east of KY 9 is zoned for Highway Commercial, Mixed-Land Use, and Residential and Agricultural.

### **Farmland**

While soil types in the study area are consistent with the potential for Prime and Unique farmland, the actual land use (and zoning) is not conducive to farming activities.

### **Community Areas of Interest**

The resources identified within and surrounding the study area include:

- Churches – there is one church in the study area, the Saint John's Church. It is located along St Johns Lane in the southeast portion of the study area. There are two other churches just outside the study area. One is on Beacon Drive south of Gloria Terrell Drive and the other is in the developed area on the west side of KY 9.
- Fire Department – The Wilder Fire Department is also located along Gloria Terrell Drive, across from the KY 9 and KY 1998 (Pooles Creek Road) intersection. This fire station is outside of the study area.
- Medical Facilities – there are two medical facilities in the commercial area on Gloria Terrell Drive, which is across from the KY 9 and KY 1998 (Pooles Creek Road) intersection. The facilities include an eye care center (Garbig Family Eye Care) and a physical therapy center (The Christ Hospital Physical and Occupational Therapy Center).
- Sports Complexes – In the commercial area along Town Drive, which is just southwest of the KY 9 and I-275 interchange, is the Town and Country sports complexes. These complexes include an athletic center used for a variety of indoor sports, a health club focused on fitness activities, and numerous outdoor facilities.
- Park-n-Pool – A park-n-pool with approximately 66 parking spots is located within the study area between KY 9 and Gloria Terrell Drive.

No park, school, hospital, or other types of community institutions were identified.

### **Hazardous Materials**

Databases from the U.S. Environmental Protection Agency (EPA), as well as a windshield survey, identified several sites with the potential for hazardous materials located within and surrounding the study area. Sites identified include gas stations, a concrete plant, and a truck repair site, among several others. No brownfield sites were identified in the study area.

### **Noise and Air Quality**

Noise sensitive land uses in the study are the Saint John's Church, the residential homes on the eastern side of KY 9 and the outdoor fields associated with the sports complexes near the I-275 and KY 9 interchange. The traffic volumes along I-275 and KY 9 may result in noise receptors that have noise volumes exceeding the noise abatement criteria; however, a lack of noise receptors in close proximity make it unlikely that noise barriers will meet KYTC's feasibility and reasonableness criteria.

As required by the Clean Air Act, the U.S. Environmental Protection Agency (EPA) set National Ambient Air Quality Standards (NAAQS) for six common air pollutants. Those that are caused by transportation-related sources include carbon monoxide (CO), ozone (O<sub>3</sub>), particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), and nitrogen dioxide (NO<sub>2</sub>). The study area is designated as non-attainment area for the 8-hour Ozone (2015) NAAQS, so additional efforts will be required to ensure any future project is in compliance with the air quality standards.

### **Historical and Archaeological Resources**

An overview of cultural historic and archaeological resources was completed for the project by Corn Island Archaeology, LLC. The overview included coordination with the Kentucky Heritage Council (KHC) and the Office of State Archaeology (OSA), as well as a review of historic maps, online databases, and a windshield survey.

Coordination with the KHC did not identify any sites recorded on the National Register of Historic Places (NRHP) within the study area. One structure, the St. John's Evangelical Church/Lutheran Church, is recorded with KHC but the NHRP eligibility status is undetermined. Six other structures were identified within the study area that appear to be at least 45 years old or older. The Johns Hill Cemetery was also identified during the overview but is located outside the study area in the northeast quadrant of the I-275 and KY 9 interchange.

### **Archaeological Resources**

Coordination with the OSA indicated that the majority of the study area has been surveyed in the past. Three archaeological sites within the study area have been recorded. This coordination, along with the site visit, contexts, and background research, indicates archaeological resources are located within the study area. However, it is worth noting that much of the current study area has been severely disturbed by previous construction, which will limit the ability to locate intact archaeological deposits.



## Chapter 4 – Improvement Concept Development and Analysis

In this chapter, the process is summarized for the identification of where improvements may be beneficial along with the development of improvement options for the identified locations. Based on the detailed traffic and crash analysis, roadway deficiencies, and consultation with the project team, a preliminary list of potential improvement options were developed and presented to the project team at Project Team Meeting #1.

### 4.1 Project Team Meeting No.1

The first of two Project Team Meetings was held virtually on May 26, 2021. Representatives included KYTC Division of Planning staff, KYTC District 6 staff, NKADD staff, OKI staff, and the consultant team. Study background information was shared through use of an ArcGIS StoryMap including the study area, objective and goals, schedule, existing traffic conditions, crash analysis, and environmental conditions. In addition, several potential improvement options were discussed and are summarized below. The first five address the inadequate Northbound KY 9 left turn storage at the I-275 westbound ramp. They are summarized as follows:

- Convert left most, northbound thru lane into a second left turn lane to enable dual left movement onto I-275 westbound ramp
- Convert left most, northbound thru lane into a second left turn lane to enable dual left movement onto I-275 westbound ramp and add a second northbound lane east of existing lanes that bypasses the I-275 eastbound and westbound ramp intersections
- Widen northbound KY 9 to accommodate dual left turn lanes and two thru lanes at the I-275 westbound ramp
- Construct displaced left turn for KY 9 northbound left turn movement for the I-275 westbound ramp
- Construct a northbound flyover ramp to replace the northbound left turn onto I-275 westbound ramp

The second group of potential improvement options address the southbound KY 9 lane imbalance, queuing, and high frequency of swideswipe crashes near the I-275 eastbound ramps. They are summarized as follows:

- Widen southbound KY 9 to maintain two southbound lanes. Allow I-275 eastbound off-ramp to KY 9 southbound to form:
  - a third southbound lane dropping as a right turn lane at Town Drive
  - a third southbound lane dropping south of Town Drive
  - a third southbound lane dropping south of Town Drive and closing Town Drive between Gloria Terrell Drive and KY 9

For additional detail regarding information presented and discussed at the meeting, refer to the meeting minutes found in **Appendix E**.

### 4.2 Analysis of Initial Improvement Options

With feedback from the project team on the potential improvement options, the next step was to further refine the list into sixteen initial improvement options. The primary goal of this preliminary analysis was to develop each option to enough detail to determine overall feasibility and determine

if more detailed analysis was warranted. Considerations included traffic analysis, geometric design, and environmental considerations. The improvement options are presented in **Table 9**.

**Table 9. Initial Improvement Options**

Improvement Option	Description
Area No. 1: I-275 Westbound Ramps	
1	Extend Left Turn Lane for I-275 Westbound Ramp from KY 9 Northbound
2	Dual Left Turn Lane onto I-275 Westbound Ramp from KY 9 Northbound
3	Flyover Ramp starting North of I-275 Bridge over KY 9
4	Flyover Ramp starting South of I-275 Bridge, after Town Drive, and over I-275
5	Separated Movement starting after Town Drive and South of I-275 Bridge onto Flyover Ramp starting North of I-275 Bridge
6*	
Area No. 2: I-275 Eastbound Ramps	
7	Half Diamond below I-275 Bridge
8	Additional Lane for I-275 Eastbound Exit Ramp onto KY 9 Southbound
9	Half 'Dog-bone' Roundabout
10*	
Area No. 3 KY 9 Mainline	
11	Provide Three KY 9 Southbound Lanes between Eastbound Ramps and Town Drive. No Lane Drop at I-275 Eastbound Exit Ramp for KY 9 Southbound, Additional Continuous Lane from I-275 Eastbound Exit Ramp to Town Drive, and Drop the Extra Lane at Town Drive
12	Provide Three KY 9 Southbound Lanes between Eastbound Ramps and just south of Town Drive. No Lane Drop at I-275 Eastbound Exit Ramp for KY 9 Southbound, Additional Continuous Lane from I-275 Eastbound Exit Ramp to Town Drive and Extend the Extra Lane past Town Drive
13	Remove Town Drive Signal, Close Town Drive, and Full Access for Steffen Lane
14	Remove Town Drive Signal, Close Town Drive, and Convert Steffen Lane to Right-In / Right-Out. Permit U-Turns at Rosewood Drive and I-275 Eastbound Ramps
15	Remove Town Drive Signal, Convert Town Drive and Steffen Lane to Right-In / Right-Out. Permit U-Turns at Rosewood Drive and I-275 Eastbound Ramps
16*	
Area No. 4: Secondary Roads	
17	Realign Town Drive and Gloria Terrell for Thru Movement
18	Realign Rosewood Drive and Gloria Terrell Drive for Thru Movement, Cul-de-sac Gloria Terrell South of Rosewood Drive, and Provide Dual Lefts from Rosewood Drive onto KY 9
19	Cul-de-sac Gloria Terrell Drive before Town Drive and after Beacon Drive. Provide Dual Lefts from Town Drive onto KY 9
20*	

\* A placeholder was left for each area to allow for an additional improvement option to be added during the discussion with the project team. They are numbered as they were during the initial analysis phase to remain consistent with the discussion found in the Project Team Meeting No. 2 Meeting Minutes.

## 4.3 Project Team Meeting No. 2

The second Project Team meeting was held on September 29, 2021 and was conducted virtually. The consultant team updated the ArcGIS StoryMap, which included updated traffic analysis and improvement options. KYTC provided valuable input on each of the improvement options and made suggestions for additional modifications. Utilizing the project team input, the refined initial list of improvement options was reduced from sixteen to eleven options to be considered in more detail. This process included modifying and consolidating multiple initial improvement options. **Table 10** provides a summary of how the initial improvement options were modified. **Table 11** provides the modified list of improvement options recommended for further analysis. The meeting minutes are found in **Appendix E**.



