US 231
US 68
US 68X

INTERSECTION IMPROVEMENT STUDY

WARREN COUNTY, KY

EXECUTIVE SUMMARY | MAY 2022

KENTUCKY TRANSPORTATION CABINET

IN PARTNERSHIP WITH

QK4 Engineering Planning

EXECUTIVE SUMMARY

Study Background

The Kentucky Transportation Cabinet (KYTC) initiated this *US 231/US 68/US 68X Intersection Improvement Study* in Bowling Green during May 2021 to evaluate transportation options to improve safety and mobility at the US 231 (Campbell Lane and Veterans Memorial Lane)/US 68 (Russellville Road and Veterans Memorial Lane)/US 68X (Russellville Road) intersection. Over 40,000 vehicles use the intersection on any given day. The study area limits extend approximately 700 feet from the intersection center: US 68X (Russellville Road) at milepoint (MP) 0.000, US 231 (Campbell Lane) at MP 13.882, and US 68 (Russellville Road and Veterans Memorial Lane) at MP 9.334. The project location is shown in **Figure ES-1**.

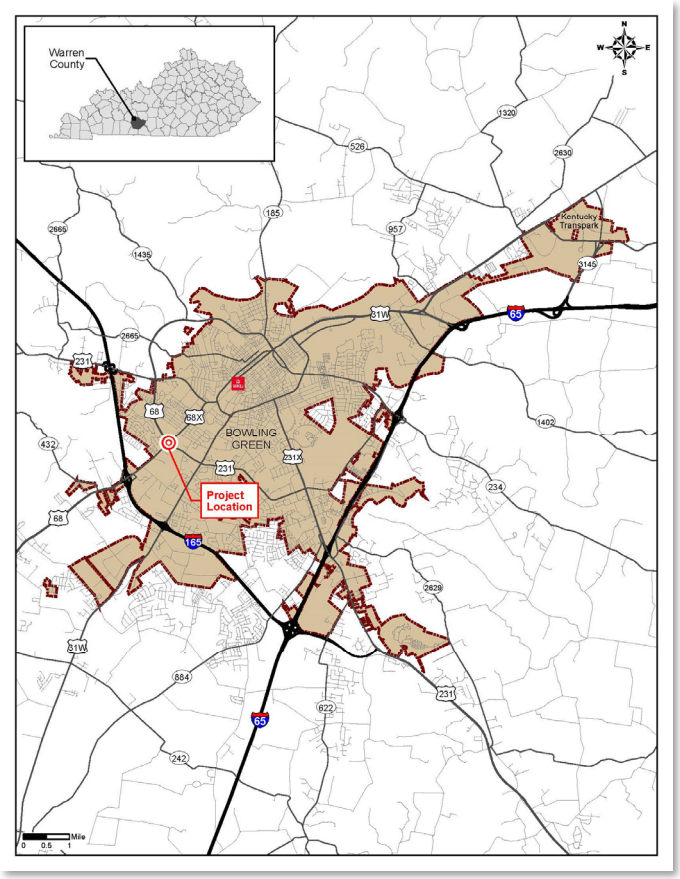

Figure ES-1: Project Location

Existing Conditions

US 68 and US 231 are classified as urban principal arterials and US 68X is an urban minor arterial. All four approaches are listed as tier 3 facilities on Kentucky's Highway Freight Network; US 68 and US 231 are on the National Highway System (NHS).

All approaches accommodate multi-lane traffic as detailed on **Figure ES-2**. Lanes are 10 feet wide on US 68X and 12 feet wide on the three other approaches. The signal operates as a semi-actuated, uncoordinated control, and follows the standard eight-phase configuration for a four-legged intersection with protected/permitted left-turn phases.

