FINAL REPORT

Western Bardstown
Connectivity
Study

WESTERN BARDSTOWN
CONNECTIVITY STUDY

NELSON COUNTY

ITEM NO. 4-8809.00

KENTUCKY
TRANSPORTATION
CABINET

IN PARTNERSHIP WITH

Kimley»Horn

cdp

APRIL 2019

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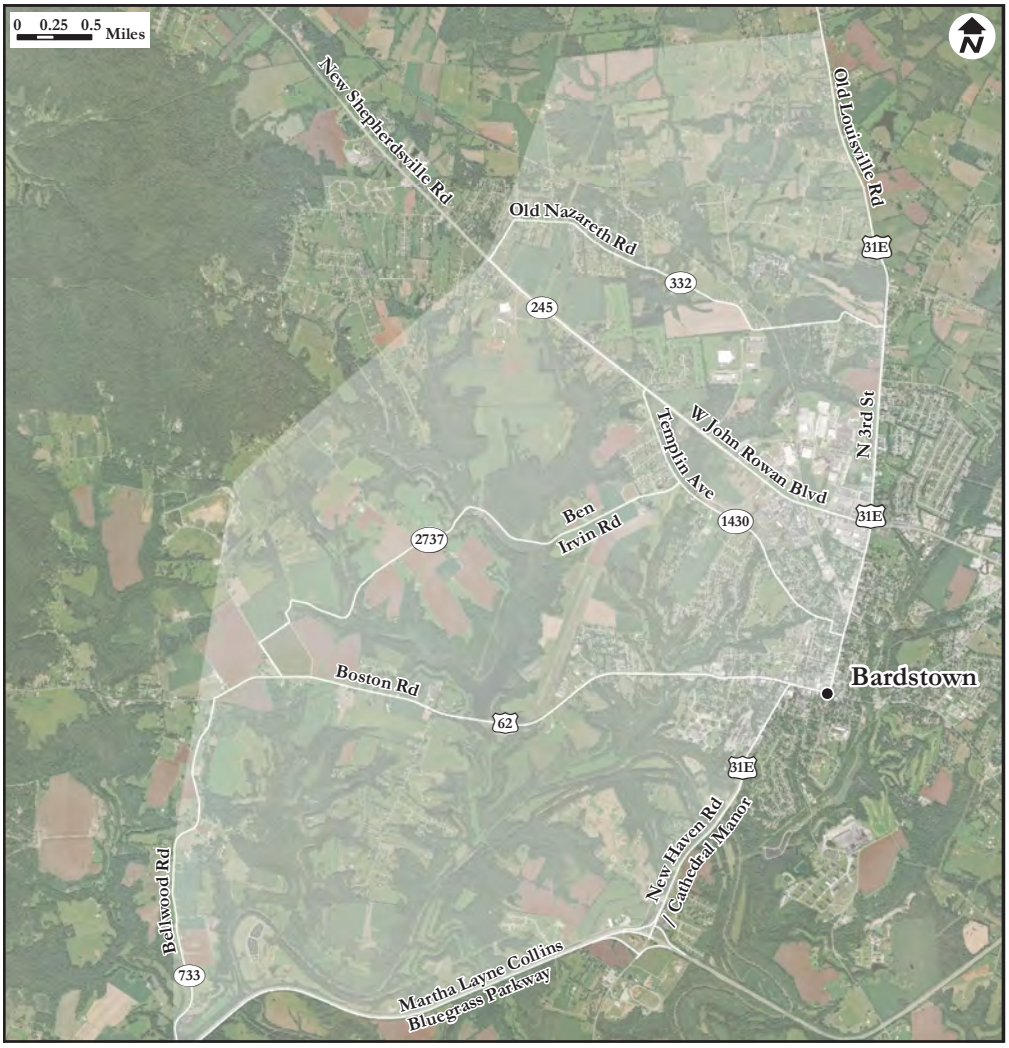
EXECUTIVE SUMMARY

Project Introduction

The *Western Bardstown Connectivity Study* was initiated by the Kentucky Transportation Cabinet (KYTC) to examine needs and identify potential alternatives that will improve connectivity and accessibility on the west side of Bardstown. Currently the east side of Bardstown is well developed with little room for expansion. The west side, however, has available land zoned for future development and lacks north-south connectivity.

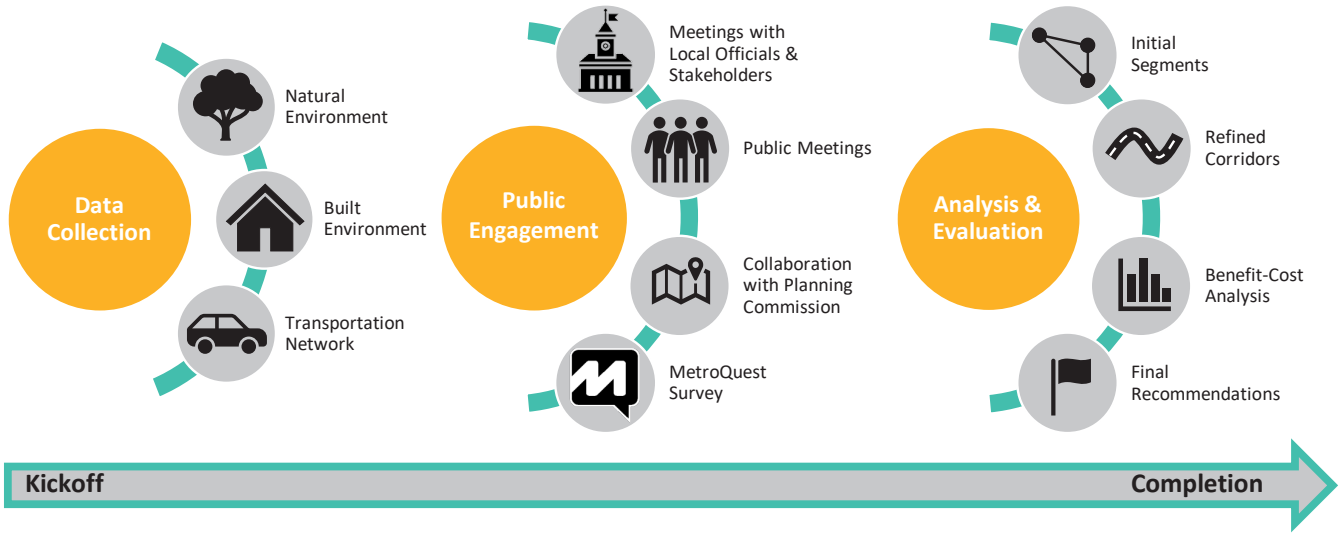
The study area is located in Nelson County, Kentucky, with a focus on the western portion of Bardstown. The boundaries are US 31E to the east and Martha Layne Collins Bluegrass Parkway (unsigned as BG 9002) to the south, and include the following state-maintained routes: US 62, KY 245, KY 332, KY 733, KY 1430, and KY 2737. The shading in the figure identifies the boundary and the major routes are highlighted within this area.

Study Area Map



Planning Process

The purpose of the *Western Bardstown Connectivity Study* is to determine transportation needs of today and establish a vision of transportation needs in western Bardstown for the future. The planning process embraced a grassroots approach that allowed the community's vision to be heard alongside support from data-driven procedures. Beginning with an assessment of existing conditions that involved an in-depth compilation of data for the study area, the study process weaved in key public engagement opportunities that fed into the analysis and evaluation of alternatives. The Draft Purpose and Need of the Project was identified through the process and provided the framework for the eventual selection of project recommendations.



Draft Purpose and Need

According to the Federal Highway Administration (FHWA), the purpose and need of a project is essential in establishing a basis for the development of the range of reasonable alternatives and assist with the identification and eventual selection of a preferred alternative. This important step helps ensure that potential alternatives are focused, efficient, practical, and best serve the transportation needs of the study area. The purpose and need of this project were molded over the course of the study to reflect changing needs as discovered through technical evaluation and public engagement. Drafts of the purpose and need were presented to the project team and the public throughout the study with the refined version presented in this report.

PURPOSE

To improve transportation network connectivity to the west of Bardstown and reduce congestion as well as improve safety by reducing crash rates in the downtown area.

NEED

The City of Bardstown has experienced growth in vehicular traffic and local truck traffic that affects safety and mobility within the study area. The project need is revealed in the areas of system linkage, capacity, and safety.

System Linkage: There are few north-to-south routes in western Bardstown that provide an alternative to traveling through downtown for passenger car and local freight traffic. The existing route (KY 2737) exhibits poor horizontal and vertical geometry. An analysis of future land use by the Joint City-County Planning Commission of Nelson County (JCCPC) determined that at least 800 acres of industrial land will be required to provide employment for the population over the next 50 years. Existing locations along US 62 and KY 245 do not currently have access to transportation infrastructure capable of supporting this growth.

Capacity: Congestion is already prevalent in the study area, and traffic forecasts suggest that volumes will continue to increase in downtown Bardstown. Additionally, local and regional truck traffic will shift due to the relocation of a nearby quarry, asphalt plant, and concrete plant and may increase if the industrial growth cited in the Nelson County Land Use Plan is realized.

Specific areas of concern include:

- US 31E (North Third Street) between KY 1430 (Templin Avenue) and KY 245 (John Rowan Boulevard) operates at Level of Service (LOS) E in the current year (2017).
- US 62 (Stephen Foster Avenue) between Elm Grove Street and US 31E (Cathedral Road) operates at LOS E in the current year (2017).
- The initial traffic forecast completed in July 2017 shows No-Build ADT on KY 245 (John Rowan Boulevard) between US 62 (Bloomfield Road) and US 31E (North Third Street) increasing from 29,900 vehicles per day to 37,600 vehicles per day in 2040. Under the build scenario, volumes increase to 42,000 vehicles per day in 2040. As such, this forecast suggests that congestion at the intersection of KY 245 (John Rowan Boulevard) and US 31E (North Third Street) will continue to increase.

Safety: Multiple high crash locations have been identified in the study area through safety analysis, including:

- East Beall Street at US 31E (North Third Street)
- KY 245 (John Rowan Boulevard) at US 31E (North Third Street)
- US 31E (North Third Street) at US 62 (Stephen Foster Avenue)
- The segment of US 31E from US 62 (Stephen Foster Avenue) to KY 245 (John Rowan Boulevard)

GOALS AND OBJECTIVES

To support the purpose and need of this project, a chief goal and objective was identified:

PROVIDE IMPROVEMENT ALTERNATIVES THAT MINIMIZE IMPACTS TO THE NATURAL AND BUILT ENVIRONMENT.