**Table 10. Modifications to Initial Improvement Options**

Initial Improvement Option #	Recommended for Further Analysis	Modified Improvement Option #	Modification / Reason for Dismissal
1	✓	1	Modify turn lane length based on traffic analysis
2	✓	2	Modify to show a dual lane entry onto I-275
3	✗		Replaced with Proposed Option 3A & 3B
4	✗		Proposed Option 3A & 3B would be lower cost, but achieve similar benefits
5	✓	3A & 3B	Modify to be closer to KY 9 and further from the Hampton Inn and Suites 3A – Includes dual lane entry onto I-275 3B – Ramp merges back to a single lane prior to I-275
6	✗		No new options recommended
7	✗		Preliminary traffic analysis showed this option to not operate as well at Option 8
8	✓	4	No modifications required
9	✗		Preliminary traffic analysis showed this option to have unacceptable operations
10	✗		No new options recommended
11	✗		Preliminary traffic analysis showed carrying the third lane south of Town Drive provided more benefit than dropping the lane as a right turn lane at Town Drive
12	✓	5A	No modifications required
13	✓	6	Widen median to improve channelization
14	✓	5B	No modifications required
15	✓	5C & 5E	No modifications required for 5C. 5E removed the third KY 9 southbound lane
16	✗		No new options recommended
17	✗*	5B & 6	Incorporate into Options 5B and 6. Modify turn lane length based on traffic analysis
18	✗*	5B, 5C, 5E, & 6	Incorporate into Options 5B, 5C, 5E, and 6. Modify back to T-intersection, but provide dual left onto KY 9
19	✓	5D	No modifications required
20	✗		No new options recommended

\* Incorporated Into Other Improvement Options

**Table 11. Improvement Options Recommended for Further Analysis**

Improvement Option #	Description
Area No. 1: I-275 Westbound Ramps	
1	Extend Left Turn Lane for I-275 Westbound Ramp from KY 9 Northbound.
2	Provide Dual Left Turn Lane onto I-275 Westbound Ramp from KY 9 Northbound with Dual Lane Entry Onto I-275.
3A	Flyover Ramp with Separated Movement Starting North of I-275 Bridge over KY 9. Provide Dual Lane Entry Onto I-275.
3B	Flyover Ramp with Separated Movement Starting North of I-275 Bridge over KY 9. Provide Single Lane Entry Onto I-275.
Area No. 2: I-275 Eastbound Ramps	
4	Provide Dual Lane I-275 Eastbound Exit Ramp.
Area No. 3 KY 9 Mainline & Secondary Roads	
5A	Provide Three KY 9 Southbound Lanes between Eastbound Ramps and just south of Town Drive. No Lane Drop at I-275 Eastbound Exit Ramp for KY 9 Southbound, Additional Continuous Lane from I-275 Eastbound Exit Ramp to Town Drive and Extend the Extra Lane past Town Drive.
5B	Improvement Option 5A Plus: Remove Town Drive Signal, Close Town Drive, and Convert Steffen Lane to Right-In / Right-Out. Permit U-Turns south of Town Drive and at the I-275 Eastbound Ramp intersection. Realign Rosewood Drive and Gloria Terrell Drive Intersection and Provide Dual Lefts from Rosewood Drive onto KY 9.
5C	Improvement Option 5A Plus: Remove Town Drive Signal, Convert Town Drive and Steffen Lane to Right-In / Right-Out. Permit U-Turns south of Town Drive and at the I-275 Eastbound Ramp intersection. Realign Rosewood Drive and Gloria Terrell Drive Intersection and Provide Dual Lefts from Rosewood Drive onto KY 9.
5D	Cul-de-sac Gloria Terrell Drive between Town Drive and Beacon Drive. Provide Dual Lefts from Town Drive onto KY 9.
5E	Remove Town Drive Signal, Convert Town Drive and Steffen Lane to Right-In / Right-Out. Permit U-Turns south of Town Drive and at the I-275 Eastbound Ramp intersection. Realign Rosewood Drive and Gloria Terrell Drive Intersection and Provide Dual Lefts from Rosewood Drive onto KY 9.
6	Improvement Option 5A Plus: Close Town Drive and Convert Steffen Lane to a Continuous Green T Intersection. Realign Rosewood Drive and Gloria Terrell Drive Intersection and Provide Dual Lefts from Rosewood Drive onto KY 9.

## 4.4 Revised Improvement Options

For each improvement option carried forward, a conceptual design was completed, traffic analysis was conducted for the future year 2045, planning-level cost estimates were developed and refined, and a high-level benefit-cost analysis was completed. The following sections describe these activities in more detail.

### Conceptual Design

For each of the improvement options recommended for further study in **Table 11**, a conceptual design was either updated or developed, if not previously completed. Design concepts were used to develop the traffic models, evaluate potential impacts, and develop planning level cost estimates.

### Traffic Operations

Building on the Existing and 2045 No Build traffic analysis described in **Section 2.4**, traffic models were developed for each improvement option using the Year 2045 AM and PM Peak traffic forecasts. As needed, traffic was redistributed for options that restricted certain movements. System-wide delay per vehicle and average travel speed was calculated for comparison to the 2045 No Build. **Table 12** lists systemwide performance measures for each improvement option.

**Table 12. Improvement Options Systemwide Traffic Results**

Scenario	AM Peak		PM Peak	
	Delay (seconds/vehicle)	Average Travel Speed (mph)	Delay (seconds/vehicle)	Average Travel Speed (mph)
2021 Existing	31.1	31.7	121.9	20.4
<b>2045 No Build and Build Options</b>				
No Build	115.0	21.6	208.0	15.1
Option 1	61.0	27.1	191.0	16.0
Option 2	54.8	28.0	160.1	18.0
Option 3A	32.4	33.1	141.2	22.1
Option 3B	41.3	31.9	153.7	23.6
Option 4	108.0	21.8	192.0	16.4
Option 5A	123.0	21.0	87.4	24.0
Option 5B	141.0	19.8	90.5	24.5
Option 5C	148.0	19.2	63.7	27.4
Option 5D	120.8	20.9	180.4	16.6
Option 5E	140.0	19.8	184.3	18.5
Option 6	133.5	20.4	80.1	25.5



## Planning Level Cost Estimates

Planning-level (high-level) cost estimates were produced for each of the improvement options by estimating the 2021 costs of Design, Right-of-way acquisition, Utilities, and Construction. No surveying or detailed design was performed. Construction quantities such as pavement, earthwork, traffic items, etc. were estimated for the proposed improvements. Factors were applied to increase this amount to account for contingencies and miscellaneous items not estimated. This cost was then multiplied by a factor to estimate the design cost. Right-of-way and utility costs were estimated through coordination with KYTC District 6. The cost summary is provided in **Table 13**.

**Table 13. Improvement Options Cost Estimate Summary**

Improvement Option	Design	Right-of-Way	Utilities	Construction	Total
Option 1	\$230,000	\$100,000	\$500,000	\$2,240,000	\$3,070,000
Option 2	\$2,360,000	\$250,000	\$1,500,000	\$23,570,000	\$27,680,000
Option 3A	\$4,050,000	\$250,000	\$1,500,000	\$40,460,000	\$46,260,000
Option 3B	\$1,880,000	\$250,000	\$1,500,000	\$18,780,000	\$22,410,000
Option 4	\$1,170,000	\$100,000	\$500,000	\$11,660,000	\$13,430,000
Option 5A	\$350,000	\$250,000	\$1,500,000	\$3,460,000	\$5,560,000
Option 5B	\$420,000	\$250,000	\$1,500,000	\$4,180,000	\$6,350,000
Option 5C	\$430,000	\$250,000	\$1,500,000	\$4,260,000	\$6,440,000
Option 5D	\$60,000	\$100,000	\$500,000	\$530,000	\$1,190,000
Option 5E	\$160,000	\$100,000	\$500,000	\$1,550,000	\$2,310,000
Option 6	\$580,000	\$250,000	\$1,500,000	\$5,780,000	\$8,110,000

## Benefit-Cost Analysis

A benefit-cost (B/C) analysis can be leveraged as one of the many tools to consider improvements and support decisions for infrastructure investment. Relying upon guidance from the U.S. Department of Transportation (USDOT) Benefit-Cost Analysis Guidance for Discretionary Grant Programs (March 2022), there are four primary areas of project benefit that can be translated into monetary values. These include:

- Travel Time Savings (vehicle-hours traveled or VHT)
- Vehicle Operating Costs (vehicle-miles traveled or VMT, which is the most common variable that affects vehicle operating costs)
- Safety Benefits (reduction in the likelihood of fatalities, injuries, and property damage resulting from crashes on the investment)
- Emissions Reduction Benefits

Costs for this planning stage are focused on capital costs, which include design, right-of-way, utilities, and construction costs. Maintenance costs are not included as the initial benefit-cost time period focuses on the initial benefit of construction. All construction costs are in constant (2021) dollars. Discounting (the process of converting the costs and benefits that take place in different years into a common year) is not included for this high-level analysis.

The emphasis for this study has been on consideration of improving safety and operational performance of the I-275/KY 9 interchange. This benefit-cost analysis focuses on identifying the traffic benefits in terms of systemwide reductions in delay and comparing that to the investment cost to determine a benefit-cost ratio. Safety benefits were examined; however, the safety benefits could not be quantified or translated to a reduction in crashes for all improvement options. To avoid an inconsistent comparison, no safety benefits were quantified, but a qualitative discussion is presented on the improvement option project sheets, where feasible.

To translate the traffic benefits associated with an improvement, travel time savings were calculated for each improvement option based on the 2045 No Build and Build VISSIM-derived average delay per vehicle. The average delay per vehicle was converted to VHT using the study area network volume. Then, each vehicle-hour was assigned a cost to the road user using the recommended occupancy rates for vehicles and trucks based on Table A-4 in the USDOT Benefit Cost Analysis Guidance. The analysis applied an average truck percentage for the AM and PM peaks based on the collected traffic data. The average occupancy rate is 1.48 for weekday passenger vehicles and 1.00 for trucks. The hourly travel time cost per person recommended in Table A-3 of the USDOT Benefit Cost Analysis Guidance in 2020 dollars is \$17.80 for all purpose general travel time and \$32.00 for truck driver travel time. For calculation purposes, travel time savings were calculated to occur during the weekday AM and PM peaks only, five days a week, for 20 years. While additional savings could be realized outside these time periods due to congestion resulting from the entertainment/sports complexes in the area, among other land uses, no traffic data analysis was available for these off-peak periods. The benefit-cost summary is presented in **Table 14**.

**Table 14. Improvement Options Benefit-Cost Analysis Summary**

Improvement Option	Travel Savings	Total Project Cost	Benefit-Cost Ratio
Option 1	\$9,030,000	\$3,070,000	2.9
Option 2	\$14,720,000	\$27,680,000	0.5
Option 3A	\$20,360,000	\$46,260,000	0.4
Option 3B	\$17,320,000	\$22,410,000	0.8
Option 4	\$3,380,000	\$13,430,000	0.3
Option 5A	\$18,420,000	\$5,560,000	3.3
Option 5B	\$15,820,000	\$6,350,000	2.5
Option 5C	\$19,300,000	\$6,440,000	3.0
Option 5D	\$3,750,000	\$1,190,000	3.2
Option 5E	\$880,000	\$2,310,000	0.4
Option 6	\$18,360,000	\$8,110,000	2.3

## 4.5 Improvement Options Project Sheets

Additional information describing and illustrating each improvement option can be found in **Figures 13-23**.