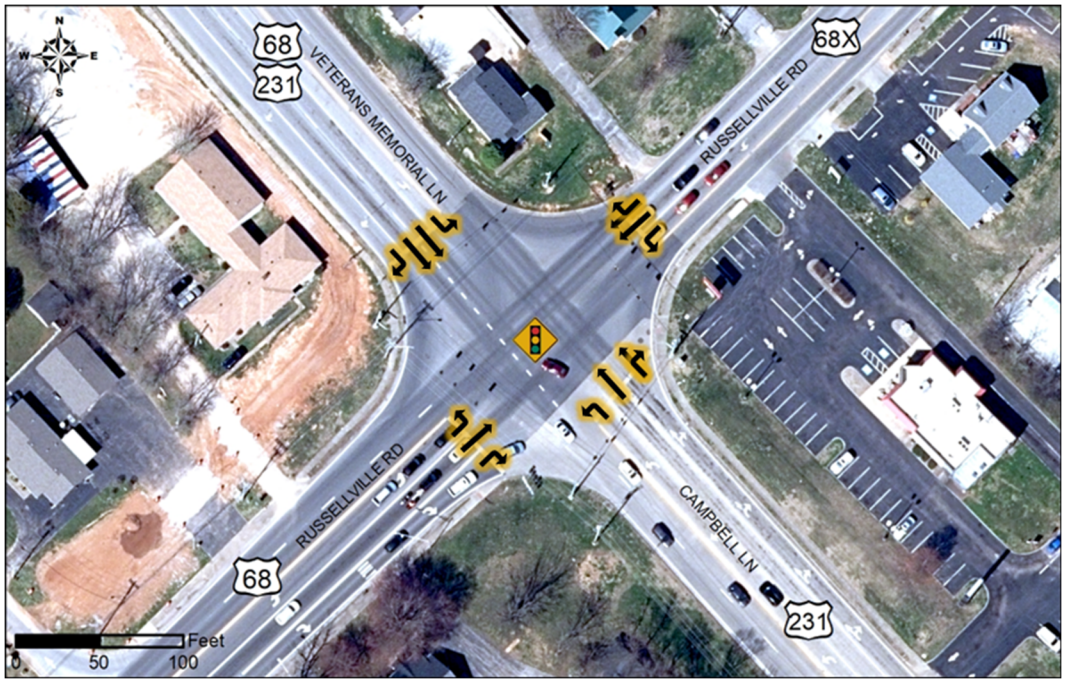

Figure ES-2: Study Intersection Configuration

Three of the four approaches are relatively straight and flat. The fourth—US 231 (Campbell Lane)—has a horizontal curve and vertial grade associated with the CSX railroad overpass about 1,000 feet east of the study intersection.

Sidewalks are present along at least one side of all intersection approaches, with pedestrian facilities in three of four quadrants but no striped crosswalks. The City of Bowling Green's 2017 *BG Moves: Multimodal Implementation Plan* identifies future greenway expansions along US 231 (Campbell Lane).

Existing and Future Traffic

Year 2021 existing traffic volumes show 40,500 cars entering the intersection during a 24-hour period, including 2,920 vehicles entering during the AM peak hour and 3,450 entering during the PM peak hour. Data show strong directional peaks in the morning: eastbound on both Russellville Road approaches and southbound on US 231. During the PM peak hour, raw volumes on each approach are higher but directional peaks are less severe. Microsimulation shows the existing intersection operates at Level of Service (LOS) D during both peak hours; left turns from each approach were congested in one or more peak hours, resulting in LOS E for these movements.

Building from existing traffic patterns, forecasts for a 2045 future analysis horizon were generated using the Bowling Green–Warren County regional travel demand model. Background socioeconomic growth assumptions in the model were adjusted to reflect the adjacent Keystone

Commons development and a new elementary school off US 68 to the south. The regional model predicted a 2.1% annual growth rate for the primary study intersection, or 61,200 entering vehicles per day in 2045. Applying hourly and directional factors, this corresponds to 4,320 vehicles entering during the AM peak hour and 5,130 entering during the PM peak hour. This degrades peak hour operations to LOS E–F; with this level of congestion, it is likely drivers would shift to other routes during the busiest periods and/or spread into other, less busy travel times.

Crash Trends

Over a four-year period from January 2017 through December 2020, 207 reported crashes were reported within the intersection vicinity, including 41 injury collisions and 166 crashes resulting in property damage only (PDO). Rear-end collisions accounted for 50% of crash types, followed by angle crashes (23%). All four approaches exhibit higher-than-expected crash rates, with a Level of Service of Safety (LOSS) rating of III or IV considering all severities. LOSS assigns ratings of I (least) through IV (most) based on how many more crashes occurred than mathematically predicted.

Environmental Setting

Natural and human environmental resources were identified from available literature and database review and a site visit. As the study area is in an urban area and largely within existing right-of-way, few environmental red flag concerns are anticipated should future project development activities occur, though additional environmental studies may be required. A geotechnical overview notes the area has an intense karst potential with underlying clay soils. A complete geotechnical investigation is recommended if the project advances, including drilling, sampling, and testing of materials.