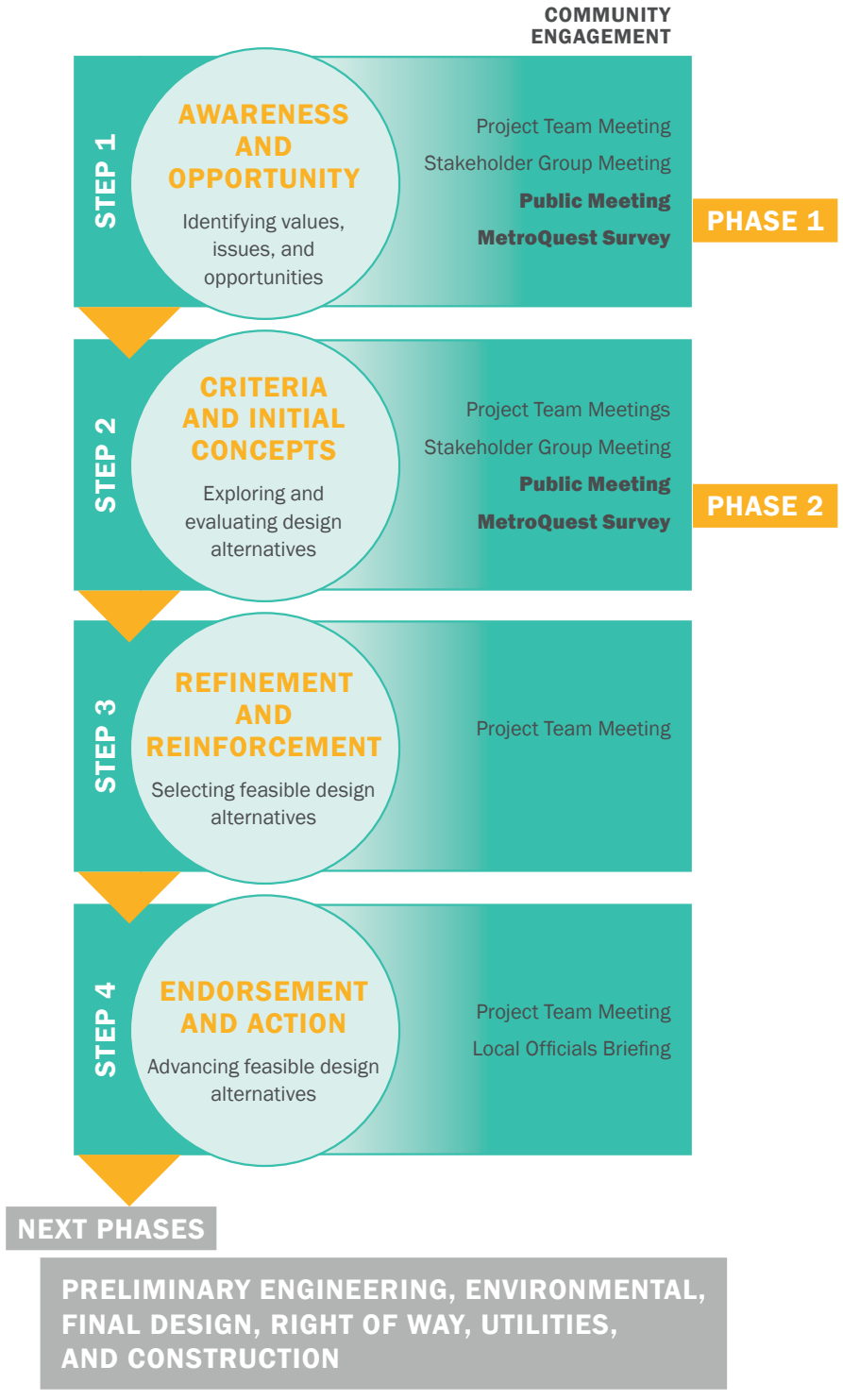
Public Engagement

The Public Engagement Plan developed specifically for this study identifies key activities, objectives, and a schedule for critical path milestones. Emphasis was placed on striking a balance between communicating project information and gathering community input for consideration as incremental decisions are made.

A heightened level of coordination ensued between the public, the JCCPC, KYTC, the Lincoln Trail Area Development District (LTADD), and the consultant team. Communication with the public occurred through the following channels:

Social Media – Promotion of study activities through KYTC Facebook and Twitter accounts.

Public Meetings – Two meetings were held during the study phase; one after completion of the existing conditions review and the second to present refined corridors and associated impacts and analysis of each. More than 200 people attended each meeting.



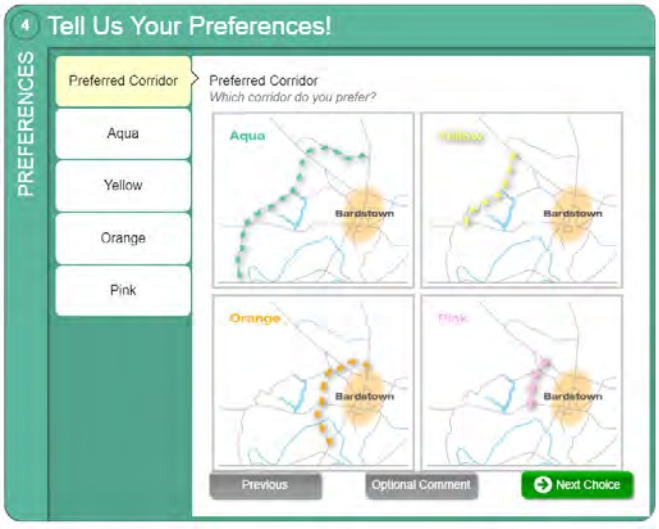
Online Engagement – Highly interactive survey formats were employed with screens designed to mirror information collected at the first and second public meetings. The first survey had 357 participants during a two-week window. The second survey achieved 426 participants during a four-week window.

Local Officials/Stakeholder Meetings – Meetings were conducted with representatives from various agencies in the study area to solicit more targeted feedback and project information.

Through these activities, the public's top-rated priority was safety, followed by connectivity, minimizing disruptions, and travel time.

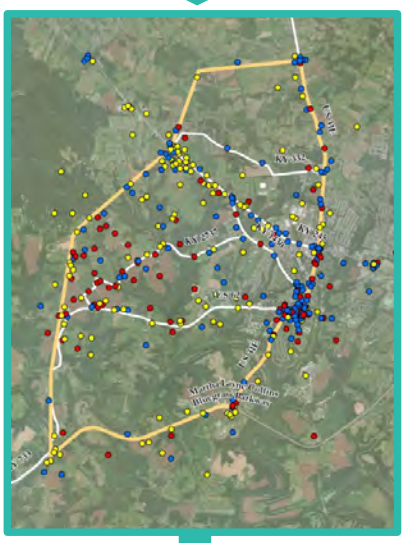
Alternatives Development and Evaluation

A process was initially used that connected individual places based on travel desires identified from the existing conditions analysis, identified issues, and input from the public and local officials/stakeholders. These connections were linked to form new roadway segments, and the segments were consolidated to form corridors. The graphics on the following page illustrate the process. To be as comparative as possible, a ranking system was applied to the segments based on rankings of the Natural Environment Impact, Built Environment Impact, and Community and Traffic Benefits.



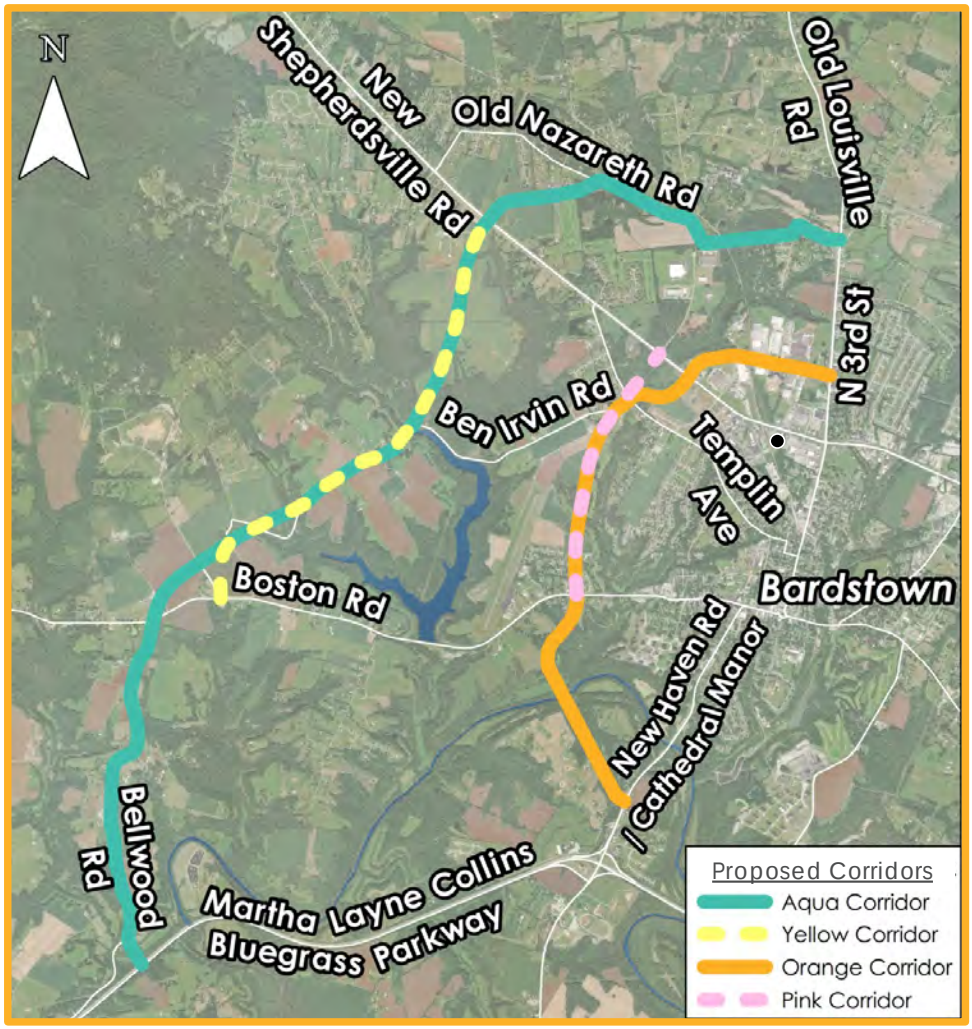
From this development process, four corridors emerged as potential options to meet the study purpose and identified needs. The Aqua Corridor represents a regional connection in the outer portion of western Bardstown. The Yellow Corridor represents a local connection between US 62 and KY 245. It aligns with the Aqua Corridor from US 62 to KY 245. The Orange Corridor represents a regional connection in western Bardstown closer to the city center, connecting to US 31E both north and south of Bardstown. The Pink Corridor represents a local connection between US 62 and KY 245 that aligns for the most part with the inner segment of the Orange Corridor.

Analyzed Public Input



Developed Segments

Evaluated Segments and Developed Corridors



Initial cost estimates were prepared prior to the second public meeting and refined following additional corridor evaluation. Based on projected 2040 traffic volumes, estimates for all corridors are based on a two-lane typical section. Orange and Pink are assumed to be urban (curb and gutter) with Aqua an Yellow rural (shoulder). The typical sections will be further refined in the next phase of design. Average KYTC unit cost information, property information from the Nelson County Property Valuation Administrator (PVA), and an analysis of utility impacts were used to determine potential costs.

Final Planning-Level Cost Estimates

Phase	Alternative			
	Aqua	Yellow	Orange	Pink
Design	$4,500,000	$1,600,000	$2,400,000	$600,000
Right-of-Way	$4,600,000	$1,910,000	$4,830,000	$1,100,000
Utilities	$5,300,000	$900,000	$4,100,000	$400,000
Construction	$45,100,000	$16,100,000	$24,300,000	$5,200,000
Total	$59,500,000	$20,510,000	$35,630,000	$7,300,000

Benefit-Cost Analysis

To assist with the decision-making process, a benefit-cost (B/C) analysis was conducted for each of the four corridors. Benefits included an assessment of travel time savings and vehicle operating costs as well as safety benefits that were determined through application of Highway Safety Manual (HSM) procedures. Costs included design, right-of-way, utilities, and construction estimates for each corridor. The results are shown in the following table:

Benefit-Cost Ratio Summary

	Aqua	Yellow	Orange	Pink
Estimated Cost (Total)	$59,500,000	$20,510,000	$35,630,000	$7,300,000
20 Year Travel Time Savings (VHT)	$0	$0	$16,778,112	$12,672,608
B/C Ratio	N/A	N/A	0.5	1.7
20 Year Cost Savings Associated with Crash Reduction	$45,253,992	$28,145,375	$56,575,618	$26,765,588
B/C Ratio	0.8	1.4	1.6	3.7
Combined Benefit	$45,253,992	$28,145,375	$73,353,730	$39,438,196
Combined B/C Ratio	0.8	1.4	2.1	5.4

Note: No travel time savings were calculated for the Aqua and Yellow corridors as the Hardin-Meade County MPO Travel Demand Model did not show appreciable differences in travel time between the No-Build and these Build corridors.

