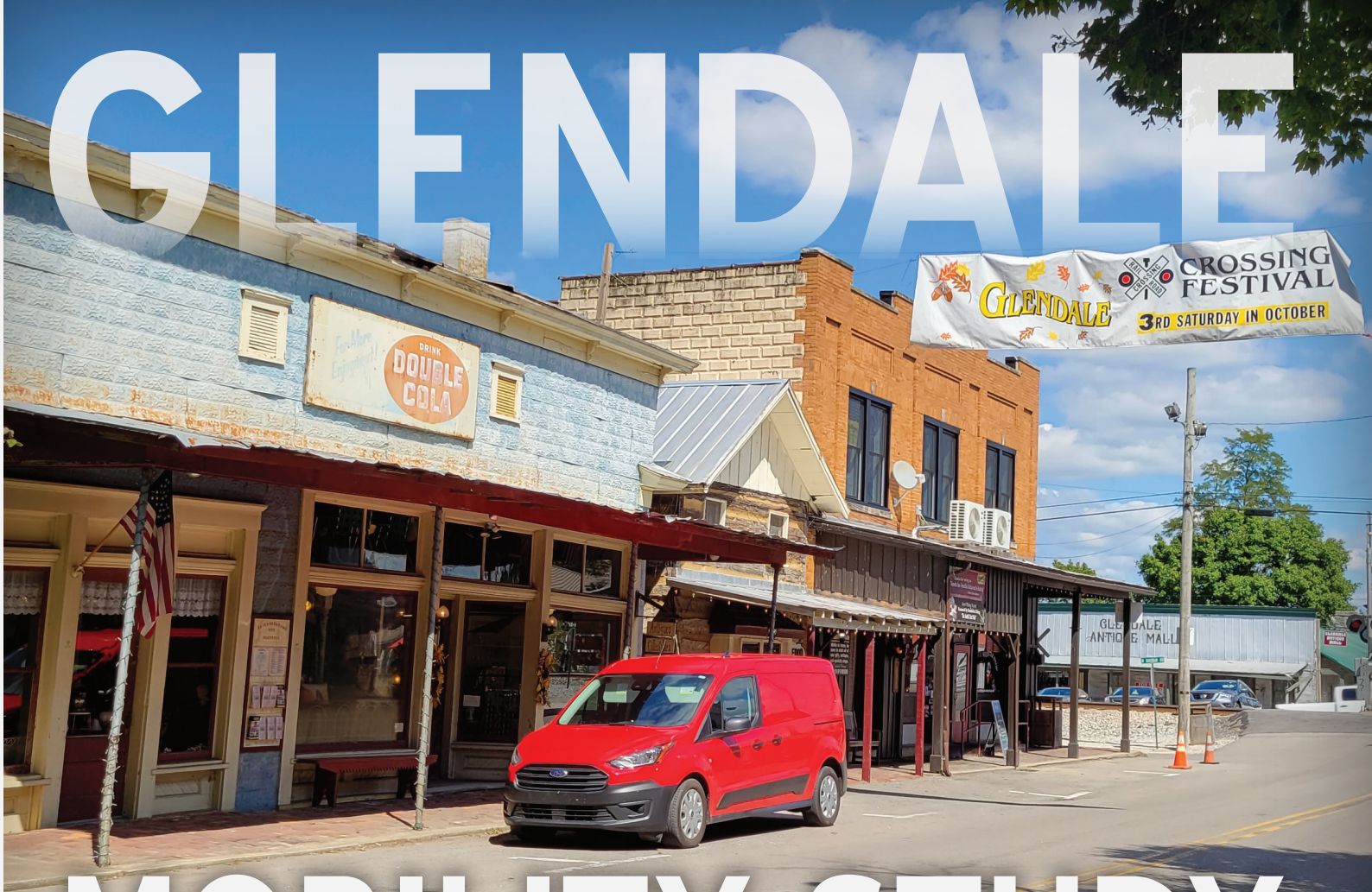
GLENDALE



MOBILITY STUDY

PREPARED FOR

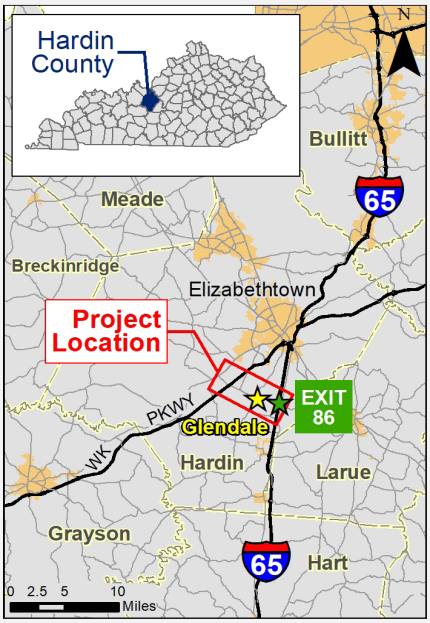
TEAM KENTUCKY®
TRANSPORTATION CABINET

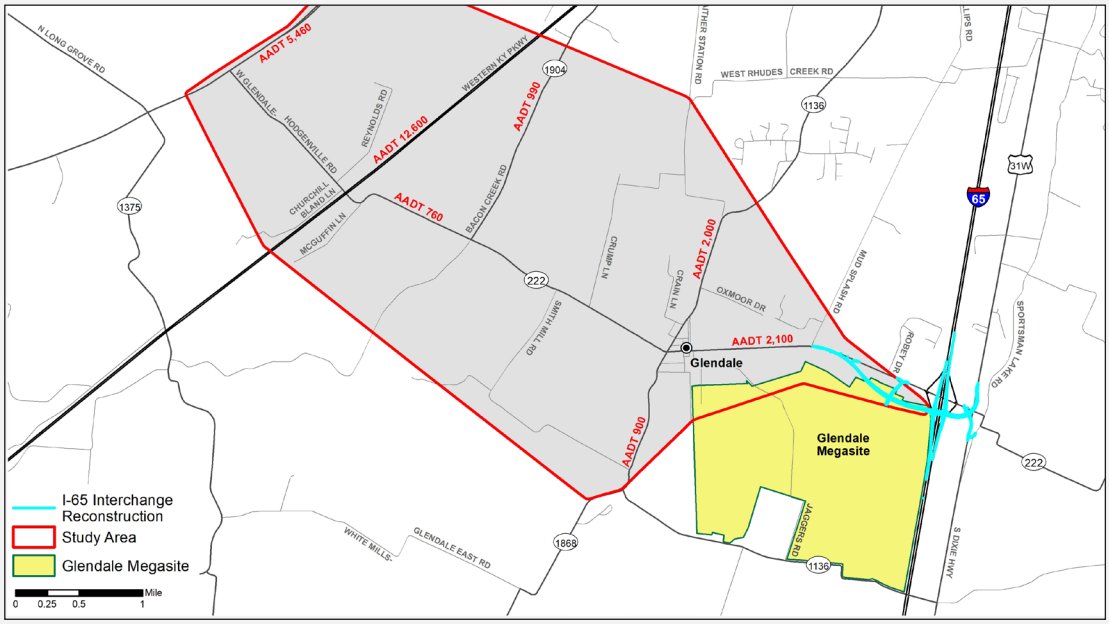
HARDIN COUNTY, KY

FINAL REPORT | OCTOBER 2023

IN PARTNERSHIP WITH

QK4
Engineering Planning





EXECUTIVE SUMMARY

Study Background

The Kentucky Transportation Cabinet (KYTC) initiated a corridor study in spring 2022 to examine mobility needs near the community of Glendale in south central Hardin County. With two new BlueOvalSK (BOSK) battery manufacturing plants under construction near Glendale, Hardin County is expecting to see 5,000 new full-time employees working at the 1,500-acre industrial site as early as 2025—adding traffic to the area's rural highways.

While several major infrastructure projects are underway in the area, this *Glendale Mobility Study* examines the local roadway network to understand what additional projects are needed to sustain anticipated growth. The study area (**Figure ES-1**) follows KY 222 from US 62 in the west to its interchange with I-65 in the east; north to south, the area is up to three miles wide to allow sufficient space to consider improving east-west connections.

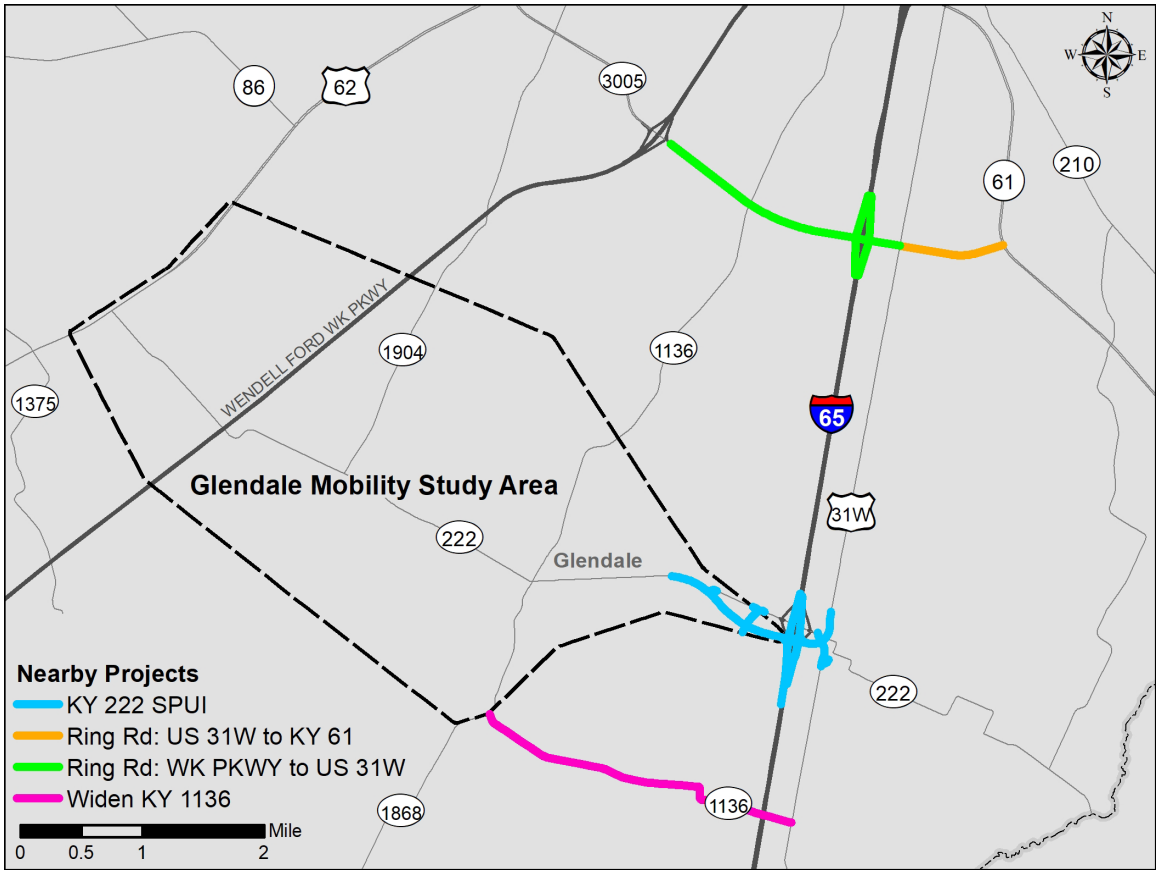


Figure ES-1: Ongoing Highway Plan Projects near Study Area

Near the study area, several highway projects are under development with funding for one or more project development phases in Kentucky's *2022 – 2028 Enacted Highway Plan*.

- **Item No. 4-20.01: I-65/KY 222 Interchange Reconstruction** is under construction, expected to open to traffic in 2024. The interchange will be reconstructed from its current diamond layout to a single point urban interchange (SPUI) with traffic signals and increased storage lanes/lengths to improve capacity, prioritizing the high-volume moves between the interchange and plant.
- **Item No. 4-198.00: Ring Road Extension**, currently under design, proposes to extend KY 3005 (Ring Road) east from its current endpoint at the Western KY Parkway to US 31W, including a new I-65 interchange.
- As a separate project, another **Ring Road Extension to Lincoln Parkway (Item No. 4-80250.00)** will not be developed until a preferred alignment is selected for Item 4-198.
- **Item No. 4-171.00 Reconstruction of KY 1136 (Gilead Church Road)**, currently in design, will improve the existing highway to provide two 12-foot-wide lanes with 8-foot-wide paved shoulders and turn lanes at key intersections.

Other previous studies and potential future projects near the study area were also considered from recent planning studies and KYTC's Continuous Highway Analysis Framework (CHAF) database.

Any improvement concepts considered should be developed to satisfy as many of the following goals as possible:

Existing Conditions

KY 222 (Glendale-Hodgenville Road) is a two-lane rural minor collector with 10-foot-wide lanes and minimal paved shoulders. Along KY 222, a series of rolling hills west of Glendale limit sight distance. Sharp curves just east of the Western KY Parkway has posted warning chevrons to alert motorists to slow down. Recent counts show 2,100 vehicles per day (vpd) use the KY 222 corridor east of Glendale compared to 800 vpd to the west. US 62, the Western Kentucky Parkway, and I-65 provide higher mobility north-south connections through the study area, with KY 1136 and US 31W providing north-south options for shorter trips.

In addition to passenger cars, school buses, farm equipment, and other vehicle types also traverse study area highways. Heavy truck traffic is common near the interchange, accessing the adjacent truck stops, and will likely increase with the development of the industrial plants. Hardin County is also home to an active bicycling community, relying on low-volume rural highways for solo rides and group events.

Historical crash data for a six-year period (January 2016 through December 2021 shows 121 crashes occurred throughout the study area: 51 along KY 222 and the remainder associated with other highways. By severity, there were three fatality crashes along KY 222, six injury crashes, and the remaining 42 crashes were property damage only. By type, most are single vehicle crashes (51%), followed by angle crashes (27%).

Environmental Overview

Much of the study area is rural, dedicated to farmlands. There is a large "PACE" easement north of Glendale plus a certified agricultural district to the west. The unincorporated community of Glendale has a higher density of residential properties, combined with several local commercial businesses, many geared to tourism/antiques. The eastern limits transition to a more highway-commercial setting, with two large truck stops/convenience stores. The developing Megasite southeast of the study area will be industrial and is expected to spur additional growth in the area as support businesses and demands for housing increase.

A records check and survey were completed to assess individual resources and potential historic districts and identify properties potentially eligible for inclusion on the National Register of Historic Places (NRHP). Shown in **Figure ES-2** alongside other environmental features, the Glendale Historic District is NRHP listed and includes 28 contributing resources plus an expanded district boundary adds 8 more resources to the north. Beyond the district, 12 individual properties within the study area are listed or were identified as potentially eligible for listing on the NRHP, requiring detailed field surveys and agency coordination should a Build concept advance for future project development.

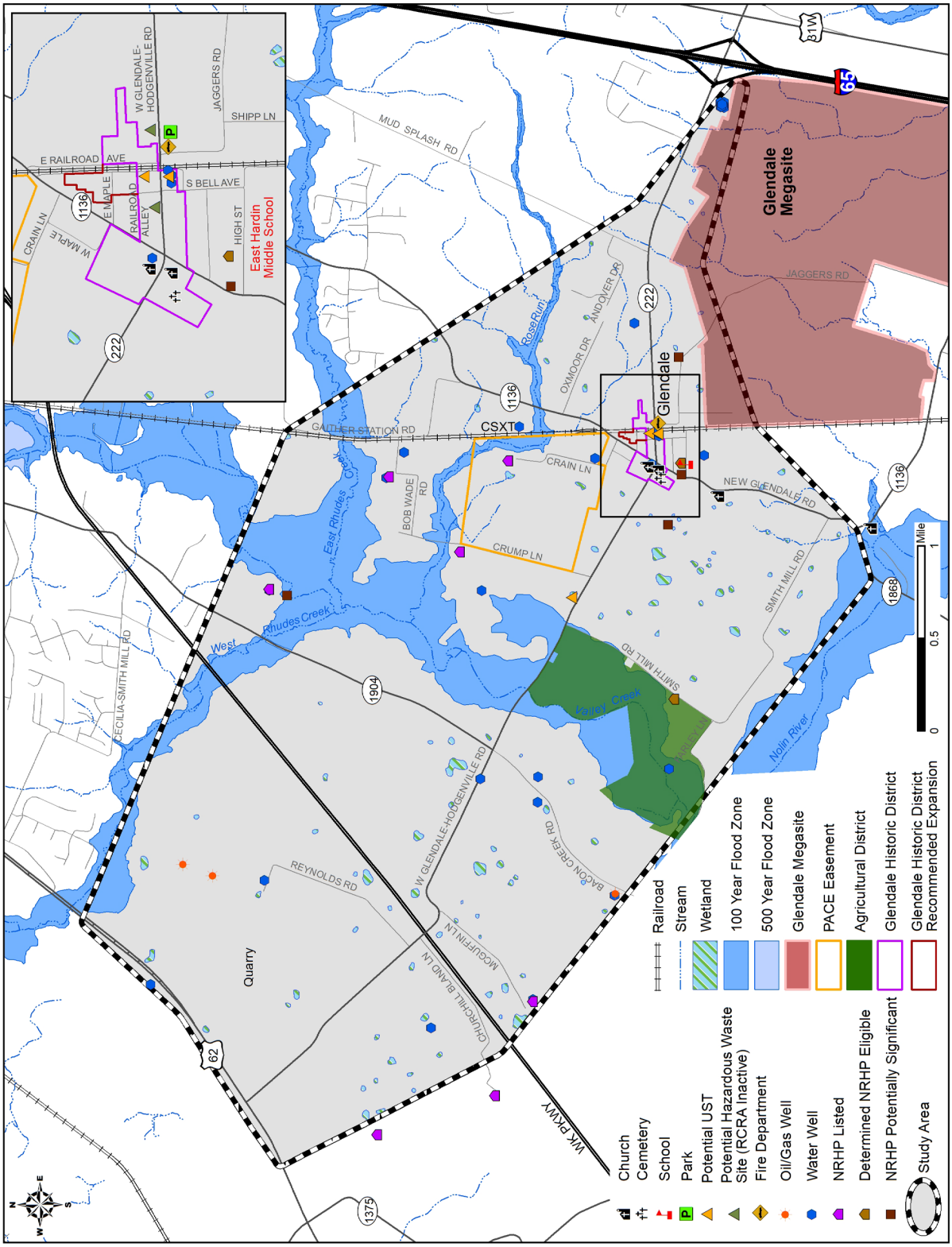


Figure ES-2: Environmental Overview

Alongside farmlands and historic resources, the study area also includes several named creeks, large floodplains, numerous wetlands, farm ponds, water wells, and groundwater springs. As the area drains into the Green River and sensitive groundwater areas around Mammoth Cave, the entire area is identified as a priority watershed.

US Fish and Wildlife Service (USFWS) records show three protected bat species have the potential to occur within the study area plus the monarch butterfly is under consideration for official listing.

The study area is located within the Western Pennyroyal physiographic region, characterized as an upland area primarily consisting of high karst potential limestones and karstic features, including frequent sinkholes. Karst terrain will likely be the most critical geotechnical factor to any new construction in the study area.

Within Glendale, the former East Hardin Middle School provides areas for sports teams' practices and community events though its future reuse is currently undetermined. There is a city park southeast of the KY 222 railroad crossing and three churches within the study area. The community hosts several local festivals throughout the year but is known for its annual Glendale Crossing Festival in October.

Future Growth

Study area needs are driven by future traffic accessing the BOSK plants, so traffic forecasts are a critical component of this study. The goal is to coordinate all projects and the future (2045) traffic scenario, including the new battery plants and future land use changes in southern Hardin County. Future regional traffic was forecast using the updated Meade-Hardin Travel Demand Model (TDM). Coordination occurred with both city and county planning representatives to help forecast the future (2045) land use scenario, built around household and job projections.

Over 1,600 new homes are expected to be constructed by 2045 within the three zones north of KY 222 between I-65 and Valley Creek. Other zones throughout south central Hardin County also exhibit substantial residential increases. The Glendale Megasite reflects 4,900 new employees by 2045, with 750+ additional jobs in the adjacent zones and even more job growth in the surrounding region. The two plants currently under construction account for the 4,900 projected jobs, with half the Megasite undeveloped but primed to support further growth. The I-65/US 31W and US 62/Railroad corridors exhibit the highest commercial/industrial growth projections.

Considering population projections, anticipated development, and TDM projections, 2045 No Build ADT volumes were forecast as shown in **Figure ES-3**, compared alongside the 2022 Existing traffic scenario. Three distinct projects are included in the No-Build assumptions: the BOSK battery plants with staggered shift start times, extension of Ring Road to US 31W, and reconstruction of

the I-65/KY 222 interchange as a SPUI. As shown, background traffic volumes continue to grow. KY 222 volumes east of Glendale and I-65 ramps to/from the north roughly double by 2045.

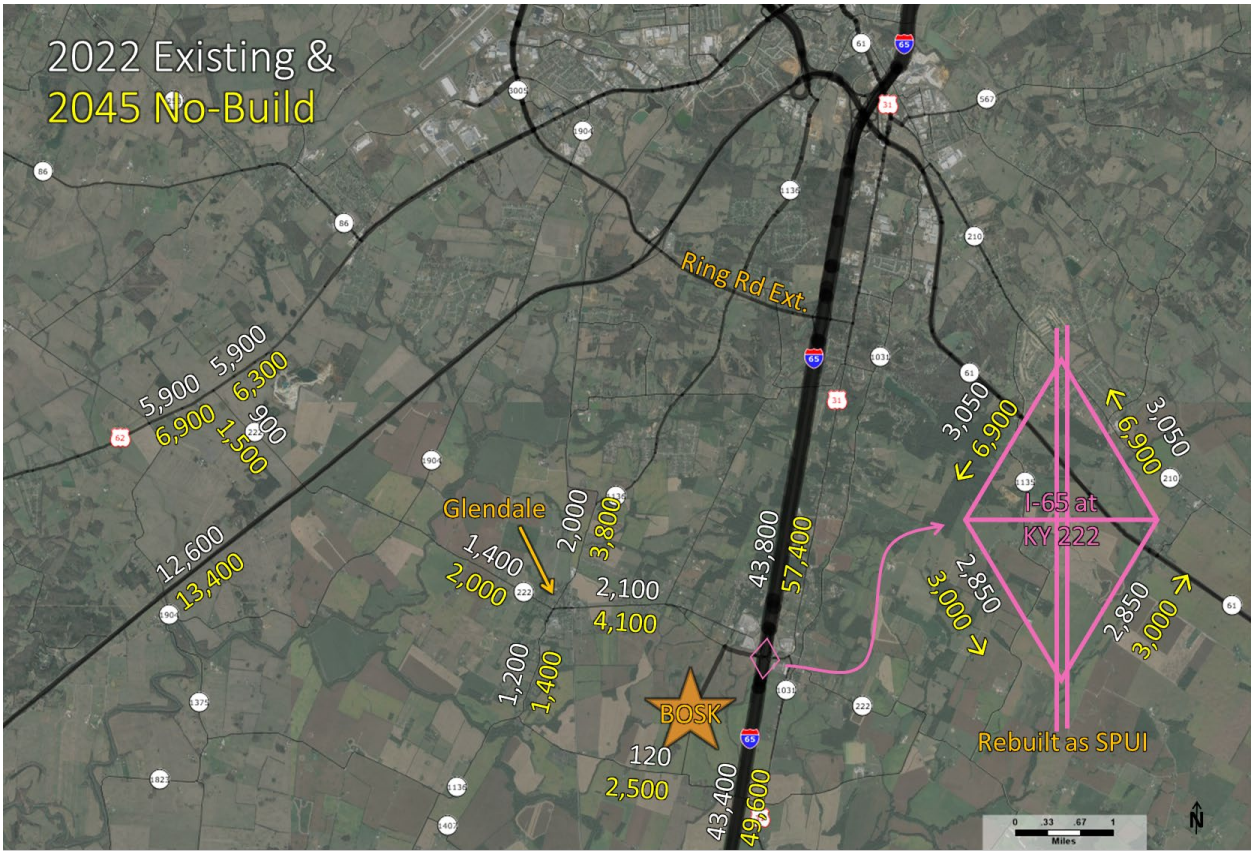


Figure ES-3: No-Build ADTs

Build Concepts Considered

Improvement concepts were developed based on a combination of input from the project team, a review of previous planning efforts, traffic projections, stakeholder feedback, and field reconnaissance.

- **Concept A** represents a northeast bypass of the Glendale community, similar to a portion of the concept identified in the 2008 *Glendale Area Transportation Study* and 2021 update. The concept routes traffic to/from the north along KY 1136 (New Glendale Road) to KY 222 and the BOSK plants without traveling through the KY 222/KY 1136 intersection in Glendale. Concept A also eliminates the need to navigate two at-grade railroad crossings (or the local short cut along East Railroad Avenue) between these destinations. Two variations were developed, shown in **Figure ES-4**. Year 2045 traffic projections estimate 2,500 vpd using a northeast bypass, well within the theoretical capacity of a two-lane

highway. For the planning study, the typical section is assumed to include two 12-foot-wide lanes with 8-foot-wide paved shoulders.

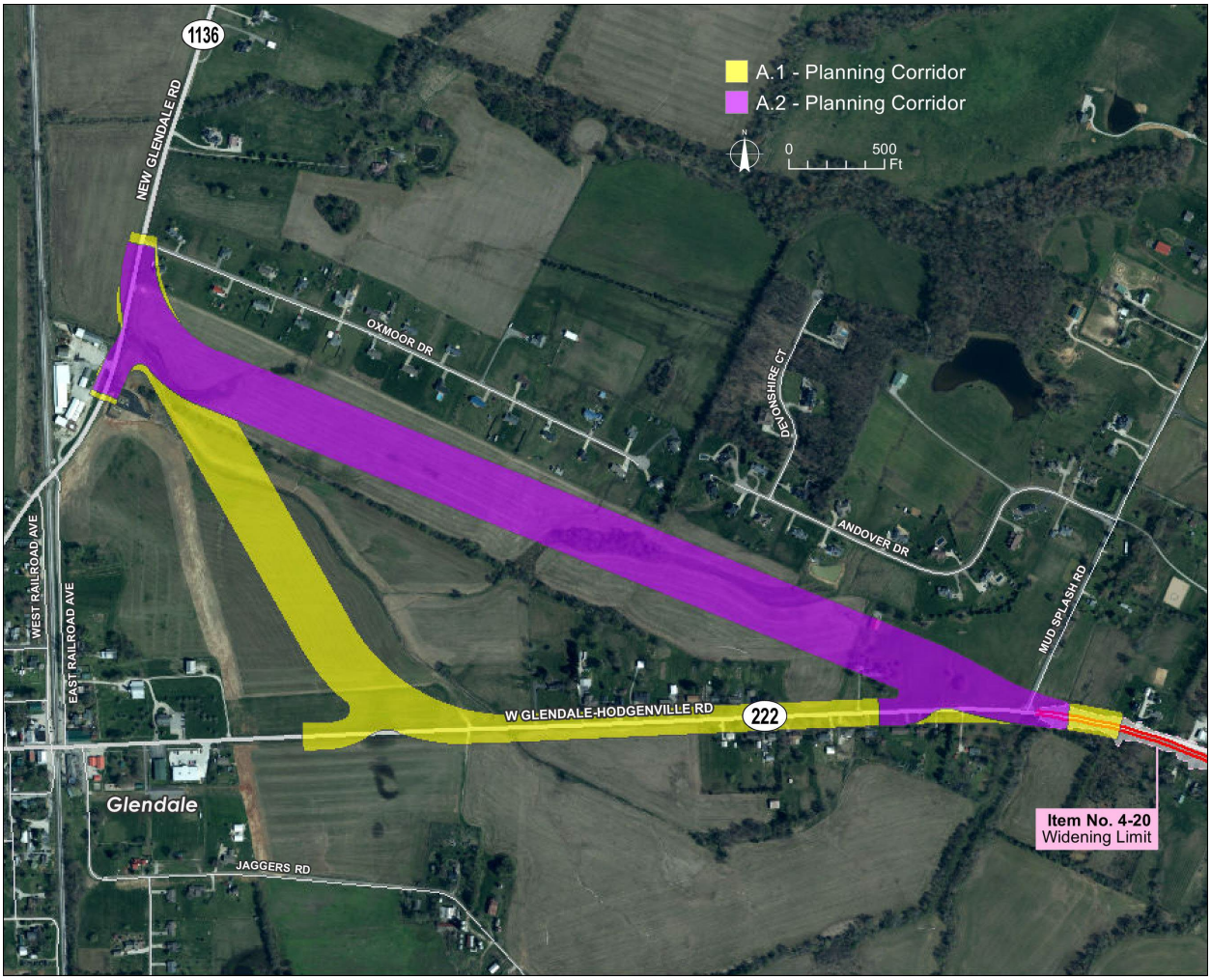


Figure ES-4: Concept A Variations

- **Concept B** represents a northwest bypass of the Glendale community, also similar to a concept identified in the 2008 and 2021 studies. The linkage was initially dismissed as infeasible, but further study in early 2023 identified potential connections.