Study Objectives

The objective of this study was to develop conceptual improvement options to address traffic flow, safety, and access at the US 231/US 68/US 68X intersection. Each improvement concept identified will address one or more of the study area's needs:

Lengthy Delays | High Mobility | Adjacent Driveways | Many Crashes | Continuing Growth | Pedestrian Safety

Improvement Concepts

A variety of improvement concepts were initially considered: additional turn lanes, a quadrant roadway system, displaced left-turn (DLT) intersection, a roundabout, and grade-separated configurations. Three Build concepts advanced for detailed study.

Build 1 (**Figure ES-3**) adds dual left-turn lanes to three of the four approaches, retiming the signal to optimize throughput. This concept improves the 2045 LOS from E–F in the No-Build to LOS D—providing the highest throughput and least delay of the options studied. Build 1 provides moderate crash savings, reducing angle crashes by about 20%, which represents about a quarter of the 207 crashes. The costs and right-of-way impacts are similar to those for the basic roundabout option (Build 3).

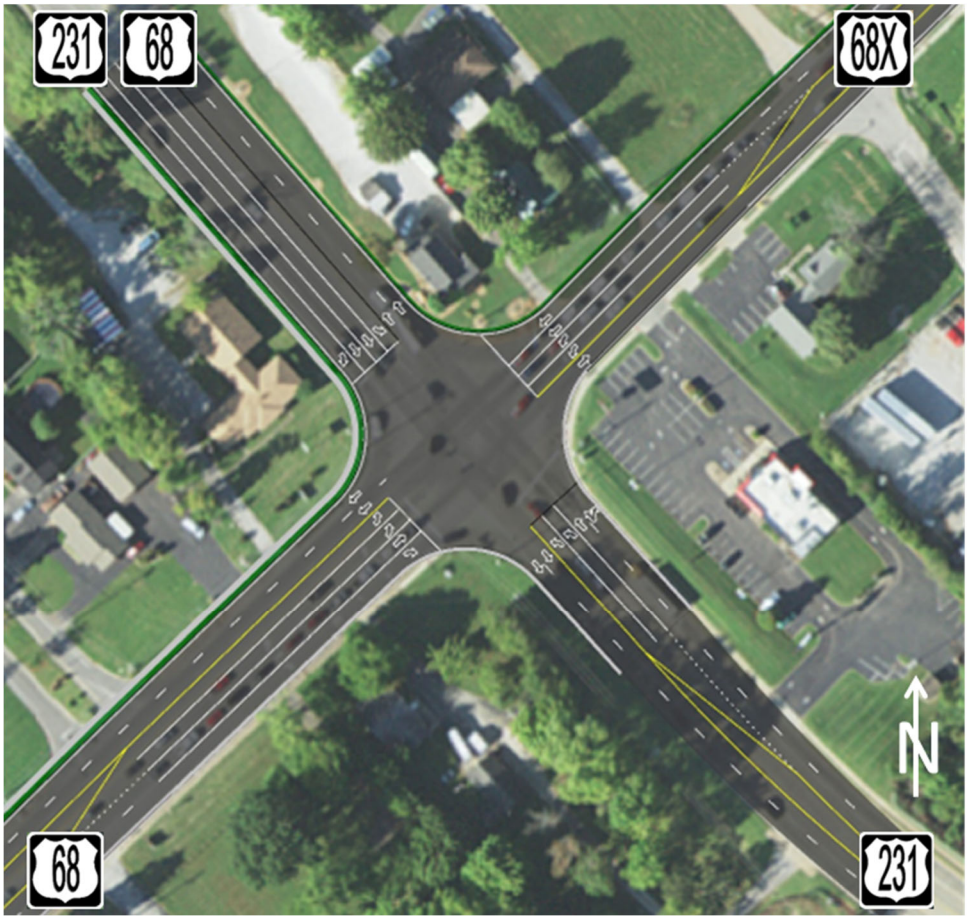

Figure ES-3: Concept Sketch for Build 1

Build 2 (**Figure ES-4**) creates a partial DLT-style intersection, which optimizes timing at the main intersection by shifting left-turning traffic on the two bypass approaches to the opposite side of the street at upstream signalized crossovers. This configuration shows 2045 peak hour traffic at LOS D–E. However, it represents a less familiar layout for drivers and adds new signals to the corridor. Since this is a more innovative layout, there is less documentation to predict how many safety benefits would result. With the highest costs and most right-of-way needed, this concept is not recommended for further consideration.