Summary of Corridor Evaluation Information

Information compiled that compares and contrasts the four corridors that were carried through to the final evaluation stage is summarized in the following table:

Corridor	Environmental Rankings		2040 Projected Traffic Volumes			# Reduction in Crashes Per Year (Compared to No-Build)	Meet Purpose and Need	Public Input (Ranked 1st)	Cost Estimate	B/C Ratio
	Natural Env.	Built Env.	Auto ADT	Truck ADT	% Reduction of Downtown ADT					
Aqua	2	3	4,200	500	20%	-24	Yes	152	$59,500,000	0.8
Yellow	1	1	3,200	400	20%	-15	Yes	57	$20,510,000	1.4
Orange	2	3	7,500	1,100	23%	-30	Yes	90	$35,630,000	2.1
Pink	1	2	5,100	650	22%	-14	Yes	70	$7,300,000	5.4

Note: Environmental Rankings are shown for the entire corridor by a ranking of 1-4; a lower number = less impacts

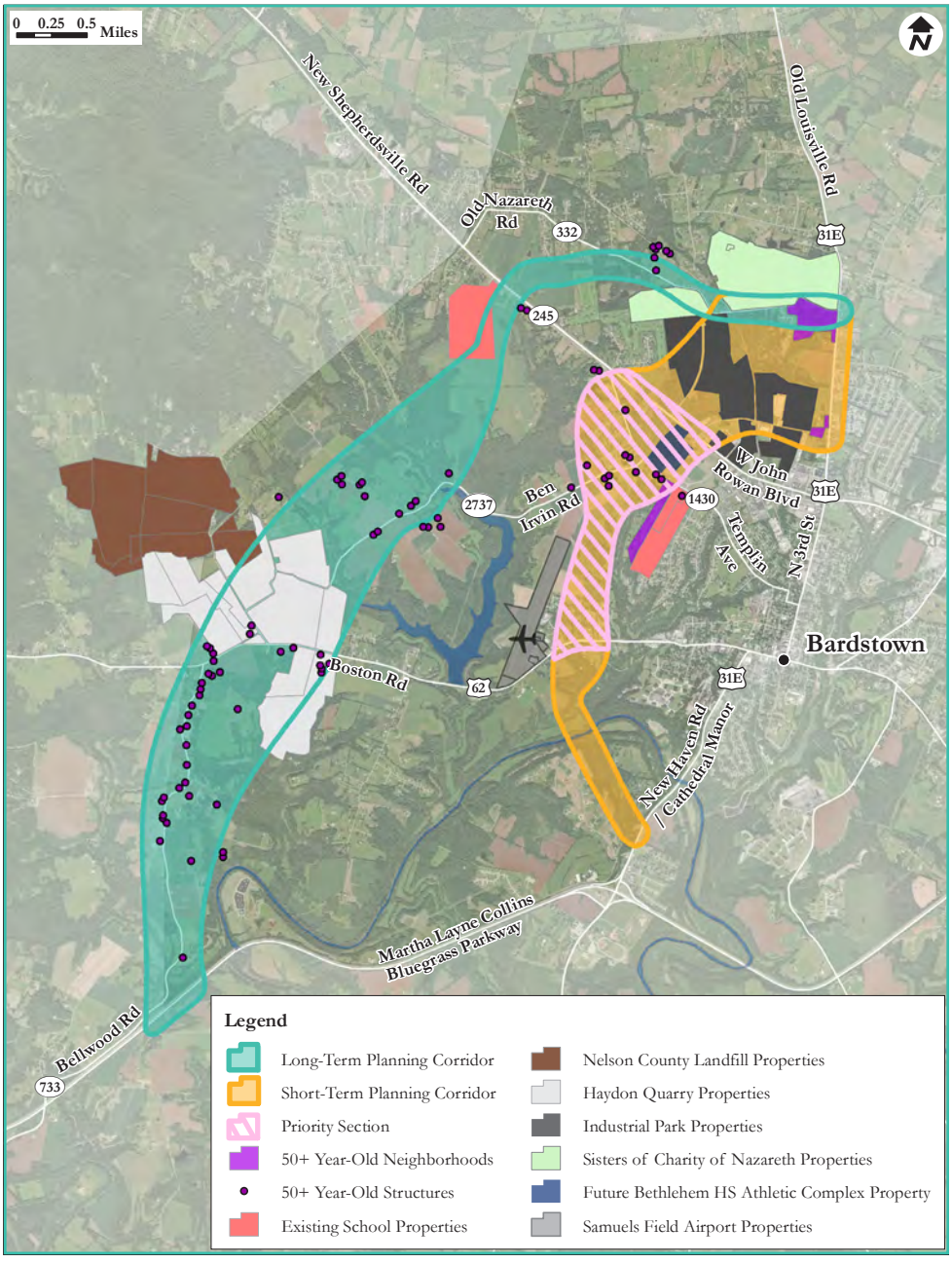
All corridors meet the purpose and need of the project to varying degrees as all improve network connectivity, reduce congestion, and have identified the potential for safety improvements in the downtown area of Bardstown. All public information meetings were well attended (200+ attendees) which helps provide an indication of the community interest in the project. The final component of this study focused on using available tools to provide a comparative look at quantifiable benefits relative to overall cost. The results of this analysis show the greatest benefit for the cost is the Pink Corridor.

Based on this information, the following are recommendations from this study:

SHORT-TERM CORRIDOR: ORANGE CORRIDOR WITH A PHASED APPROACH FOCUSING ON THE PINK CORRIDOR AS A SUBSET OF THE OVERALL CONNECTIVITY PLAN

LONG-TERM CORRIDOR: AQUA CORRIDOR

In the context of this study, the nomenclature of short-term indicates a more immediate need with long-term referring to future need in a larger-scale regional perspective. The map below displays these recommendations in context with community features/resources. For flexibility in transitioning to the next phase of project development, the corridor bands have been widened. The larger areas will allow for future design decisions to be made for known areas identified as part of the additional corridor information and allow flexibility for design decisions to be made that are the most beneficial with least impact.



SHORT-TERM

The Orange Corridor provides a full connection from US 31E south of Bardstown to north of Bardstown on the west side. Within this corridor, the Pink Corridor is identified as the highest priority. This section connects US 62 and KY 245. The estimated planning-level cost estimates for both the Orange and Pink Corridor subset are given in the table below.

Short-Term Planning Corridor Cost Estimates

Phase	Alternative	
	Orange	Pink
Design	$2,400,000	$600,000
Right-of-Way	$4,830,000	$1,100,000
Utilities	$4,100,000	$400,000
Construction	$24,300,000	$5,200,000
Total	$35,630,000	$7,300,000

Additional considerations for future development of this recommendation include:

- Development of Phase I design plans related to initial termini at US 62 and KY 245 that enable the continuation of the corridor to the north and south.
- Evaluation of the connection/initial termini at US 62 as it relates to minimizing impacts to the identified Environmental Justice Area.
- Evaluation of the connection/initial termini at KY 245 as it relates to the identified Bethlehem High School Athletic Complex.
- Evaluation of potential adjustment of the northern Orange segment between KY 245 and US 31E using Wilson Parkway to Old Nazareth Road through further review of the Bardstown Industrial Development Corporation Trust.

LONG-TERM

The Aqua Corridor provides a far western connection from Martha Layne Collins Bluegrass Parkway to US 31E to the north. The estimated planning-level cost estimate for the Aqua Corridor is given in the table below.

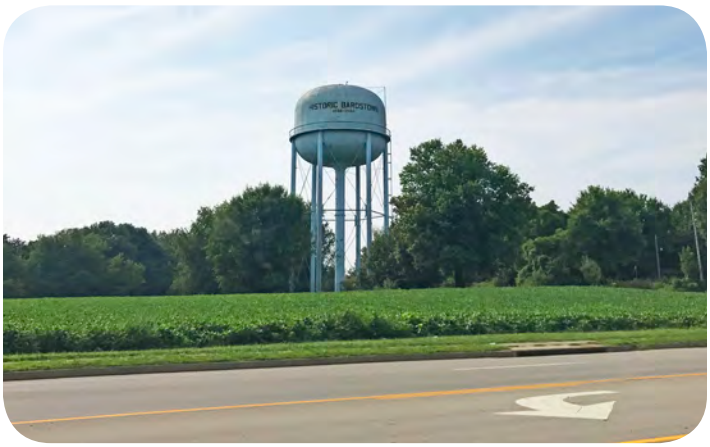
Long-Term Planning Corridor Cost Estimates

Phase	Alternative
	Aqua
Design	$4,500,000
Right-of-Way	$4,600,000
Utilities	$5,300,000
Construction	$45,100,000
Total	$59,500,000

Current growth patterns and associated projected use does not justify the cost at this time. If needs change in the future or growth outpaces current projections, re-evaluation of this as a near-term need may be warranted. At this time, it remains a viable long-range plan transportation element.

NEXT STEPS

The next phase for the project would be Phase 1 Design (Preliminary Engineering and Environmental Analysis) to further define the Orange Corridor and provide design plans for the Pink Corridor priority section. Kentucky's FY 2018 - FY 2024 Highway Plan has $500,000 identified for the design phase in the year 2020. Subsequent project phases will be evaluated by Kentucky's Strategic Highway Investment Formula for Tomorrow (SHIFT) program which is a data-driven, objective approach to compare capital improvement projects and prioritize transportation spending.



CHAPTER 1 — INTRODUCTION

Background

The *Western Bardstown Connectivity Study* was initiated by the Kentucky Transportation Cabinet (KYTC) to examine needs and identify potential alternatives that will improve connectivity and accessibility on the west side of Bardstown. Currently the east side of Bardstown is well developed with little room for expansion. The west side, however, has available land zoned for future development and lacks north-south connectivity.

The project was initially listed in Kentucky's FY 2014-FY 2020 Highway Plan with State Priority Project (SPP) funds and identified as a new route study. Funds were not authorized for the project at that time. The project was re-listed in the Kentucky's FY 2016-FY 2022 Highway Plan as a design project for fiscal year 2017. Given the project's history including initial development of location by the Joint City-County Planning Commission (JCCPC) of Nelson County and debate between various stakeholders, KYTC ultimately determined that a planning study should be completed prior to moving forward that included a heavy emphasis on public outreach and engagement. The *Western Bardstown Connectivity Study* began in December 2017 and the future design phase for the project has $500,000 authorized SPP funding scheduled for fiscal year 2020. No other phases of this project are identified in the Highway Plan.