- **Concept AB** represents a full northern bypass of the Glendale community, connecting to KY 222 on either side of town—providing an alternate path for traffic currently passing through town. Year 2045 traffic projections estimate 1,800-3,300 vpd using a north bypass, well within the theoretical capacity of a two-lane highway. For the planning study, the typical section is assumed to include two 12-foot-wide lanes with 8-foot-wide paved shoulders. Options for both at-grade and grade separated rail crossings were considered along the route shown in **Figure ES-5**.

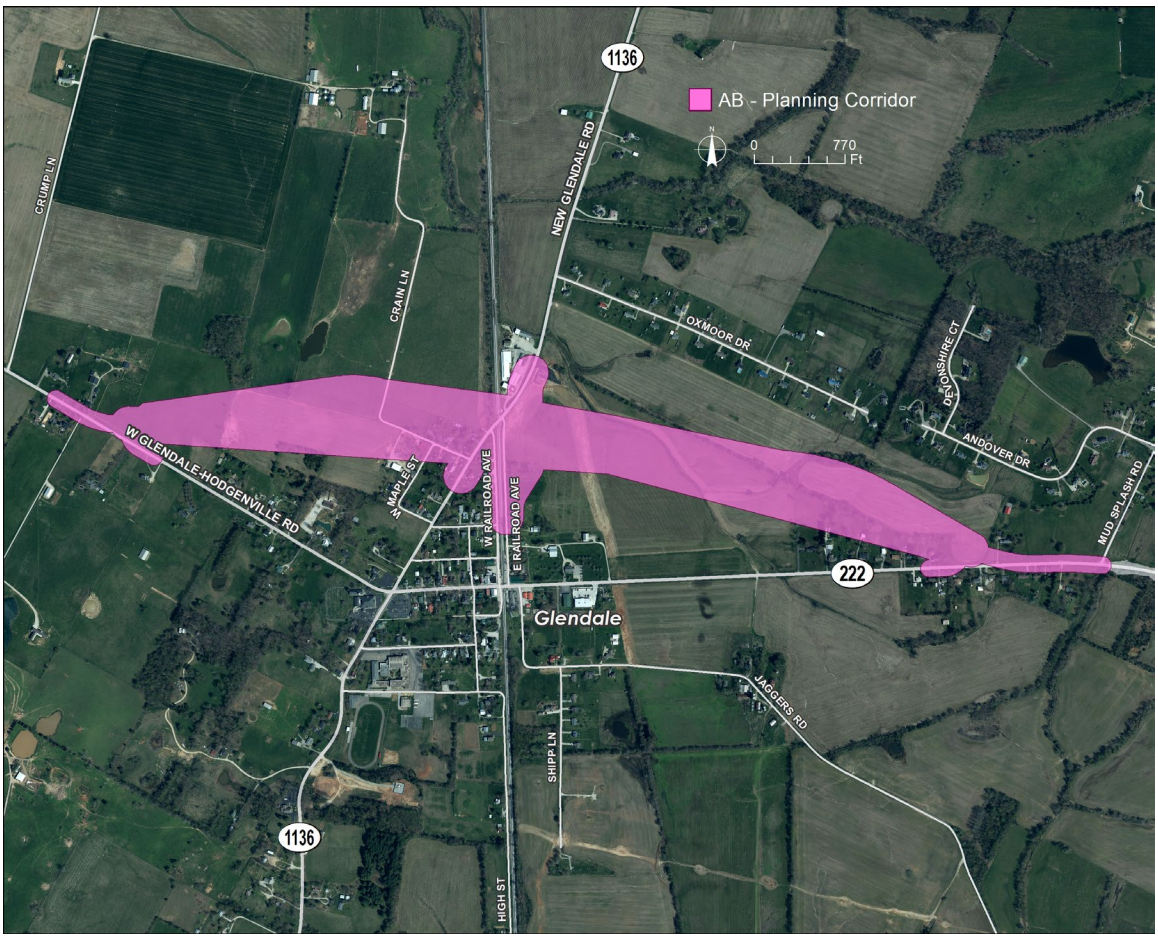


Figure ES-5: Concept AB

- **Concept C** includes a new interchange with I-65 at KY 1136 (Gilead Church Road), which is proposed for minor widening as part of Item No. 4-171. A new I-65 interchange would shorten the trip to/from the south and divert some traffic from the busy ramps at Exit 86. The proposed interchange would serve an estimated 5,200 vpd in 2045, divided among the four ramps.

- **Concept D** includes a new interchange with the Western KY Parkway at KY 222 (Glendale-Hodgenville Road) and improved east/west connection. Five variations of Concept D were considered and are shown in **Figure ES-6**. More southern routes could rely on KY 1136 (Gilead Church Road) to reach the BOSK plants while more northern routes could rely on a new South Glendale Bypass with a grade-separated railroad overpass to reach the BOSK plants. The proposed interchange would serve 2,600 vpd in 2045 divided among the four ramps but would not pull traffic away from the busy I-65/KY 222 interchange. Traffic using KY 222 to travel east/west increases versus the No-Build scenario. Based on projected 2045

traffic, a two-lane highway provides adequate capacity for anticipated volumes; the same typical section is assumed as for Concept A.

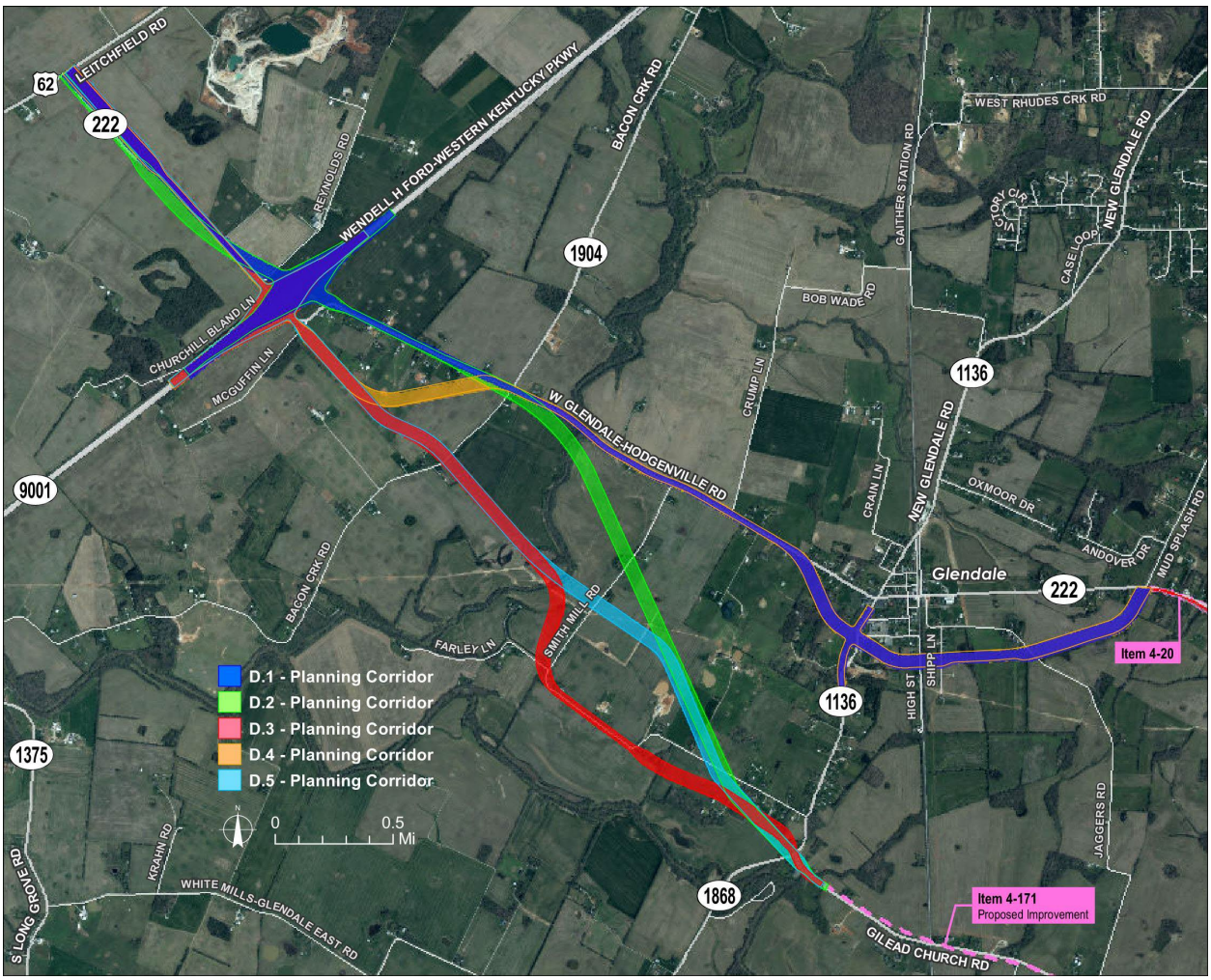


Figure ES-6: Concept D Variations

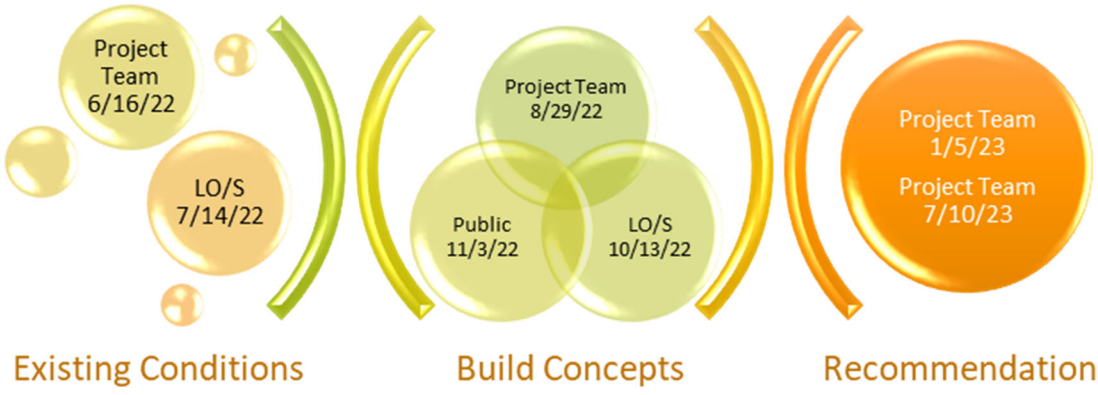
Cost estimates in 2023 dollars are summarized in **Table ES-1**.

Table ES-1: Planning-Level Cost Estimates by Phase

Concept	Design	Right-of-Way	Utility	Construction	Total
Concept A Northeast Bypass	$500,000	$1.5M	$300,000 - $1.0M	$4.8M - $5.6M	**$7.6M - $7.9M**
Concept B Northwest Bypass	$700,000 - $1.9M	$2.7M - $3.9M	$1.6M - $2.3M	$5.6M - $17.9M	**$10.8M - $26.0M**
Concept C KY 1136 Interchange	$1.5M	$6.5M	$1M	$18M	**$27M**
Concept D WKY Parkway Interchange	$2.6M - $3.9M	$8.9M - $13.3M	$1.6M-$3.0M	$31.4M - $45.8M	**$45.5M - $66.0M**

Meetings

Collaborative project team, local official/stakeholder (LO/S), and public engagement efforts occurred through the course of the study.



During October and November 2022, surveys were collected to obtain community perspectives on the proposed concepts.[1] Overall, 146 completed surveys were submitted. Questions asked about Concepts A, C, and D—which would provide the most value and which, if any, should advance for further project development. Overall, each Build concept received more support than opposition. Concept C received the most support (80% in favor), especially for providing benefit for BOSK traffic with minimal impact to historic Glendale, farmlands, etc. Concept A received the

[1] Concept AB was developed following the Fall 2022 public outreach.

least public support of the three Build concepts but was noted to provide more benefits for historic Glendale than Concept D. **Concept A.2 (Purple)** was favored over **Concept A.1 (Yellow)** nearly 3:1 while results were divided among Concept D options.

Following the development of Concept AB in early 2023, updates were provided via the study website to publicize the expanded concept as well. This generated extensive public interest on social media. During August and September, 1,408 surveys were received indicating a strong opposition to Concept AB and priority to minimize impacts on the community.

Recommendations

Overall, Concept A (Northeast Bypass) is the highest priority. Both variations should be considered during preliminary engineering efforts, especially if much time elapses between the conclusion of this planning effort and obligation of design funds, as the area is rapidly changing. Concept A satisfies the study goals, is consistent with recommendations from previous studies, and received stakeholder support.

Concept C (KY 1136 Interchange) is also recommended for preliminary engineering and environmental activities. The currently proposed transportation network is sufficient to handle the increased traffic based on current employment and shift assumptions; however, private developments can arise more quickly than public roadway projects and generate high volumes of traffic. Beginning project development work early can streamline implementation timelines but construction is not recommended at this time.

Finally, Concepts B (Northwest Bypass) and D (WKY Parkway/East-West Connection) are not recommended at this time.

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ACRONYMNS LIST

ADT	Average Daily Traffic
CHAF	Continuous Highway Analysis Framework
DHV	Design Hourly Volume
EEC	Excess Expected Crashes
FHWA	Federal Highway Administration
HDM	Highway Design Manual
HIS	Highway Information System
IMR	Interchange Modification Report
KDOW	Kentucky Division of Water
KHC	Kentucky Heritage Council
KYTC	Kentucky Transportation Cabinet
LEP	Limited English Proficiency
LO/S	Local Officials/Stakeholders
LOS	Level of Service
LOSS	Level of Service of Safety
LTADD	Lincoln Trace Area Development District
LWCF	Land and Water Conservation Fund
MP	Milepoint
MPH	Miles Per Hour
MPO	Metropolitan Planning Organization
MSAT	Mobile Source Air Toxics
NAAQS	National Ambient Air Quality Standards
NBIS	National Bridge Inventory System
NEPA	National Environmental Policy Act
NHS	National Highway System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NTN	National Truck Network
PACE	Purchase of Agricultural Conservation Easement
PVA	Property Valuation Administrator
SHIFT	Strategic Highway Investment Formula for Tomorrow
SHPO	State Historic Preservation Office
SPR	Statewide Planning and Research funds
SPUI	Single Point Urban Interchange
STAA	Surface Transportation Assistance Act
TDM	Travel Demand Model
TED	Transportation Enterprise Database
TIP	Transportation Improvement Program
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
UST	Underground Storage Tank
v/c	Volume-to-Capacity Ratio
vpd	vehicles per day

1.0 INTRODUCTION

The Kentucky Transportation Cabinet (KYTC) initiated a corridor study in spring 2022 to look at mobility needs near the community of Glendale in south central Hardin County (**Figure 1**).

When, in 2021, Ford Motor Company and BlueOval SK (BOSK) announced two new battery manufacturing plants would be located near Glendale, the future of the historic community shifted. As early as 2025, Hardin County is expecting to see 5,000 new full-time employees working at the 1,500-acre "Megasite"—adding traffic to the area's rural highways.

While several major infrastructure projects are underway in the area, this KYTC *Glendale Mobility Study* examines the local roadway network to understand what additional capacity projects are needed to sustain anticipated growth.

This study was completed with federal Statewide Planning and Research (SPR) funds.

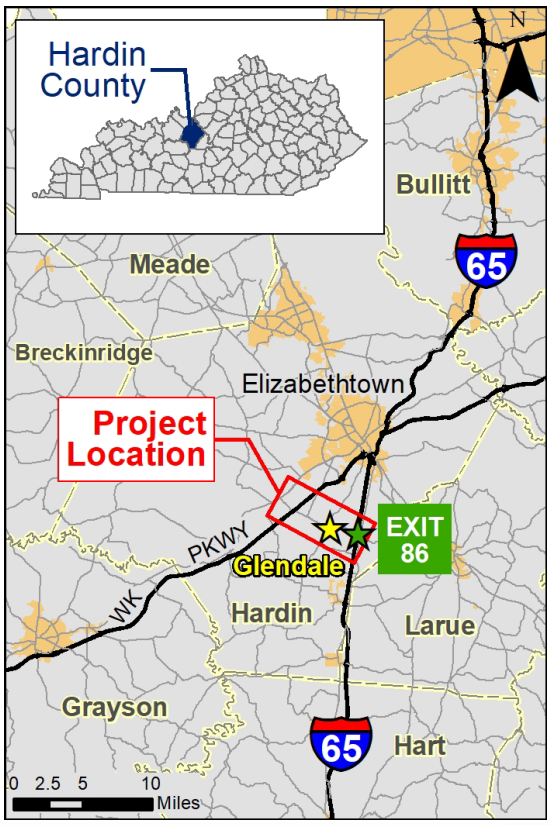


Figure 1: Project Location

Summer 2022 construction along KY 222 near I-65

Study tasks (**Figure 2**) include creating an inventory of existing conditions, defining goals for the study, forecasting existing and future traffic, identifying red flag environmental issues, developing Build concepts with construction cost estimates, seeking community input, and documenting the study process and results. The following chapters explore these efforts.

Figure 2: Study Tasks

The study area (**Figure 3**) follows KY 222 from US 62 in the west to its interchange with I-65 in the east and covers KY 222 milepoints (MP) 0.000–6.459 in Hardin County. North to south, the area is up to three miles wide to allow sufficient space to consider improving east-west connections. The study area is in the Lincoln Trail Area Development District (LTADD) and within the boundaries of the Elizabethtown-Radcliff Metropolitan Planning Organization (MPO).

1.1 Other Nearby Projects

One of the initial steps in the planning process was to understand what committed projects near the study area are ongoing, influencing the "existing" conditions.

Ford Motor Company and SK Innovation are constructing two electric battery manufacturing plants on the 1,500-acre BlueOval SK (BOSK) Battery Park industrial site southwest of I-65 Exit 86 near Glendale. The $5.8 billion investment—the single largest economic development project[2] in Kentucky's history—is expected to begin production in 2025 with 5,000 full-time employees. While site designs and circulation patterns are still being refined at the time of this study, construction is underway.

[2] Online at https://ced.ky.gov/Newsroom/NewsPage/20210928_Ford_SK

Near the study area, several highway projects (**Figure 3**) are under development with funding for one or more project development phases in Kentucky's *2022 –2028 Enacted Highway Plan*.[3]

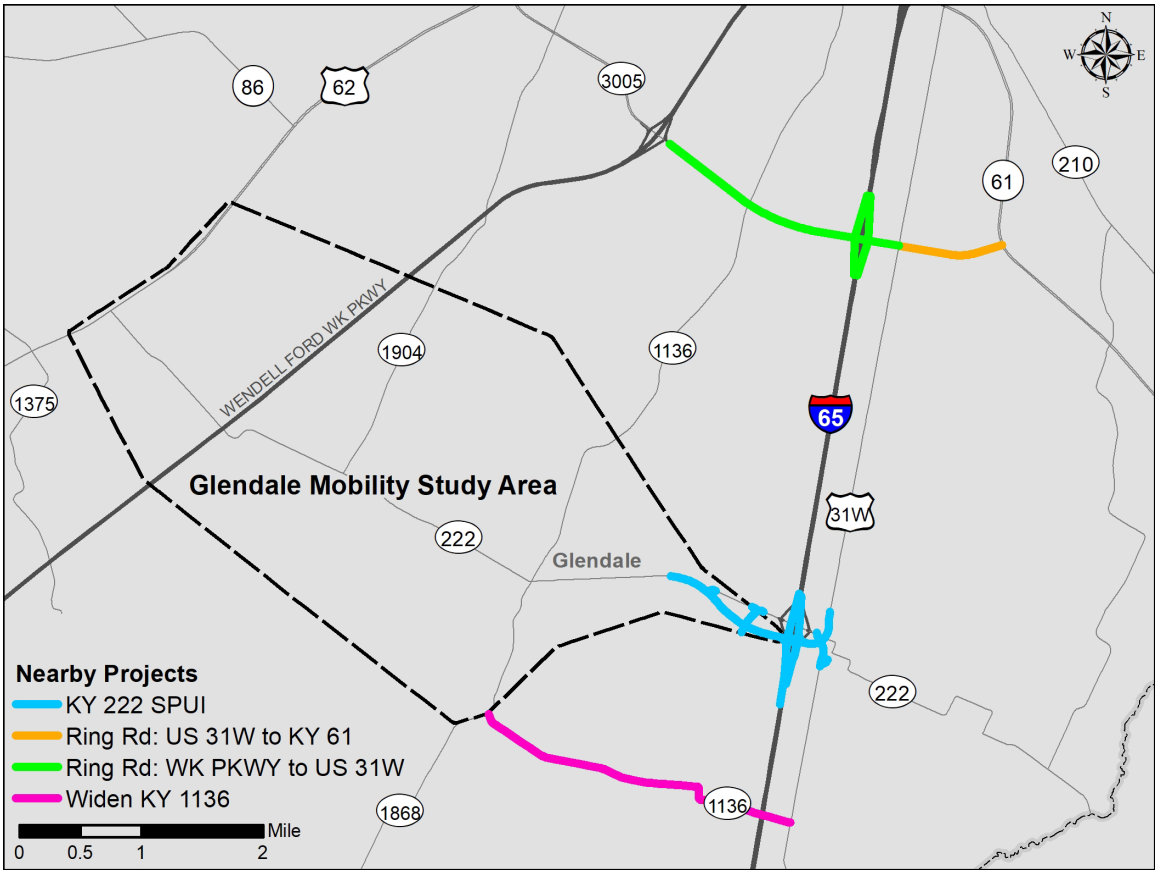


Figure 3: Ongoing Highway Plan Projects near Study Area

- **Item No. 4-20.01: I-65/KY 222 Interchange Reconstruction** is under construction, expected to open to traffic in 2024. The interchange will be reconstructed from its current diamond layout to a single point urban interchange (SPUI) with traffic signals and increased storage lanes/lengths to improve capacity.
- **Item No. 4-198.00: Ring Road Extension** initially advanced with state funding—including identifying a preferred alignment and beginning to purchase right-of-way. Following a pause to secure funding, the project is moving again with federal funds. KYTC is updating past studies to meet federal requirements, revisiting previous alignments, and re-

[3] Online at https://transportation.ky.gov/Program-Management/Pages/2022-Enacted-Highway-Plan.aspx

coordinating with the public. The Highway Plan includes $6 million for right-of-way and utility funding in the biennium.

- As a separate project, another **Ring Road Extension to Lincoln Parkway (Item No. 4-80250.00)** shows FY 2023 design funding in the Highway Plan but work will not begin until a preferred alignment is selected for Item 4-198.

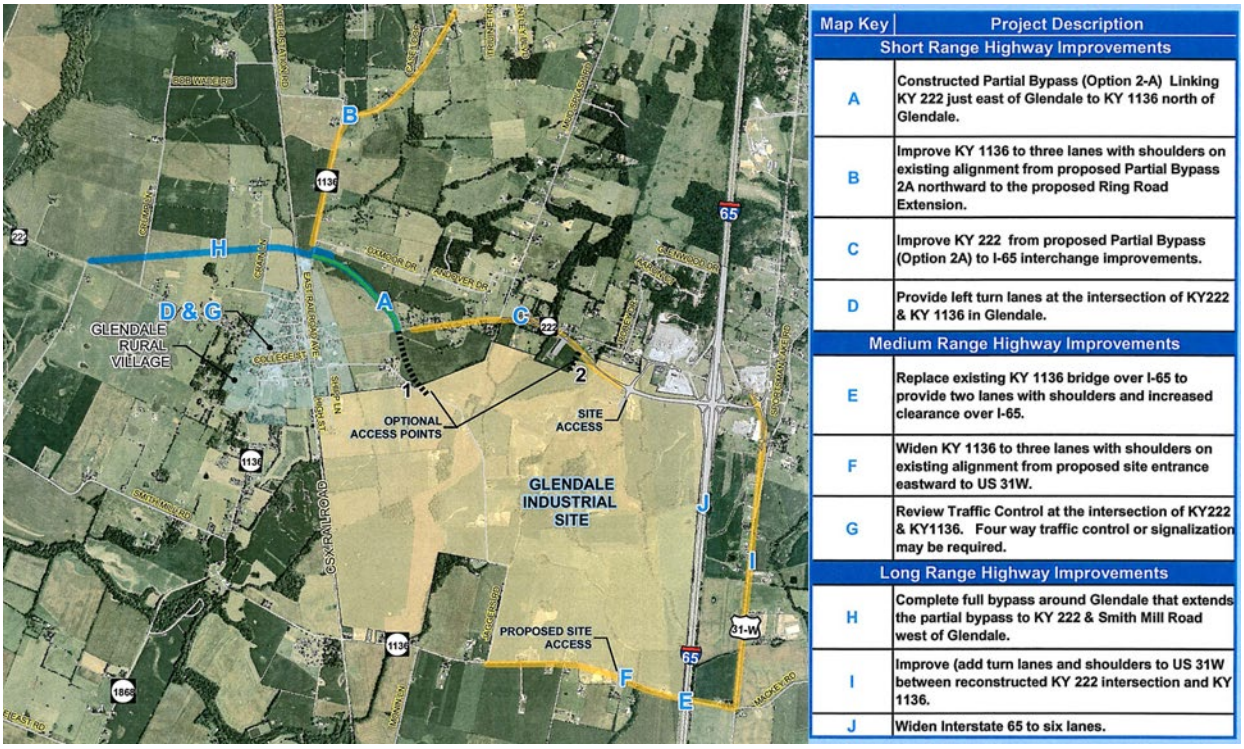
- **Item No. 4-171.00 Reconstruct KY 1136 (Gilead Church Road)** will improve the existing highway to provide two 12-foot-wide lanes with 8-foot-wide paved shoulders and turn lanes at key intersections. Designs exist to realign substandard geometry and add a grade-separated railroad crossing. The Highway Plan includes FY 2024 construction funding, though likely to progress in phases, focusing on the section between US 31W and the railroad first then continuing east to KY 1868.

Completed Planning Studies

Other previous studies and potential future projects near the study area have been compiled from recent planning studies and KYTC's Continuous Highway Analysis Framework (CHAF) database.

In 2008, Radcliff-Elizabethtown MPO and LTADD completed the *Glendale Area Transportation Study*[4] that identified fiscally responsible, scalable mobility projects that could be implemented over time to support development of the Megasite with a single industrial tenant. Recommendations are presented in **Figure 4**.

[4] Online at https://radcliff-elizabethtown-mpo.org/index.php/library/studies/



Map Key	Project Description
Short Range Highway Improvements	
A	Constructed Partial Bypass (Option 2-A) Linking KY 222 just east of Glendale to KY 1136 north of Glendale.
B	Improve KY 1136 to three lanes with shoulders on existing alignment from proposed Partial Bypass 2A northward to the proposed Ring Road Extension.
C	Improve KY 222 from proposed Partial Bypass (Option 2A) to I-65 interchange improvements.
D	Provide left turn lanes at the intersection of KY222 & KY 1136 in Glendale.
Medium Range Highway Improvements	
E	Replace existing KY 1136 bridge over I-65 to provide two lanes with shoulders and increased clearance over I-65.
F	Widen KY 1136 to three lanes with shoulders on existing alignment from proposed site entrance eastward to US 31W.
G	Review Traffic Control at the intersection of KY222 & KY1136. Four way traffic control or signalization may be required.
Long Range Highway Improvements	
H	Complete full bypass around Glendale that extends the partial bypass to KY 222 & Smith Mill Road west of Glendale.
I	Improve (add turn lanes and shoulders to US 31W between reconstructed KY 222 intersection and KY 1136.
J	Widen Interstate 65 to six lanes.

Figure 4: 2008 MPO/ADD Study Recommendations

The study included coordination with a technical advisory committee and stakeholder interviews but had limited public involvement. Key local concerns were preserving historic Glendale/ community identity, maintaining tourism, opposing/supporting development, and accommodating freight traffic. Traffic impacts for the No-Build and several Glendale bypass scenarios were studied. The study also affirmed the importance of the Ring Road extension project, noting "the support businesses to the [Glendale] site [should] be located in the Ring Road corridor before allowing other development in the industrial overlay zone along US 31W east of the site."