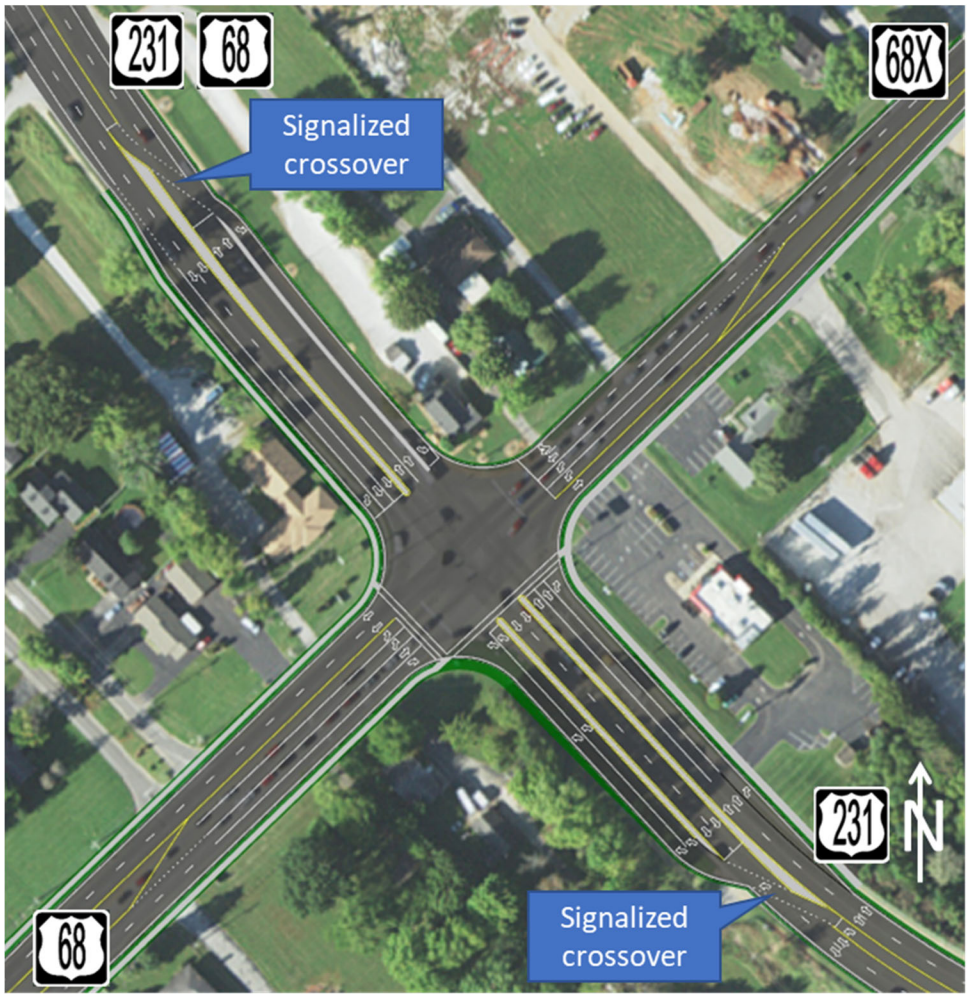

Figure ES-4: Concept Sketch for Build 2

Build 3 (**Figure ES-5** on the following page) reconstructs the intersection as a two-lane roundabout, which offers the lowest capacity of the concepts considered but could be fine-tuned in future design stages. This concept provides more than enough capacity to handle existing peak

hour turning movements and it has the best safety rating—decreasing vehicle crashes by about half and offering the safest crossing options for pedestrians with refuges in splitter islands. Costs and right-of-way impacts for the roundabout are similar to Build 1, although these do not account for future enhancements to improve throughput—e.g., adding slip lanes.