This report follows the chronological order of the study, with project information presented in the following chapters:

Study Area

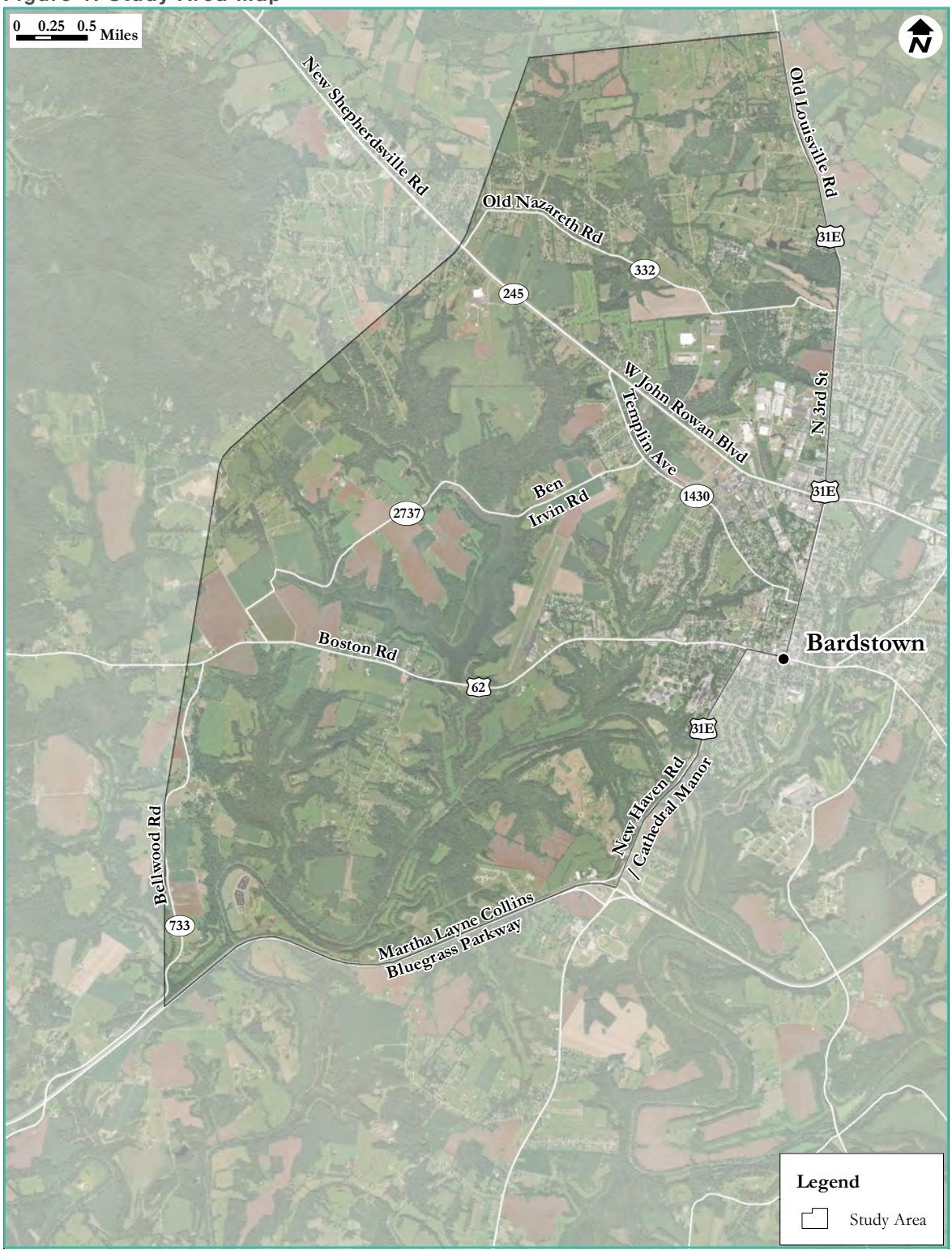
The study area is located in Nelson County, Kentucky with a focus on the western portion of Bardstown. The boundaries are US 31E (known locally as New Haven Road and Old Louisville Road) to the east and Martha Layne Collins Bluegrass Parkway (unsigned as BG 9002) to the south. **Figure 1** provides a graphical depiction of the study area. The area primarily consists of rural agricultural and residential land uses to the west of Bardstown, with urban commercial and industrial land uses in the downtown area. As the second-oldest city and fourth-oldest county in Kentucky, Bardstown and Nelson County are rich in history. Bardstown has previously been named the "Most Beautiful Small Town in America" in the Rand McNally/USA Today 2012 Best of the Road competition[2].

The roadway network within the study area serves both local and regional travel, as Bardstown is geographically centered between Louisville, Bowling Green, and Lexington. Tourism also brings travelers to the area to see the self-proclaimed title of "Bourbon Capital of the World" by visiting its distinguished distilleries, to visit My Old Kentucky Home State Park, and to see historic Bardstown. Bardstown is the county seat of Nelson County and is home to over one-fourth of the county's population (13,165 of 45,640) as of 2017, according to the U.S. Census Bureau. The study area consists of eight KYTC-maintained routes.

They include:

- Martha Layne Collins Bluegrass Parkway (unsigned as BG 9002)
- US 31E (New Haven Road, Cathedral Manor, North 3rd Street, and Old Louisville Road)
- US 62 (Boston Road and West Stephen Foster Avenue)
- KY 245 (New Shepherdsville Road, West John Rowan Boulevard)
- KY 332 (Old Nazareth Road)
- KY 1430 (Templin Avenue)
- KY 2737 (Ben Irvin Road)
- KY 733 (Bellwood Road)

Figure 1: Study Area Map



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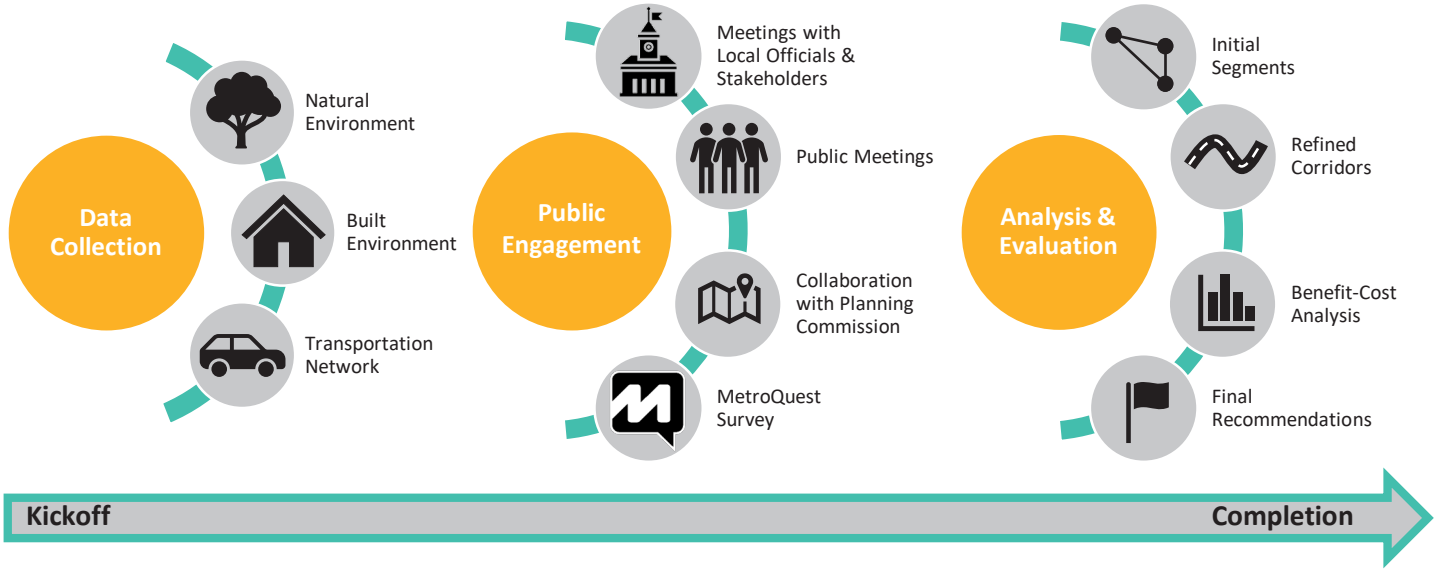
CHAPTER 2 — PLANNING PROCESS

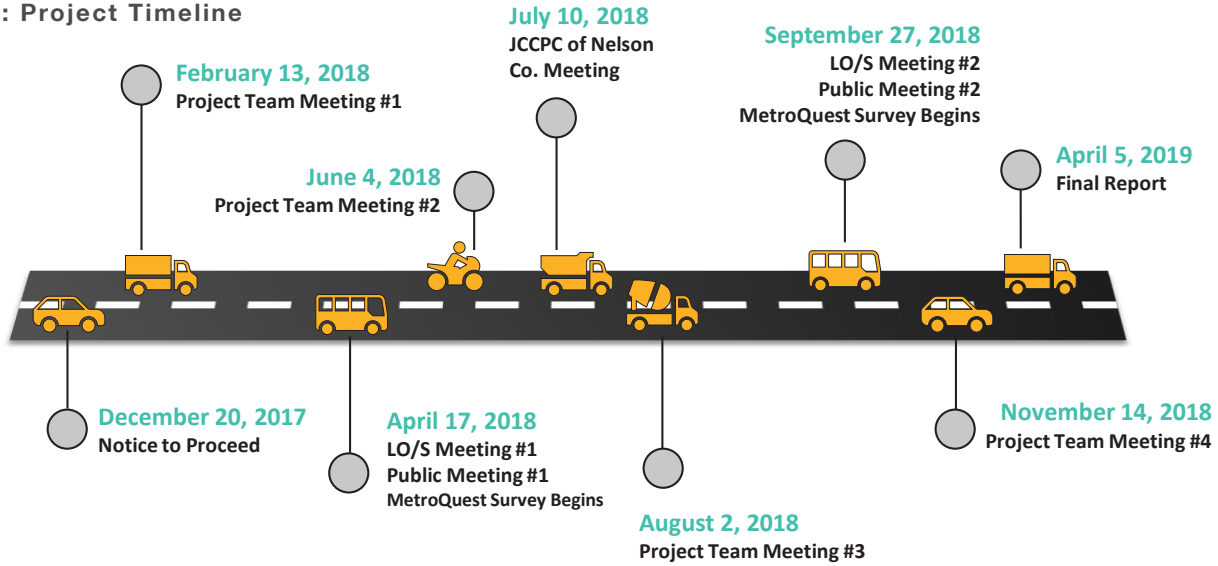
The purpose of the *Western Bardstown Connectivity Study* is to determine transportation needs of today and establish a vision of transportation needs in western Bardstown for the future. The planning process embraced a grassroots approach that allowed the community's vision to be heard alongside support from data-driven procedures. Beginning with an assessment of existing conditions that involved an in-depth compilation of data for the study area, the study process weaved in key public engagement opportunities that fed into the analysis and evaluation of alternatives. The Draft Purpose and Need of the Project was identified through the process and provided framework for the eventual selection of project recommendations.

Figure 2: Planning Process



The study involved several opportunities for public input, including two public meetings, two online surveys, two local officials and stakeholders (LO/S) meetings, and correspondence throughout. Additionally, a meeting was held with the Joint City-County Planning Commission (JCCPC) of Nelson County to listen and understand their identified needs. These meetings helped guide the planning process and produce potential alternatives that best represented the community's needs and vision for connectivity in western Bardstown. Four project team meetings also were part of the process, providing discussion points at key study milestones, as shown in the project timeline in **Figure 3**.

Figure 3: Project Timeline



Task	2017	2018												2019			
	Dec*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Existing Conditions																	
Traffic Forecasting/ Modeling																	
Purpose and Need																	
Environmental Overview/ Socioeconomic Study																	
Geotechnical Overview																	
Analysis of Conditions and Improvement Alternatives																	
Benefit-Cost Analysis																	
Study Documentation																Draft	Final

**Notice to Proceed = Dec. 20, 2017*

CHAPTER 3 — EXISTING CONDITIONS

Introduction

Prior to identifying the needs and opportunities of transportation in western Bardstown, an analysis of existing conditions within the study area was performed. This chapter presents an assessment of these conditions, including planned or committed projects, existing roadway and traffic characteristics, and an analysis of crash history. Understanding the existing conditions provides a foundation for identifying the region's transportation needs and better prepares the community for discussions on transportation investments. Existing conditions data was collected from KYTC's Highway Information System (HIS) database, the KYTC Traffic Count Reporting System, site visits, existing project plans, existing traffic studies, and aerial photography.