**Figure 13. Improvement Option 1 – Extend Northbound Left Turn Lane on KY 9**


LOCATION INFORMATION											
<p><b>Location</b> County: Campbell Route: KY 9 (MP:17.6 to 18.0)</p> <p>Northbound KY 9 to I-275 Westbound</p>	 <div>1</div>										
EXISTING CONDITIONS											
<p><b>Existing Features</b></p> <ul style="list-style-type: none"> <li>170' of storage for existing left turn lane</li> <li>12' lane widths and outside paved shoulder width of 10' along KY 9</li> <li>I-275 - 65 mph; KY 9 - 45 mph to the south, 55 mph to the north</li> </ul> <p><b>Issues</b> The left turn from KY 9 to the on-ramp for westbound I-275 is a heavy turning movement. Currently, there is a large concentration of rear end crashes between the ramp intersections on KY 9 in the northbound direction where queue spillover occurs. There were 107 northbound crashes between the ramp intersections and 91% were rear end crashes, while 6% were sideswipes.</p>	<p><b>TRAFFIC DATA</b> KY 9 No Build (AADT): 2021: 24,400 2045: 31,000</p> <p><b>CRASH DATA</b> KY 9 NB Crashes: Total: 107 Rear End: 97 Serious Injury: 1</p>										
IMPROVEMENT CONCEPT											
<p><b>Description</b> Improve left turn onto I-275 westbound on-ramp by converting left most thru lane to a left turn lane. Existing two thru lanes will be maintained by developing another lane right of the existing lanes. In the short-term, extending the left turn storage should reduce queue spillback into the KY 9 northbound thru lanes and provide a safety benefit. Possible constraints with this option are the utilities below the northbound shoulder on KY 9 and future capacity constraints.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"> <li>AM Peak: 54 sec/veh delay reduction / 5.5 mph speed increase</li> <li>PM Peak: 17 sec/veh delay reduction / 0.9 mph speed increase</li> </ul>	<p><b>COST ESTIMATE</b> 2021 Dollars</p> <table> <tr> <td>Design:</td><td>\$230,000</td></tr> <tr> <td>ROW:</td><td>\$100,000</td></tr> <tr> <td>Utilities:</td><td>\$500,000</td></tr> <tr> <td>Const.:</td><td>\$2,240,000</td></tr> <tr> <td>Total:</td><td>\$3,070,000</td></tr> </table> <p><b>BENEFIT-COST RATIO</b> 2.9</p> <p><b>PROJECT PRIORITY</b> Short-Term</p>	Design:	\$230,000	ROW:	\$100,000	Utilities:	\$500,000	Const.:	\$2,240,000	Total:	\$3,070,000
Design:	\$230,000										
ROW:	\$100,000										
Utilities:	\$500,000										
Const.:	\$2,240,000										
Total:	\$3,070,000										



Figure 13. Improvement Option 1 – Extend Northbound Left Turn Lane on KY 9 (continued)



**Figure 14. Improvement Option 2 –Dual Left Turn Lanes on KY 9**



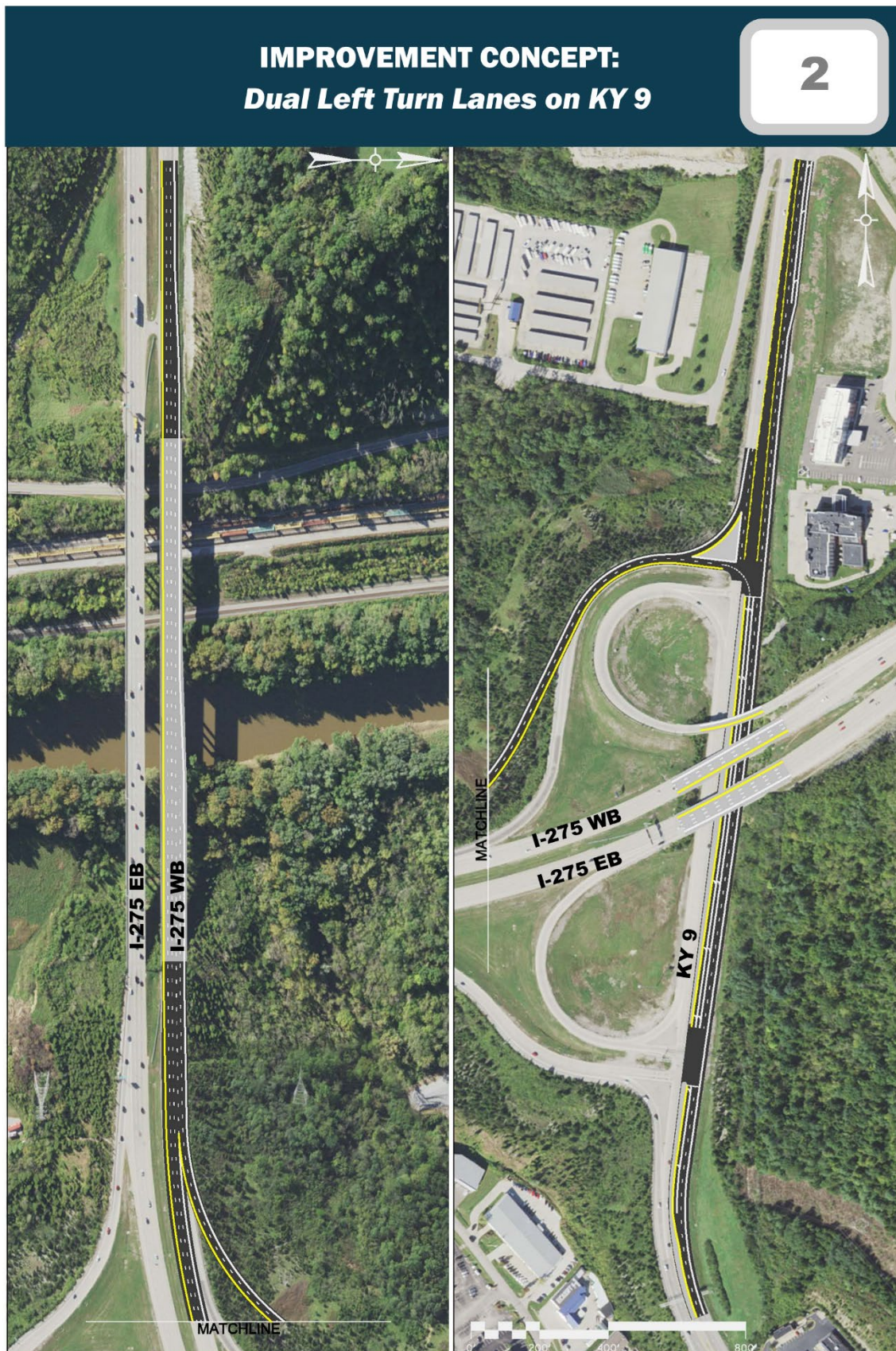
LOCATION INFORMATION		
<p><b>Location</b></p> <p>County: Campbell</p> <p>Route: I-275 (MP 77.2 to 77.7); I-275 Ramp (MP 0.0 to 0.3); KY 9 (MP 17.5 to 18.1)</p> <p>Northbound KY 9 to I-275 Westbound</p>		
EXISTING CONDITIONS		
<p><b>Existing Features</b></p> <ul style="list-style-type: none"> <li>• 170' of storage for existing left turn lane</li> <li>• 12' lane widths and outside paved shoulder width of 10' along KY 9</li> <li>• I-275 - 65 mph; KY 9 - 45 mph to the south, 55 mph to the north</li> <li>• Existing I-275 On-Ramp Acceleration is 600' (Required 1000')</li> </ul> <p><b>Issues</b></p> <p>The left turn from KY 9 to the on-ramp for westbound I-275 is a heavy turning movement. Currently, there is a large concentration of rear end crashes between the ramp intersections on KY 9 in the northbound direction where queue spillover occurs. There were 107 crashes between the ramp intersections and 91% were rear end crashes, while 6% were sideswipes. 39 crashes occurred at I-275 ramp merge with mainline with 21% being sideswipes.</p>	<p><b>TRAFFIC DATA</b></p> <p>KY 9 No Build (AADT):</p> <p>2021: 24,400</p> <p>2045: 31,000</p> <p><b>CRASH DATA</b></p> <p>KY 9 NB Crashes:</p> <p>Total: 107</p> <p>Rear End: 97</p> <p>Serious Injury: 1</p>	
IMPROVEMENT CONCEPT		
<p><b>Description</b></p> <p>Improve left turn storage onto I-275 westbound on-ramp by converting existing left turn lane and left most thru lane to dual left turns. Two thru lanes will be maintained by widening to the outside and within the I-275 bridge piers. Widen existing I-275 westbound on-ramp to the north to allow dual receiving lanes which will address the short ramp acceleration length. Increasing the left turn storage should reduce queue spillback into the KY northbound thru lanes and provide a safety benefit. Constraints with this option are the utilities under the northbound KY 9 shoulder and the impact to the Licking River Bridge due to the dual lane ramp entry.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"> <li>• AM Peak: 60 sec/veh delay reduction / 6.4 mph speed increase</li> <li>• PM Peak: 48 sec/veh delay reduction / 2.9 mph speed increase</li> </ul>	<p><b>COST ESTIMATE</b></p> <p>2021 Dollars</p> <p>Design: \$2,360,000</p> <p>ROW: \$250,000</p> <p>Utilities: \$1,500,000</p> <p>Const.: \$23,570,000</p> <p>Total: \$27,680,000</p> <p><b>BENEFIT-COST RATIO</b></p> <p>0.5</p> <p><b>PROJECT PRIORITY</b></p> <p>Not Recommended</p>	



Figure 14. Improvement Option 2 – Dual Left Turn Lanes on KY 9 (continued)