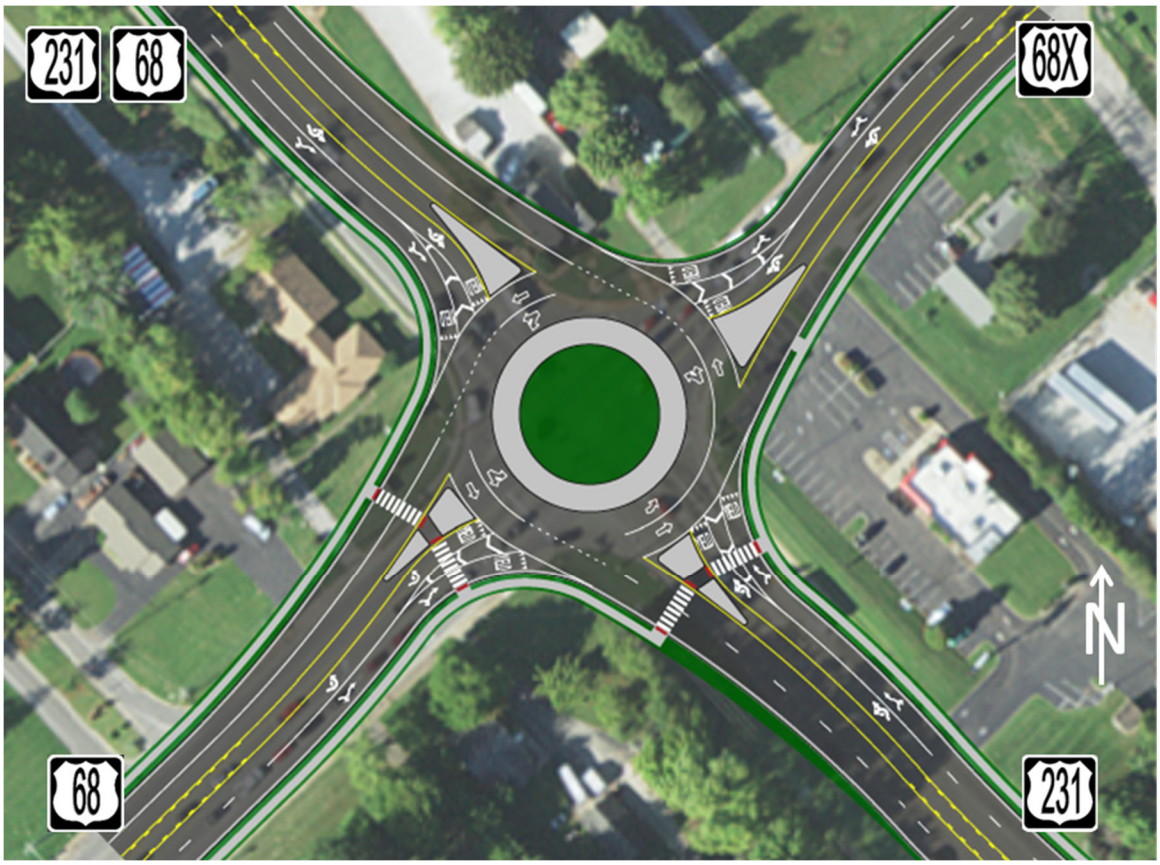

Figure ES-5: Concept Sketch for Build 3

Following technical analyses, the project team met virtually[1] with local officials and stakeholders to provide an overview of the study findings and present the three Build concepts. During the meeting, participants were polled to confirm the top three study area concerns: lengthy delays, continuing development, and high crash rates. Twelve of 14 poll respondents (86%) preferred the roundabout concept. Nine of 14 identified the displaced left style intersection as the least preferred solution.

[1] In-person gatherings were limited due to the COVID pandemic.

Project sheets (found in **Section 6.3**) provide additional details. **Table ES-1** provides a summary table of the three Build concepts considered with bold text noting the best performers in each category.

Table ES-1: Comparison of Build Concepts

Metric	Build 1: Dual Lefts	Build 2: Partial DLT	Build 3: Roundabout
2045 Traffic Operations	**Best**	Medium Less familiar and adds new signals	Least Future enhancement options
Crash Reductions	Medium $600,000 annual crash savings	Least Up to $500,000 annual crash savings	**Best** $1,700,000 annual crash savings
Pedestrian Connections	Medium	Least	**Best** Shorter crossings, steady traffic flow
Cost	**$7.2M**	$11.1M	**$7.4M**
Approx. ROW	**1.3 ac** Fewest impacts	2.6 ac	**1.5 ac**
Stakeholder Input	14% Preferred 21% Liked Least	64% Liked Least	**86% Preferred**

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