Study Area Projects

A summary of study area projects was compiled based on reviews of Kentucky's FY 2018 – FY 2024 Highway Plan. KYTC Continuous Highway Analysis Framework (CHAF) projects, and the Nelson County 2035 Comprehensive Plan.

Based on this review, there are several current or planned projects that are in or adjacent to the study area. Projects identified through KYTC are shown in **Figure 4** and identified by letter. These include:

- A: KY 245 CHAF – Widen KY 245 from Flaget Hospital through county line to Happy Hollow Road.
- B: US 31E CHAF – Widening and access management improvements on US 31E between Nazareth Drive and KY 509.
- C: KY 1430 CHAF – Widen Templin Avenue between Chambers Boulevard and Ben Irvin Road/KY 2737.
- D: Item No. 4-80050.00 – Construction of a roundabout at the intersection of US 31E and US 62. Identified phase is construction in year 2020 at $1,500,000.

Projects identified through Nelson County are shown on **Figure 5**.

One additional new route CHAF project was identified in the database:

- Construct northeastern bypass of Bardstown from US 31E north to US 62 to relieve congestion and improve connectivity

This project is not included in the Committed or Planned Projects map as it is a new route project and a preferred route has not been identified at this time.

Six additional projects have been completed in recent years within the study area. These include:

- 2018: US 150 at Bluegrass Parkway Interchange
- 2014: US 31E Road Diet from Broadway to Forest Avenue
- 2005: US 62 Reconstruction at Dump Hill
- 2005: US 31E Five-Lane Widening from KY 245 to KY 332
- 1998–2012 (Three Construction Segments): KY 245 Five-Lane Widening from US 62 to Flaget Hospital
- 2000: US 31E Reconstruction at Beech Fork Bridge

Figure 4: Committed or Planned Projects in Study Area (KYTC)

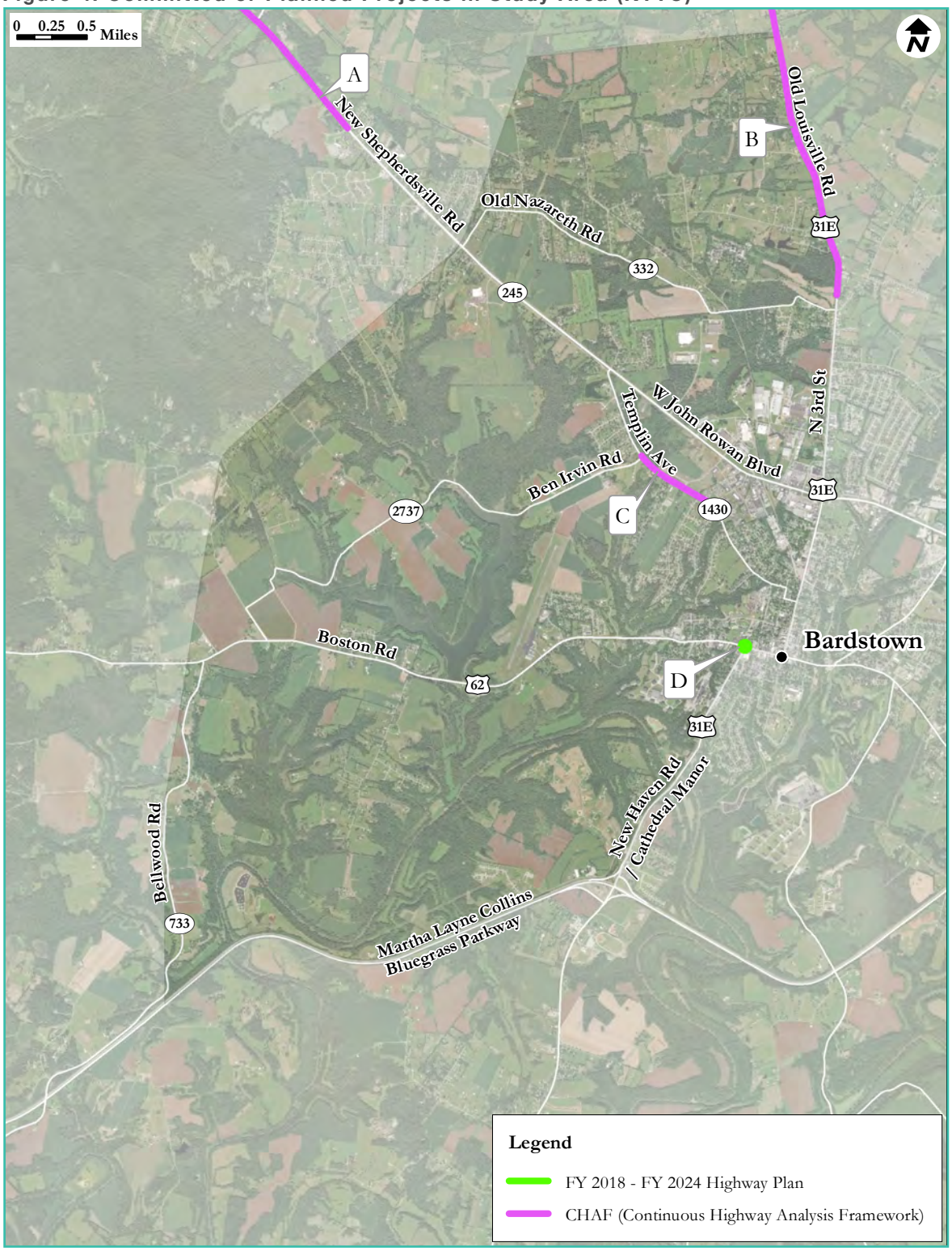
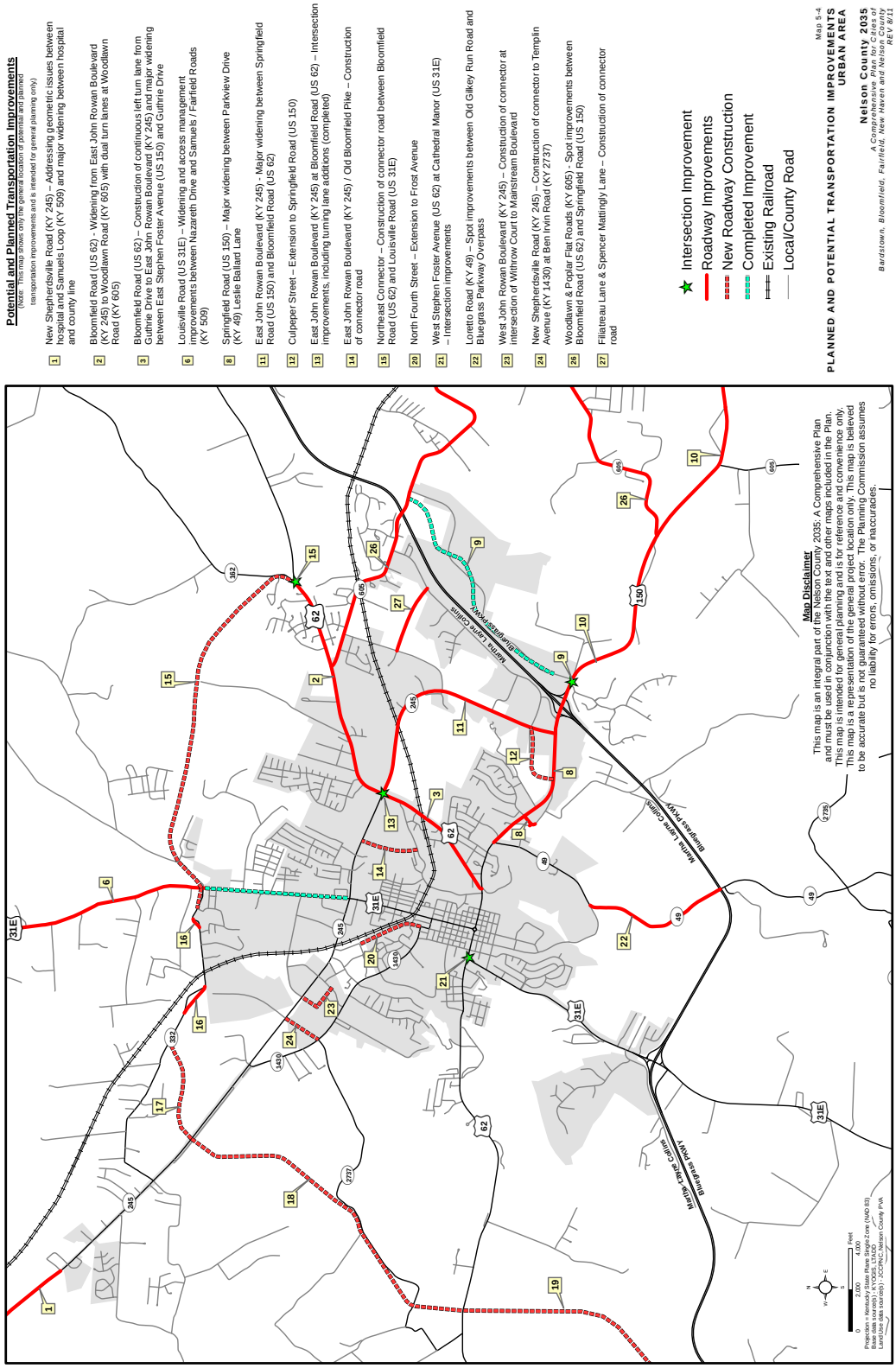


Figure 5: Potential and Planned Transportation Improvements (Nelson County)



Roadway Characteristics

ROADWAY CONFIGURATION/ROADWAY GEOMETRICS

Current geometric characteristics of the KYTC-maintained roadways in western Bardstown were identified and compared with roadway design standards and common practices as set forth in AASHTO's *A Policy on Geometric Design of Highways and Streets, 7th Edition, 2018*. Roadways included in this evaluation are: KY 1430, KY 245, KY 332, KY 733, KY 2737, US 31E, and US 62. All horizontal and vertical curves were evaluated and rated based on a scale of A-F. Curves at a C or below are identified as deficient. **Table 1** shows the number of deficiencies per route. The specific locations for each route and grading are shown on maps provided in **Appendix A**. Additional geometric information and data compiled for each route is listed in **Table 2**.

Table 1: Number of Horizontal and Vertical Deficiencies Per Route

	Horizontal Curve Grade				Vertical Curve Grade		
Route	C	D	E	F	C	D	E
KY 1430	-	-	1	-	3	1	-
KY 245	All curves within acceptable standards						
KY 332	4	8	-	4	-	-	-
KY 733	3	-	4	-	-	-	-
KY 2737	9	4	8	4	-	-	-
US 31E	1	-	-	1	10	1	1
US 62	1	-	-	-	1	3	2

Table 2: Route Characteristics

Road	Begin Milepoint	End Milepoint	ADT*	% Trucks & Buses	# Lanes	Shoulder Width (ft.)	Lane Width (ft.)	Posted Speed Limit (mph)	Median
KY 1430	0.000 (US 31E)	0.390 (Westwind Trail)	2,500	N/A	2	2	12	35	Undivided
KY 1430	0.390 (Westwind Trail)	0.520	5,500	5.5	2	2	10	35	Undivided
KY 1430	0.520	1.050	5,500	5.5	2	2	10	45	Undivided
KY 1430	1.050	1.352 (Sunset Dr.)	5,500	5.5	2	3	10	55	Undivided
KY 1430	1.352 (Sunset Dr.)	2.297 (KY 245)	4,700	5.5	2	3	10	55	Undivided
KY 245	3.342 (US 31E)	3.910 (Chambers Blvd.)	23,800	14.1	4	2	12	45	TWLTL
KY 245	3.910 (Chambers Blvd.)	5.150 (KY 1430/ Wedgewood Dr.)	23,800	14.1	4	2	12	55	TWLTL
KY 245	5.150 (Templin Ave./ Wedgewood Dr.)	6.529 (KY 332/ Stonehouse Rd.)	20,900	14.1	4	10	12	55	TWLTL
KY 2737	0.000 (US 62)	3.870 (KY 1430/ Templin Ave.)	800	N/A	2	3	8	55	Undivided
KY 332	0.000 (KY 425)	1.307 (Froman Greenwell Rd.)	1,300	N/A	2	2	8	35	Undivided
KY 332	1.307 (Froman Greenwell Rd.)	3.115 (US 31E)	1,300	N/A	2	2	8	35	Undivided
KY 733	9.756 (Martha Layne Collins Bluegrass Pkwy.)	13.292	500	N/A	2	4	9	55	Undivided
KY 733	13.292	13.543 (US 62)	500	N/A	2	4	9	35	Undivided
US 31E	11.933 (Martha Layne Collins Bluegrass Pkwy.)	13.460	9,800	8.4	2	8	12	55	Undivided
US 31E	13.460	13.742 (W Muir Ave.)	9,800	8.4	2	4	11	45	Undivided
US 31E	13.742 (W Muir Ave.)	13.972 (US 62)	9,800	8.4	2	4	11	35	Undivided
US 31E	13.972 (US 62)	14.090 (4th St.)	17,600	6.1	2	4	11	35	Undivided

*ADT = Average Daily Traffic

Table 2 (Cont'd.)