Historic Glendale derives its identity from the railroad that bisects it

The 2008 report was updated by the 2021 *Glendale Area Transportation Study Update.*[4] The update contains similar recommendations to the 2008 report, with some adjustments to priorities. Five improvements are "strongly recommended" to be in place by opening day of the new plants:

- I-65/KY 222 interchange reconstruction (Item 4-20.01, currently under construction)
- Widening KY 1136 (Gilead Church Road) to three lanes (Item 4-171.00, in design)
- Northeast bypass of Glendale
- Access road to KY 222 serving the northwest portion of the Megasite
- Improve KY 1136 (New Glendale Road) from the proposed Glendale bypass to Ring Road

As part of the Item 4-20.01 interchange reconstruction project, an *Interchange Modification Report* (IMR) was completed in 2020, updating an earlier 2008 analysis. The 2020 IMR compares updated traffic forecasts and crash statistics to demonstrate that the SPUI design for the I-65/KY 222 interchange satisfies the Federal Highway Administration's (FHWA) latest *Policy for Access to the Interstate System*. Turning movement counts at several intersections along KY 222 were conducted in 2019 to support this effort.

To project regional traffic distributions in 2045, a 2022 traffic forecast report for the Item 4-171.00 widening project along KY 1136 used the statewide travel demand model with the latest growth assumptions at the Megasite.

Identified CHAF Projects. KYTC's CHAF database lists other project concepts and provides the starting point for the biennial SHIFT process[5] that evolves into the Highway Plan's two-year budget cycle. CHAF projects are shown in pink in **Figure 5** and additional information is summarized in **Table 1**.

[5] SHIFT, or the Strategic Highway Investment Formula for Tomorrow, is a data-driven project scoring process to compare and prioritize statewide capital improvement projects to make better use of limited transportation funds in the Commonwealth's biennial budget.

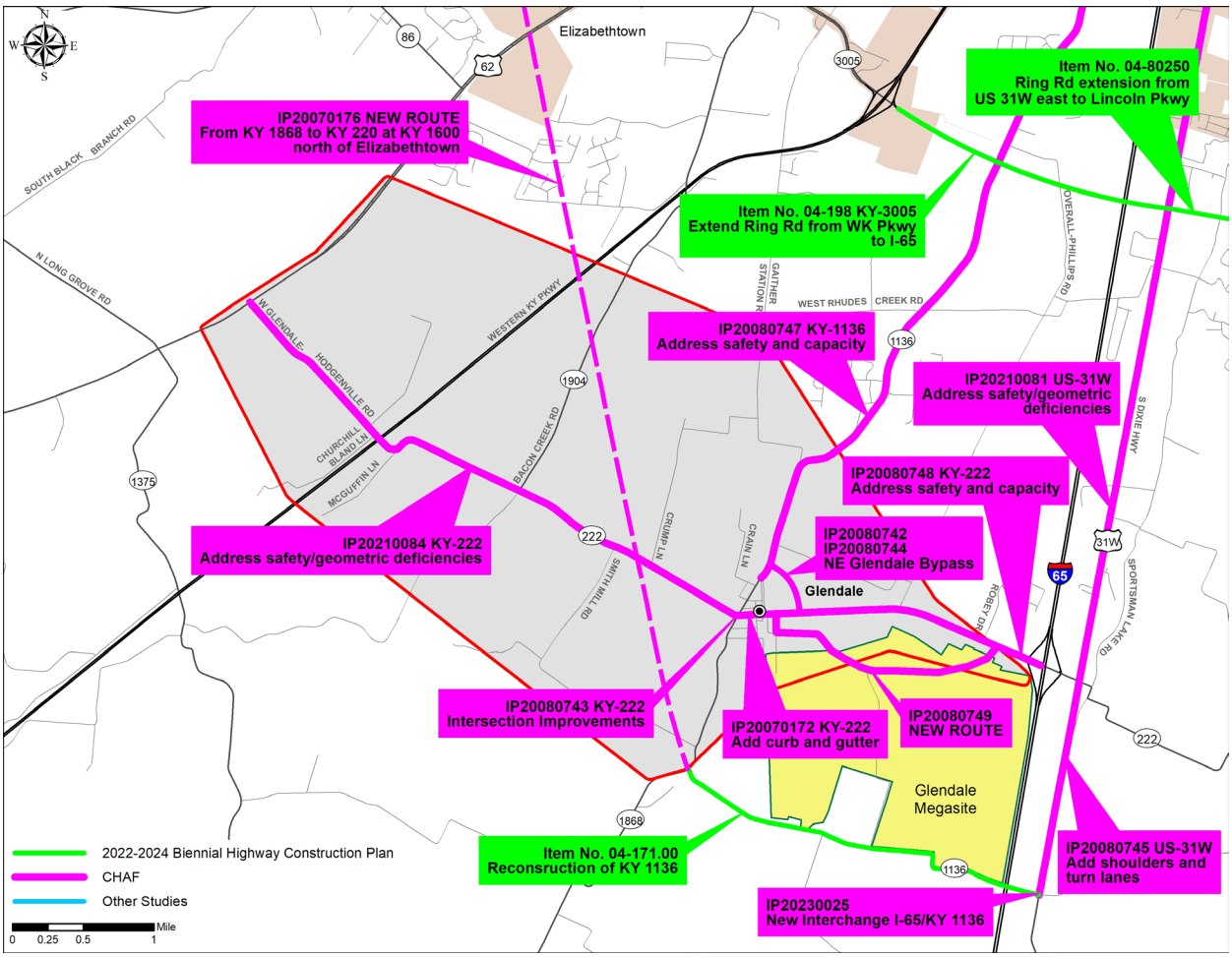


Figure 5: CHAF Concepts near Study Area

Table 1: KYTC CHAF Database Projects

CHAF	Route	BMP	EMP	Purpose	Total Cost
IP20070172	KY 222	4.24	4.44	Add curb/gutter to improve drainage along KY 222 in Glendale	$1.3M
IP20070176	KY 1136	2.77	3.94	Extend KY 1136 from KY 1868 south of Glendale to KY 220/KY 1600 north of Elizabethtown	$157M
IP20080742	KY 222	3.24	4.24	Construct a northeast bypass around Glendale	$5.2M
IP20080743	KY 222	4.2	4.3	Improve intersection to address safety at KY 222/KY 1136 in Glendale	$1.2M
IP20080744[1]	KY 222	4.24	5.38	Construct a northeast bypass around Glendale	$4.0M
IP20080745[1]	US 31W	7.99	9.53	Add shoulders and turn lanes to US 31W between KY 1136 and KY 222	$7.8M
IP20080747	KY 1136	4.25	9.94	Address capacity and safety along KY 1136 from the proposed Glendale bypass to the US 31W bypass in Elizabethtown	$32.4M

CHAF	Route	BMP	EMP	Purpose	Total Cost
IP20080748	KY 222	4.45	6.46	Address safety and capacity along KY 222 from the proposed Glendale bypass to the I-65/KY 222 interchange reconstruction limits	$3.5M
IP20080749	-	-	-	Construct a new connector from Jaggers Rd to KY 222 east of Glendale	$8.0M
IP20210081[1]	US 31W	9.53	14.81	Address safety and geometric deficiencies along US 31W from KY 222 to KY 61 (Lincoln Pkwy)/Western KY Pkwy intersection	$37.4M
IP20210084	KY 222	0.00	4.24	Address safety and geometric deficiencies along KY 222 from US 62 to Glendale	$32.5M
Item 4-29 IP20230025[1,2]	I-65	83.414	84.74	New interchange along I-65 at KY 1136 just south of Glendale	$27.2M

[1] Sponsored in SHIFT 2024; [2] Added as recommendation from current study

2.0 EXISTING CONDITIONS

Existing transportation conditions of the corridor are described in the following sections. Information on the characteristics of the roadway geometry, functional classification, bridges, traffic volumes and operations, and crash history were obtained from KYTC's Highway Information System (HIS) database, KYTC's Transportation Enterprise Database (TED), bridge inspection reports, traffic counts, and field reviews.

2.1 Roadway System Designations

Functional Classification is the process of grouping streets and highways according to the character of travel service and access to adjacent land use they provide. This classification system recognizes that travel involves movement through a hierarchical system of facilities that progress from lower classifications handling short, locally oriented trips to higher classifications serving longer distance travel at higher mobility levels. A roadway's classification is further designated as urban or rural based upon whether it is within FHWA's Adjusted Urban Area boundaries. The major functional classes with brief definitions are listed below.

Freeways & Interstates	Provide high speed, high mobility links for long distance trips.
Principal Arterials	Serve major centers for metropolitan areas, provide a high degree of mobility, and can also provide mobility through rural areas.
Minor Arterials	Provide service for trips of moderate length, serve geographic areas smaller than their Principal Arterial counterparts, and offer connectivity to the Principal Arterial system.
Collectors	Gather traffic from local roads and funnel to the arterial network. Classified as either a major or minor collector; generally serve intra-county travel and shorter trips.
Local Roads	Not intended for long distance travel, except at the origin or destination end of the trip, due to their direct access to abutting land. Often designed to discourage through traffic.

Additionally, functional classification is used as a tool for transportation agencies and designers. A roadway's functional class suggests expectations about roadway design: specifically, vehicle speed, capacity, and the roadway's relationship to land use development. Federal legislation uses functional classification in determining eligibility under the Federal-aid program. Transportation agencies typically describe roadway system performance, benchmarks, and goals by functional classification.

Functional Class. KY 222 is classified as a rural minor collector. The Western Kentucky Parkway is the only arterial route within the study area. The nearest interchanges are at White Mills (five miles south) and Ring Road (four miles north). **Figure 6** presents functional classifications for state-maintained highways within the study area.

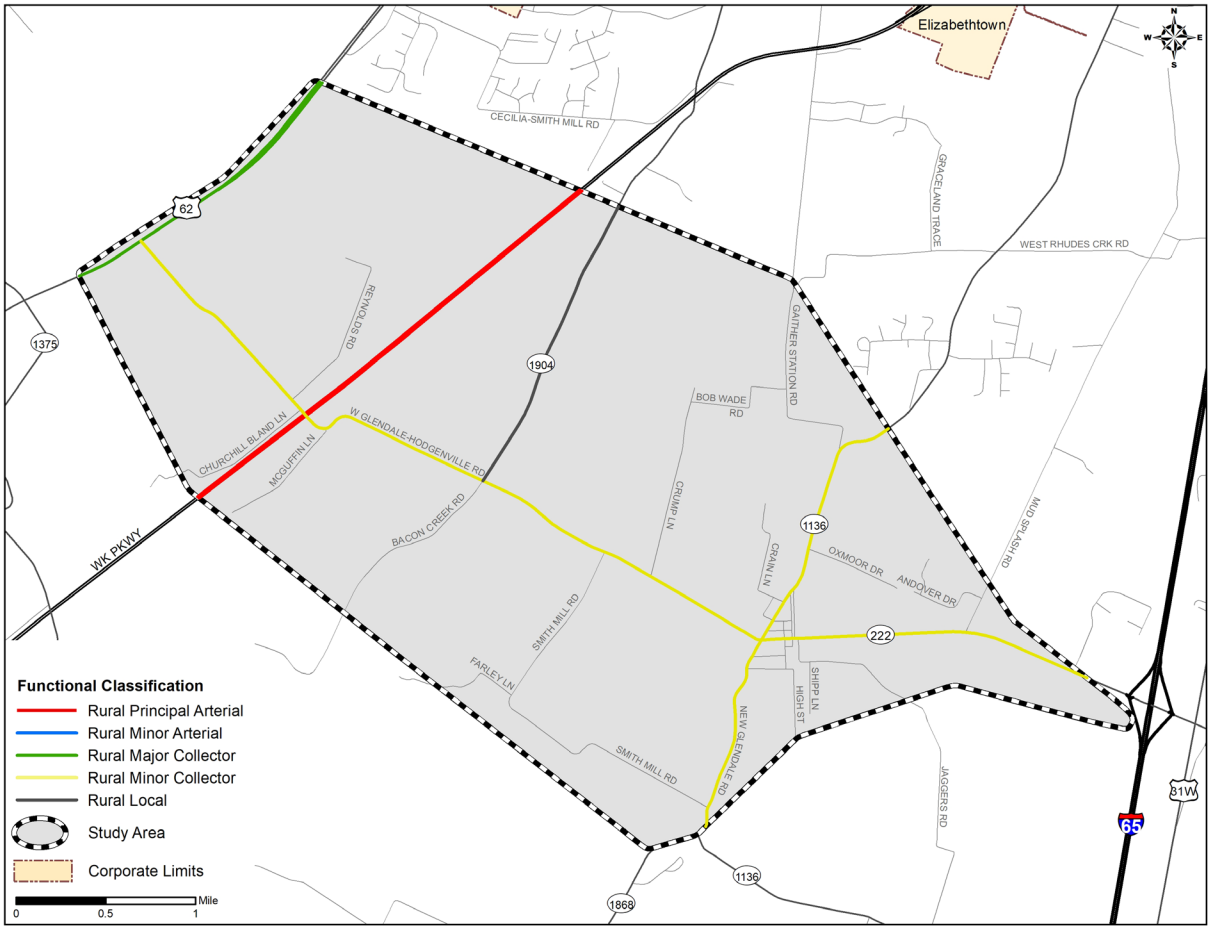


Figure 6: Functional Classification of Study Area Routes

Truck Route. In compliance with the Surface Transportation Assistance Act of 1982 (STAA), Kentucky established a network of highways on which commercial vehicles with increased dimensions may operate. These "STAA" vehicles include semi-trucks with 53-foot-long trailers and single-unit trucks with a total length of 45 feet. STAA routing in Kentucky corresponds to the National Truck Network (NTN), plus state-maintained highways within five miles of the NTN, 15 miles from interstate or parkway interchanges, and one mile from the interchange on other public highways.

The Western KY Parkway is the ony federally designated truck route within the study area—plus I-65 just to the east. I-65, the parkway, US 62, and KY 222 are on the Kentucky Highway Freight Network.

Highway Systems. The National Highway System (NHS) includes roadways important to the nation's economy, defense, and mobility. The Western KY Parkway is the ony NHS route within the study area.

The Kentucky State Highway System classifies state-maintained roadways by the type of service and function they provide. KY 222 and KY 1136 are classified as a state secondary system, meaning they are regionally significant routes of shorter distance which provide mobility and access to land use activity, generally serving smaller cities and county seats within a region.

2.2 Roadway Geometric Characteristics

KYTC's HIS database was queried to obtain route geometric characteristics, including speed limits, number of lanes and lane widths, shoulder type and width, and horizontal curve data.

Lanes and Shoulders. KY 222 is a two-lane undivided highway with 10-foot-wide lanes and minimal paved shoulders. Lane and shoulder widths for other study area routes are presented in **Figure 7**. KYTC's *Highway Design Manual* (HDM) [6] recommends 11-foot-wide lanes for rural collector highways carrying 2,000 vehicles per day (vpd) or more.

Narrow typical section along rural KY 222

[6] Online at https://transportation.ky.gov/Organizational-Resources/Policy%20Manuals%20Library/Highway%20Design.pdf

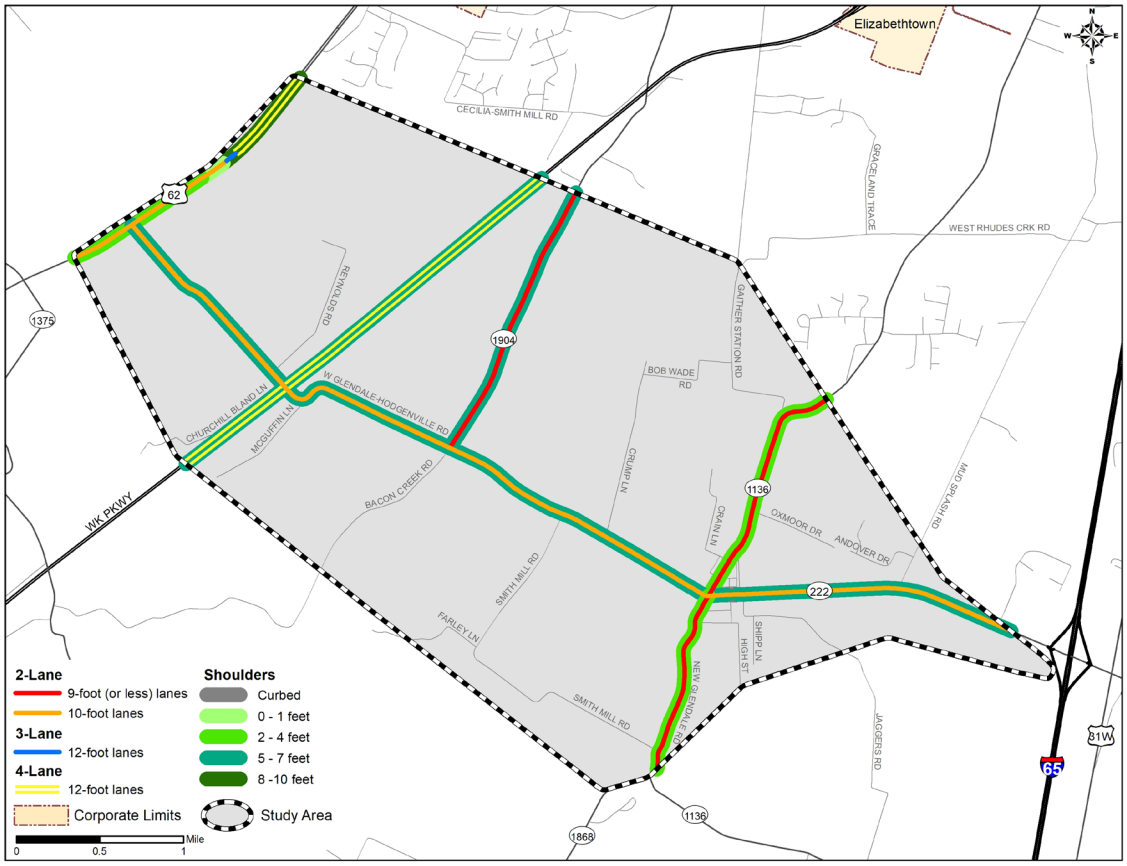


Figure 7: Lane and Shoulder Configurations for Study Routes

Speed Limits. The posted speed limit for rural highways through most of the study area is 55 mph: along US 62, KY 222 west of Glendale, KY 1904, and KY 1136 north of Glendale. Posted speed limits drops to 35 mph along KY 1136 and KY 222 through Glendale and increase to 45 mph east and south of Glendale. Western KY Parkway is posted at 70 mph.

Horizontal and Vertical Curves. HIS data were reviewed to identify any substandard grades or curves along the study route and major intersecting cross-streets. Collected data were compared to HDM design recommendations for maximum vertical grades and minimum horizontal curves.

At a planning level, KYTC organizes horizontal curves into six classes, graded A (most sweeping) through F (sharpest), as listed in **Table 2**. Similarly, KYTC organizes vertical grades into six classes, graded A (flattest) through F (steepest), as shown in **Table 3**.

Table 2: Horizontal Curve Class

Code	Description (degrees)
A	0.0-3.4
B	3.5-5.4
C	5.5-8.4
D	8.5-13.9
E	14.0-27.9
F	28+

Table 3: Vertical Grade Class

Code	Description (percent)
A	0.0-0.4
B	0.5-2.4
C	2.5-4.4
D	4.5-6.4
E	6.5-8.4
F	8.5+

HDM Exhibit 700-023[4] recommends maximum vertical grades of 6% to 7% for rural collector highways carrying 2,000 vpd or more, varying based on terrain—Class D or better in **Table 3**. For a 55-mph design speed, a minimum radius for horizontal curves of 960 feet is recommended. This equates to Class C or better in **Table 2**.

Sharp curves and steep hills along KY 222

Along KY 222, a series of rolling hills west of Glendale limit sight distance. Sharp curves just east of the Western KY Parkway has posted warning chevrons to alert motorists to slow down. **Figure 8** illustrates the worst horizontal curves and vertical grades throughout the study area.

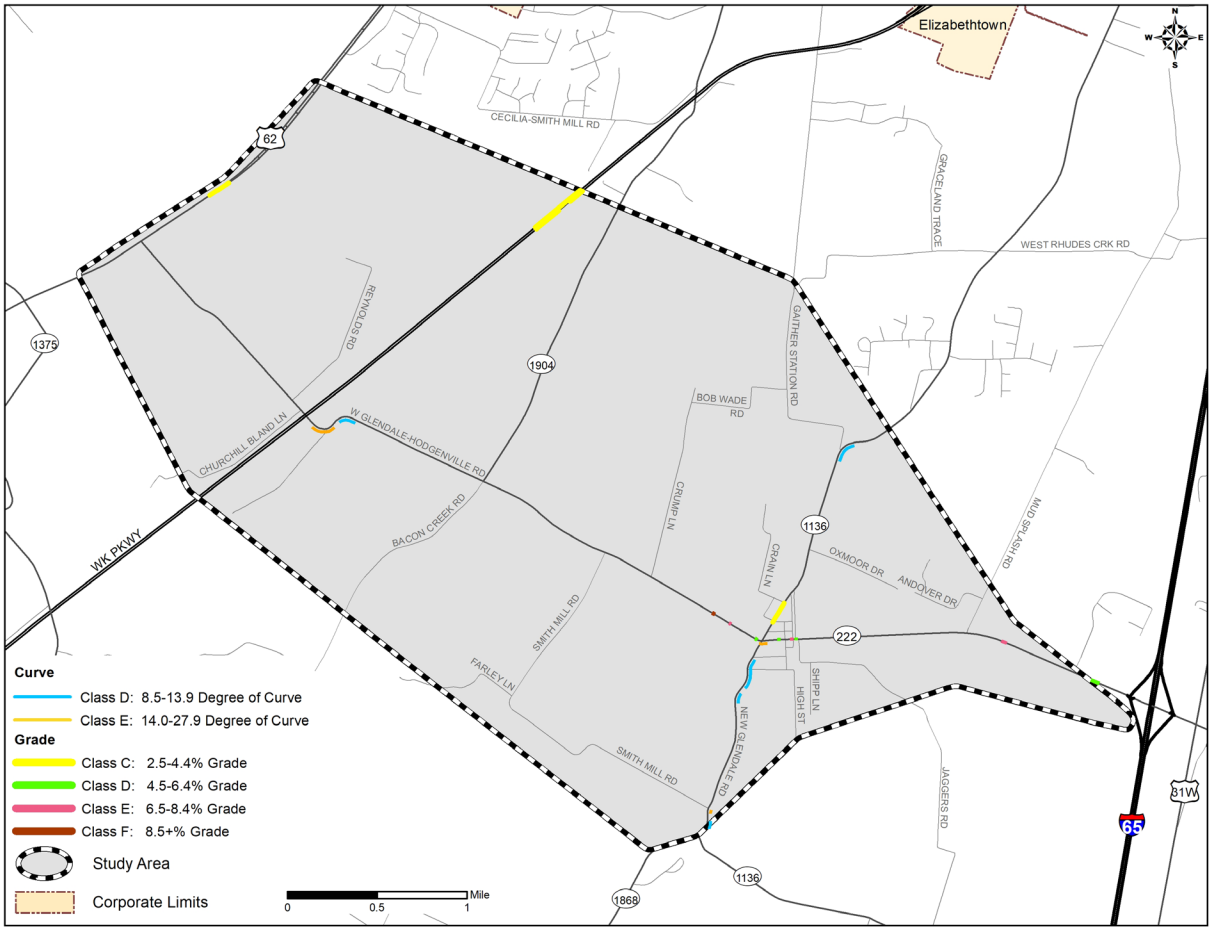


Figure 8: Study Area Curves and Grades

2.3 Bridges

The National Bridge Inventory (NBI) condition rating is determined by the lowest rating for the deck, superstructure, substructure, or culvert. A bridge is considered structurally deficient if any bridge component (deck, superstructure, substructure, or culvert) is in poor condition, warranting monitoring or repairs.

There are two bridges on the study portion of KY 222. Neither bridge is considered structurally deficient. Bridge inventory data are in **Table 4** and locations are shown in **Figure 9**. Repairs on the Western KY Parkway overpass were completed in 2022.

Table 4: KY 222 Structures Inventory

Bridge ID	BMP	EMP	Features Intersected	Inspection Date	Condition	Built
047B00190N	1.310	1.350	Western KY Pkwy	11/2022	Good	2022
047B00046N	2.810	2.860	Valley Creek	11/2022	Fair/Posted	1954

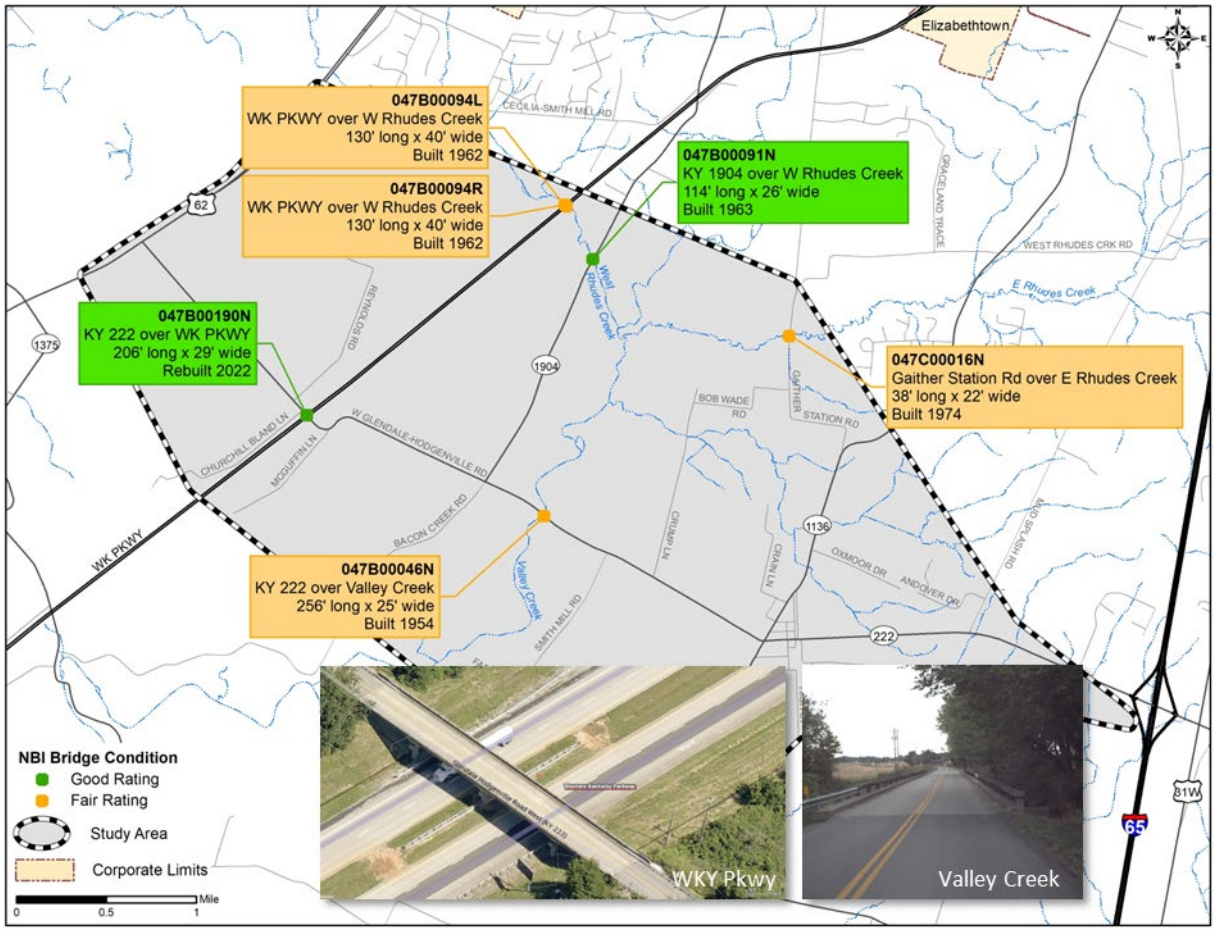


Figure 9: Study Area Structures

2.4 Year 2022 Traffic

Available existing traffic volumes for the study area roadways, including truck percentages, hourly factors, and peak hour directional distributions were reviewed. Recent counts show 2,100 vpd use the KY 222 corridor east of Glendale compared to 760 vpd to the west. The segment of KY 222 between I-65 and US 31W has shown substantial growth over the past two decades while other segments demonstrate negligible growth.