**Figure 15. Improvement Option 3A – Flyover Ramp to I-275 WB On-Ramp (Dual Lane Entry)**

LOCATION INFORMATION		
<p><b>Location</b></p> <p>County: Campbell</p> <p>Route: I-275 (MP 77.2 to 77.9); I-275 Ramp (MP: 0.0 to 0.3); KY 9: (MP 17.4 to 18.0)</p> <p>Northbound KY 9 to I-275 Westbound</p>		
EXISTING CONDITIONS		
<p><b>Existing Features</b></p> <ul style="list-style-type: none"> <li>170' of storage for existing left turn lane</li> <li>12' lane widths and outside paved shoulder width of 10' along KY 9</li> <li>I-275 - 65 mph; KY 9 - 45 mph to the south, 55 mph to the north</li> </ul> <p><b>Issues</b></p> <p>The left turn from KY 9 to the on-ramp for westbound I-275 is a heavy turning movement. Currently, there is a large concentration of rear end crashes between the ramp intersections on KY 9 in the northbound direction where queue spillover occurs. There were 107 crashes between the ramp intersections and 91% were rear end crashes, while 6% were sideswipes. 39 crashes occurred at I-275 ramp merge with mainline with 21% being sideswipes.</p>	<p><b>TRAFFIC DATA</b></p> <p>KY 9 No Build (AADT):</p> <p>2021: 24,400</p> <p>2045: 31,000</p> <p><b>CRASH DATA</b></p> <p>KY 9 NB Crashes:</p> <p>Total: 107</p> <p>Rear End: 97</p> <p>KY 9/I-275 WB Ramp: 2 Fatalities</p>	
IMPROVEMENT CONCEPT		
<p><b>Description</b></p> <p>Relocate left turn for I-275 westbound on-ramp by separating movement at the KY 9 and I-275 eastbound ramps intersection and bridging over KY 9 to tie into the existing I-275 westbound on-ramp. A dual lane entry to I-275 would be provided which will address the short ramp acceleration length. Removing the left turn traffic from KY 9 would provide a safety benefit at the intersection. Constraints with this option are the utilities under the northbound KY 9 shoulder and the impact to the Licking River Bridge due to the dual lane entry. A design exception would be required for the entry curve for the flyover bridge which has a 30 mph design speed. The entry curve to the interstate is a 50 mph curve. The new ramp will require significant fill increasing overall cost.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"> <li>AM Peak: 83 sec/veh delay reduction / 11.5 mph speed increase</li> <li>PM Peak: 67 sec/veh delay reduction / 7.0 mph speed increase</li> </ul>	<p><b>COST ESTIMATE</b></p> <p>2021 Dollars</p> <p>Design: \$4,050,000</p> <p>ROW: \$250,000</p> <p>Utilities: \$1,500,000</p> <p>Const.: \$40,460,000</p> <p>Total: \$46,260,000</p> <p><b>BENEFIT-COST RATIO</b></p> <p>0.4</p> <p><b>PROJECT PRIORITY</b></p> <p>Long-Term</p>	



Figure 15. Improvement Option 3A – Flyover Ramp to I-275 WB On-Ramp (Dual Lane Entry)  
(continued)





**Figure 16. Improvement Option 3B – Flyover Ramp to I-275 WB On-Ramp**


LOCATION INFORMATION		
<p><b>Location</b> County: Campbell Route: I-275 Ramp (MP: 0.0 to 0.2); KY 9: (MP 17.4 to 18.0)  Northbound KY 9 to I-275 Westbound</p>		<div>3B</div>
EXISTING CONDITIONS		
<p><b>Existing Features</b></p> <ul style="list-style-type: none"> <li>170' of storage for existing left turn lane</li> <li>12' lane widths and outside paved shoulder width of 10' along KY 9</li> <li>I-275 - 65 mph; KY 9 - 45 mph to the south, 55 mph to the north</li> </ul> <p><b>Issues</b> The left turn from KY 9 to the on-ramp for westbound I-275 is a heavy turning movement. Currently, there is a large concentration of rear end crashes between the ramp intersections on KY 9 in the northbound direction where queue spillover occurs. There were 107 crashes between the ramp intersections and 91% were rear end crashes, while 6% were sideswipes.</p>	<p><b>TRAFFIC DATA</b> KY 9 No Build (AADT): 2021: 24,400 2045: 31,000</p> <p><b>CRASH DATA</b> KY 9 NB Crashes: Total: 107 Rear End: 97 Serious Injury: 1 KY 9/I-275 WB Ramp: 2 Fatalities</p>	
IMPROVEMENT CONCEPT		
<p><b>Description</b> Relocate left turn for I-275 westbound on-ramp by separating movement at the KY 9 and I-275 eastbound ramps intersection and bridging over KY 9 to tie into the existing I-275 westbound on-ramp. The two lanes would have approximately 310' to merge to a single lane. Removing the left turn traffic from KY 9 would provide a safety benefit at the intersection. Constraints with this option are the utilities under the northbound KY 9 shoulder. A design exception would be required for the entry curve for the flyover bridge which has a 30 mph design speed.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"> <li>AM Peak: 74 sec/veh delay reduction / 10.3 mph speed increase</li> <li>PM Peak: 54 sec/veh delay reduction / 8.5 mph speed increase</li> </ul>	<p><b>COST ESTIMATE</b> 2021 Dollars Design: \$1,880,000 ROW: \$250,000 Utilities: \$1,500,000 Const.: \$18,780,000 Total: \$22,410,000</p> <p><b>BENEFIT-COST RATIO</b> 0.8</p> <p><b>PROJECT PRIORITY</b> Not Recommended</p>	



Figure 16. Improvement Option 3B – Flyover Ramp to I-275 WB On-Ramp (continued)





**Figure 17. Improvement Option 4 – I-275 EB Dual Lane Exit**


LOCATION INFORMATION		
<p><b>Location</b> County: Campbell Route: I-275 (MP 77.3 to 77.6); I-275 Ramp (MP: 0.0 to 0.3)  I-275 Eastbound Off-Ramp to KY 9</p>		<div>4</div>
EXISTING CONDITIONS		
<p><b>I-275 Existing Features</b></p> <ul style="list-style-type: none"> <li>Three lanes in each direction on I-275; Single lane exit for I-275 EB Off-Ramp widening to three lanes at intersection with KY 9, including a free flow channelized right turn onto southbound KY 9</li> <li>I-275 - 65 mph; KY 9 South of I-275 - 45 mph</li> </ul> <p><b>Issues</b> One of the larger movements in the study area is the right turn from the I-275 eastbound off-ramp onto KY 9. Congestion on the ramp and on the I-275 ramp approach is regularly observed due to this heavy exiting volume. 95 crashes occurred along I-275 eastbound approaching the off-ramp with 76% being rear end crashes and 12% being sideswipe crashes. Existing LOS during the PM Peak is D and F at the KY 9 intersections with Town Drive and I-275 Eastbound Ramps, respectively.</p>		<p><b>TRAFFIC DATA</b> I-275 No Build (AADT) 2021: 98,200 2045: 124,700</p> <p><b>CRASH DATA</b> I-275 EB Crashes: Total: 95 Rear End: 72 Sideswipe: 11 Fatality: 1</p>
IMPROVEMENT CONCEPT		
<p><b>Description</b> Upgrade I-275 eastbound off-ramp to be a dual lane exit. This will impact the I-275 eastbound Licking River Bridge in order to get the deceleration lengths for the extra lane.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"> <li>AM Peak; 7 sec/veh delay reduction / 0.2 mph speed increase</li> <li>PM Peak: 16 sec/veh delay reduction / 1.3 mph speed increase</li> </ul>		<p><b>COST ESTIMATE</b> 2021 Dollars Design: \$1,170,000 ROW: \$100,000 Utilities: \$500,000 Const.: \$11,660,000 Total: \$13,430,000</p> <p><b>BENEFIT-COST RATIO</b> 0.3</p> <p><b>PROJECT PRIORITY</b> Not Recommended</p>

Figure 17. Improvement Option 4 – I-275 EB Dual Lane Exit (continued)





**Figure 18. Improvement Option 5A – Third Southbound Lane on KY 9**

LOCATION INFORMATION												
<p><b>Location</b></p> <p>County: Campbell</p> <p>Route: KY 9 (MP: 17.1 to 17.6)</p> <p>KY 9 Southbound at I-275 Eastbound Off-Ramp</p>												
EXISTING CONDITIONS												
<p><b>KY 9 Existing Features</b></p> <ul style="list-style-type: none"><li>Two lanes each direction with mountable median</li><li>12' lane width; 10' outside paved shoulder width</li><li>45 mph Posted Speed Limit</li></ul> <p><b>Issues</b></p> <p>At the I-275 EB off-ramp, KY 9 drops to a single lane while the channelized right turn from the ramp merges with KY 9 reforming two southbound lanes. This lane drop results in a lane imbalance for the southbound direction and is observable at both the eastbound and westbound ramp intersections. 16 southbound crashes occur at the ramp merge with KY 9 and 12 are sideswipe crashes. Existing LOS during the PM Peak is D, F, and E at the KY 9 intersections with Town Drive, I-275 Eastbound Ramps, and I-275 Westbound Ramps, respectively.</p>	<p><b>TRAFFIC DATA</b></p> <p>KY 9 No Build (AADT):</p> <p>2021: 24,400</p> <p>2045: 31,000</p> <p><b>CRASH DATA</b></p> <p>KY 9 SB Crashes at Ramp Merge:</p> <p>Total: 16</p> <p>Sideswipe: 12</p> <p>Fatality: 1</p>											
IMPROVEMENT CONCEPT												
<p><b>Description</b></p> <p>Keep both southbound lanes on KY 9 at the I-275 eastbound of-ramp and add another lane for ramp traffic. Tie in the channelized right turn from the I-275 ramp as a third lane. All three lanes will extend past Town Drive and be dropped before Rosewood Drive. Significant fill is needed along KY 9. It is recommended to be rock rill in order to achieve a 2:1 slope and minimize ROW impacts to businesses along Town Drive. Removing the lane drop at the intersection would improve the lane utilization and improve safety, specifically the high percentage of sideswipe crashes.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"><li>AM Peak: 8 sec/veh delay increase / 0.6 mph speed reduction</li><li>PM Peak: 121 sec/veh delay reduction / 8.9 mph delay increase</li></ul>	<p><b>COST ESTIMATE</b></p> <p>2021 Dollars</p> <table><tr><td>Design:</td><td>\$350,000</td></tr><tr><td>ROW:</td><td>\$250,000</td></tr><tr><td>Utilities:</td><td>\$1,500,000</td></tr><tr><td>Const.:</td><td>\$3,460,000</td></tr><tr><td>Total:</td><td>\$5,560,000</td></tr></table> <p><b>BENEFIT-COST RATIO</b></p> <p>3.3</p> <p><b>PROJECT PRIORITY</b></p> <p>Short Term</p>	Design:	\$350,000	ROW:	\$250,000	Utilities:	\$1,500,000	Const.:	\$3,460,000	Total:	\$5,560,000	
Design:	\$350,000											
ROW:	\$250,000											
Utilities:	\$1,500,000											
Const.:	\$3,460,000											
Total:	\$5,560,000											