Road	Begin Milepoint	End Milepoint	ADT*	% Trucks & Buses	# Lanes	Shoulder Width (ft.)	Lane Width (ft.)	Posted Speed Limit (mph)	Median
US 31E	14.090 (4th St.)	14.195 (US 62 East/ Courthouse Sq.)	17,600	6.1	4	0	11	25	Undivided
US 31E	14.195 (US 62 E/ Courthouse Sq.)	14.218	12,900	8.1	4	2	11	25	-
US 31E	14.218	14.518 (Brashear Ave.)	12,900	8.1	2	0	14	25	Undivided
US 31E	14.518 (Brashear Ave.)	14.612 (KY 1430/ Beall Ave.)	12,900	8.1	2	0	14	35	Undivided
US 31E	14.612 (KY 1430/ Beall Ave.)	15.148 (West Forrest Ave.)	16,600	8.1	2	0	11	35	TWLTL
US 31E	15.148 (West Forrest Ave.)	15.269	16,600	8.1	3	1	11	35	TWLTL
US 31E	15.269	15.400 (KY 245)	16,600	8.1	4	1	12	35	Undivided
US 31E	15.400 (KY 245)	16.729 (KY 332/Plum Run Rd.)	16,100	7.3	4	1	12	45	TWLTL
US 31E	16.729 (KY 332/Plum Run Rd.)	16.850	8,900	2.7	4	1	12	45	TWLTL
US 31E	16.850	17.170	8,900	2.7	2	1	12	45	Undivided
US 31E	17.170	20.536 (KY 509)	8,900	2.7	2	4	12	55	Undivided
US 62	10.168 (KY 733)	11.725 (Hubbards Ln.)	3,600	9.2	2	4	11	55	Undivided
US 62	11.725 (Hubbards Ln.)	13.540	4,600	9.2	2	4-11	11	55	Undivided
US 62	13.540	13.729 (State St.)	4,600	6.4	2	11	11	45	Undivided
US 62	13.729 (State St.)	13.921 (N Elm Grove Ave.)	4,600	6.4	2	9	11	35	Undivided
US 62	13.921 (N Elm Grove Ave.)	14.274 (US 31E Junction)	7,800	9.2	2	9-0	11	35	Undivided

*ADT = Average Daily Traffic

STRUCTURES

Determining the location and status of existing bridges and culverts in the region can help when prioritizing transportation needs and identifying potential solutions in the study area. Structures identified through KYTC's Bridge Data Miner service along KYTC maintained routes within the study area can be seen in **Table 3**. The roadway geometrics maps in **Appendix A** show the specific location of each identified structure. A bridge is classified as structurally deficient if the deck, superstructure, or substructure is rated in "poor" condition or below (0 to 4 rating) on the National Bridge Inventory (NBI) rating scale. One structure within the study area was identified as structurally deficient—the structure at Buffalo Creek on KY 2737.

Table 3: Identified Structures Information

Bridge ID	Roadway	Milepoint	Intersection	Year Built	Length (ft.)	Sufficiency Rating	NBI Conditions Ratings			Structurally Deficient? (Yes or No)
							Deck	Superstructure	Substructure	
090B00115N	US 62	13.000	Withrow Creek	2006	696	99.8	7	7	7	No
090B00103N	US 62	12.000	Sympson Lake Spillway	1980	57	98.3	7	8	7	No
090B00044N	US 31E	11.000	Bluegrass Pkwy.	1964	213	71.4	7	6	6	No
090B00081N	KY 733	11.000	Cedar Creek	1952	40	99.9	N	N	N	No
090B00107N	KY 2737	2.000	Buffalo Creek	1976	34	49.3	7	4	6	Yes
090B00063N	KY 1430	1.000	Withrow Creek	1934	27	93.1	N	N	N	No

TRUCK ROUTES AND WEIGHT CLASSIFICATION

Existing truck routes and weight classification in the study area were identified to provide a framework of where truck traffic is designated to travel. The Kentucky Highway Freight Network designations were used to identify these routes and can be seen in **Figure 6**. In addition, the locations of major employers (those with over 100 employees) were identified since they contribute to this truck traffic. They can be seen in **Figure 6**. Haydon Materials, a major local generator of freight traffic, recently moved their quarry operations to the west side of Bardstown, located north of US 62 and west of KY 2737.

Aside from the truck routes identified by the Kentucky Highway Freight Network, truck weight classes were also identified using the KYTC HIS and are shown in **Figure 7**.

Figure 6: Kentucky Highway Freight Network

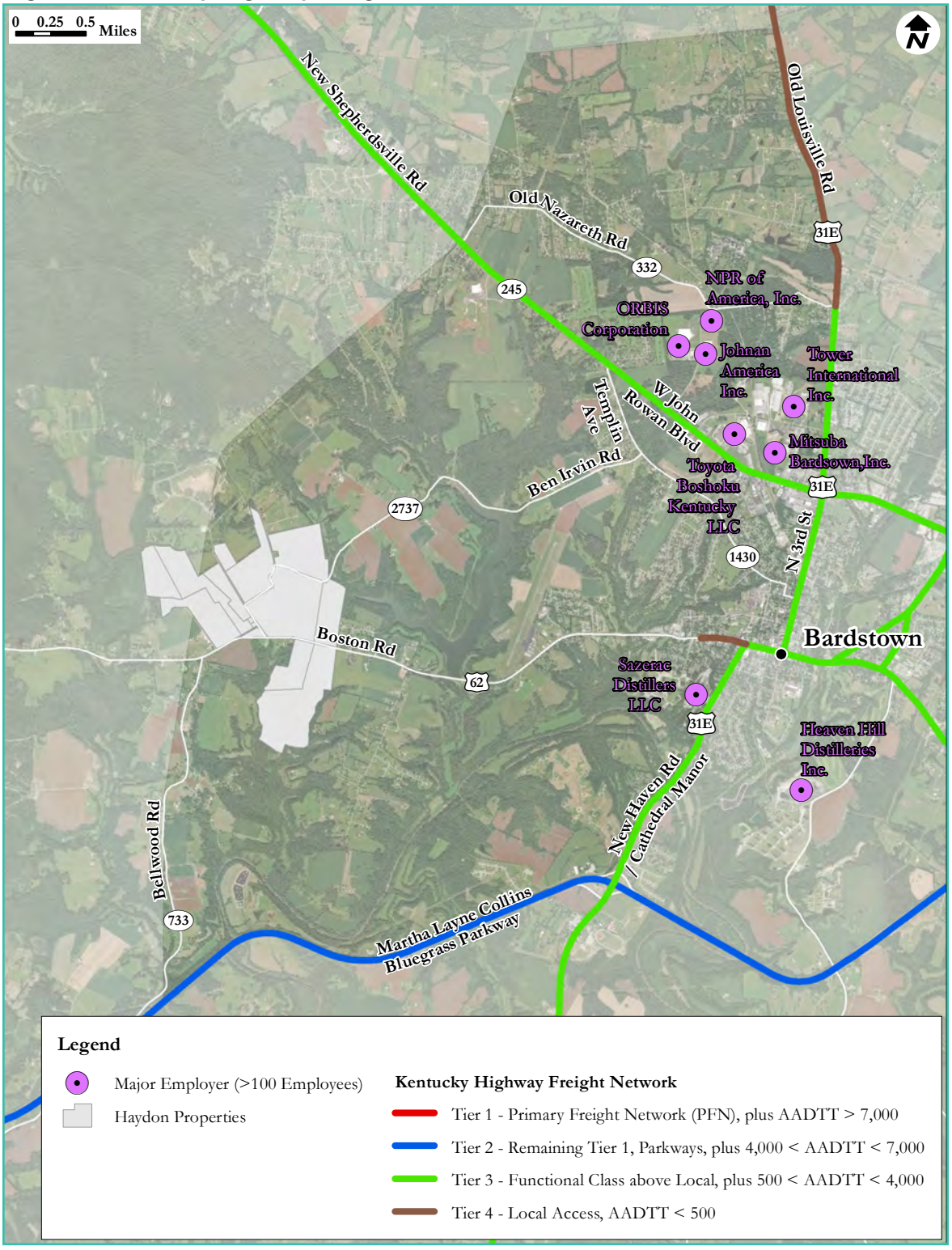
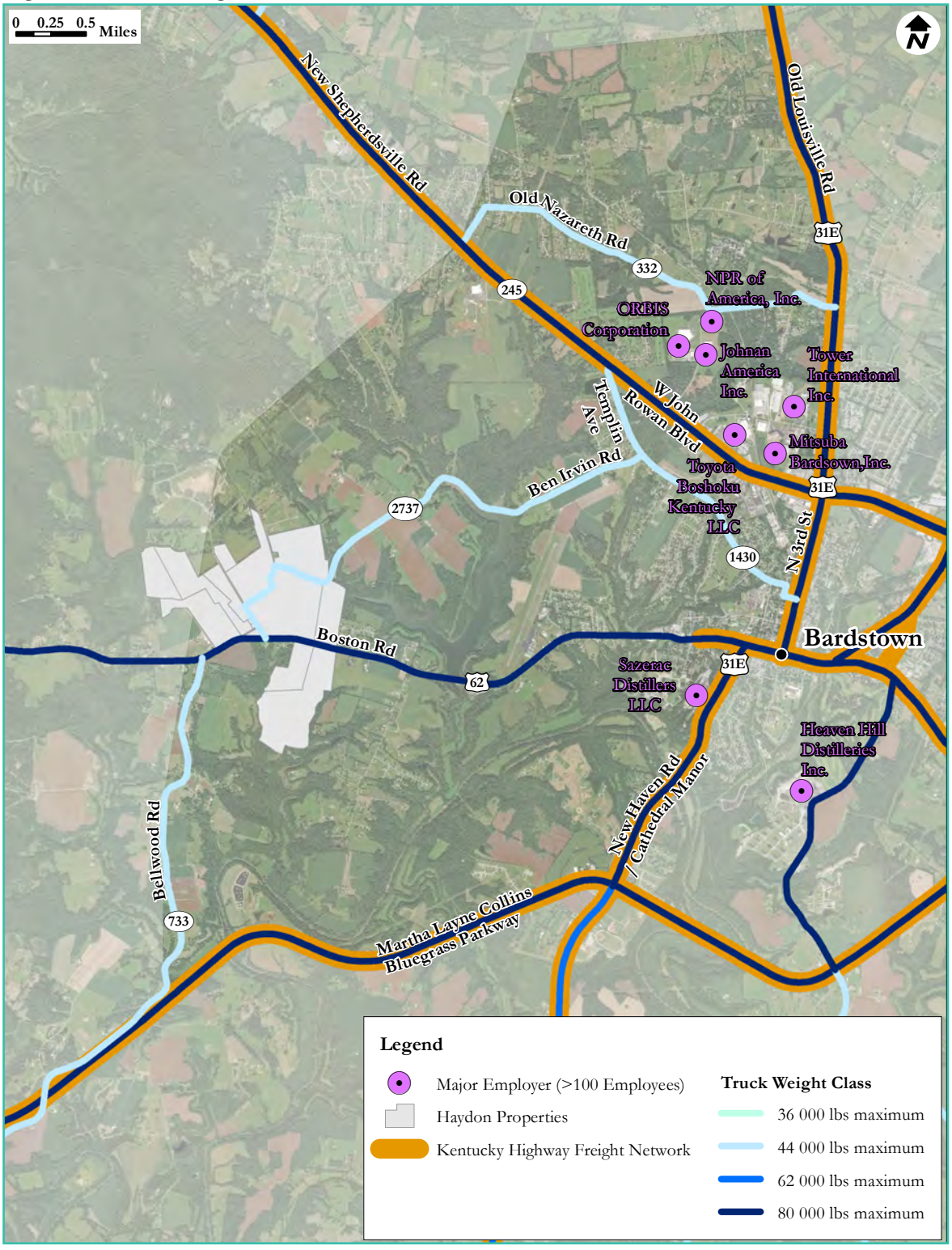
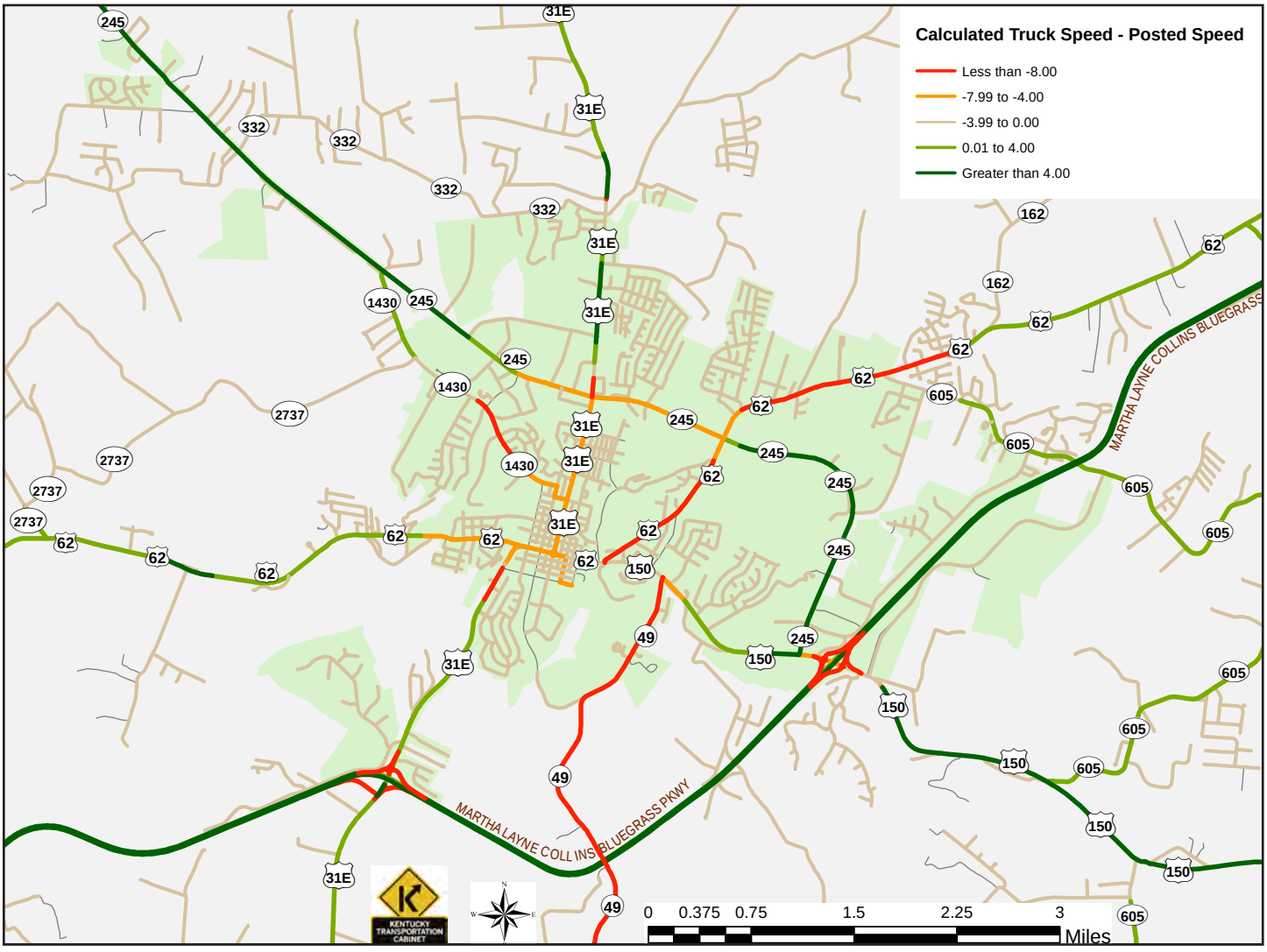