In addition, 12-hour turning movement counts were collected at two intersections during April 2022, classifying vehicles into one of five categories: motorcycles, cars, buses, single-unit trucks, and articulated trucks. Counts were conducted at the KY 222 intersections with US 62 and KY 1136 while ramp volumes from the 2020 IMR were applied for traffic near the eastern study area limits. Average Daily Traffic (ADT) segment volumes and peak hour turning movement counts are shown in **Figure 10**. Additional traffic information is in the *Traffic Forecast Report* in **Appendix A**.

All intersections currently operate as two-way stop-controls; however, signalized intersections will be added as part of the I-65/KY 222 SPUI.

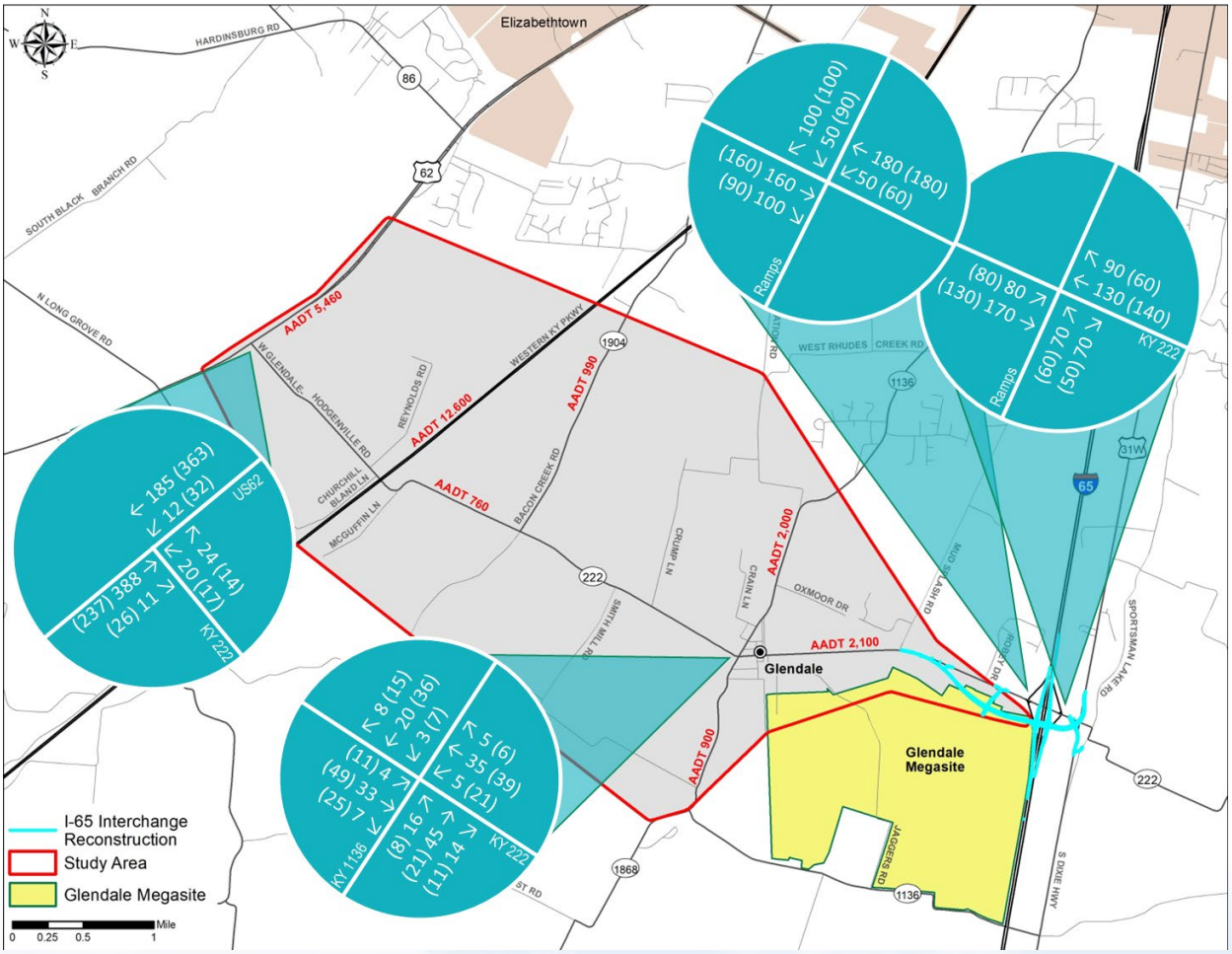


Figure 10: 2022 Traffic Volumes

School buses, farm equipment, and other vehicle types also traverse rural study area routes

Other Roadway Users. In addition to passenger cars, school buses, farm equipment, and other vehicle types also traverse study area highways. Heavy truck traffic is common near the interchange, accessing the adjacent truck stops, and likely to increase with the development of the industrial plants.

Hardin County is also home to an active bicycling community, relying on low-volume rural highways for solo rides and group events. KYTC adopted a Complete Streets Policy[7] in September 2022, committing to partnering with other agencies to:

- Identify opportunities to promote and provide safe, convenient access and travel for all users of the transportation network while reducing crash rates and the severity of crashes.
- Improve mobility and accessibility for all individuals.
- Support mode shift to non-motorized transportation.
- Ensure early coordination to identify potential actions/strategies.

Consideration of the needs of all modal users is critical throughout the planning and project development process.

2.5 Crash History

Historical crash data retrieved from KYTC's TED warehouse were evaluated for study area roadways for a six-year period (January 2016 through December 2021). Crash location, severity, and manner of collision are shown in **Figure 11**. During this timeframe, 121 crashes occurred throughout the study area: 51 along KY 222 and the remainder associated with other highways. A table of corresponding crash data is in **Appendix B**.

Severity. By severity, there were 3 fatality crashes along KY 222 (noted as stars in **Figure 11**), 6 injury crashes, and the remaining 42 crashes were property damage only. Two fatalities involved motorcycles and the third fatality was an angle collision at the intersection with Bacon Creek Road.

Manner of Collision. The manner of collision breakdown is shown in **Figure 12**. The majority are single vehicle crashes, followed by angle crashes.

[7] Online at https://transportation.ky.gov/BikeWalk/Pages/Complete-Streets.aspx

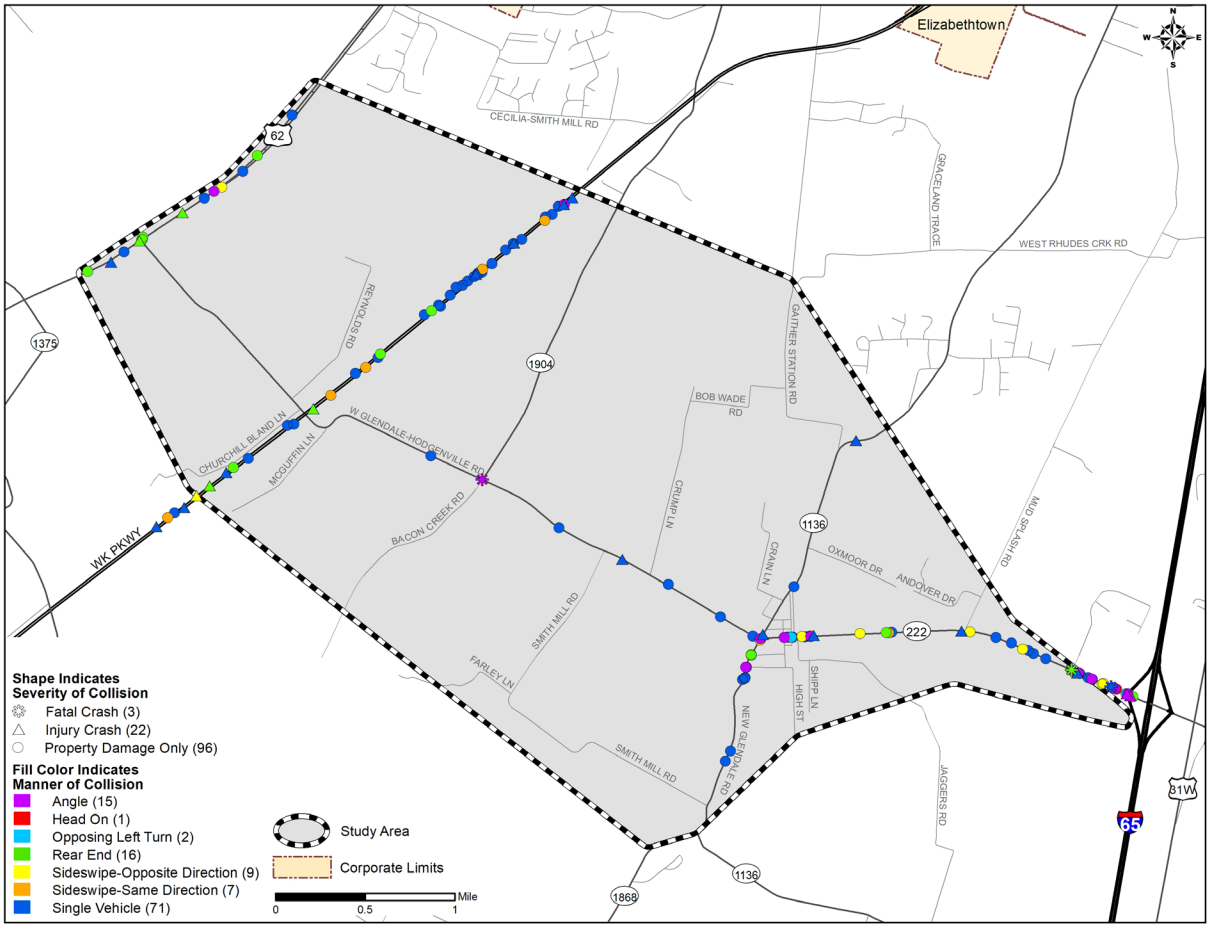


Figure 11: Crashes by Severity and Manner of Collision

Considering just KY 222 crashes, 27% occurred in wet weather and 35% represent nighttime crashes. Nearly half (47%) are roadway departures, which tend to be more severe than other crash types. Roadway departures are one of the emphasis areas identified by KYTC's Office of Highway Safety.[8]

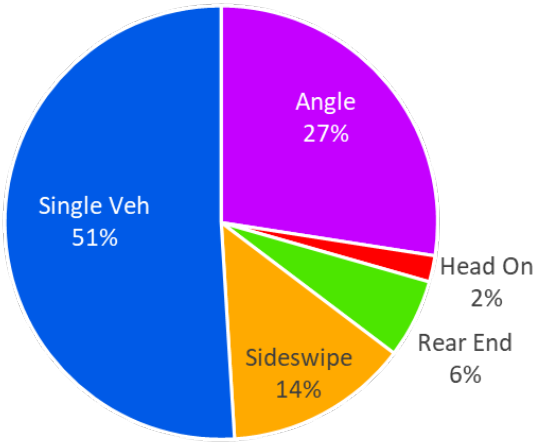


Figure 12: Crashes by Manner of Collision

[8] Online at https://transportation.ky.gov/HighwaySafety/Pages/default.aspx

2.5.1 Level of Service of Safety

Level of Service of Safety (LOSS) is a refined statistical methodology in the *Highway Safety Manual* and is used to evaluate safety needs. It replaces the former critical rate factor analyses. Excess Expected Crashes (EEC) data are based on a crash prediction model estimating the number of crashes expected at an intersection or on a roadway segment of a given type and length. The estimates represent the number of excess crashes a segment is experiencing compared to other roadways of its type, adjusting for traffic volumes and a statistical correction. EEC is positive when more crashes are occurring than expected and negative when fewer crashes are occurring than expected.

EECs are grouped into one of four categories, identified as the LOSS. Summarized graphically in **Figure 13**, LOSS categories I and II represent sites with fewer than anticipated crashes, while categories III and IV represent sites with more than anticipated crashes. As the figure illustrates, LOSS-IV has above 1.5 standard deviations more crashes than expected. Because LOSS-IV sites experience such elevated crash rates, there is a higher probability that safety countermeasures at these locations will result in larger improvements.

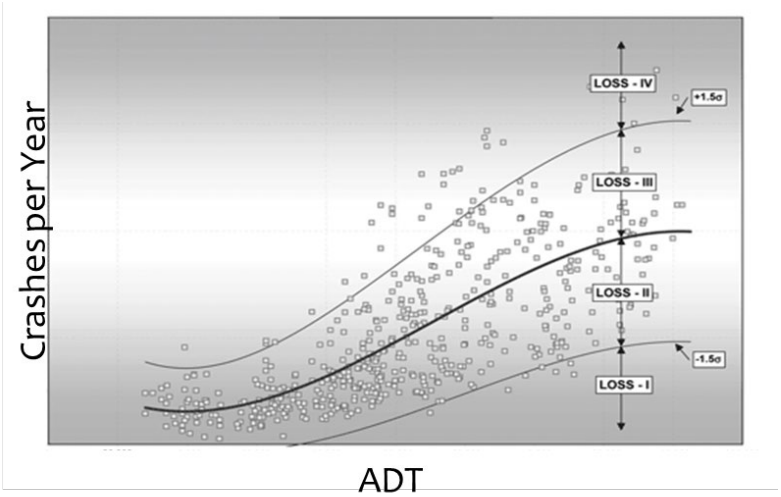


Figure 13: LOSS Categorical Thresholds

Figure 14 presents LOSS for study area roadways. Orange represents calculations for severe "KAB" crashes—fatalities, severe injuries, and minor injuries—while yellow and pink represent calculations based on non-severe "CO" crashes.

The highest LOSS ratings (i.e., sites with the greatest potential to improve safety) within the study area correspond to the Western KY Parkway and the portion of KY 222 that is being reconstructed as part of the Item 4-20.01 interchange project.

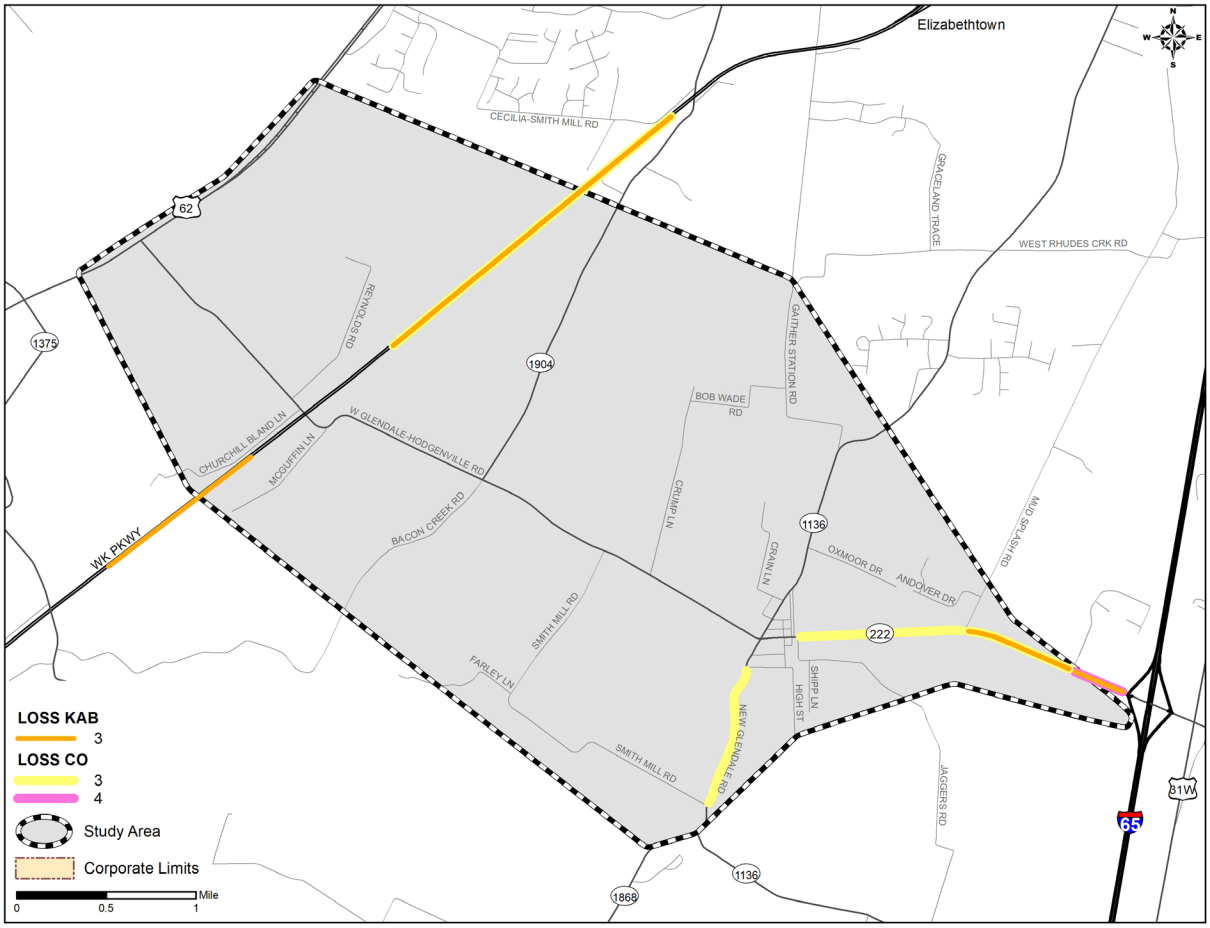


Figure 14: Study Area LOSS Ratings

3.0 ENVIRONMENTAL OVERVIEW

An environmental overview was prepared to identify resources for consideration during the development of transportation improvement concepts. Shown in **Figure 15**, natural and human environmental resources were identified from available literature, database review, and site visits.

The purpose of this overview was not to quantify potential environmental impacts, but instead to identify potential environmental issues to consider during the project development process. This information should aid the project team in making decisions to avoid, minimize, and/or plan for mitigation of potential project impacts, as appropriate. Should future projects develop following this study, additional environmental studies may be required.

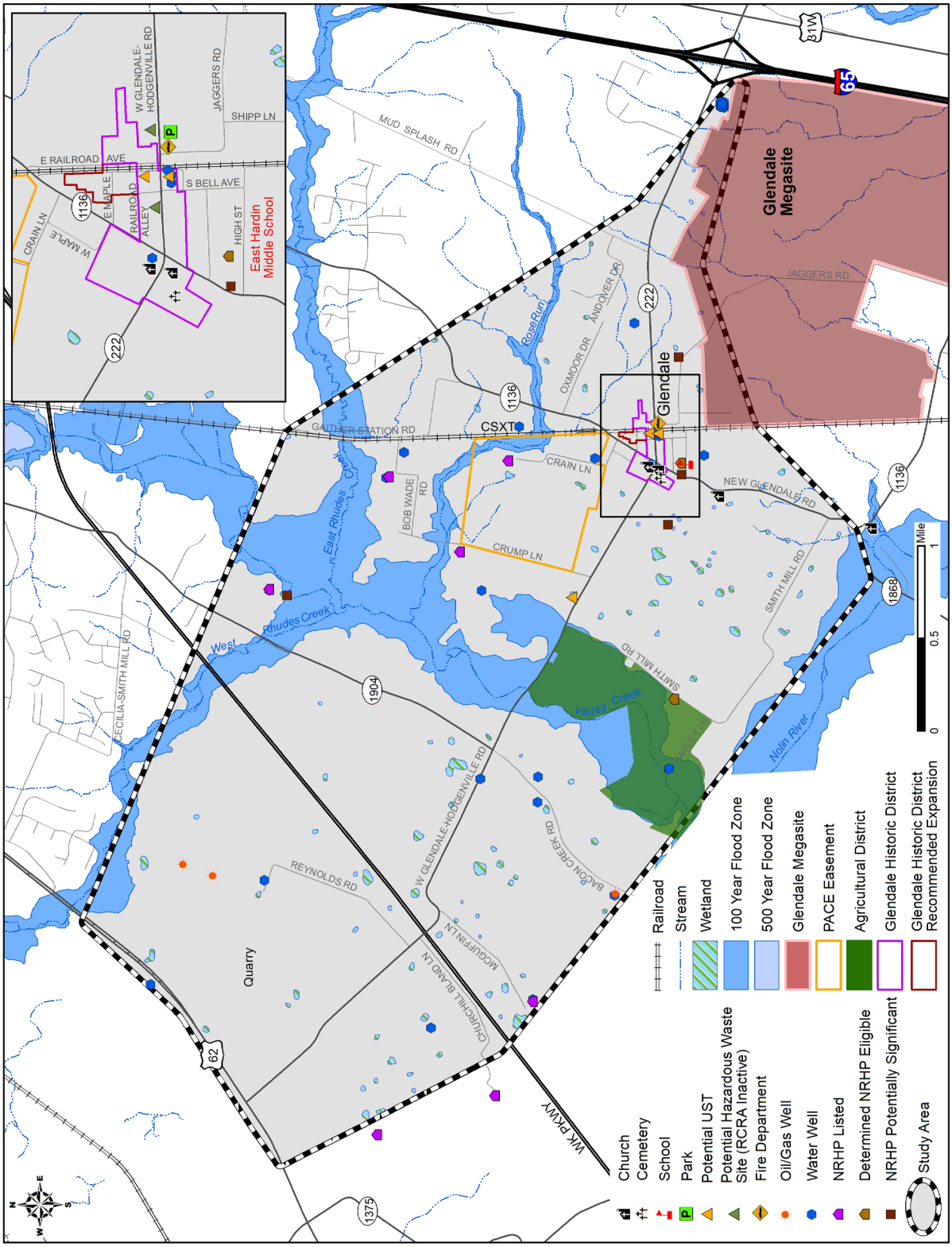


Figure 15: Environmental Overview

If there is a federal nexus (e.g., federal funds, lands, permits, etc.) on a future project, then the procedures established from the National Environmental Policy Act (NEPA) must be followed. NEPA requires, to the fullest practicable extent, that federal actions be interpreted and administered in accordance with its environmental protection goals. It requires an interdisciplinary approach in planning and decision-making for any action that adversely impacts the environment. The potential environmental impacts and need for safe and efficient transportation must be considered to reach a decision that is in the best overall public interest.

3.1 Natural Environment

The natural environment includes all living and non-living things occurring naturally (not artificial or human-built). This includes aquatic ecology, such as rivers, streams, and wetlands; threatened and endangered species; farmlands; and geotechnical resources.

Water Resources. There are several named water resources in the study area. West Rhudes Creek, East Rhudes Creek, and Rose Run feed into Valley Creek in the central portion of the study area. Valley Creek flows into the Nolin River, located just south of the study area limits. Large floodplains follow the streams, covering swaths of the adjacent rolling farmlands.

As the area drains into the Green River and sensitive groundwater areas around Mammoth Cave, the entire area is identified as a Kentucky Division of Water (KDOW) priority watershed.

Valley Creek below KY 222

Numerous wetlands, small lakes, and ponds are also located within the southern half of the study area. No federally designated Wild or Scenic Rivers or Outstanding State Resource Waters exist in the study area. Several water wells and two groundwater springs are within the study area limits.

Impacts to streams and wetlands require permit coordination with the US Army Corps of Engineers, US Coast Guard, and/or KDOW, depending on the scale of the water resource and potential disturbance.

Listed Species. The US Fish and Wildlife Service (USFWS) maintains a database of federally protected species—listed as endangered or threatened under the *Endangered Species Act.* Three listed bat species have the potential to occur within the study area. Additionally, the monarch butterfly is under consideration for official listing. Listing statuses for all species are shown in **Table 5**. There is no designated critical habitat within the study area.

Table 5: Listed Threatened and Endangered Species

Group	Name	Scientific Name	Status
Mammals	Gray Bat	*Myotis grisescens*	Endangered
Mammals	Indiana Bat	*Myotis sodalis*	Endangered
Mammals	Northern Long-eared Bat	*Myotis septentrionalis*	Threatened
Insect	Monarch Butterfly	*Danaus plexippus*	Candidate

A habitat assessment may be needed in the early stages of project development for future project(s) to assess potential project impact to threatened and endangered species. Projects that occur within an area of known bat habitat will require project-specific evaluation to assess appropriate minimization/mitigation measures. KYTC maintains a Programmatic Conservation Memorandum of Agreement for Forest Dwelling Bats to streamline measures to minimize impacts for Indiana and northern long-eared bats. For other federally listed species, specific ecological surveys may be required for projects that have the potential to impact habitat. Coordination with the USFWS Kentucky Field Office will be necessary to determine the need for future project-specific surveys.

Farmland Classifications. Beyond Glendale, much of the study area is actively farmed. Natural Resource Conservation Service (NRCS) soil survey maps were reviewed to identify farmland classifications within the study area. The geographic distribution of the farmland classifications is shown in **Figure 16**. The study area includes 67% prime farmland soils; an additional 14% is considered prime farmland if drained, protected from flooding, or not frequently flooded. Farmlands of statewide importance represent another 15% and the remaining 5% is not considered prime farmland.

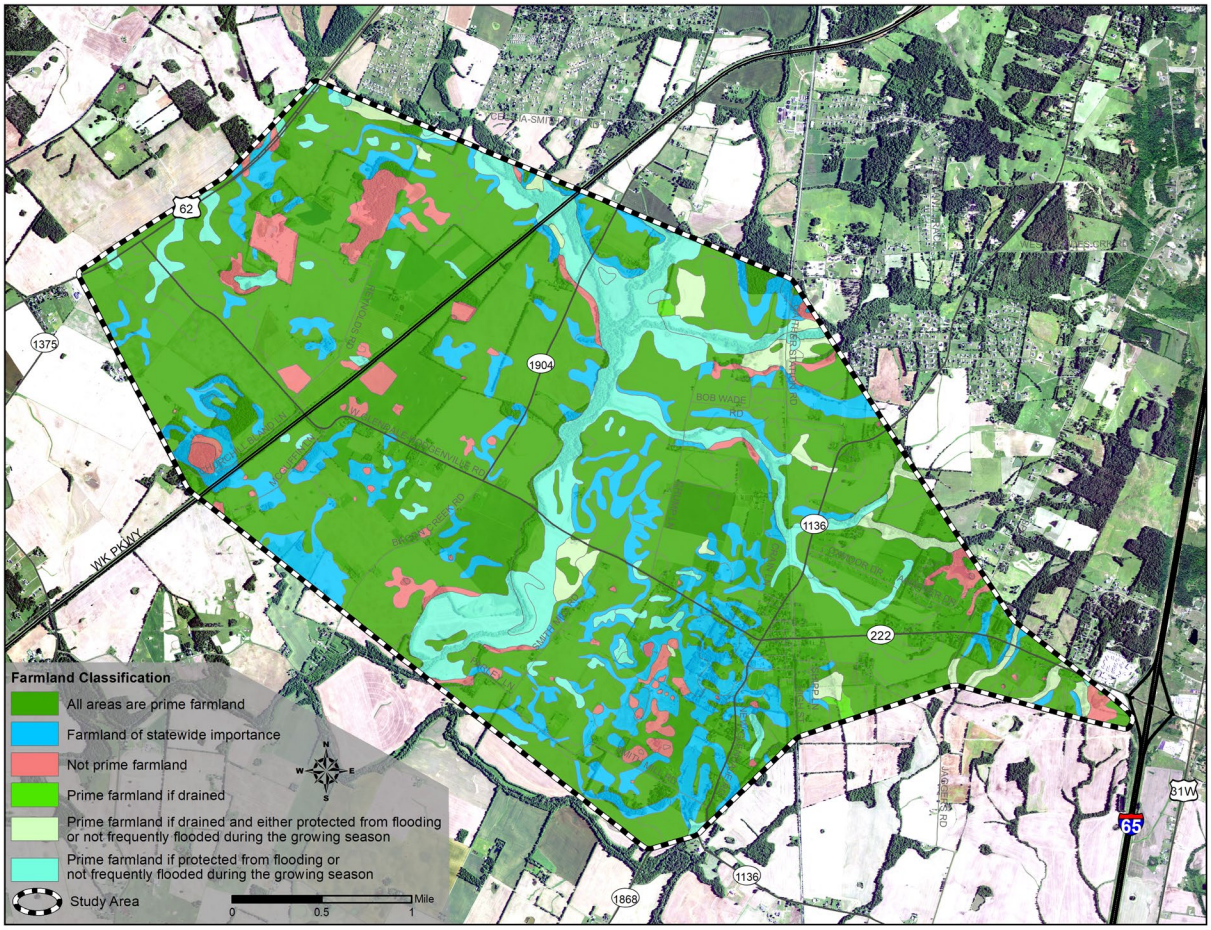


Figure 16: NRCS Farmland Soil Classifications

A protected agricultural easement covers 293 acres north and west of Glendale. This easement is protected in perpetuity through the Purchase of Agricultural Conservation Easement (PACE) Corporation[9]. There is also one certified agricultural district listed with the KY Division of Conservation. The district covers 312 acres at 240 Farley Lane, shown in green in **Figure 15**.