Figure 18. Improvement Option 5A – Third Southbound Lane on KY 9 (continued)





**Figure 19. Improvement Option 5B – Widen KY 9, Close Town Drive and Convert Steffen Lane to Right-In/Right-Out**

LOCATION INFORMATION		
<p><b>Location</b> County: Campbell Route: KY 9 (MP: 17.1 to 17.6); Town Drive; Steffen Lane</p> <p>KY 9 Southbound at I-275 Eastbound Off-Ramp and Town Drive</p>		
EXISTING CONDITIONS		
<p><b>Town Drive Existing Features</b></p> <ul style="list-style-type: none"> <li>Four lanes at KY 9</li> <li>12' lane width</li> <li>No paved shoulder width</li> <li>20 mph Posted Speed Limit</li> <li>Two lanes south of intersection</li> </ul>	<p><b>KY 9 Existing Features</b></p> <ul style="list-style-type: none"> <li>Two lanes each direction with mountable median</li> <li>12' lane width; 10' outside paved shoulder width</li> <li>45 mph Posted Speed Limit</li> </ul>	<p><b>TRAFFIC DATA</b> KY 9 No Build (AADT): 2021: 24,400 2045: 31,000</p> <p><b>CRASH DATA</b> KY 9 Crashes at Town Drive Total: 101 Rear End: 73 Angle: 12 Severe Injury: 1</p>
<p><b>Issues</b> The lane drop along KY 9 and the proximity of the Town Drive intersection to the I-275 Eastbound Ramps results in congestion and safety concerns. LOS at Town Drive is currently D in the PM Peak. Systemwide delay is worse during the PM Peak, when traffic is predominantly heading southbound on KY 9. It is currently 122 sec/veh and expected nearly double to 208 sec/veh by 2045. Over 100 crashes were identified near the Town Drive intersection, with 72% being rear end crashes and 21% being either angle or sideswipe crashes.</p>		
IMPROVEMENT CONCEPT		
<p><b>Description</b> Keep both southbound lanes on KY 9 at the I-275 eastbound of-ramp and add another lane for ramp traffic. Tie in the channelized right turn from the I-275 ramp as a third lane. Close Town Drive to all traffic and remove the traffic signal. A crash reduction would be anticipated from the closure of Town Drive. Convert Steffen Lane to a right-in / right-out and provide a U-turn loon for both directions of KY 9 traffic. Reconfigure the Gloria Terrell Drive/Rosewood Drive intersection. Significant fill is needed along KY 9. It is recommended to be rock fill in order to achieve a 2:1 slope and minimize ROW impacts to businesses along Town Drive.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"> <li>AM Peak: 26 sec/veh delay increase / 1.8 mph speed reduction</li> <li>PM Peak: 118 sec/veh delay reduction / 9.4 mph speed increase</li> </ul>		<p><b>COST ESTIMATE</b> 2021 Dollars</p> <p>Design: \$420,000 ROW: \$250,000 Utilities: \$1,500,000 Const.: \$4,180,000 Total: \$6,350,000</p> <p><b>BENEFIT-COST RATIO</b> 2.5</p> <p><b>PROJECT PRIORITY</b> Not Recommended</p>

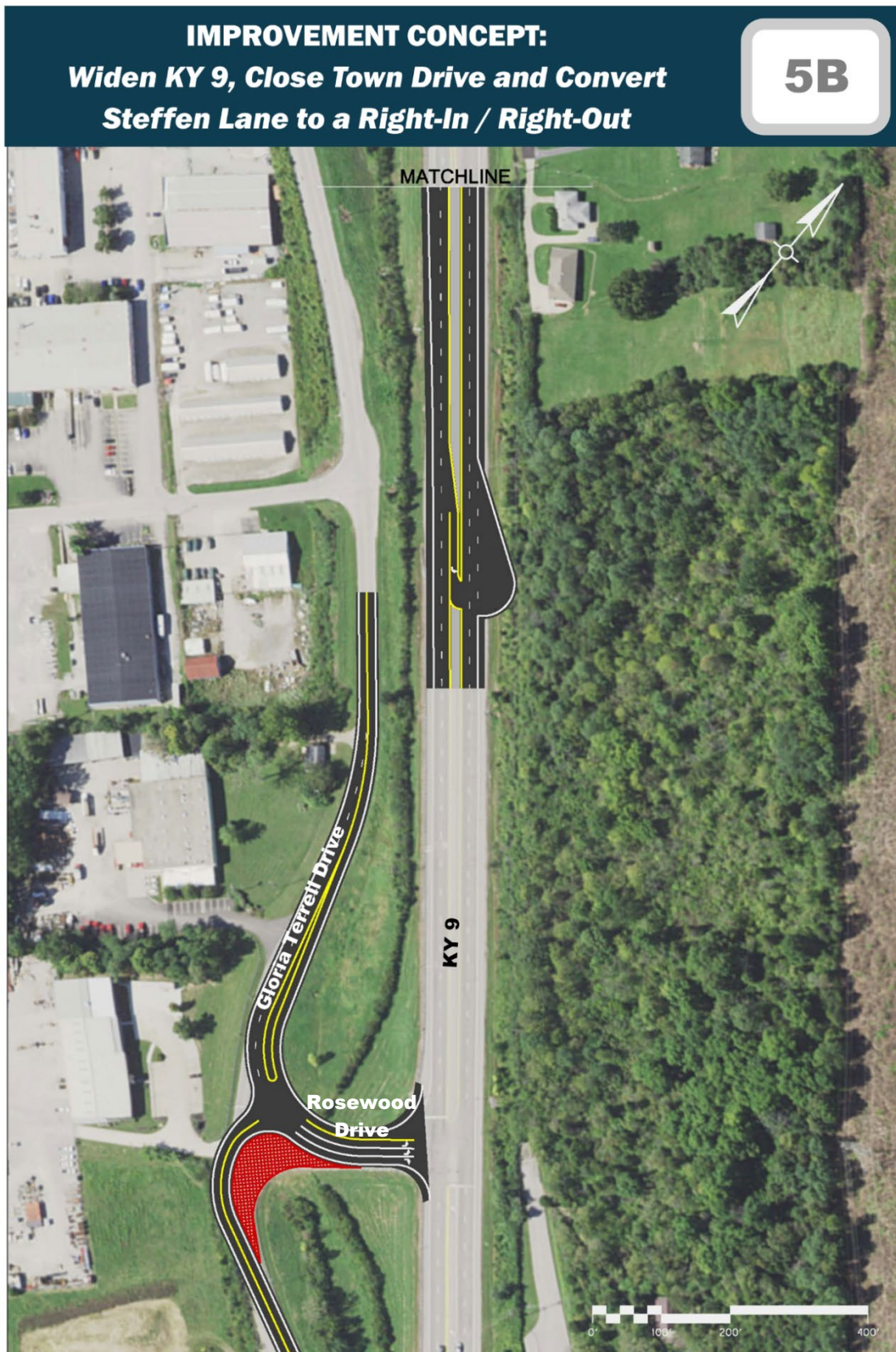


Figure 19. Improvement Option 5B – Widen KY 9, Close Town Drive and Convert Steffen Lane to Right-In/Right-Out (continued)





Figure 19. Improvement Option 5B – Widen KY 9, Close Town Drive and Convert Steffen Lane to Right-In/Right-Out (continued)



**Figure 20. Improvement Option 5C – Widen KY 9 and Convert Town Drive and Steffen Lane to a Right-In/Right-Out**

LOCATION INFORMATION												
<p><b>Location</b></p> <p>County: Campbell</p> <p>Route: KY 9; Town Drive; Steffen Lane</p> <p>MP: 17.05 to 17.60</p> <p>KY 9 Southbound at I-275 Eastbound Off-Ramp and Town Drive</p>												
EXISTING CONDITIONS												
<p><b>Town Drive Existing Features</b></p> <ul style="list-style-type: none"><li>• Four lanes at KY 9</li><li>• 12' lane width</li><li>• No paved shoulder width</li><li>• 20 mph Posted Speed Limit</li><li>• Two lanes south of intersection</li></ul>	<p><b>KY 9 Existing Features</b></p> <ul style="list-style-type: none"><li>• Two lanes each direction with mountable median</li><li>• 12' lane width; 10' outside paved shoulder width</li><li>• 45 mph Posted Speed Limit</li></ul>	<p><b>TRAFFIC DATA</b></p> <p>KY 9 No Build (AADT):</p> <p>2021: 24,400</p> <p>2045: 31,000</p> <p><b>CRASH DATA</b></p> <p>KY 9 Crashes at Town Drive</p> <p>Total: 101</p> <p>Rear End: 73</p> <p>Angle: 12</p> <p>Severe Injury: 1</p>										
<p><b>Issues</b></p> <p>The lane drop along KY 9 and the proximity of the Town Drive intersection to the I-275 Eastbound Ramps results in congestion and safety concerns. LOS at Town Drive is currently D in the PM Peak. Systemwide delay is worse during the PM Peak, when traffic is predominantly heading southbound on KY 9. It is currently 122 sec/veh and expected nearly double to 208 sec/veh by 2045. Over 100 crashes were identified near the Town Drive intersection, with 72% being rear end crashes and 21% being either angle or sideswipe crashes.</p>												
IMPROVEMENT CONCEPT												
<p><b>Description</b></p> <p>Keep both southbound lanes on KY 9 at the I-275 eastbound off-ramp and add another lane for ramp traffic. Tie in the channelized right turn from the I-275 ramp as a third lane. Convert Town Drive and Steffen Lane to a right-in / right-out and provide a U-turn loon for both directions of KY 9 traffic. A crash reduction would be anticipated from the removal of the signal at Town Drive. Reconfigure the Gloria Terrell Drive/Rosewood Drive intersection. Significant fill is needed along KY 9. It is recommended to be rock rill in order to achieve a 2:1 slope and minimize ROW impacts to businesses along Town Drive.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"><li>• AM Peak: 33 sec/veh delay increase / 2.4 mph speed reduction</li><li>• PM Peak: 144 sec/veh delay reduction / 12.3 mph speed increase</li></ul>	<p><b>COST ESTIMATE</b></p> <p>2021 Dollars</p> <table><tr><td>Design:</td><td>\$430,000</td></tr><tr><td>ROW:</td><td>\$250,000</td></tr><tr><td>Utilities:</td><td>\$1,500,000</td></tr><tr><td>Const.:</td><td>\$4,260,000</td></tr><tr><td>Total:</td><td>\$6,440,000</td></tr></table> <p><b>BENEFIT-COST RATIO</b></p> <p>3.0</p> <p><b>PROJECT PRIORITY</b></p> <p>Short-Term</p>		Design:	\$430,000	ROW:	\$250,000	Utilities:	\$1,500,000	Const.:	\$4,260,000	Total:	\$6,440,000
Design:	\$430,000											
ROW:	\$250,000											
Utilities:	\$1,500,000											
Const.:	\$4,260,000											
Total:	\$6,440,000											