Figure 7: Truck Weight Class



Understanding the importance of goods movement and time sensitivity of freight delivery, the Hardin-Meade County Sub-Area Travel Demand Model provides output by travel speed and by vehicle type. The data shows the differentials between the posted speed and calculated truck speed. Calculated truck speed is a function of roadway geometrics and traffic flow within the area. Areas that result in trucks traveling less than the posted speed provide some indication of where there could be travel issues and help identify areas that may benefit from additional connectivity to improve flow. The map generated by KYTC Division of Planning is included as **Figure 8**.

Figure 8: KYTC Calculated Truck Speed Differentials

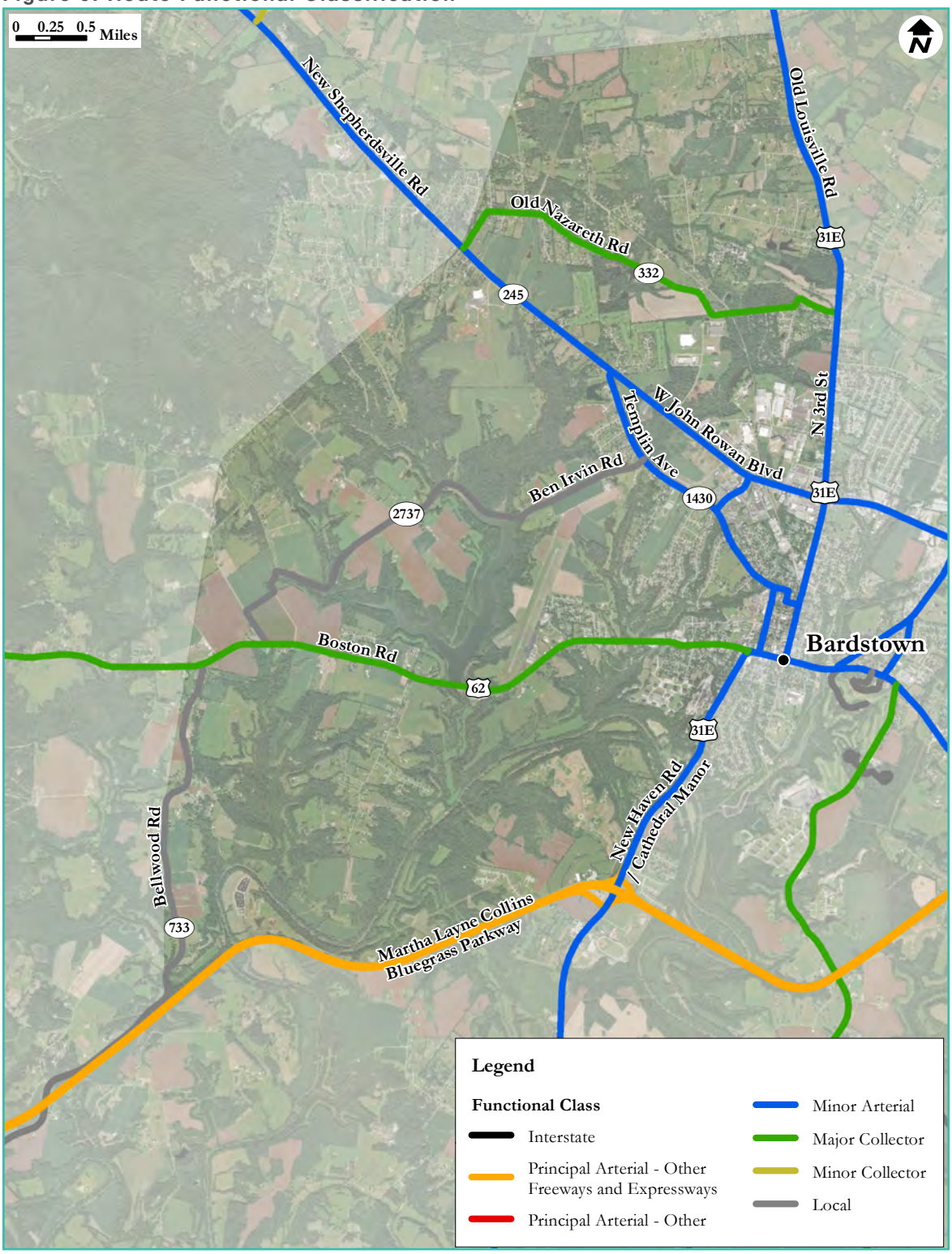


FUNCTIONAL CLASSIFICATION

All roadway travel involves movement through a tiered system of interconnected roads. Functional classification is an important hierarchy method of categorizing these different roadways based on how they are intended to be used for travel. Functional classification is assigned based on guidance from the *Federal Highway Administration – Highway Functional Classification Concepts, Criteria and Procedures (2013)* document. Knowing these roadway classes is important for understanding current and future travel in the region.

Figure 9 shows the functional classes of major roadways in the study area.

Figure 9: Route Functional Classification



PEDESTRIAN AND BICYCLE FACILITIES

Existing pedestrian and bicycle features were identified in Bardstown, including sidewalks and bike lanes. These features can be seen in **Figure 10**. There are dedicated bike lanes along US 31E in each direction from Brashear Avenue to Halstead Avenue. There are two large-scale bike routes identified that come through Bardstown, including the Trans America Trail (national east-west trail) and the Central Heartlands Trail (statewide north-south trail). These trails, as well as two trails proposed in the Nelson County 2035 Comprehensive Plan, can be seen in the Existing and Potential Recreational Paths map shown in **Figure 11**. Unofficial multimodal travel patterns in Bardstown also were estimated by using GPS data from the running and cycling app, STRAVA Global Heat Map (2018), and are shown in **Figures 12 and 13**. For additional detail on pedestrian and bicycle facilities in the study area, refer to the Pedestrian & Bicycle Consideration Review prepared by KYTC for this study in **Appendix B**.