Should federal funds be used on future projects, the *Farmland Protection Policy Act* must be followed. With the potential to convert farmland, coordination with the local NRCS office is required.

Geotechnical. KYTC Geotechnical Branch prepared a *Geotechnical Overview Report* to help identify geotechnical concerns that may affect potential project designs. A summary of those findings is provided here, with the full report in **Appendix C**.

[9] https://www.kyagr.com/marketing/PACE.html

The study area is located within the Western Pennyroyal physiographic region, characterized as an upland area primarily consisting of high-karst potential limestones and karstic features, including frequent sinkholes.

The study area is primarily underlain by Mississippian Ste. Genevieve Limestone and St. Louis Limestone bedrock. NRCS soil data shows surficial soil deposits within approximately 40 inches of the ground surface consist primarily of silt loam, with some clay loam, silty clay loam, sandy clay loam, variant fine sandy loam, and bedrock. Low-plasticity fat clays are typical in the study area. Common along floodplains, alluvium in the study area consists of sand, silt, and clay, with chert pebbles and lenses of chert pebbles.

Because the bedrock underlying the study area has a high karst potential, well developed underground drainage systems including caves, sinkholes, and/or springs can be expected. Sinkholes that form in the Ste. Genevieve Formation are generally deep with steep sides. Multiple sinkholes, varying in size from a few feet in length to a few thousand feet in length, are shown in **Figure 17,** but there are no known caves. Working in areas affected by karst can prove to be unpredictable. Due to the abundance of karst features, rockline depths/elevations can vary greatly in a relatively short distance. Karst terrain will likely be the most critical factor to any new construction in the study area.

Representative view of topography with rolling hills and visible sinkholes

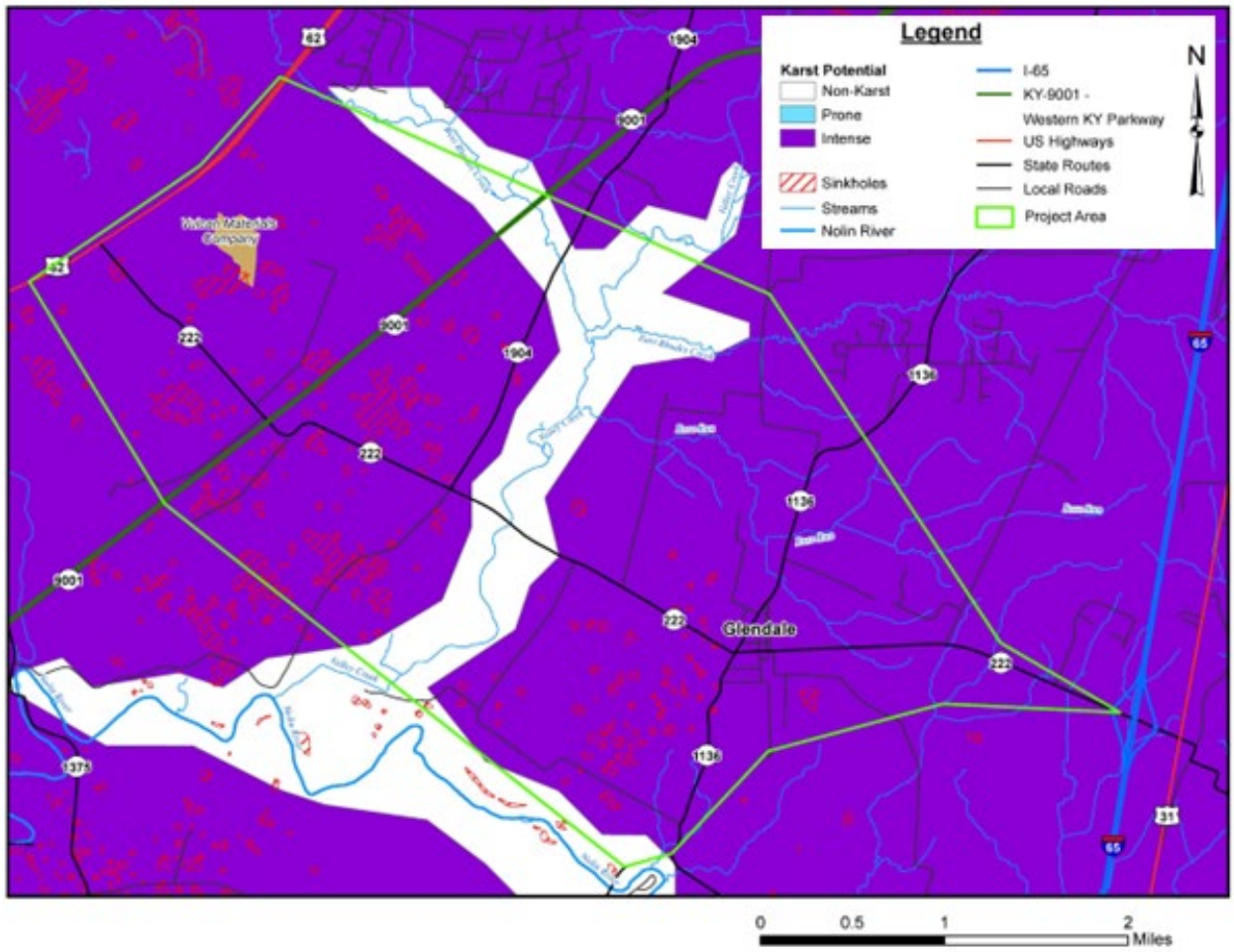


Figure 17: Karst Potential

Vulcan Materials Company operates the Vulcan Materials quarry in the northwest corner of the study area, along US 62. This active quarry extracts limestone for the purposes of crushed aggregate.

There are two known faults in the study area's vicinity, but they are beyond the area's limits.

The area is prone to landslides in soil cuts that are at least 10 feet tall. Therefore, where depth to bedrock exceeds 10 feet, there will be an increased risk for slides.

A complete geotechnical investigation—including drilling, sampling, and testing of materials—will be needed to anticipate and plan for any special treatment of issues encountered during future project development. This may include the taking of pavement cores as directed by the project team.

3.2 Human Environment

The human environment includes people and the resources they define: land use, community features, cultural historic resources, pollution (hazardous materials, air quality, noise), etc. Each could potentially be impacted by any future projects. The following sections identify these resources for consideration during the project development process.

Land Use. Much of the study area is rural, dedicated to farmlands. The unincorporated community of Glendale has a higher density of residential properties, combined with several local commercial businesses, many geared to tourism/antiques. The eastern limits transition to a more highway-commercial setting, with two large truck stops/convenience stores. The latest zoning for the area is shown in **Figure 18**.

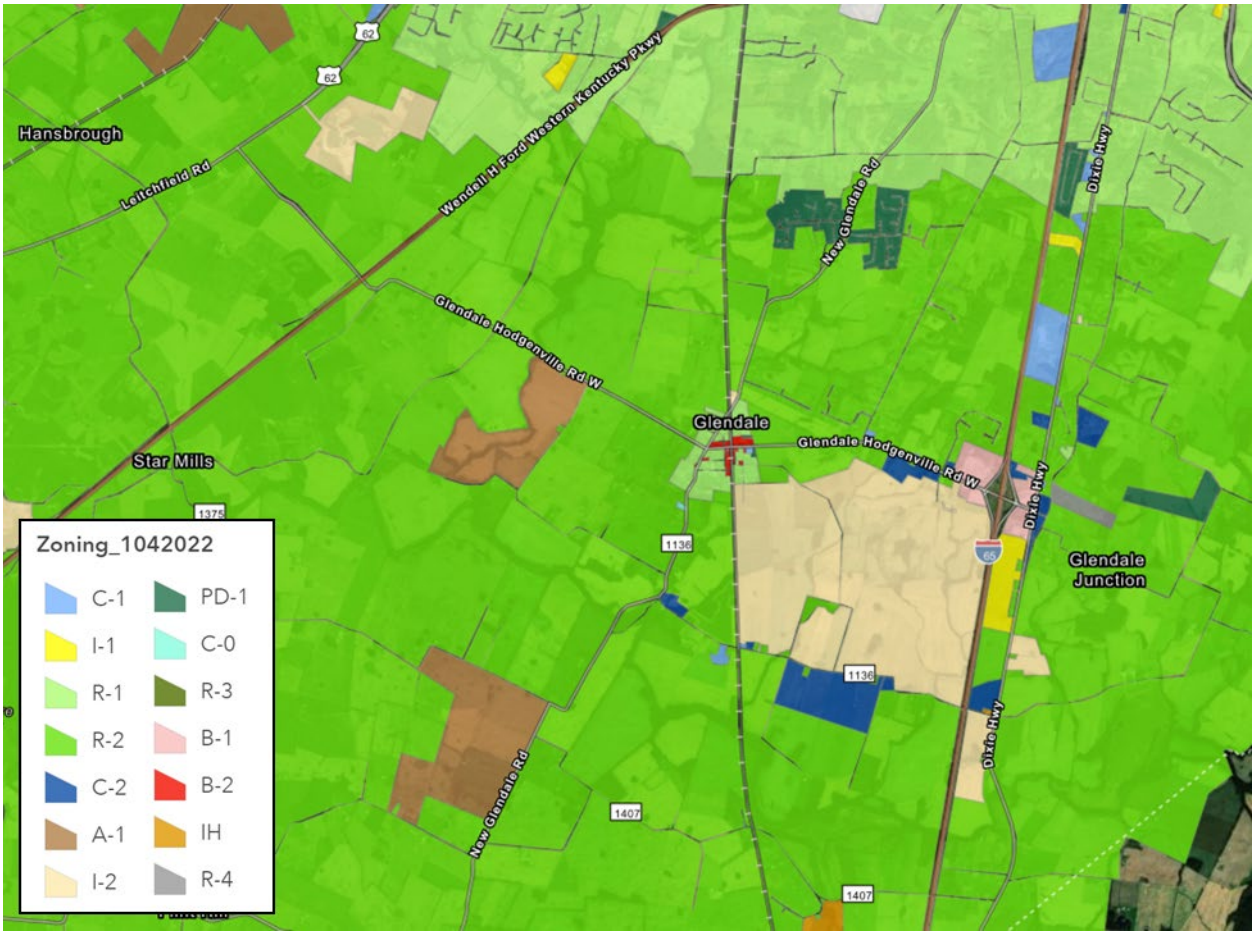


Figure 18: Hardin County Zoning, as of August 2023

The developing Megasite southeast of the study area will be industrial and is expected to spur additional growth in the area as support businesses and demands for housing increase. Anticipated growth patterns are discussed further in **Chapter 6.0**.

Community Features. A few community resources are located within Glendale; however, most of the civic services are based in Elizabethtown six miles to the north. The Glendale Volunteer Fire Department is located along KY 222 just east of the railroad tracks.

Schools. Former East Hardin Middle School is located south of Glendale, between College and High Streets. A new campus was constructed along New Glendale Road in Elizabethtown, with students transitioned to the new facility for the fall 2021 school year. The Glendale facility still provides areas for sports teams' practices and community events. Its future reuse is undetermined currently.

Study area students are bused to elementary schools in Sonora or Cecilia, East Hardin Middle School, and Central Hardin High School.

Parks/Recreation. Glendale City Park is located southeast of the KY 222 railroad crossing. The park features playground equipment, a ball field, half-court basketball, a gazebo for concerts, a covered picnic shelter, and open greenspace for outdoor play.

Glendale City Park

The community hosts several local festivals throughout the year but is known for its annual Glendale Crossing Festival in October, featuring a parade, arts and crafts, refreshments, and more.

Churches and Cemeteries. There are three churches within the study area:

- Glendale United Methodist Church, northwest of the KY 222/KY 1136 intersection
- Glendale Christian Church, southwest of the KY 222/KY 1136 intersection
- Little Zion Baptist Church, 7151 New Glendale Road

Two of the three churches have large cemeteries adjacent. The potential to encounter other unknown or unmarked burial sites exists, particularly in rural areas, and should be considered throughout future project development phases.

Historic Resources. Initially, a *Cultural Historic Overview* (**Appendix D**) was completed for the study area to identify properties within the study area that are listed or eligible for listing on the National Register of Historic Places (NRHP). A Kentucky Heritage Council (KHC) records review identified 65 previously recorded resources within or adjacent to the study area. A survey was also completed to assess individual resources and potential historic districts and identify potentially significant properties that will require additional research to formally evaluate their eligibility for listing in the NRHP.

Most notably, the Glendale Historic District is NRHP listed—shown in red in **Figure 19**—and includes 28 contributing resources. Shown in pink, an expanded district boundary was proposed in 2005 to add 15 more resources but was never finalized. Even if final determinations had been made, physical conditions and survey methodologies change over time so eligibility assessments are typically updated if they are more than five years old. An updated eligibility investigation in Summer 2023 recommended a smaller boundary expansion (blue area), adding eight resources as contributing north of the NRHP-listed district. KHC concurred with the recommendation in July 2023. Beyond the district, 12 individual properties within the study area are listed or were identified as potentially eligible for listing on the NRHP (see **Table 6**). As methodologies have evolved since the NRHP-listed resources were nominated, it is possible a larger footprint (e.g., including associated farm fields) could be considered part of their NRHP boundaries.

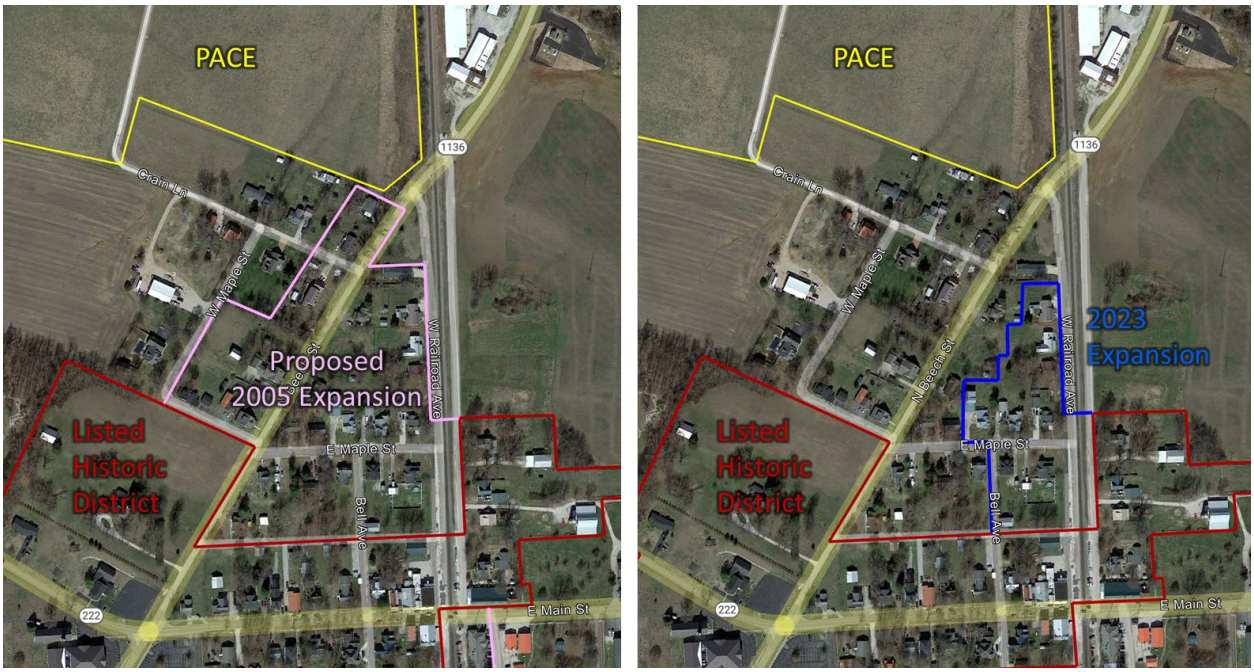
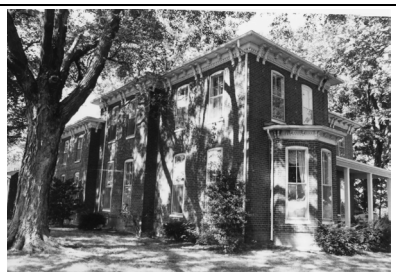


Figure 19: Comparison of Historic District Boundaries

Should federal monies or permits be included in future projects, field survey and coordination with KHC will be required to assess project impacts to cultural historic resources.

Table 6: "Red Flag" Historic Resources in Study Area

 Chestnut Grove (HD-5) Crump Lane south of Rose Run NRHP Listed	 Maplehurst (HD-7) Off Bob Wade Rd NRHP Listed	 Dr. Abel House (HD-200) ¾ mi west of KY 222 S-curve NRHP Listed
 Maple Hill (HD-9) Off Crain Ln NRHP Listed	 George Smith House (HD-11) Off KY 1904 by Valley Creek NRHP Listed, poor condition	 1890s Residence (HD-1082) Smith Mill Rd near Valley Creek NRHP Eligible
 T-Plan Residence (HD-1086) KY 1136 north of High St Potentially NRHP Eligible	 Jaggers Farm Jaggers Rd Potentially NRHP Eligible	 E. Hardin Middle (HD-1091) Between College/High streets NRHP Eligible as group

		N/A
Transitional Log House 1/3 mi SW of KY 222/KY 1136 Potentially NRHP Eligible	Gilead Baptist Church/Cemetery KY 1136/KY 1868 intersection Potentially NRHP Eligible	Smith's Mill (HD-333) Valley Creek north of Rhudes Cr Potentially NRHP Eligible

Archaeological Resources Potential. An *Archaeological Overview* was prepared for the study area. A records review identified eight previous surveys conducted and 70 identified sites within or adjacent to the study area. None are NRHP listed. To protect identified resources, known site locations are not included on public mapping. Identified sites are generally clustered within the community of Glendale, along floodplains, and scattered within the Megasite property.

Records review indicated 984 archaeological sites have been previously recorded in Hardin County. Most of these sites consist of prehistoric, open habitations without mounds (52%) and historic farms/residences (25%). Many sites are found on dissected uplands (42%), followed by floodplains (18%), and undissected uplands (16%).

Review of historic maps shows approximately 508 historic structures within or adjacent to the study area. The soil data show that portions of the study area have the potential to contain deeply buried, intact archaeological deposits.

Field surveys and coordination with the KHC will be required should federal permits or funds be required for future project development phases. **Appendix E**, on file with KYTC, includes additional information about the archaeological overview.

Socioeconomic Profile. LTADD completed a socioeconomic study for the corridor (**Appendix F**) to highlight potential areas statistically likely to contain elevated concentrations of minority, elderly, economically disadvantaged, limited English proficiency (LEP), and/or disabled populations. The study corridor covers portions of two US Census block groups, with the Western KY Parkway forming the boundary between. Statistics are summarized in **Table 7**, reported from 2020 American Community Survey five-year estimates. Concentrations for Hardin County serve as the reference threshold, highlighting any block group populations exceeding this level. As shown, the western portion of the study area has a greater concentration of elderly persons than the

encompassing county although it should be noted most of the block group population lies beyond the study area boundary.

Table 7: Socioeconomic Metrics for Study Area Block Groups

Metric	Kentucky	Hardin County	Tract 17.01 BG3 (West)	Tract 16.03 BG1 (East)
Population	4,461,952	109,627	1,457	1,802
% Minority	15.9%	24%	7%	8%
In Poverty	16.6%	11%	8%	1%
% Aged 65+	16.4%	14%	19%	10%
Disabled	21.2%	20%	14%	6%
LEP	2.3%	2%	0%	0%

Section 4(f). Section 4(f) of the *Department of Transportation Act of 1966* applies to federally funded projects. It is a substantive law that applies to land from publicly owned parks, recreation areas, wildlife and waterfowl refuges, and public or private historic sites eligible for or listed on the NRHP. A federally funded highway project that uses a Section 4(f) property can only be approved after a determination is made that no prudent or feasible alternative to the use of the property exists and that project planning minimizes harm to Section 4(f) sites.

Potential Section 4(f) protected properties within the study area are public parks plus cultural historic and archaeological sites eligible for listing or listed on the NRHP. No wildlife and waterfowl refuges are located within the study area.

Section 6(f). Section 6(f) of the *Land and Water Conservation Fund (LWCF) Act* applies to both state and federally funded projects. The LWCF provides federal grants to acquire land for outdoor recreation, protect important natural areas, and develop or renovate outdoor recreation facilities (campgrounds, picnic areas, swimming facilities, etc.). Impacts must be addressed when projects result in permanent conversion of outdoor recreation property that was acquired or developed using LWCF grant assistance. No properties that have received LWCF funds were identified within the study area.

Hazardous Materials Considerations. Readily available records from the US Environmental Protection Agency (USEPA) were compiled to illustrate the range of monitored sites within the study area. There are no open underground storage tanks (UST); however, there are closed USTs at three locations noted in **Figure 15**: two businesses in the historic Glendale area plus one farther

west along KY 222. Records also identify a handful of inactive RCRA sites[10] in the vicinity, but text descriptions suggest they are mapped incorrectly, actually lying beyond the study area.

Air Quality Considerations. USEPA has established National Ambient Air Quality Standards (NAAQs) for six criteria pollutants: ozone, lead, nitrogen dioxide, sulfur dioxide, carbon monoxide, and particulate matter ($PM_{2.5}$ and PM_{10}). Hardin County is in attainment for all criteria pollutants.

The study area is located within an MPO; therefore, any federally funded transportation projects should be included in the MPO's transportation improvement program (TIP) and statewide TIP to ensure air quality conformity requirements are satisfied. Future federal projects may need to analyze potential Mobile Source Air Toxics (MSAT) impacts based on the project type. FHWA has developed a tiered approach for three categories to analyze MSAT in NEPA documents, depending on specific project circumstances. The three tiers and associated level of analysis are no potential/exempt projects requiring no analysis, low potential requiring a qualitative analysis, and higher potential requiring quantitative analysis. Based on traffic volumes, any proposed improvements most likely fall into one of the lower two categories.

Noise Considerations. There are noise sensitive receptors in the vicinity of potential future improvements. Noise sensitive receptors include all outdoor areas of frequent human use such as residential areas, parks, cemeteries, hospitals, churches, schools, and some commercial properties with exterior use.

Specific traffic noise impact analyses may be required in future project development activities. State funded projects do not require a traffic noise impact analysis, unless directed by the legislature. However, federally funded projects that add capacity or shift traffic closer to sensitive receptors do require the consideration of traffic noise impacts.

4.0 INITIAL COORDINATION EFFORTS

Collaborative project team, local official/stakeholder (LO/S), and public engagement efforts occurred through the course of the study. The project team included KYTC District 4 and Central Office staff from various disciplines, LTADD staff, and consultant personnel. Coordination efforts were essential for identifying areas of concern and potential improvement opportunities. Summaries of all meetings are in **Appendix G**.

[10] RCRA, or sites covered by the *Resource Conservation and Recovery Act*, include the generation, transportation, treatment, storage, and disposal of hazardous waste and is overseen by the USEPA.

4.1 Project Team Meeting No.1

The project team met on June 16, 2022, to review existing conditions information and prepare for the upcoming LO/S outreach. The team reviewed existing conditions including roadway geometry, traffic flow, high crash locations, and environmental resources. There are numerous projects underway and planned in the vicinity; local leaders are very interested in being engaged. The majority of the meeting addressed travel demand model assumptions as future traffic is critical in anticipating study area needs.

Consultant staff held one-on-one discussions with the county planning commission director, county engineer, and city planner during June 15–16 to obtain feedback on anticipated future land use changes and socioeconomic growth assumptions. While KYTC updated its regional travel demand model to reflect the latest employment assumptions at the BOSK plants, input from local planners and decision makers helps inform bigger picture growth assumptions for the surrounding region.

The model and future growth assumptions are discussed further below.

4.2 Local Official and Stakeholder Meeting No.1

The project team met with local officials and other stakeholders July 14, 2022, at Glendale Christian Church. The meeting covered a host of ongoing transportation projects in the area—the interchange reconstruction, Ring Road extension, and KY 1136 reconstruction—and included information about this planning study.

Study area needs are driven by future traffic accessing the BOSK plants and supporting development, so traffic forecasts are a critical component of this study. The goal is to coordinate all projects and the future (2045) traffic scenario, including the new battery plants and future land use changes in southern Hardin County. Future regional traffic was forecast using the updated Meade-Hardin Travel Demand Model (TDM). Coordination occurred with both city and county planning representatives to help forecast the future (2045) land use scenario, built around household and job projections. Hardin County's ongoing *Comprehensive Plan* update[11] forecasts 33,000 to 50,000 new households in the larger region. The current TDM includes 14,000 new households in Hardin County (40,000 in 2018 versus 54,000 in 2045) and 38,000 new jobs (46,000 in 2018 versus 84,000 in 2045), including 5,000 at BOSK. Maps showing current TDM growth assumptions were distributed, and

July Stakeholder Meeting

[11] Online at https://www.hardincountyplan.org/

attendees were asked to review/comment on the assumptions. Comments focused primarily on the following issues:

- Most recent growth has occurred along US 62 near Cecilia. Other infrastructure improvements are being advanced that would support future development.
- Glendale's sewer plant will be near capacity once BOSK is operational. More investment and capacity will be required to support significant residential growth.
- Current plans for BOSK use about 600 acres of the 1,500-acre Megasite. If the remainder develops with similar intensity in the future, it will change traffic patterns.

Other attendee comments emphasized the need for a new Northeast Glendale Bypass, limited funding to address statewide needs, and consideration of a new I-65 interchange south of the Megasite, e.g. near the KY 1136 overpass.

5.0 STUDY GOALS AND OBJECTIVES

The intent of this study is to examine future traffic demands alongside the existing highway network and currently ongoing projects, identify locations where improvements are needed but not addressed by currently ongoing projects, and then prioritize improvements to the network. according to which concepts are needed first and which represent longer term improvements. Any improvement concepts considered should be developed to satisfy as many of the following goals as possible:

6.0 2045 TRAFFIC FORECAST AND NO-BUILD OPERATIONS

The Hardin-Meade regional TDM, along with recent mainline and turning movement counts, formed the basis of future year 2045 traffic projections. The complete *Traffic Forecast Report* is in **Appendix A**.

6.1 Future Year Traffic Assumptions

The regional TDM estimated future year growth for all study area roadway segments. The model simulated a 24-hour period, relying on hourly and directional factors to derive design hourly volumes (DHV). At a high level, the model overlaid the roadway network over anticipated changes in household and employment levels for geographic zones to project changes in traffic flows.

Socioeconomic assumptions were reviewed and adjusted to reflect current background growth assumptions. The No-Build scenario includes construction of the two BOSK battery plants within the Megasite and construction of the Ring Road extension to US 31W (Item No. 4-198).

Household and employment growth assumptions are shown in **Figure 20** and **Figure 21**; darker shading represents higher growth. As shown, over 1,600 new homes are expected to be constructed by 2045 within the three zones north of KY 222 between I-65 and Valley Creek. Other zones throughout south central Hardin County also exhibit substantial residential increases.