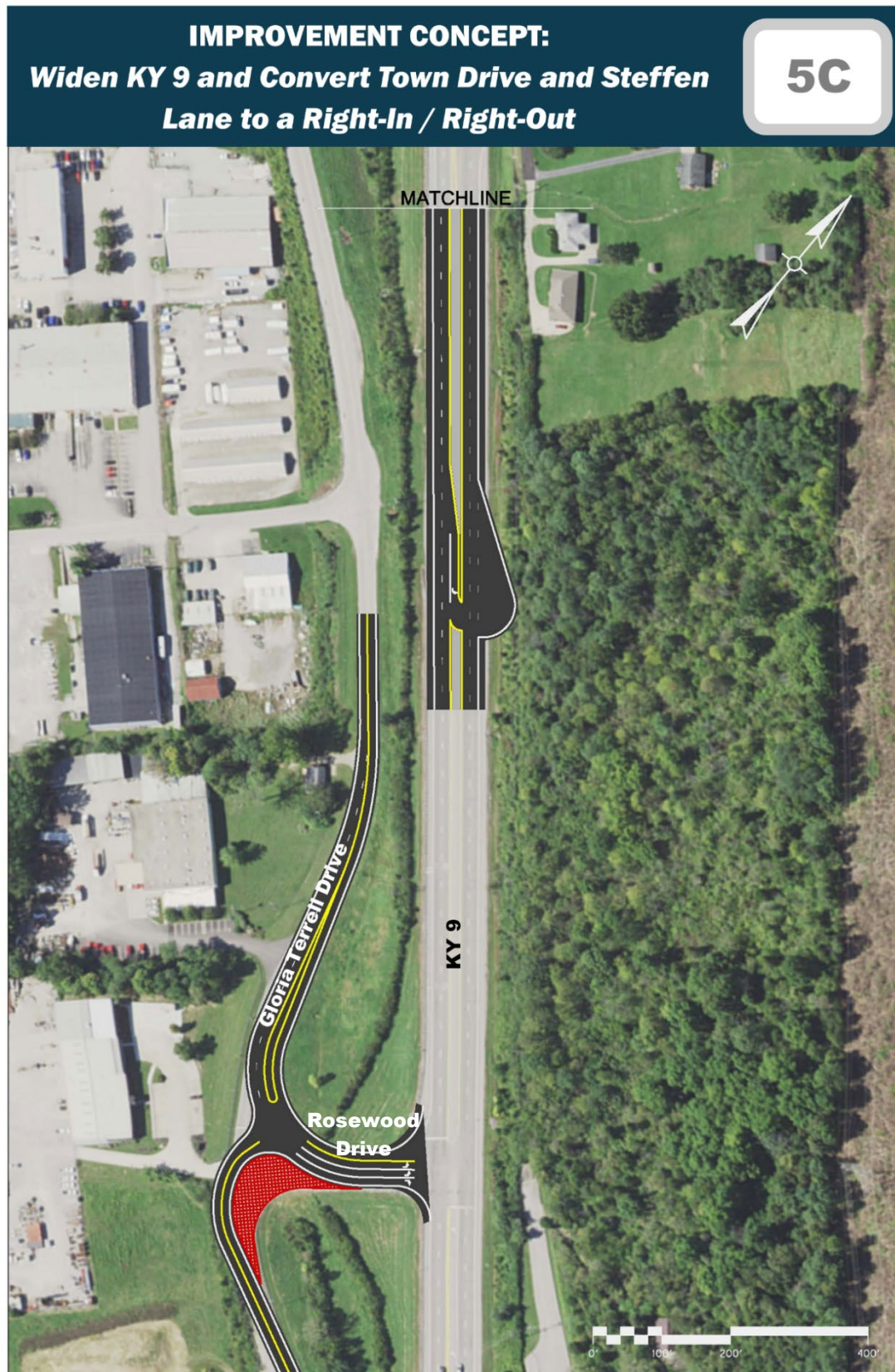


Figure 20. Improvement Option 5C – Widen KY 9 and Convert Town Drive and Steffen Lane to a Right-In/Right-Out (continued)





Figure 20. Improvement Option 5C – Widen KY 9 and Convert Town Drive and Steffen Lane to a Right-In/Right-Out (continued)

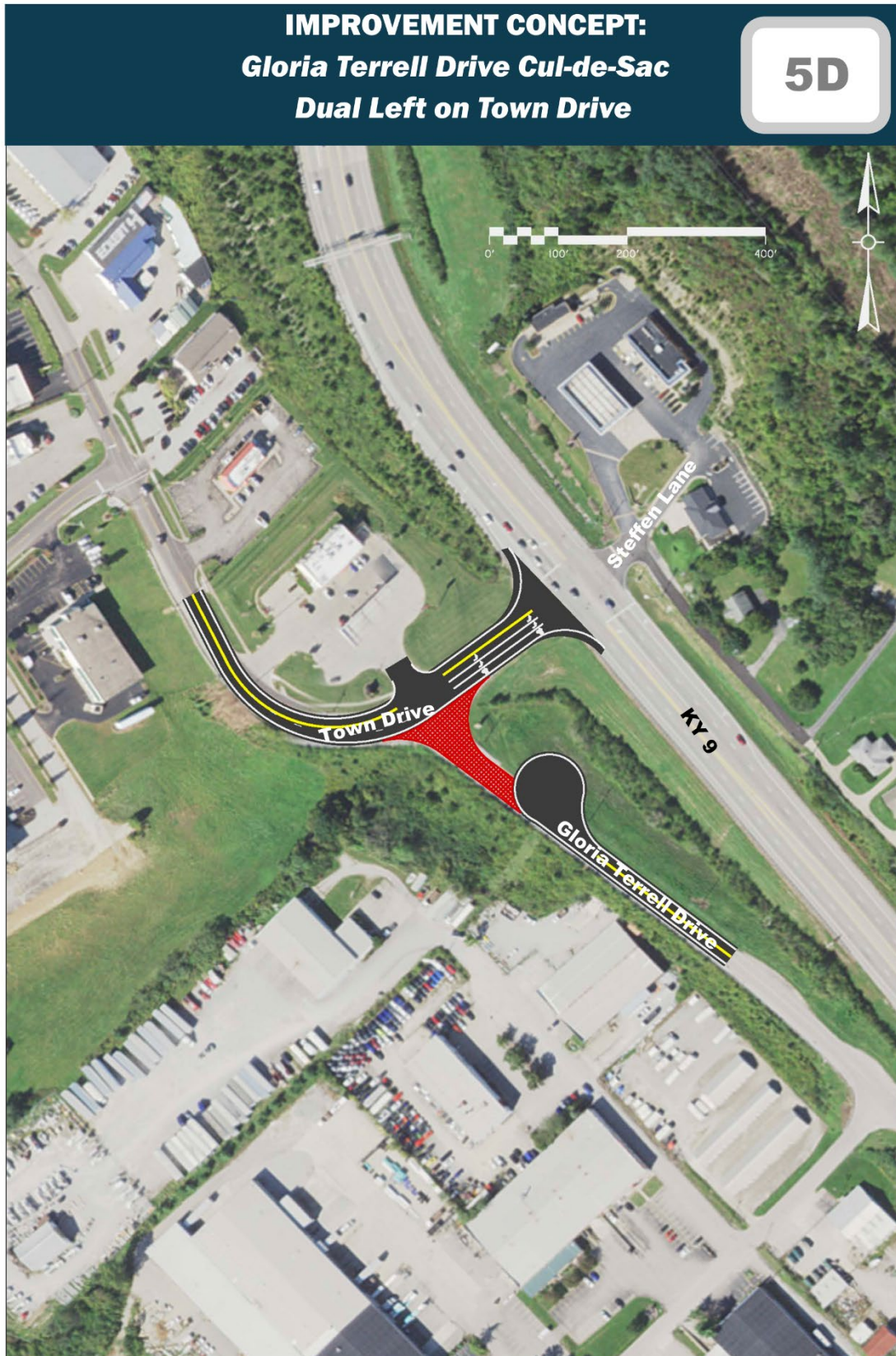


**Figure 21. Improvement Option 5D – Gloria Terrell Drive Cul-de-Sac/Dual Left on Town Drive**

LOCATION INFORMATION											
<p><b>Location</b> County: Campbell Route: KY 9; Town Drive; Steffen Lane MP: 17.05 to 17.60</p> <p>Town Drive at Gloria Terrell Drive</p>	 										
EXISTING CONDITIONS											
<p><b>Town Drive Existing Features</b></p> <ul style="list-style-type: none"> <li>• Four lanes at KY 9</li> <li>• 12' lane width</li> <li>• No paved shoulder width</li> <li>• 20 mph Posted Speed Limit</li> <li>• Two lanes south of intersection</li> </ul> <p><b>Issues</b> The KY 9/Town Drive and Town Drive/Gloria Terrell Drive intersections are closely spaced leading to congestion and safety concerns. There are periods of heavy traffic on Town Drive due to the facilities it provides access to (i.e. the movie theater and recreation complex). It is difficult to flush traffic at KY 9 due to the single left turn lane and the all-way stop at Gloria Terrell Drive which impacts traffic progression on KY 9.</p>	<p><b>TRAFFIC DATA</b> KY 9 No Build (AADT): 2021: 24,400 2045: 31,000</p> <p><b>CRASH DATA</b> KY 9 Crashes at Town Drive Total: 101 Rear End: 73 Angle: 12 Severe Injury: 1</p>										
IMPROVEMENT CONCEPT											
<p><b>Description</b> Close access to Gloria Terrell Drive from Town Drive. Construct a cul-de-sac on Gloria Terrell Drive west of Beacon Drive. Add additional left turn lane from Town Drive to KY 9. Signal efficiency at KY 9 would improve with the dual left turn lane and removal of the all-way stop condition at Gloria Terrell Drive.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"> <li>• AM Peak: 6 sec/veh delay increase / 0.7 mph speed reduction</li> <li>• PM Peak: 28 sec/veh delay reduction / 1.5 mph speed increase</li> </ul>	<p><b>COST ESTIMATE</b> 2021 Dollars</p> <table> <tr> <td>Design:</td><td>\$60,000</td></tr> <tr> <td>ROW:</td><td>\$100,000</td></tr> <tr> <td>Utilities:</td><td>\$500,000</td></tr> <tr> <td>Const.:</td><td>\$530,000</td></tr> <tr> <td>Total:</td><td>\$1,190,000</td></tr> </table> <p><b>BENEFIT-COST RATIO</b> 3.2</p> <p><b>PROJECT PRIORITY</b> Not Recommended</p>	Design:	\$60,000	ROW:	\$100,000	Utilities:	\$500,000	Const.:	\$530,000	Total:	\$1,190,000
Design:	\$60,000										
ROW:	\$100,000										
Utilities:	\$500,000										
Const.:	\$530,000										
Total:	\$1,190,000										