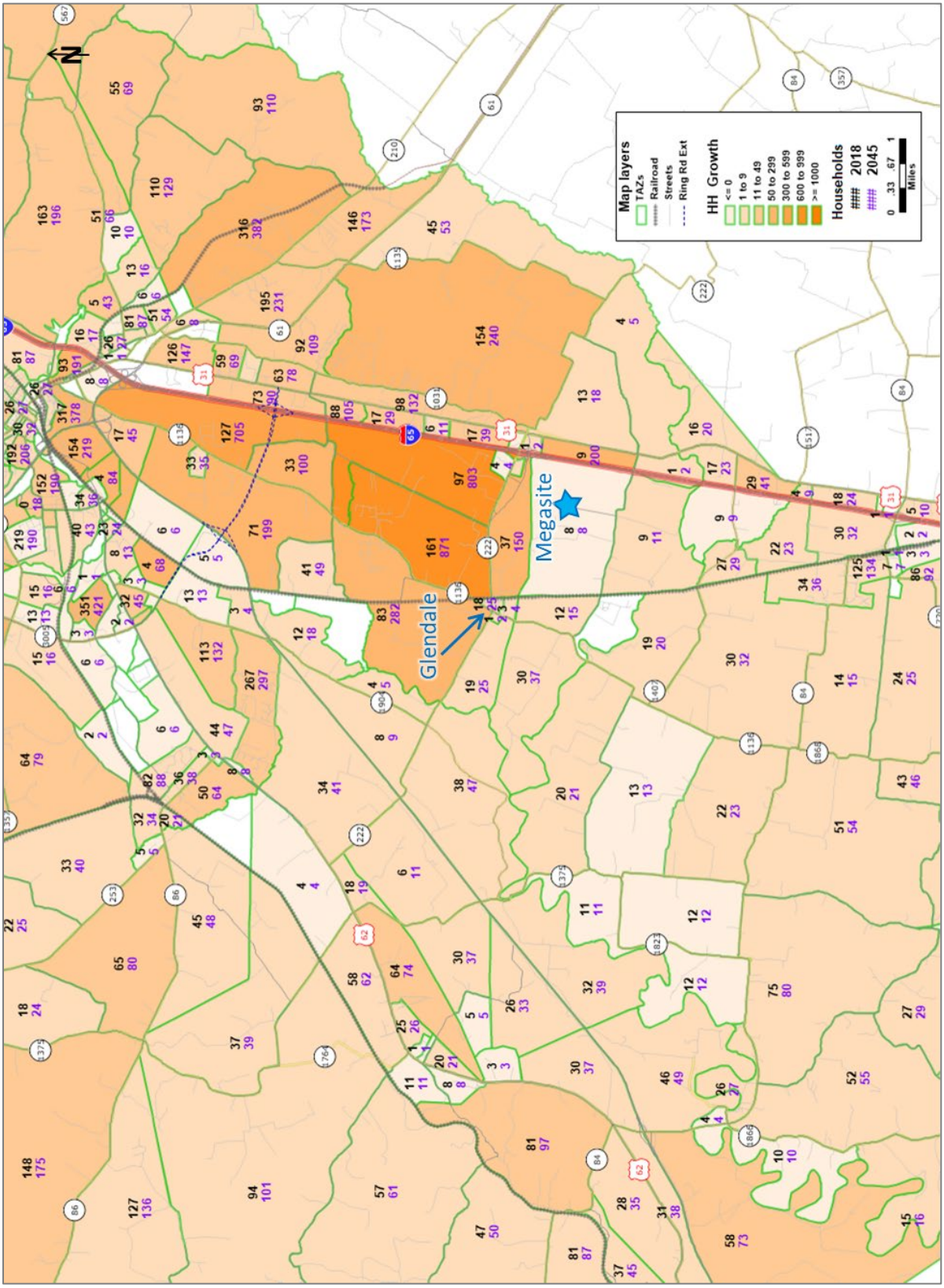


Figure 20: Household Growth in Region Model

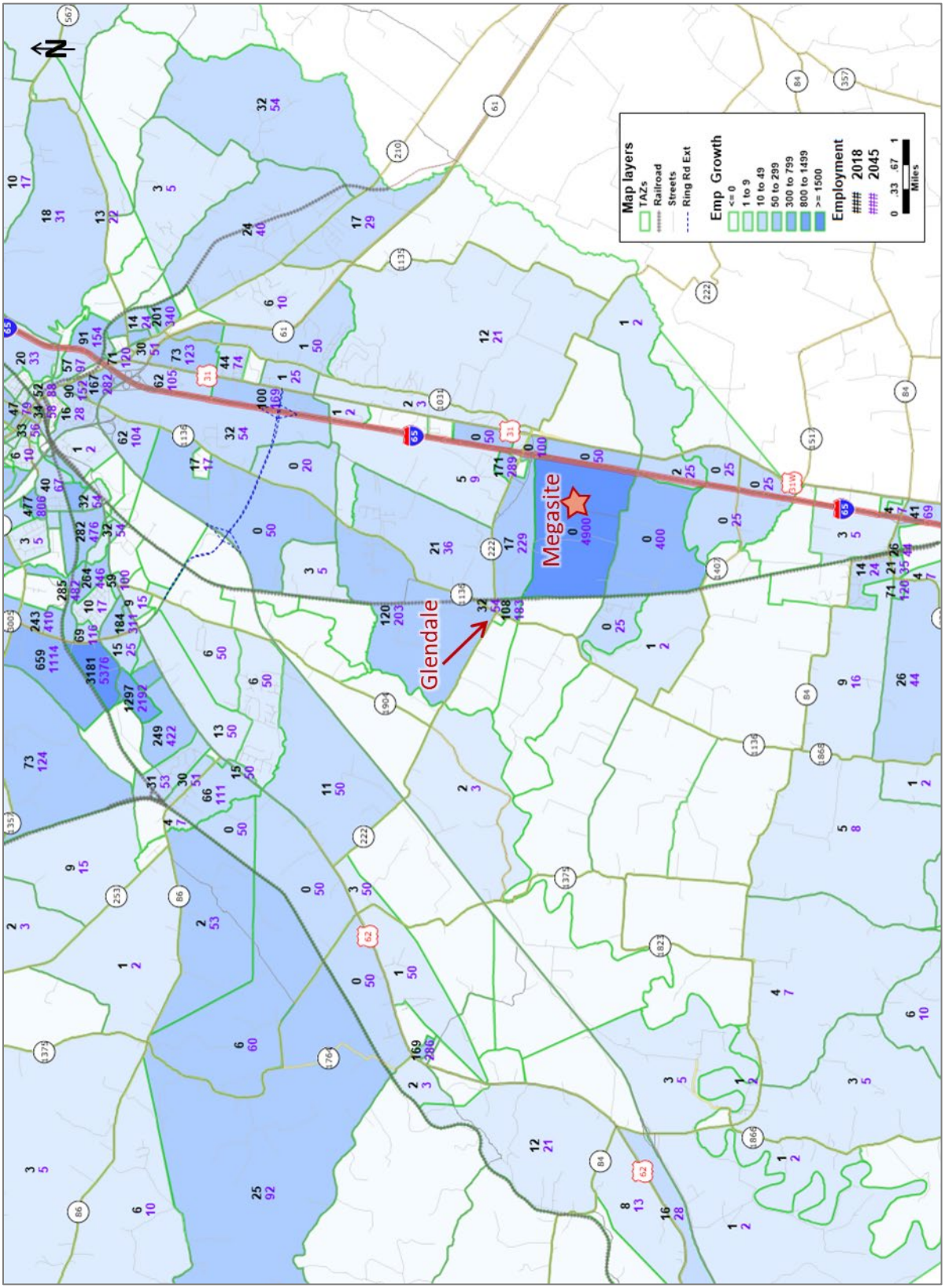


Figure 21: Employment Growth in Region Model

The Megasite reflects 4,900 new employees by 2045, with 750+ additional jobs in the adjacent zones and even more job growth in the surrounding region. The I-65/US 31W and US 62/Railroad corridors exhibit the highest commercial/industrial growth projections.

6.2 2045 No-Build Traffic

Considering population projections, anticipated development, and TDM projections, 2045 No-Build ADT volumes were forecast as shown in **Figure 22**, compared alongside the 2022 Existing traffic scenario. Three distinct projects are included in the No-Build assumptions: the BOSK battery plants with staggered shift start times, extension of Ring Road to US 31W, and reconstruction of the I-65/KY 222 interchange as a SPUI.

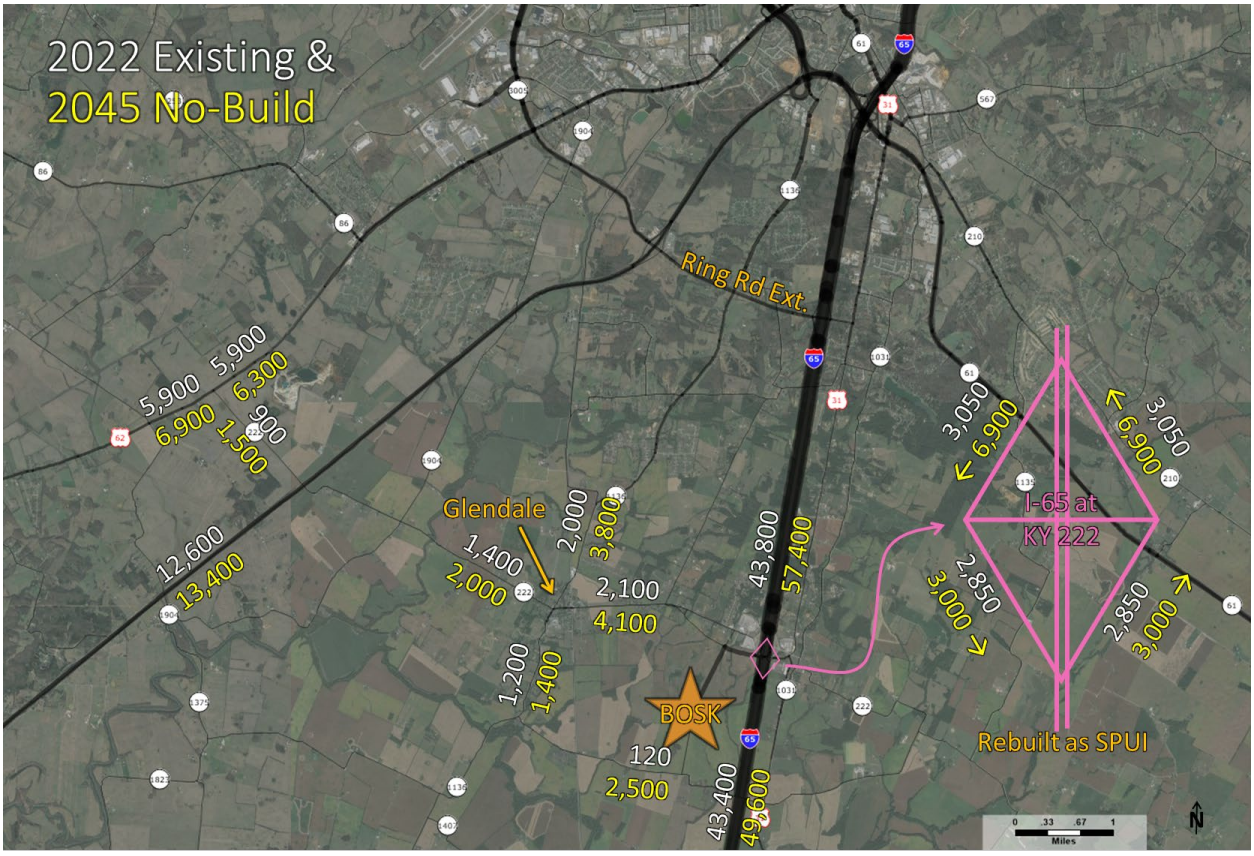


Figure 22: No-Build ADTs

As shown, background traffic volumes continue to grow. KY 222 volumes east of Glendale and I-65 ramps to/from the north roughly double by 2045. When/if the remaining Megasite acreage develops, these forecasts are likely to increase further.

The distribution of BOSK employee commuting patterns is largely speculative. Derived from socioeconomic growth patterns in the newly updated regional model, about 75% of trips accessing the BOSK site are assumed to use the north plant entrance along KY 222, traveling

to/from areas primarily north of Glendale. This is consistent with larger population centers to the north—i.e., Elizabethtown and the Metro Louisville area. This distribution was compared with other recent traffic forecasts in the vicinity—associated with site work at BOSK and the Item No. 4-171 widening project along KY 1136—and represents a midpoint between distributions from these independent efforts. Peak hour forecasts assume BOSK employee shifts between the two plants have staggered start times, spreading demand over a longer duration to optimize available capacity.

Additional test scenarios with higher employment projections were run to gauge the sensitivity of the model; projections in the busiest areas near the KY 222 interchange are highly dependent on how the BOSK site operates. Assumptions about how many employees are divided among how many shifts, whether shifts follow staggered start times, and how access to the site is distributed play a major role in determining how the surrounding highway network serves demands.

6.2.1 Traffic Operations

Two commonly applied highway performance indicators, level of service (LOS) and volume-to-capacity (v/c) ratios, were calculated to describe traffic operations along the corridor. Computations were performed in accordance with *Highway Capacity Manual 6th Edition* procedures for study route segments.

Level of Service. LOS is a qualitative measure that describes traffic conditions based on measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience. LOS typically represents a driver's perspective of traffic conditions based on perceived congestion. As illustrated in **Figure 23**, LOS A is associated with free flow conditions, high freedom to maneuver, and little or no delay. Conditions at or near capacity typically are associated with LOS E. LOS F represents oversaturated traffic conditions beyond capacity, with low travel speeds, little or no freedom to maneuver, and lengthy delays. LOS D is generally acceptable.

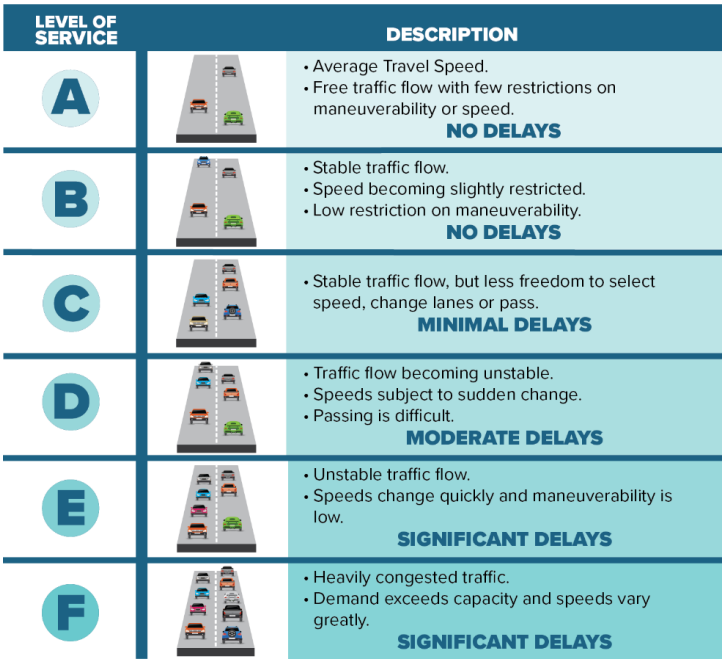


Figure 23: Level of Service (LOS)

LOS was determined for the highest traffic hour based on DHV calculations,

applying K- and d-factors (i.e., hourly and directional adjustments) to ADT counts to approximate peak hourly flows.

Volume-to-Capacity. Another measure, v/c, compares traffic volume using a facility to its theoretical capacity over a specific duration, one hour in this instance. A v/c ratio greater than 1.0 indicates a route has exceeded its theoretical capacity and additional throughput may be justified. As v/c is measured over an hour period by segment, a roadway or intersection could be congested during peak commuter periods but show a relatively low v/c averaged over a longer duration.

Based on forecast No-Build volumes, study area highway segments and intersections operate at LOS C or better during both peak hours. The highest v/c is 0.55, associated with I-65 thru lanes north of Glendale. During the AM peak hour, the southbound right turn from the I-65 off-ramp is approaching capacity; however, associated lane configurations and signal timing for the Item No. 4-20 SPUI project are being evaluated concurrent with this study.

7.0 CONCEPT DEVELOPMENT

Improvement concepts were developed based on a combination of input from the project team, a review of previous planning efforts, TDM projections, stakeholder feedback, and field reconnaissance. Concept types were organized into four basic categories, based on geography (**Figure 24**). Each is discussed further in the following subsections.

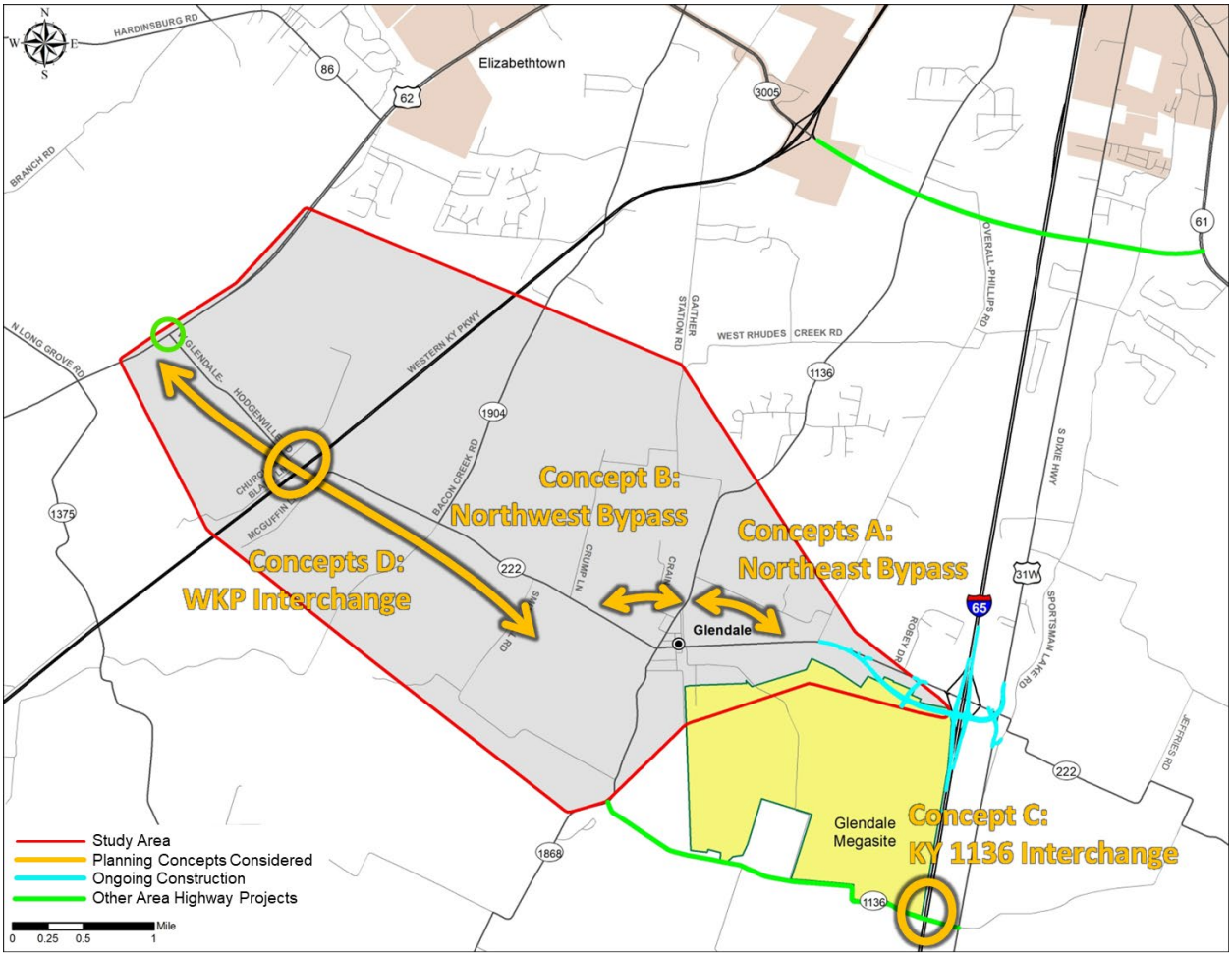


Figure 24: Types of Build Concepts Considered

In addition to coordination with the larger community (**Chapter 8.0**), three project team meetings were held during the development of Build concepts: August 29, 2022; September 15, 2022; and July 10, 2023. Each involved an iterative discussion of Build concepts, refining the range of options considered prior to coordination with the larger community.

7.1 Concept A: Northeast Bypass

Concept A represents a northeast bypass of the Glendale community, similar to the concept identified in the 2008 *Glendale Area Transportation Study* and 2021 update. The concept is to

route traffic to/from the north along KY 1136 (New Glendale Road) to KY 222 and the BOSK plants without traveling through the KY 222/KY 1136 intersection in Glendale. Concept A also eliminates the need to navigate two at-grade railroad crossings between these destinations—or follow the narrow, local cut-through along East Railroad Avenue.

Two variations were initially developed, shown in **Figure 25**. Later in the study process, a combined Concept AB approach (**Section 7.3**) expanded the range of options considered.

Figure 25: Concept A Variations

Both connect between KY 1136 north of the railroad crossing and KY 222 near Mud Splash Road, where the improved length of KY 222 associated with the Item No. 4-20 interchange reconstruction project ties back to existing KY 222. Both were developed to minimize property impacts, avoid the adjacent pump station, and minimize impacts to existing and planned utilities. While details will be determined as part of any future design phases, proposed corridors make the new bypass the thru movement, discouraging pass-thru trips in Glendale.

While both options have the same endpoints, **Concept A.1 (Yellow)** curves closer to Glendale, widening a half-mile stretch of existing KY 222 to reach the improved highway at Mud Splash Road. **Concept A.2 (Purple)** creates a straight connection between Oxmoor Drive and the stream.

Year 2045 traffic projections estimate 2,500 vpd using a Northeast Bypass, within the capacity of a two-lane highway. For the planning study, the typical section is assumed to include two 12-foot-wide lanes with 8-foot-wide paved shoulders. The 8-foot-wide paved shoulders provide a refuge for cyclists, consistent with KYTC's Complete Streets policy. The corridors shown on the map are much wider than needed, providing a conservative envelope for future environmental and engineering work should this concept advance for additional project development.

7.2 Concept B: Northwest Bypass

Concept B represents a northwest bypass of the Glendale community, also similar to a concept identified in the 2008 and 2021 studies. However, two large environmental constraints limit the feasibility of a new alignment connector through this area: a NRHP historic district to the south and a PACE easement to the north.

With the laws in place to protect these resource types, a new Northwest Bypass was initially considered to be infeasible. However, with the train derailment in March 2023 and "near miss" in July 2022, the project team decided to take a closer look at options to reduce conflict points with the railroad tracks. The earlier *Glendale Area Transportation Studies* and public input during Fall 2022 also supported a "full" northern bypass that connected to KY 222 on both ends instead of stopping at KY 1136, though a northern bypass met strong public opposition in Summer 2023.

7.3 Concept AB: Full North Bypass

Concept AB, which was developed after the public outreach discussed in **Section 8.2**, represents a full northern bypass of Glendale, connecting to KY 222 on either end. Shown in **Figure 26,** variations follow a similar alignment but explored both at-grade and grade separated railroad crossings.

Year 2045 traffic projections estimate 3,300 vpd east of KY 1136 and 1,800 vpd to the west, within the capacity of a two-lane highway. As in Concept A, the typical section assumed two 12-foot-wide lanes with 8-foot-wide paved shoulders. Access is assumed to be partially controlled, to preserve bypass-style mobility rather than promoting a new development corridor. The corridor shown on the map is much wider than needed, providing a conservative envelope for future environmental and engineering work should this concept advance for additional project development.

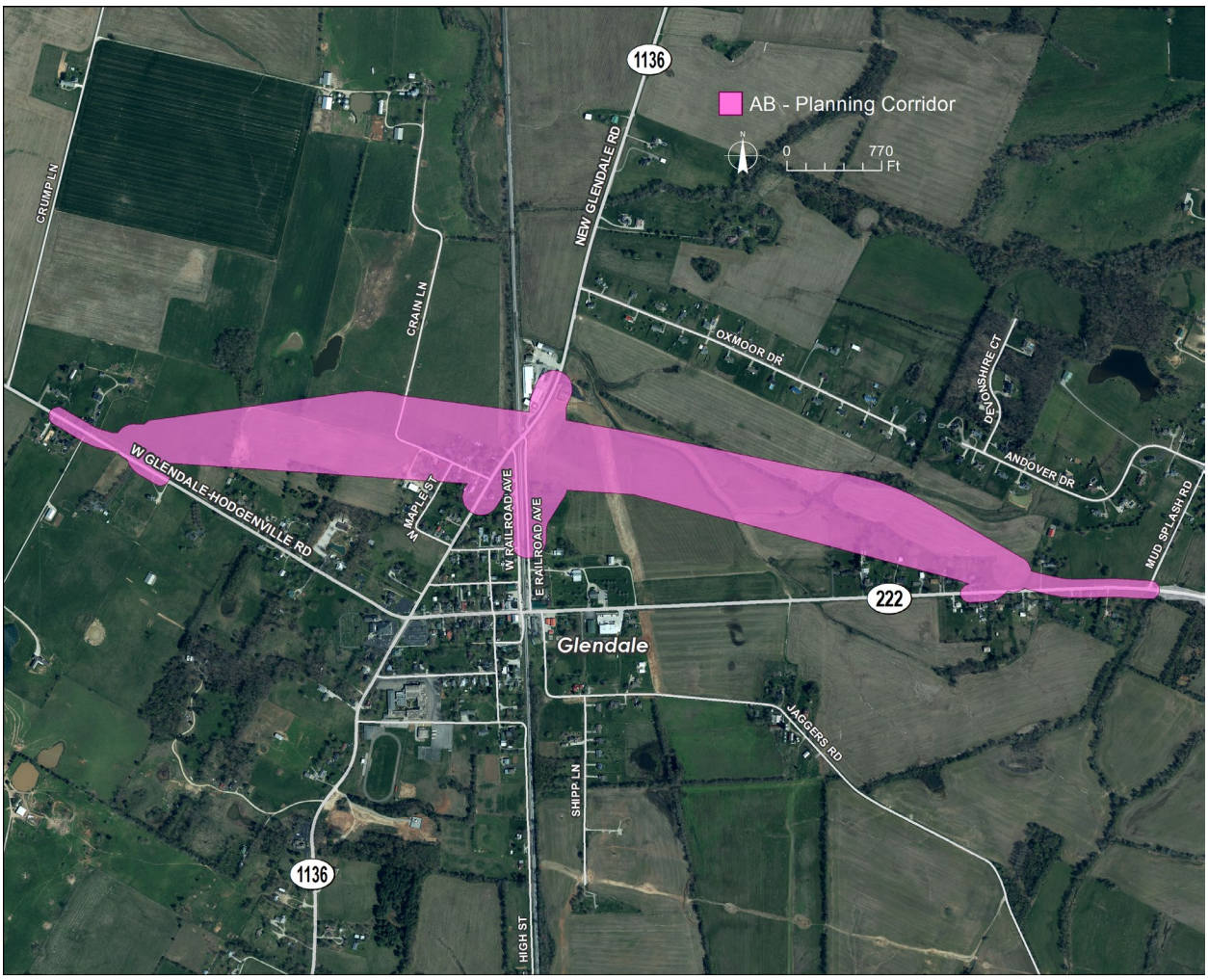


Figure 26: Concept AB

A full bypass of Glendale provides benefits over a northeast bypass, providing an alternate route for cut-through traffic from both the west and north.

7.4 Concept C: New I-65 Interchange at KY 1136

Concept C includes a new interchange with I-65 at KY 1136 (Gilead Church Road). Shown in red in **Figure 27**, Item 4-171 is currently in the design phase, developing a wider KY 1136 to handle increased traffic. Two lanes are proposed, but right-of-way limits were developed to accommodate eventual widening to four or five lanes if warranted. A new I-65 interchange is not part of Item 4-171.

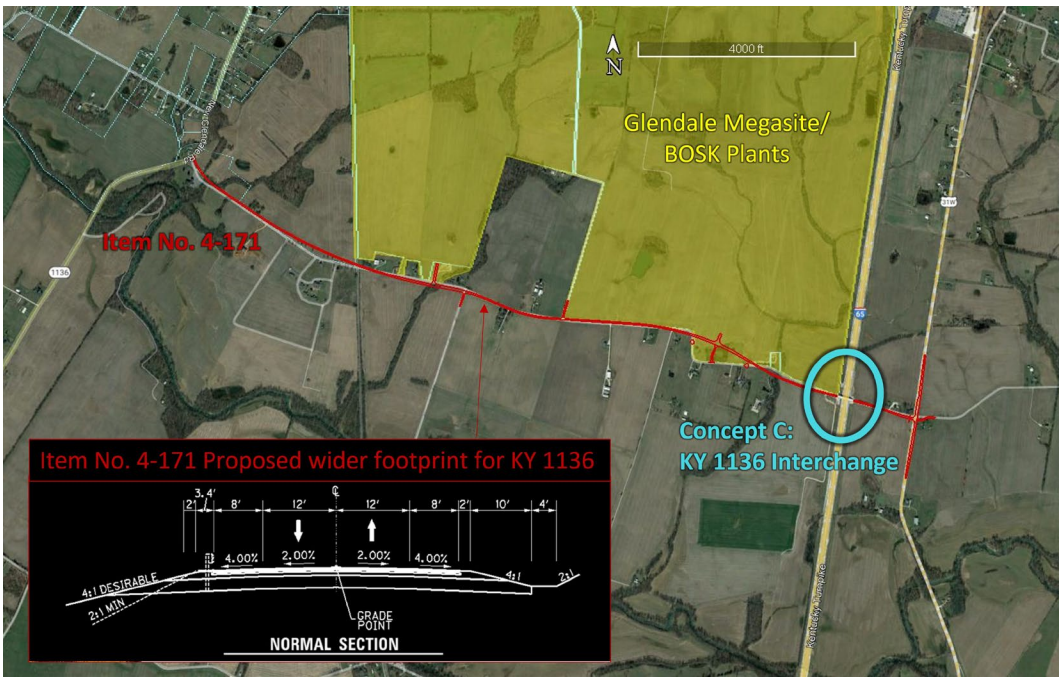


Figure 27: Location of Concept C

A new interchange was coded into the regional TDM to forecast the Concept C Build scenario traffic, summarized in **Figure 28**. As shown, a new I-65 interchange would shorten the trip to/from the south and divert some traffic from the busy ramps at Exit 86. The new interchange would serve an estimated 5,200 vpd in 2045, divided among the four ramps. Traffic using KY 222 is lower than the No-Build volume as more traffic shifts to KY 1136 (Gilead Church Road). Operationally, study area highway segments and intersections continue to operate at LOS C or better during both peak hours.