Figure 21. Improvement Option 5D – Gloria Terrell Drive Cul-de-Sac/Dual Left on Town Drive  
(continued)



**Figure 22. Improvement Option 5E – Convert Town Drive and Steffen Lane to a Right-In/Right-Out**

LOCATION INFORMATION												
<p><b>Location</b></p> <p>County: Campbell</p> <p>Route: KY 9; Town Drive; Steffen Lane</p> <p>MP: 17.05 to 17.60</p> <p>KY 9 Southbound at I-275 Eastbound Off-Ramp and Town Drive</p>												
EXISTING CONDITIONS												
<p><b>Town Drive Existing Features</b></p> <ul style="list-style-type: none"><li>• Four lanes at KY 9</li><li>• 12' lane width</li><li>• No paved shoulder width</li><li>• 20 mph Posted Speed Limit</li><li>• Two lanes south of intersection</li></ul>	<p><b>KY 9 Existing Features</b></p> <ul style="list-style-type: none"><li>• Two lanes each direction with mountable median</li><li>• 12' lane width; 10' outside paved shoulder width</li><li>• 45 mph Posted Speed Limit</li></ul>	<p><b>TRAFFIC DATA</b></p> <p>KY 9 No Build (AADT):</p> <p>2021: 24,400</p> <p>2045: 31,000</p> <p><b>CRASH DATA</b></p> <p>KY 9 Crashes at Town Drive</p> <p>Total: 101</p> <p>Rear End: 73</p> <p>Angle: 12</p> <p>Severe Injury: 1</p>										
<p><b>Issues</b></p> <p>The proximity of the Town Drive intersection to the I-275 Eastbound Ramps results in congestion and safety concerns. LOS at Town Drive is currently D in the PM Peak. Systemwide delay is worse during the PM Peak, when traffic is predominantly heading southbound on KY 9. It is currently 122 sec/veh and expected nearly double to 208 sec/veh by 2045. Over 100 crashes were identified near the Town Drive intersection, with 72% being rear end crashes and 21% being either angle or sideswipe crashes.</p>												
IMPROVEMENT CONCEPT												
<p><b>Description</b></p> <p>Convert Town Drive and Steffen Lane to a right-in / right-out and provide a U-turn loon for both directions of KY 9 traffic. A crash reduction would be anticipated from the removal of the signal at Town Drive. Reconfigure the Gloria Terrell Drive/Rosewood Drive intersection.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"><li>• AM Peak: 25 sec/veh delay increase / 1.8 mph speed reduction</li><li>• PM Peak: 24 sec/veh delay reduction / 3.4 mph speed increase</li></ul>	<p><b>COST ESTIMATE</b></p> <p>2021 Dollars</p> <table><tr><td>Design:</td><td>\$160,000</td></tr><tr><td>ROW:</td><td>\$100,000</td></tr><tr><td>Utilities:</td><td>\$500,000</td></tr><tr><td>Const.:</td><td>\$1,550,000</td></tr><tr><td>Total:</td><td>\$2,310,000</td></tr></table> <p><b>BENEFIT-COST RATIO</b></p> <p>0.4</p> <p><b>PROJECT PRIORITY</b></p> <p>Not Recommended</p>		Design:	\$160,000	ROW:	\$100,000	Utilities:	\$500,000	Const.:	\$1,550,000	Total:	\$2,310,000
Design:	\$160,000											
ROW:	\$100,000											
Utilities:	\$500,000											
Const.:	\$1,550,000											
Total:	\$2,310,000											



Figure 22. Improvement Option 5E – Convert Town Drive and Steffen Lane to a Right-In/Right-Out (continued)





Figure 22. Improvement Option 5E – Convert Town Drive and Steffen Lane to a Right-In/Right-Out (continued)



**Figure 23. Improvement Option 6 – Widen KY 9, Close Town Drive and Convert Steffen Lane to a Continuous Green T Intersection**

LOCATION INFORMATION												
<p><b>Location</b></p> <p>County: Campbell</p> <p>Route: KY 9; Town Drive; Steffen Lane</p> <p>MP: 17.05 to 17.61</p> <p>KY 9 Southbound at I-275 Eastbound Off-Ramp and Town Drive</p>		<div>6</div>										
EXISTING CONDITIONS												
<p><b>Town Drive Existing Features</b></p> <ul style="list-style-type: none"><li>• Four lanes at KY 9</li><li>• 12' lane width</li><li>• No paved shoulder width</li><li>• 20 mph Posted Speed Limit</li><li>• Two lanes south of intersection</li></ul>	<p><b>KY 9 Existing Features</b></p> <ul style="list-style-type: none"><li>• Two lanes each direction with mountable median</li><li>• 12' lane width; 10' outside paved shoulder width</li><li>• 45 mph Posted Speed Limit</li></ul>	<p><u>TRAFFIC DATA</u></p> <p>KY 9 No Build (AADT):</p> <p>2021: 24,400</p> <p>2045: 31,000</p> <p><u>CRASH DATA</u></p> <p>KY 9 Crashes at Town Drive</p> <p>Total: 101</p> <p>Rear End: 73</p> <p>Angle: 12</p> <p>Severe Injury: 1</p>										
<p><b>Issues</b></p> <p>The lane drop along KY 9 and the proximity of the Town Drive intersection to the I-275 Eastbound Ramps results in congestion and safety concerns. LOS at Town Drive is currently D in the PM Peak. Systemwide delay is worse during the PM Peak, when traffic is predominantly heading southbound on KY 9. It is currently 122 sec/veh and expected nearly double to 208 sec/veh by 2045. Over 100 crashes were identified near the Town Drive intersection, with 72% being rear end crashes and 21% being either angle or sideswipe crashes.</p>												
IMPROVEMENT CONCEPT												
<p><b>Description</b></p> <p>Keep both southbound lanes on KY 9 at the I-275 eastbound off-ramp and add another lane for ramp traffic. Tie in the channelized right turn from the I-275 ramp as a third lane. Close Town Drive and convert Steffen Lane to a Continuous Green T. Provide a U-turn loon for both directions of KY 9 traffic. The median for KY 9 would be widened to provide the channelized movements and appropriate deceleration and acceleration to and from Steffen Lane. Reconfigure the Gloria Terrell Drive/Rosewood Drive intersection. Significant fill is needed along KY 9. It is recommended to be rock rill in order to achieve a 2:1 slope and minimize ROW impacts to businesses along Town Drive.</p> <p><b>Systemwide Operations Results</b></p> <ul style="list-style-type: none"><li>• AM Peak: 19 sec/veh delay increase / 1.2 mph speed reduction</li><li>• PM Peak: 128 sec/veh delay reduction / 10.4 mph speed increase</li></ul>		<p><u>COST ESTIMATE</u></p> <p>2021 Dollars</p> <table><tr><td>Design:</td><td>\$580,000</td></tr><tr><td>ROW:</td><td>\$250,000</td></tr><tr><td>Utilities:</td><td>\$1,500,000</td></tr><tr><td>Const.:</td><td>\$5,780,000</td></tr><tr><td>Total:</td><td>\$8,110,000</td></tr></table> <p><u>BENEFIT-COST RATIO</u></p> <p>2.3</p> <p><u>PROJECT PRIORITY</u></p> <p>Not Recommended</p>	Design:	\$580,000	ROW:	\$250,000	Utilities:	\$1,500,000	Const.:	\$5,780,000	Total:	\$8,110,000
Design:	\$580,000											
ROW:	\$250,000											
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Total:	\$8,110,000											



Figure 23. Improvement Option 6 – Widen KY 9, Close Town Drive and Convert Steffen Lane to a Continuous Green T Intersection (continued)