Concept C shortens the route between areas south/east of Glendale and the BOSK site. For example, a trip from Sonora to the Glendale Megasite today is 6.5 miles versus 4.5 miles if Concept C were open to traffic.

The KY 1136 interchange would be 1.45 miles south of the KY 222 overpass once the Item 4-20.01 construction project is complete. If the concept advances, additional coordination with FHWA will be required to satisfy interchange spacing requirements and to demonstrate engineering and operational feasibility for a new interchange.

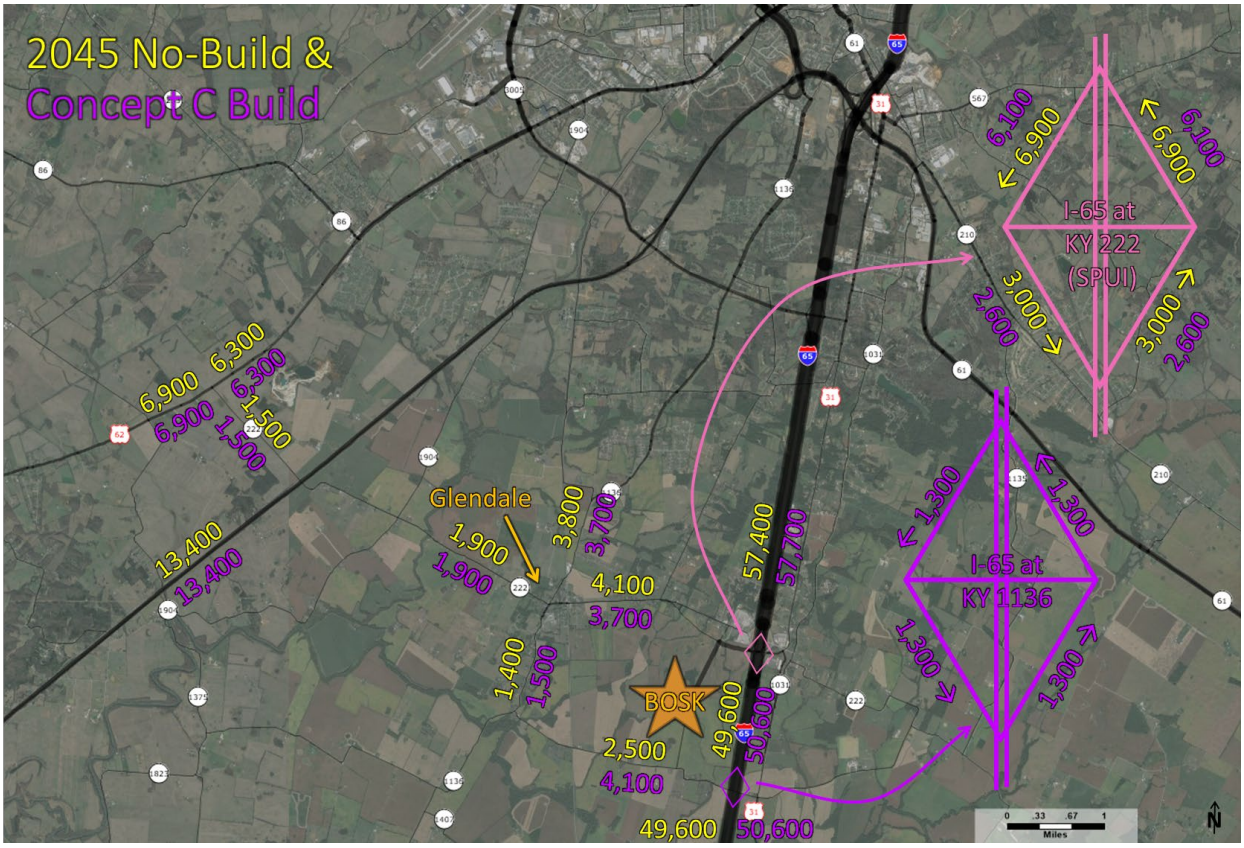


Figure 28: Concept C Build Daily Traffic

7.5 Concept D: New I-65 Interchange at Western KY Parkway

Concept D includes a new interchange with the Western KY Parkway at KY 222 (Glendale-Hodgenville Road) and improved east/west connection. A range of corridors could serve this purpose—beginning near the US 62/KY 222 intersection, crossing over the parkway at or near the existing KY 222 overpass, and tying to KY 1136 (New Glendale Road) somewhere between Gilead Church Road and Glendale. More southern routes could rely on KY 1136 (Gilead Church Road) to reach the BOSK plants while more northern routes could rely on a new South Glendale Bypass with a grade-separated railroad overpass to reach the BOSK plants. Five variations of Concept D were considered and are shown in **Figure 29**.

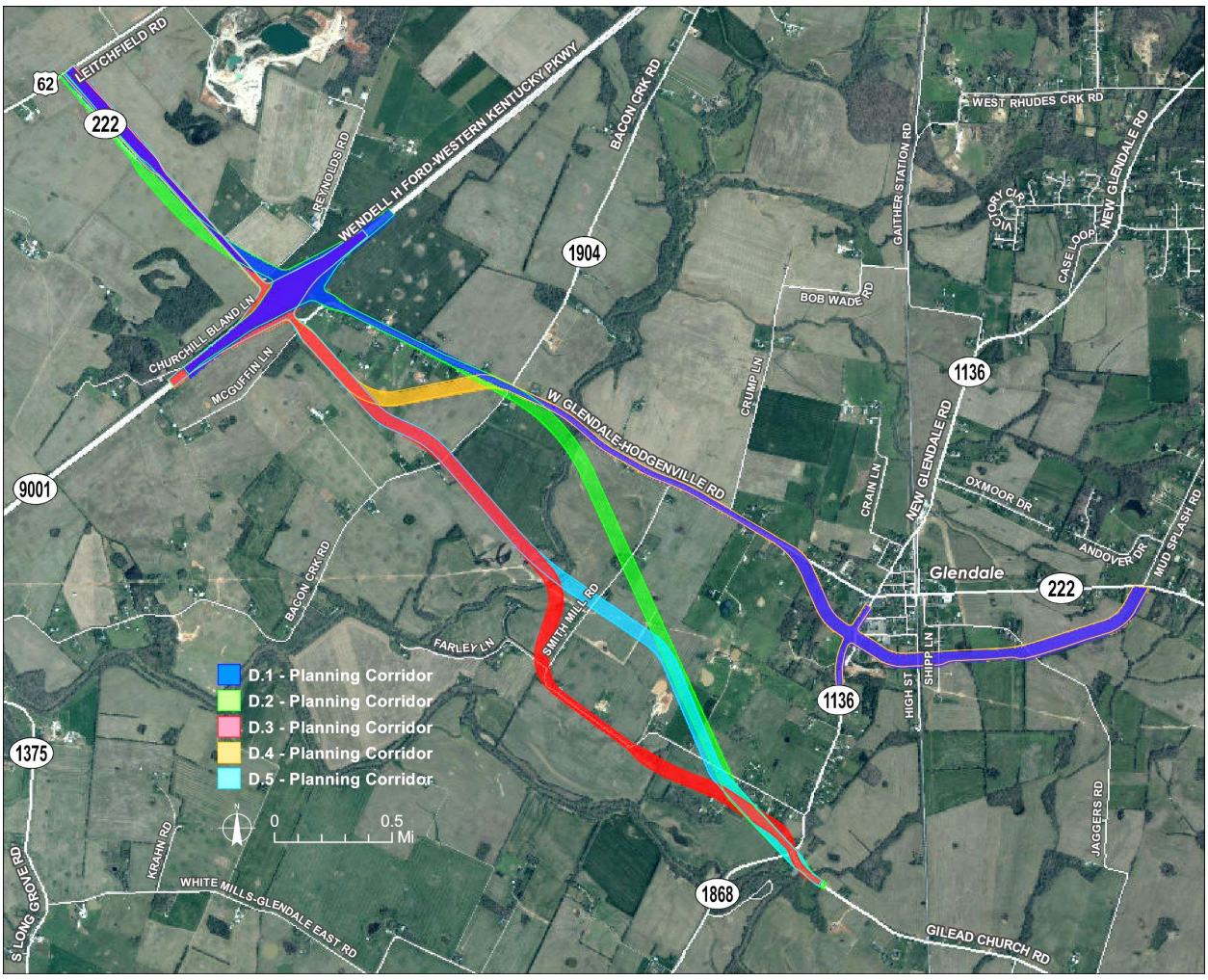


Figure 29: Concept D Variations

Concept D.1 (Dark Blue) follows much of existing KY 222, widening the roadway to provide two 12-foot-wide driving lanes and 8-foot-wide paved shoulders. It crosses the parkway north of the existing overpass, requiring a new bridge and ramps but avoiding the existing S-curves along KY 222. Approaching Glendale, the route curves south of town to provide a new grade-separated railroad crossing near the former school, and then ends near the KY 222/Mud Splash Road intersection. About 2,000 feet of KY 1136 (New Glendale Road) would have to be realigned.

Concept D.2 (Green) generally follows/widens KY 222 from US 62 to near Bacon Creek Road, then swings to the south. The route crosses the parkway north of the existing overpass and meets KY 1136 (New Glendale Road) at Gilead Church Road. BOSK traffic would use improved KY 1136 to access the plants via their southern entrance.

Concept D.3 (Red) generally follows existing KY 222 from US 62 through the parkway overpass, then is on new alignment east of the parkway, following a portion of Smith Mill Road before connecting to improved KY 1136 (Gilead Church Road).

Concepts D.4 (Orange) and **D.5 (Light Blue)** form connectors between sections of the other concepts above.

A new parkway interchange was coded into the regional TDM to forecast the Concept D Build scenario traffic, summarized in **Figure 30**. As shown, the new interchange would serve 2,600 vpd divided among the four ramps but would not pull traffic away from the busy I-65/KY 222 interchange. Traffic using KY 222 to travel east/west increases versus the No-Build scenario. Concept D options that include a new east-west connection south of existing KY 222 would divert traffic from KY 222; forecasts estimate 2,000 vpd on a new east-west connector with a 32% reduction in traffic traveling through Glendale.

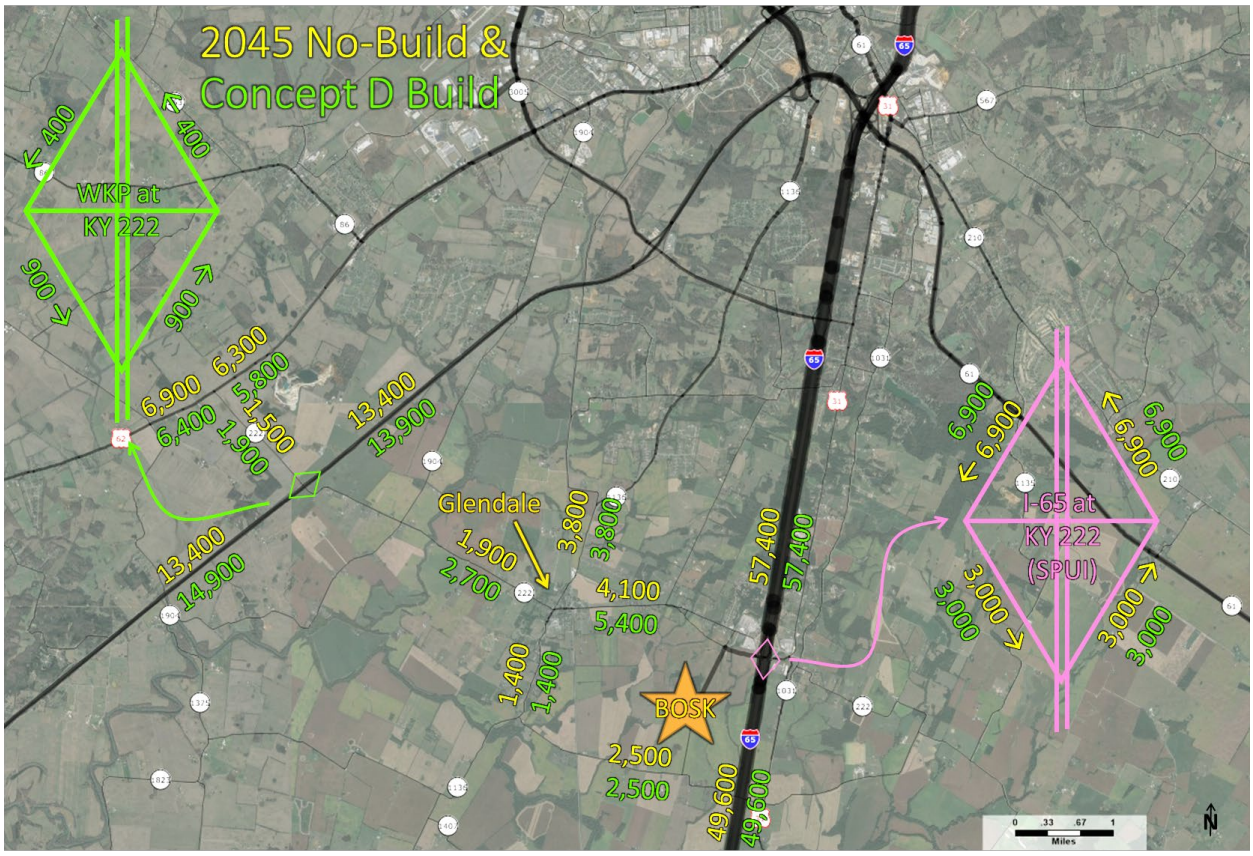


Figure 30: Concept D Build Daily Traffic

Based on projected 2045 traffic, a two-lane highway provides adequate capacity for anticipated volumes. For the planning study, the typical section for an improved east/west connection is assumed to include two 12-foot-wide lanes with 8-foot-wide paved shoulders. Operationally,

study area highway segments and intersections continue to operate at LOS C or better during both peak hours. The corridors shown on the map are much wider than needed, providing a conservative envelope for future environmental and engineering work should this concept advance for additional project development.

Concept D provides a shorter route between areas south/west of Glendale and the BOSK site. For example, a trip from Leitchfield to the Glendale Megasite today is 30.2 miles/34 minutes, and will be 33.2 miles/30 minutes once the Item No. 4-198 Ring Road extension is open to traffic; whereas, the same trip would be around 28 miles/27–28 minutes if one of the Concept D options were open to traffic.

8.0 COORDINATION MEETINGS ON BUILD CONCEPTS

Following concept development efforts described in **Chapter 7.0**, the project team engaged with other stakeholders to present and discuss options. Meeting summaries for each coordination point are included in **Appendix G**, arranged chronologically.

8.1 Local Official and Stakeholder Meeting No. 2

A second meeting with LO/S was held October 13, 2022. An online StoryMap[12] was created to present existing conditions, summarize Build concepts, and collect feedback from viewers. The project team used the StoryMap to guide the discussion, answering attendee questions about proposed improvements.

Most of the group discussion focused on the Build concepts. **Concept A.2 (Purple)** was generally preferred over **Concept A.1 (Yellow)** as it has fewer property impacts. Attendees generally recognized the benefits of Concept C and asked if funding could be made available to begin design work ahead of the next budget cycle. Regarding Concept D, preferences were divided but attendees preferred concepts that connected at Gilead Church Road over those closer to Glendale to minimize impacts to the community.

Attendees were encouraged to promote the upcoming public meeting and survey, discussed below.

[12] Online at GlendaleStudy.com

8.2 Public Meeting

Roadside Ad

An open house public meeting was held at the old East Hardin Middle School in Glendale on November 3, 2022. The public meeting notice and accompanying survey were promoted via District 4 social media accounts, media releases, the study website, and roadside signs. The project website contained mirror information and survey questions related to the in-person meeting at which there were three information stations and members of the project team circulating to answer questions. There was no formal presentation.

Beyond the sign-in tables, a station included the background information about the study: boards explaining why KYTC was completing the study, its goals and objectives, and the organization of the Build concepts. In addition, two sets of boards on each side of the cafeteria presented large-scale mapping of Concepts A, C, and D alongside basic traffic and typical section information. A laptop and big screen provided internet-based maps for exploring each Build concept in more detail. A final table provided paper copies of the survey, giving the public the opportunity to provide feedback on the concepts presented and record other suggestions or concerns. In total, 277 individuals attended the meeting.

November 2022 Public Meeting

8.2.1 Survey Responses

During October and November, surveys were collected to obtain community perspectives on the proposed concepts. Overall, 146 completed surveys were submitted.

The first question asked participants to rank the relative importance of the four study goals (**Chapter 5.0**). Reducing future traffic flows within historic Glendale and minimizing impacts to the human and natural environment were the highest priorities, with facilitating safe and efficient traffic movements to/from the BOSK plants rated lowest.

Other questions asked about Concepts A, C, and D—which would provide the most value and which, if any, should advance for further project development. It should be noted that Concept AB had not been developed at the time of the public meeting. Overall, each Build concept received more support than opposition. Concept C received the most support (80% in favor), especially for providing benefit for BOSK traffic with minimal impact to historic Glendale, farmlands, etc. Concept A received the least public support of the three Build concepts but was noted to provide more benefits for historic Glendale than Concept D.

Survey participants were asked to identify their preferences regarding Concept A, a Northeast Glendale Bypass. As shown in **Figure 31**, 57% of participants support advancing Concept A. Of those supporters, **Concept A.2 (Purple)** was favored over **Concept A.1 (Yellow)** nearly 3:1. The "other" category represents two votes for No-Build and four comments elaborating on why one of the two options was preferred. Open-ended comments supporting Concept A.2 noted that it provides a straighter connection, impacts fewer property owners, and is further from Glendale. Noise impacts—within Glendale and to adjacent neighborhoods—were mentioned as a concern with either bypass option.

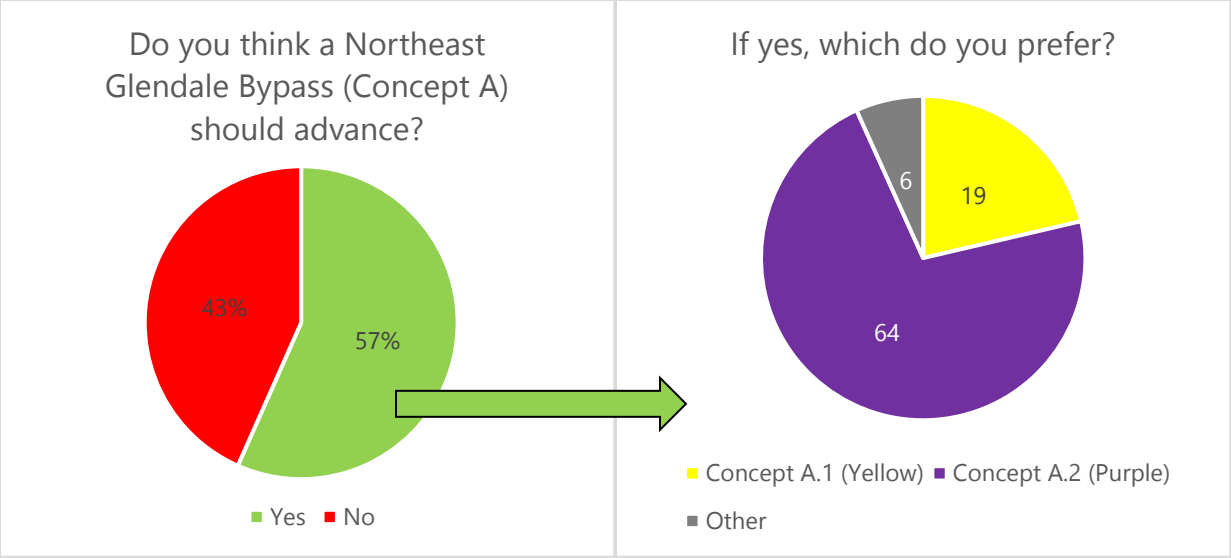


Figure 31: Survey Responses for Concept A Preferences

Survey participants were also asked to identify their preferences regarding Concept D, a new parkway interchange with improved east-west connectivity. As shown in **Figure 32**, 67% of participants support advancing Concept D. Of these supporters, **Concepts D.3 (Red)** and **D.1 (Dark Blue)** received the most support but have the fewest common elements to infer which underlying features stakeholders liked. **Concepts D.5 (Light Blue)** and **D.2 (Green)** were rated medium, and no one selected **D.4 (Orange)**. Disruptive impacts to homes, farmlands, and water resources were common concerns associated with each of the larger corridors.

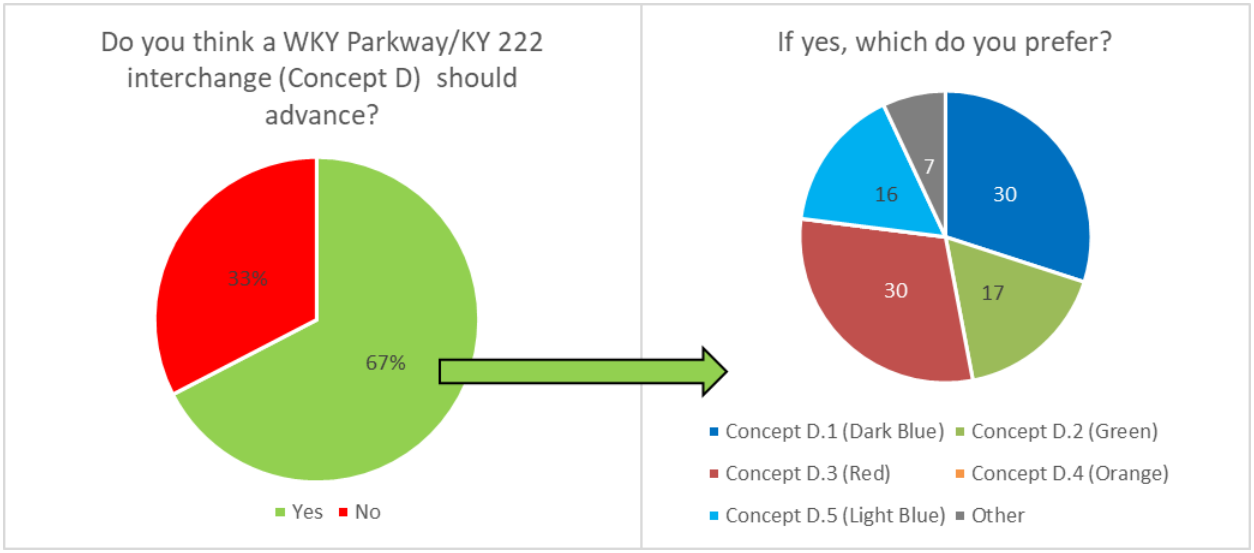


Figure 32: Survey Responses for Concept D Preferences

Recurring themes from open-ended comments included:

- The community predates BOSK; therefore, its needs should be prioritized, including a robust sentiment that Glendale's small-town character should not be changed.
- Without a northwest bypass, Concept A provides limited value.
- Other rural roadways in the vicinity should be improved: KY 1136, Farley Lane, and KY 224.
- With other ongoing transportation projects in the vicinity, are more connections needed?
- The timing of the study, following disruptions due to the pandemic and ongoing construction work associated with both utility and roadway projects, has been challenging for some residents and business owners. However, the opportunity to engage with KYTC and have a voice in the process was widely appreciated.

8.3 Project Team Meeting No. 3

The project team held a third coordination meeting January 5, 2023, to review the improvement concepts, discuss costs/impacts, and concur on priorities. Input from public surveys and both LO/S meetings were considered as well. With rapid development patterns impacting land use and traffic demands, specific priorities could shift based on changing conditions and implementation timelines. Current recommendations are presented in the next chapter.

8.4 Project Team Meeting No. 4

With the train derailment in March 2023 and "near miss" in July 2022, the project team decided to take a closer look at options to reduce conflict points with the railroad tracks. This effort included a more detailed assessment of the historic district boundary, documented in **Appendix D**, and development of Concept AB variations discussed in **Section 7.3**. The team met again on July 10, 2023, to discuss these investigations and build internal consensus prior to engaging with LO/S again.

8.5 Local Officials and Stakeholders Meeting No. 3

The project team presented updates on the study process—including Concept AB—to local officials and stakeholders and other interested parties on August 15, 2023. Concept AB was presented as an option to discourage high speed, cut-through trips in town and to provide an improved railroad crossing while preserving access for local businesses. Attendees expressed concern about potential residential impacts to the community. Opinions were divided whether safety benefits of a grade separated crossing outweigh the increased aesthetic and property impacts. Following the August 15 meeting, the project team updated the website, launched a second online survey, and held numerous one-on-one conversations with concerned property owners.

8.5.1 Second Public Survey

Over a three-week comment period in August and September 2023, 1,408 public surveys were submitted via the project website, focusing on the addition of Concept AB since the initial public outreach effort. Of the responses, 42% indicated they live and/or work within Glendale, plus 38% representing other Hardin County residents/employees, and the remainder representing a larger geographic spread.

Overall, 89% of responses preferred Concept A (Northeast Bypass) to Concept AB (Full North Bypass). Results were similar considering responses from only Glendale residents/employees, with 86% preferring Concept A.

Opinions were divided whether an at-grade or grade separated railroad crossing was preferred. At-grade was preferred by 25% while grade separated was preferred by 10%; the majority of participants were undecided or skipped the question.

Most participants preferred the existing KY 222 at-grade crossing downtown remain open to vehicular traffic, even if Concept AB were constructed. Maintaining this vehicular link was preferred by 45% of all survey participants, or 59% of survey participants who live/work in Glendale.

The survey also asked individuals to rank the studied concepts from most to least important. Summarized in **Figure 33**, darker colors represent a higher priority with lighter colors for lower priorities. Entries rated a lower priority than No-Build were omitted. As shown, No-Build was preferred by the majority of individuals—69% ranked No-Build as one of their top two priorities. Concept C (KY 1136 Interchange) followed with the second-most top priority rankings at 15%. Trends considering the subset of survey participants who live/work in Glendale were similar. It should be noted that several comments indicated confusion with the survey: "No-Build" in this instance may have been interpreted as "do not build Concept AB" or a more general "no transportation improvements at all."

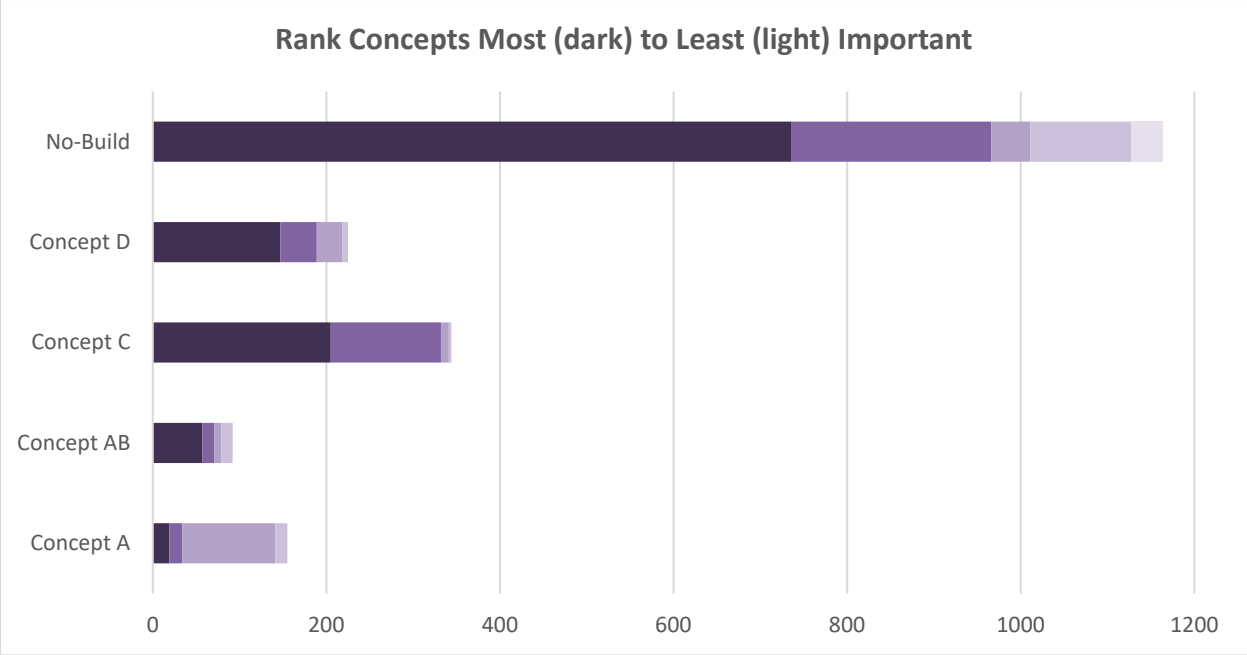


Figure 33: Second Survey Concept Ranking

An open-ended comment box also provided interested parties an opportunity to submit further comments or questions to the project team. Responses were received from 564 individuals, summarized by topic below. A transcript of submitted comments is included as **Appendix H**.