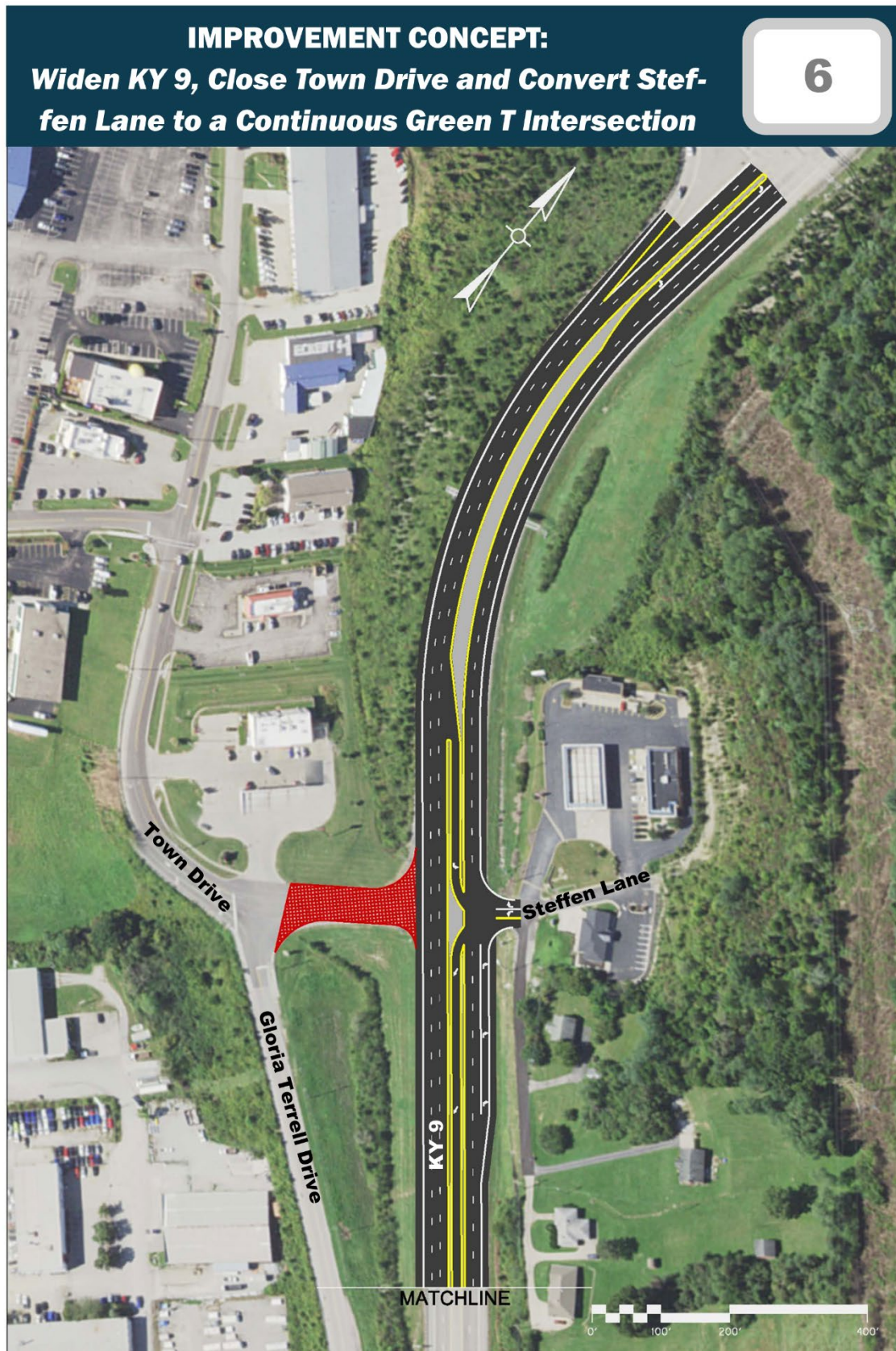
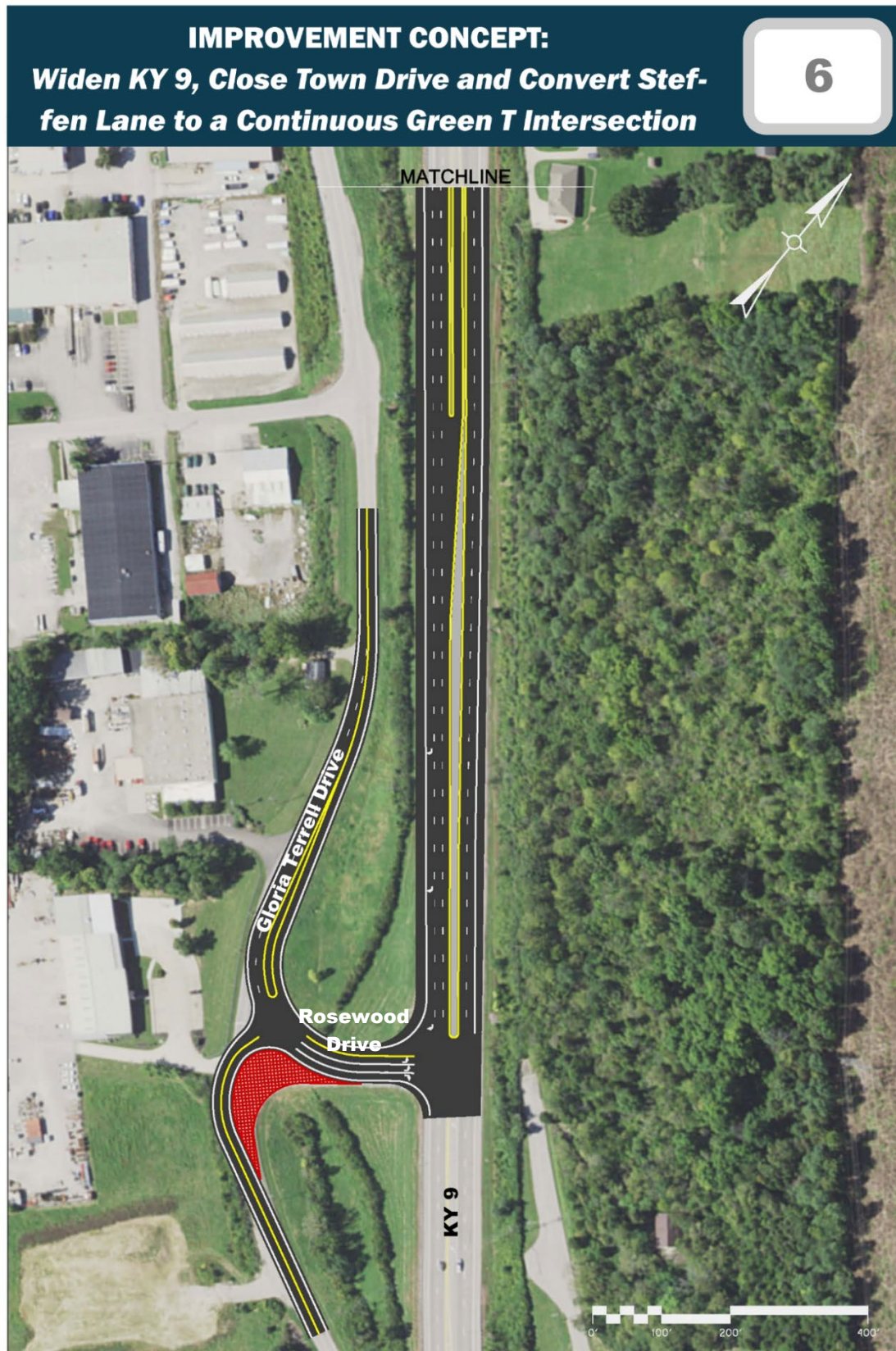




Figure 23. Improvement Option 6 – Widen KY 9, Close Town Drive and Convert Steffen Lane to a Continuous Green T Intersection (continued)



## Chapter 5 – Study Outcomes

### 5.1 Final Evaluation of Improvement Options

The project team concluded that based on the engineering analysis, potential environmental impacts, benefit-cost analysis, and costs, seven of the eleven improvement options were not recommended for further consideration at this time. The recommendations are summarized below:

- When compared to Improvement Option 1, Improvement Option 2 had a significantly higher total cost and lower benefit-cost ratio; therefore, Improvement Option 1 is recommended for further consideration over Option 2.
- While Improvement Option 3B had a higher benefit-cost ratio and lower total cost when compared to Option 3A, the westbound on ramp for Option 3B does not meet the required minimum acceleration length. Given Improvement Option 3A, corrects this deficiency, it is recommended for further consideration.
- Improvement Option 4 is not recommended due to its high costs and low travel savings resulting in a low benefit-cost ratio.
- When compared to Improvement Options 5A and 5C, Options 5B, 5E, and 6 all have a lower travel savings and benefit-cost ratios. Improvement Option 5D provides a comparable benefit-cost ratio due to its lower costs; however, doesn't benefit the overall system as much as Options 5A and 5C, therefore, they are recommended for further consideration.

### 5.2 Prioritized Projects

The KY 9 Scoping Study resulted in a range of conceptual improvements for future implementation. Improvement options primarily focused on addressing four areas where congestion and safety concerns were identified through examination of documented crash records and traffic analysis. Utilizing additional tools including operations analysis, traffic forecasting and project team input, a prioritized list of improvement options has been compiled. The prioritization is broken down by the following categories:

- **Short-Term** projects include those that are relatively low-cost and have minimal impacts. Due to their cost, these projects may still need to go through the SHIFT process to be constructed.
- **Long-Term** projects are higher-cost and may have additional impacts. While they are anticipated to take longer to fund and construct, they will help to meet the future transportation needs of the KY 9 and I-275 corridors in terms of operations and safety. These projects would go through the SHIFT process to be constructed.

**Table 15** lists the improvement options and their priority as assigned.

### 5.3 Next Steps

At this time, no additional funding is programmed to further study this interchange or for future phases of specific improvement options presented in this study. Improvement Options 1 and 5C are proposed as short-term options. It should be noted that Improvement Option 5C includes all components of Option 5A; therefore, both are not required to be completed. Improvement Option 3A is recommended as a long-term option.

The next phase in the project development process is Preliminary Engineering and Environmental Analysis (commonly referred to as Phase I Design). If federal funds are used and/or permits will be required, additional environmental analyses will be needed to satisfy the National Environmental

Policy Act (NEPA). Improvement options will need to be incorporated into OKI's Metropolitan Transportation Plan and Transportation Improvement Program (TIP), and KYTC's Statewide Transportation Improvement Plan (STIP). Furthermore, Improvement Option 3A would require an Interchange Modification Report (IMR) to analyze the impacts to the interstate in more detail. This would include analyzing each interchange east and west of the KY 9 interchange.

## 5.4 Additional Information

Written requests for additional information should be sent to KYTC Division of Planning Director, 200 Mero Street, Frankfort, Kentucky 40622. Additional information regarding this study can be obtained from the District 6 Planning Section at (859) 341-2700 or by mail at District 6, 421 Buttermilk Pike, Covington, KY 41017.

**Table 15. Summary of Improvement Option Priority**

Improvement Option	Description	Cost (DRUC*)	Priority
Option 1	Extend Left Turn Lane for I-275 Westbound Ramp from KY 9 Northbound.	\$ 3,070,000	Short-Term
Option 3A	Flyover Ramp with Separated Movement Starting North of I-275 Bridge over KY 9. Provide Dual Lane Entry Onto I-275.	\$ 46,260,000	Long-Term
Option 5A	Provide Three KY 9 Southbound Lanes between Eastbound Ramps and just south of Town Drive. No Lane Drop at I-275 Eastbound Exit Ramp for KY 9 Southbound, Additional Continuous Lane from I-275 Eastbound Exit Ramp to Town Drive and Extend the Extra Lane past Town Drive.	\$ 5,560,000	Short-Term
Option 5C	Improvement Option 5A Plus: Remove Town Drive Signal, Convert Town Drive and Steffen Lane to Right-In / Right-Out. Permit U-Turns south of Town Drive and at the I-275 Eastbound Ramp intersection. Realign Rosewood Drive and Gloria Terrell Drive Intersection and Provide Dual Lefts from Rosewood Drive onto KY 9.	\$ 6,440,000	Short-Term

\*DRUC – Design, Right-of-Way, Utilities, Construction in 2021 Dollars