- 84% of comments included a preservation theme: saving Glendale, reducing property impacts, avoiding residential displacements, etc.
- Concepts C and D received more support than Concepts A or AB, primarily as they are farther from Glendale and were perceived to reduce impacts.
- Numerous individuals noted that they found Concept AB and/or the 2023 survey to be confusing.

- A few comments identified improvements along other routes: US 31W, US 62, or the KY 1136 railroad crossing.
- Additional signage to route trucks to a preferred access route was suggested.

9.0 RECOMMENDATIONS

Alongside traffic operations and community input, costs and impacts are also important considerations in the decision-making process.

9.1 Cost Estimates

Planning-level design concepts were used to estimate preliminary quantities of high-cost construction items including earthwork, pavement, and structures. Construction costs were tabulated using the KYTC District 4 average unit bid prices. KYTC District 4 provided right-of-way and utility cost estimates based on conceptual model disturb limits, aerial imagery, utility records, and approximate locations of existing right-of-way and property lines generated from property valuation administrator (PVA) data, and utility records. Planning-level cost estimates by phase are presented in **Table 8** with costs shown in 2023 dollars. Each construction phase estimate includes an additional 30% for contingencies.

Table 8: Planning-Level Cost Estimates by Phase

Concept	Design	Right-of-Way	Utility	Construction	Total
Concept A Northeast Bypass	$500,000	$1.5M	$300,000 - $1.0M	$4.8M - $5.6M	**$7.6M - $7.9M**
Concept B Northwest Bypass	$700,000 - $1.9M	$2.7M - $3.9M	$1.6M - $2.3M	$5.6M - $17.9M	**$10.8M - $26.0M**
Concept C KY 1136 Interchange	$1.5M	$6.5M	$1M	$18M	**$27M**
Concept D WKY Parkway Interchange	$2.6M - $3.9M	$8.9M - $13.3M	$1.6M-$3.0M	$31.4M - $45.8M	**$45.5M - $66.0M**

9.2 Environmental Impacts

Alongside costs, impacts to the human and natural environment are another consideration when evaluating between Build concepts. **Table 9** compares key impacts for the new alignment options

considered. Design options and potential impacts for a Concept C interchange will require future study if this concept advances.

Table 9: Environmental Impacts, Bypass Options

Feature	Concept A	Concept B	Concept D
Disturbed Footprint	11-12 ac	7-11 ac	56-95 ac
Stream Impacts	3 crossings; 344-1,022 ft	-	0-457 ft
Wetland Impacts	-	-	0.3-0.8 ac
Water wells	-	-	0-1
Forested Bat Habitat	<1 ac	-	2-7 ac
Prime Farmland Soils	10-12 ac	5-10 ac	32-88 ac
Statewide Important Soils	0-1 ac	1-2 ac	5-15 ac
Potential Relocations	0-1	0-10	1-6

While none of the Build concepts directly impact NRHP-listed or -eligible resources, Concepts A.1, B, D.1, and D.4 are located closest to the historic Glendale community. Concepts D.3 and D.5 near HD-1082 are located relatively near historic farmsteads with to-be-determined boundaries (**Figure 34**). A more robust analysis of potential effects will be required should any Build concept advance.

Figure 34: Build Concepts near HD-1082

Any Concept D corridor would impact the certified agricultural district; Concepts D.1 and D.4 follow existing KY 222 in the vicinity to minimize impacts. Some variations of Concept B impact the PACE easement, requiring around five acres of right-of-way within the property.

9.3 Recommendations and Project Sheets

Overall, Concept A (Northeast Bypass) is the highest priority. Both variations should be considered during preliminary engineering efforts, especially if much time elapses between the conclusion of this planning effort and obligation of design funds, as the area is rapidly changing. Concept A satisfies the four study goals (i.e., safe and efficient movements to BOSK, reduce traffic downtown,

minimize human and natural impacts, and safety/mobility of all users), is consistent with recommendations from previous studies, and received stakeholder support.

Concept C (KY 1136 Interchange) is also recommended for preliminary engineering and environmental activities. The currently proposed transportation network—with a reconstructed KY 222 interchange (constructed by 2024) and improved KY 1136 (Gilead Church Road) in 2025—is sufficient to handle the increased traffic to the BOSK site based on current employment and shift assumptions. However, there are approximately 600 acres of undeveloped land remaining on the BOSK site and the Hardin County Planning and Development Commission has identified much of the surrounding land as future industrial or interstate commercial land use. As seen with the BOSK manufacturing facility, private developments can arise more quickly than public roadway projects and generate high volumes of traffic. Beginning preliminary engineering and environmental studies on Concept C can save 18-24 months in project development should this occur, but construction is not recommended at this time.

Finally, Concepts B (Northwest Bypass) and D (WKY Parkway/East-West Connection) are not recommended at this time but may warrant reevaluation as future development continues.

- Concept B faced substantial public opposition, largely related to the potential for residential relocations and impacts to the community. Therefore, any future build concepts considered should seek to minimize residential impacts.
- Concept D has the least benefit for traffic, highest costs, and greatest environmental impacts. While any future project development efforts should consider a range of alignments, connections to KY 1136 (Gilead Church Road) are preferred over connections to KY 222. The northern options (**Concepts D.1** and **D.4**) lead to greater potential impacts on the downtown Glendale community (i.e., property impacts and increased noise), preclude future use of the former middle school, and result in higher costs than the more southern connections.

Individual information sheets for improvement concepts are presented on the following pages.

Concept A.1 (Yellow)

High Priority	New Route: From KY 1136 MP 4.4 to KY 222 MP 5.4

IMPROVEMENT DESCRIPTION:

- Northeast Glendale Bypass: two-lane connection (12-foot-wide lanes with 8-foot-wide paved shoulders) between KY 222 and KY 1136 to provide alternate route for thru traffic outside historic Glendale

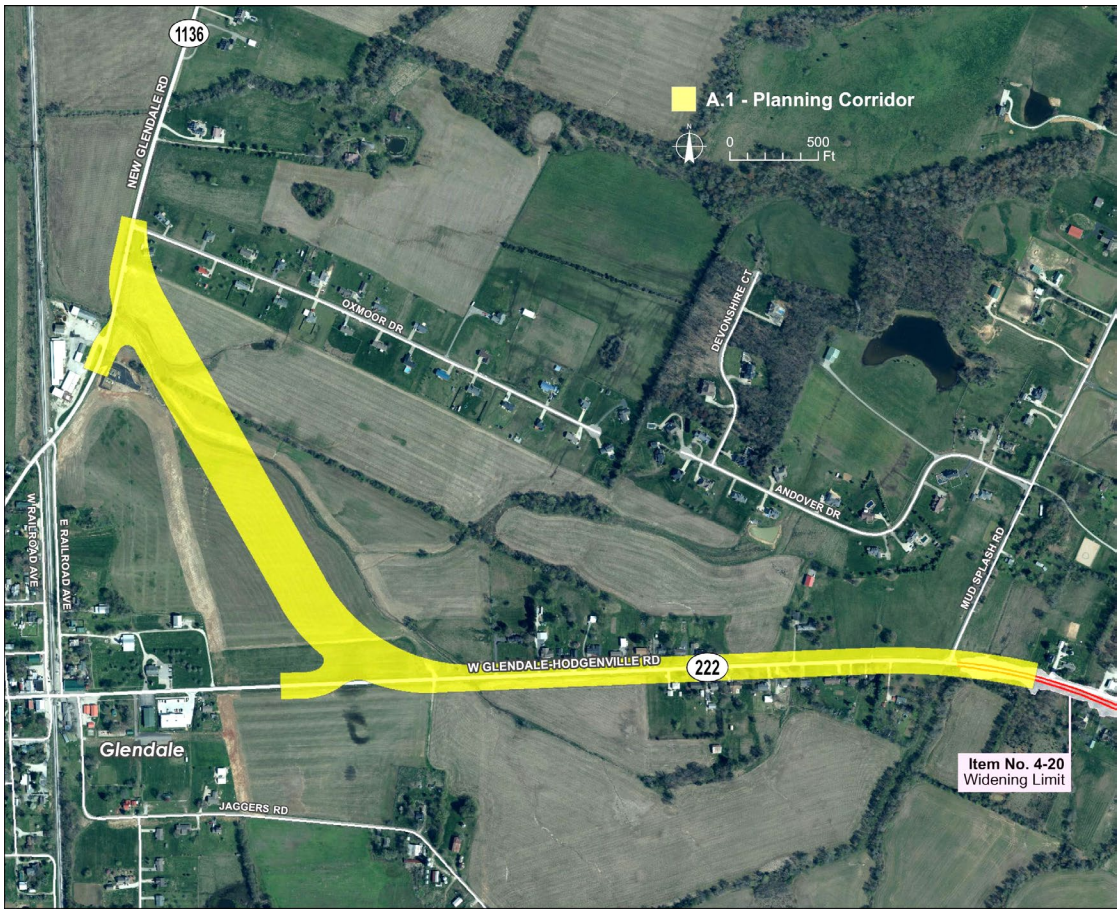
Phase Estimate	(2022 dollars)
Design:	$0.4 M
Right-of-Way:	$1.4 M
Utilities:	$1.0 M
Construction:	$4.8 M
Total Cost:	**$ 7.6 M**

IDENTIFIED NEEDS:

2022 Traffic:	KY 222: 2,100 vpd with 6% trucks | KY 1136: 2,000 vpd with 5% trucks
2045 Traffic:	No-Build: 4,200-4,800 vpd | Build: 2,500 vpd shifts to new bypass
Crashes:	14 crashes (2 injuries) on KY 222 between KY 1136 and Mud Splash Road
Geometry:	KY 222: 10 ft lanes with 0-1 ft shoulders | KY 1136: 9 ft lanes with 0-1 ft shoulders
Other:	Bypass traffic avoids two at-grade rail crossings

POTENTIAL ENVIRONMENTAL RED FLAGS: Streams, nearby residences, bat habitat

PROJECT LOCATION:



Concept A.2 (Purple)

High Priority | New Route: From KY 1136 MP 4.4 to KY 222 MP 5.4

IMPROVEMENT DESCRIPTION:

- Northeast Glendale Bypass: two-lane connection (12-foot-wide lanes with 8-foot-wide paved shoulders) between KY 222 and KY 1136 to provide alternate route for thru traffic outside historic Glendale

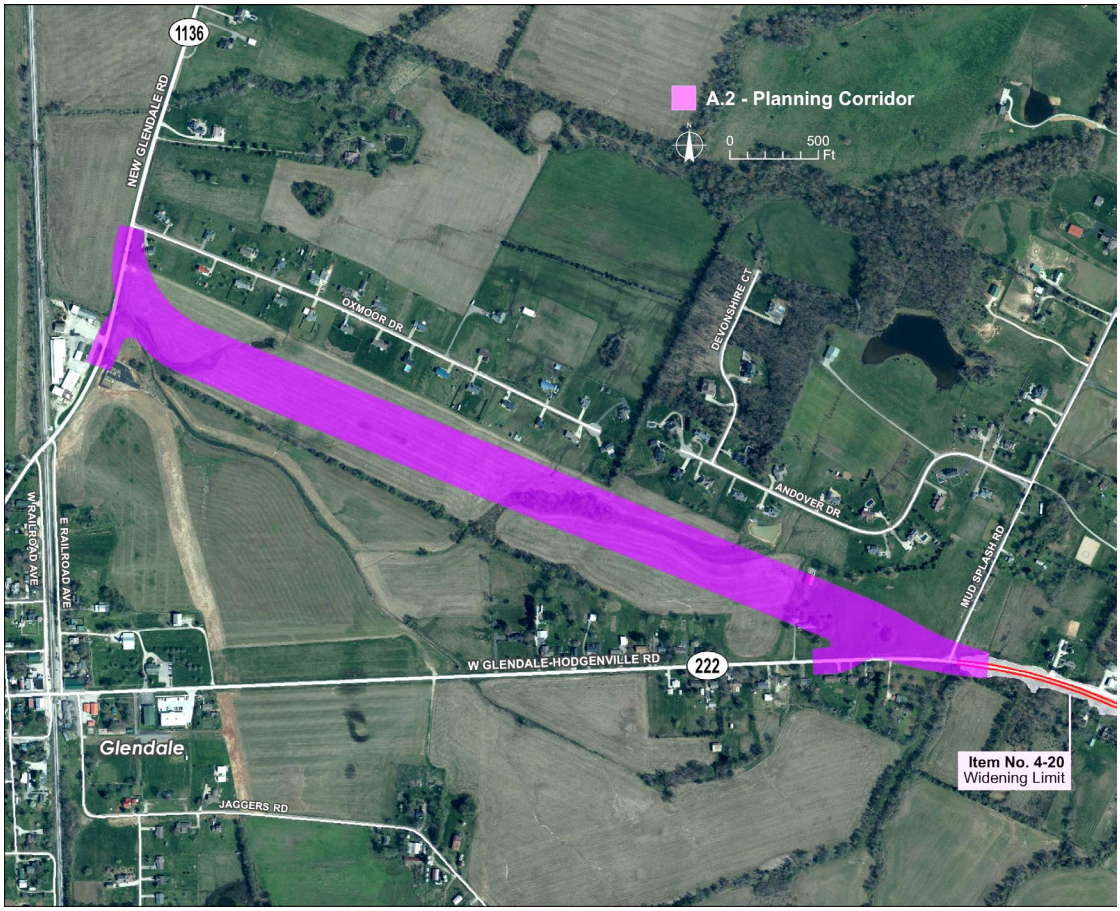
Phase Estimate	(2022 dollars)
Design:	$0.5 M
Right-of-Way:	$1.5 M
Utilities:	$0.3 M
Construction:	$5.6 M
Total Cost:	**$7.9 M**

IDENTIFIED NEEDS:

2022 Traffic:	KY 222: 2,100 vpd with 6% trucks | KY 1136: 2,000 vpd with 5% trucks
2045 Traffic:	No-Build: 4,200-4,800 vpd | Build: 2,500 vpd shifts to new bypass
Crashes:	14 crashes (2 injuries) on KY 222 between KY 1136 and Mud Splash Road
Geometry:	KY 222: 10 ft lanes with 0-1 ft shoulders | KY 1136: 9 ft lanes with 0-1 ft shoulders
Other:	Bypass traffic avoids two at-grade rail crossings

POTENTIAL ENVIRONMENTAL RED FLAGS: Streams, nearby residences, bat habitat

PROJECT LOCATION:



Concept B	
Long-Term	New Route: From KY 222 MP 3.7 to KY 1136 MP 4.4

IMPROVEMENT DESCRIPTION:

- Northwest Glendale Bypass: two-lane connection (12-foot-wide lanes with 8-foot-wide paved shoulders) around town to provide alternate route for thru traffic outside historic Glendale

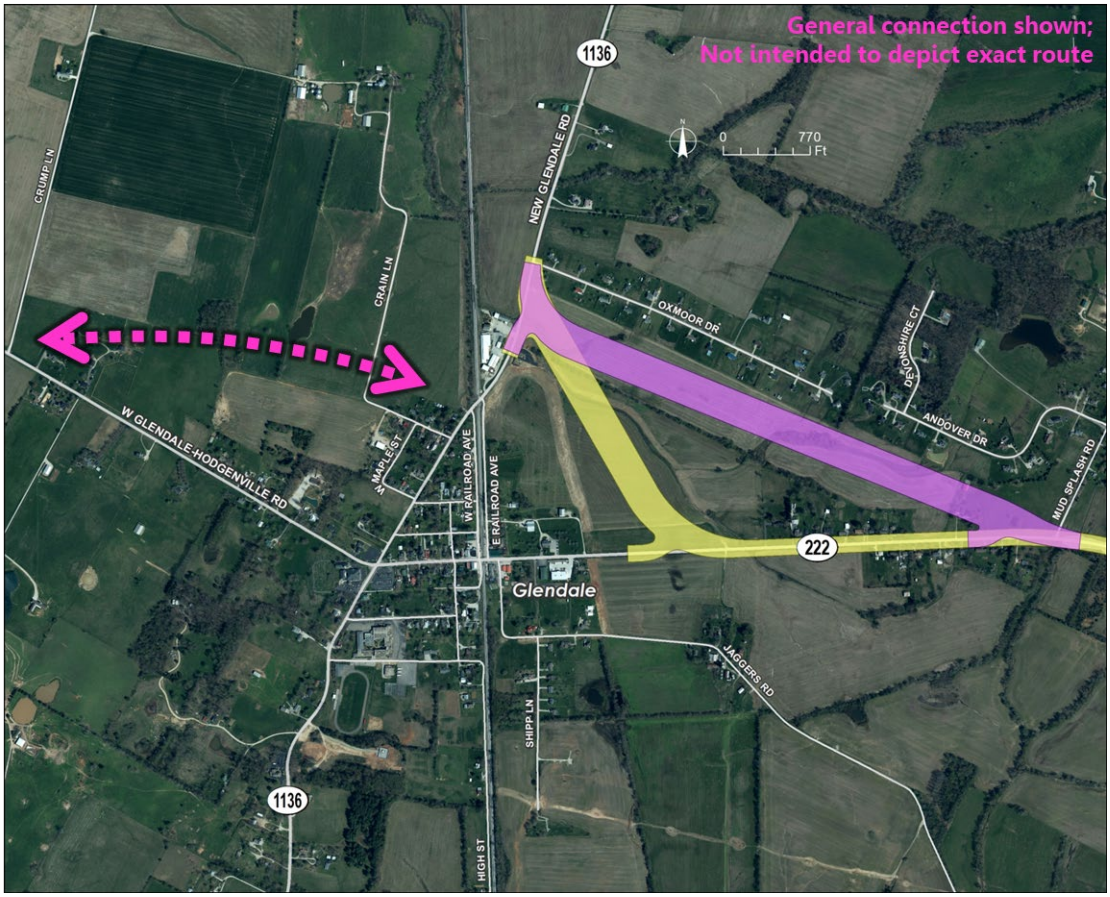
Phase Estimate	(2023 dollars)
Design:	$0.7-1.9 M
Right-of-Way:	$2.7-3.9 M
Utilities:	$1.6-2.3 M
Construction:	$5.6-17.9 M
Total Cost:	**$10.8-26.0 M**

IDENTIFIED NEEDS:

2022 Traffic:	KY 222: 2,100 vpd with 6% trucks
2045 Traffic:	No-Build: 2,200-4,200 vpd | Build: 1,800 vpd shifts to new bypass
Crashes:	5 crashes (0 injuries) on KY 222 between MP 3.7-4.243
Geometry:	KY 222: 10 ft lanes with 0-1 ft shoulders
Other:	

POTENTIAL ENVIRONMENTAL RED FLAGS: Streams, nearby residences, bat habitat

PROJECT LOCATION:



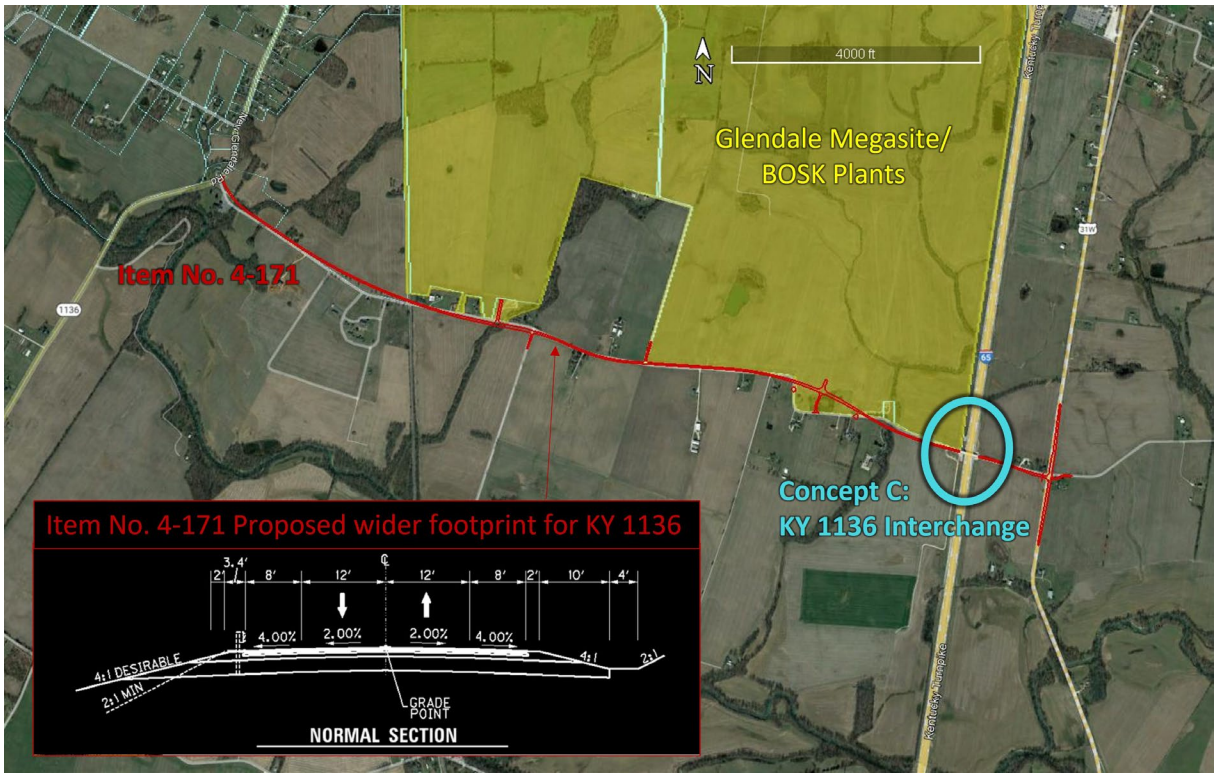
Concept C			
As Needed	New I-65 Interchange near MP 84.1		
IMPROVEMENT DESCRIPTION: • New I-65 interchange at/near KY 1136 overpass		Phase Estimate	(2022 dollars)
		Design:	$0.5 M
		Right-of-Way:	$1.5 M
		Utilities:	$1 M
		Construction:	$18 M
		Total Cost:	**$27 M**

IDENTIFIED NEEDS:

2022 Traffic:	125 vpd
2045 Traffic:	No-Build: 2,500 vpd | Build: 4,100 vpd on KY 1136 and 5,200 vpd total ramp traffic
Crashes:	N/A
Geometry:	KY 1136: 9 ft lanes with 1 ft shoulders
Other:	Item 4-171 in design process to widen to two 12 ft lanes with 8 ft shoulders

POTENTIAL ENVIRONMENTAL RED FLAGS: TBD

PROJECT LOCATION:



Concept D	
Long-Term	New Route: From US 62 MP 10.3 to KY 1136 MP 2.75

IMPROVEMENT DESCRIPTION:

- New Western KY Parkway interchange at/near existing KY 222 overpass (Approx. MP 129)
- Improved two-lane connection (12-foot-wide lanes with 8-foot-wide paved shoulders) between US 62 and KY 1136 (Gilead Church Road) south of Glendale

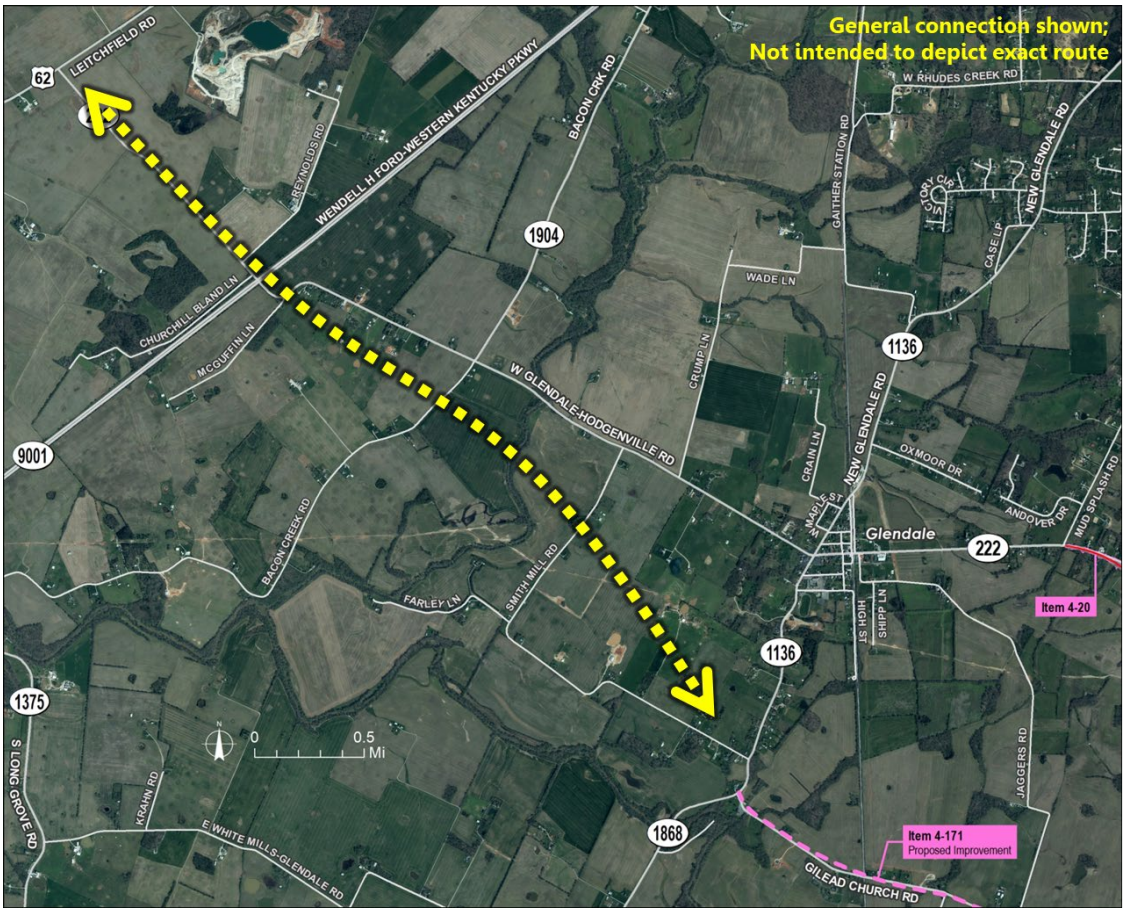
Phase Estimate	(2022 dollars)
Design:	$2.6-3.9 M
Right-of-Way:	$8.9-13.3 M
Utilities:	$1.6-3.0 M
Construction:	$31.4-45.8 M
Total Cost:	**$45.5-66.0 M**

IDENTIFIED NEEDS:

2022 Traffic:	KY 222: 760-2,100 vpd with 6% trucks
2045 Traffic:	No-Build: 1,500-4,800 vpd | Build: 2,000 vpd shifts to new alignment
Crashes:	24 crashes (1 fatal + 3 injuries) on KY 222 between US 62 and Mud Splash Road
Geometry:	KY 222: 10 ft lanes with 0-1 ft shoulders
Other:	Class D-E curves east of WKP overpass; Class E-F grades west of Glendale

POTENTIAL ENVIRONMENTAL RED FLAGS: Streams, farmlands, ag. district, potential historic, bat habitat, wetlands, karst/groundwater

PROJECT LOCATION:



10.0 NEXT STEPS

Further funding will be necessary to advance any improvement concept to the design phase; additional funding should be pursued immediately for Concept A.

Once funding is identified, the next phase in the project development process is Phase I Design (Preliminary Engineering), including environmental analyses to be eligible for federal funding. Concept C, requiring an access modification for the interstate system, will have a federal component including an *Interchange Justification Study* to assess traffic and safety impacts once specific designs are available.

Once funding is identified, KYTC's Statewide TIP should be amended to reflect any future project development phases.

11.0 ADDITIONAL INFORMATION

Written requests for additional information should be sent to:

KYTC Division of Planning
ATTN: Director
200 Mero Street, 4th Floor West
Frankfort, KY 40622
Phone: 502.564.7183