Figure 10: Existing Pedestrian and Bicycle Facilities

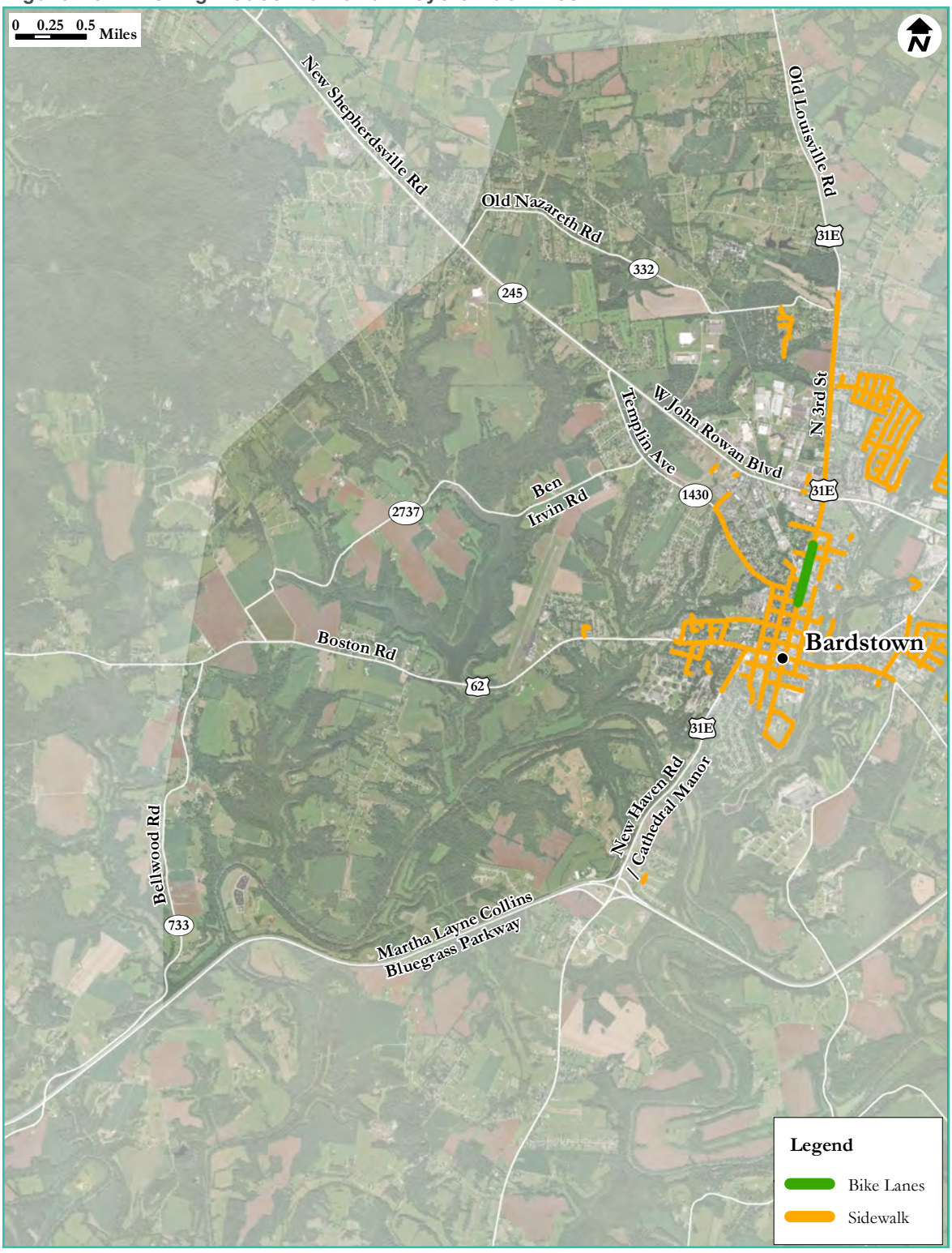
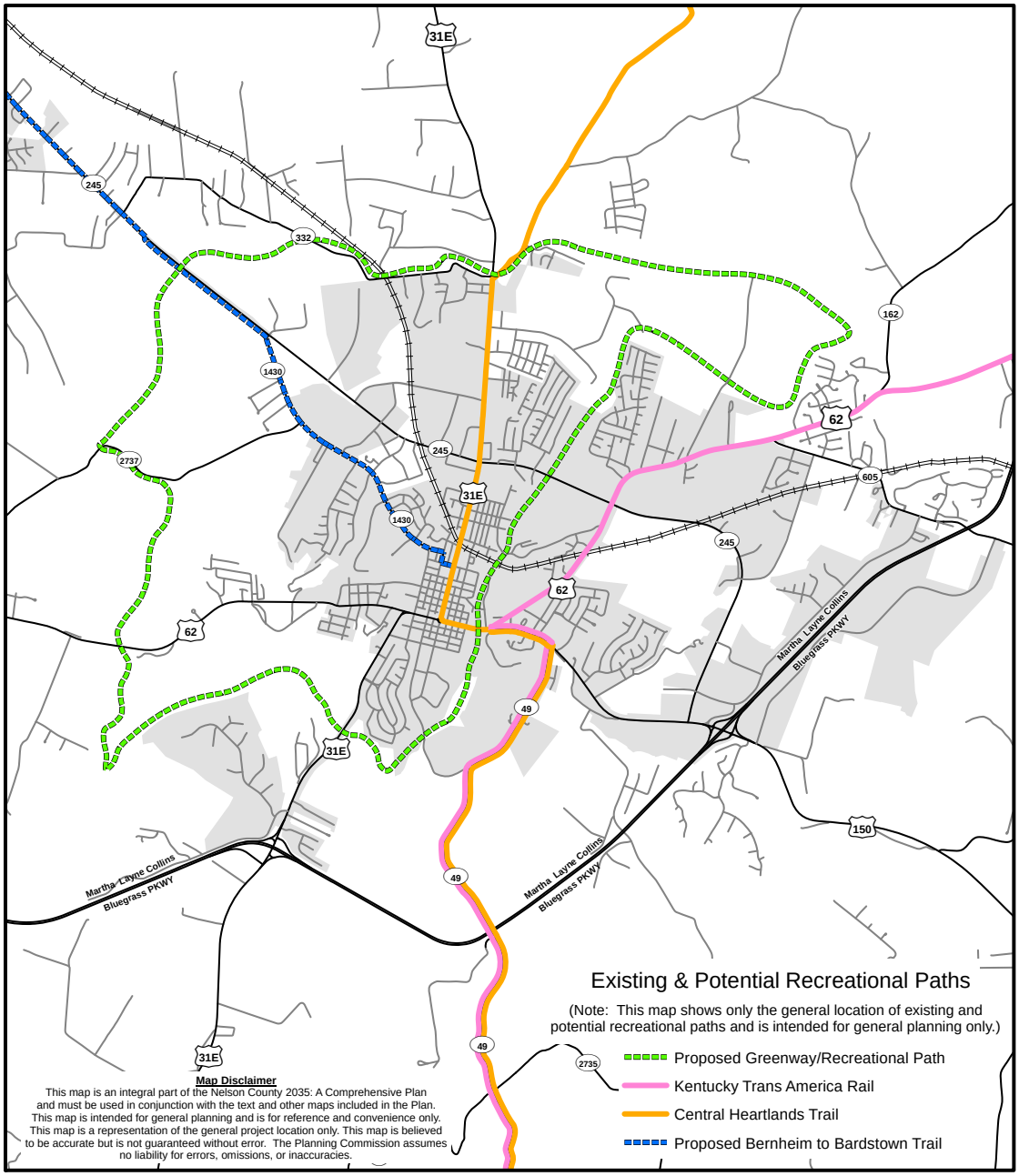


Figure 11: Nelson County Comprehensive Plan Existing and Planned Recreational Paths



N
W E
S
Feet
0 2,000 4,000

Projection = Kentucky State Plane Single Zone (NAD 83)
Base data source(s) - KYOGIS, LTADD
Land Use data source(s) - JCCPNC, Nelson County PVA

Map 5-8

EXISTING AND POTENTIAL RECREATIONAL PATHS URBAN AREA

Nelson County 2035
A Comprehensive Plan for Cities of Bardstown, Bloomfield, Fairfield, New Haven and Nelson County
REV 8/11

The maps shown are "heat maps" which show use and intensity by color from yellow to orange to white.

Figure 12: Bicycle Usage

Figure 13: Popular Run/Walk Routes

Existing Traffic Characteristics

VOLUMES

Existing traffic volumes (average daily traffic or ADT) for the study area were obtained through the KYTC Traffic Count Reporting System, including raw volumes and truck traffic percentages. Turning movement counts were conducted at the US 31E/US 62 and US 31E/KY 245 intersections in 2017 as part of the initial traffic forecast for a new route (*Traffic Forecast Technical Report, July 2017*). Additional turning movement count data (AM and PM peak hours) was collected as part of this study to further evaluate the impacts of a new route related to the existing conditions of the intersections and roadway segments. **Figure 14** shows the existing traffic counts and locations of turning movement counts (TMC) for the study area. **Appendix C** includes the traffic forecast reports performed by KYTC Division of Planning.

LEVELS OF SERVICE

A level of service (LOS) analysis was performed for major existing intersections and segments. As illustrated in **Figure 15**, LOS is a qualitative measure of determining the operational characteristics of a roadway facility. It is used to define the quality of traffic operations based on measures such as vehicle speed, travel time, comfort and convenience, maneuverability, congestion, and delay. There are six levels of service for each type of facility. The levels are designated by letters, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Acceptable operations for roadways in rural areas are LOS C or better. In urban areas, the threshold for desirable operations is LOS D or better. **Table 4** and **Figure 16** show the existing levels of service for KYTC-maintained roadway segments and intersections in the study area.

In addition to providing the range of traffic flow according to letter grade, another representative statistical measure is the volume to capacity ratio (V/C). A V/C ratio represents the proportion of traffic demand using the roadway for a designated time period in relation to its theoretical capacity to serve the demand. A V/C ratio equal to or greater than 0.9 in rural areas and 1.0 in urban areas indicates the road is operating at or above its theoretical design capacity. The V/C ratios for each study area roadway segment are displayed in **Table 4**.

Figure 15: Graphical Depiction of Level of Service

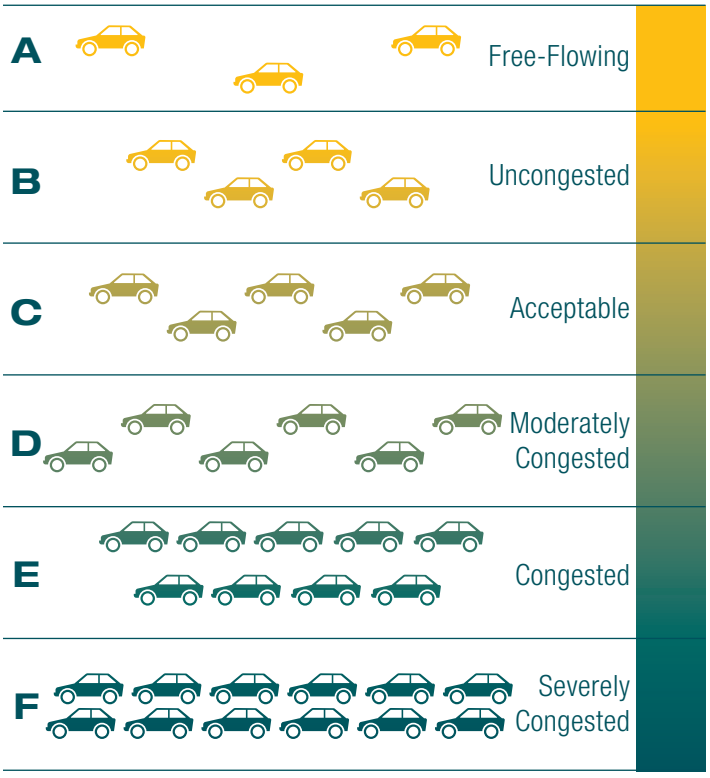


Figure 14: 2017 (Existing) Average Daily Traffic Volumes

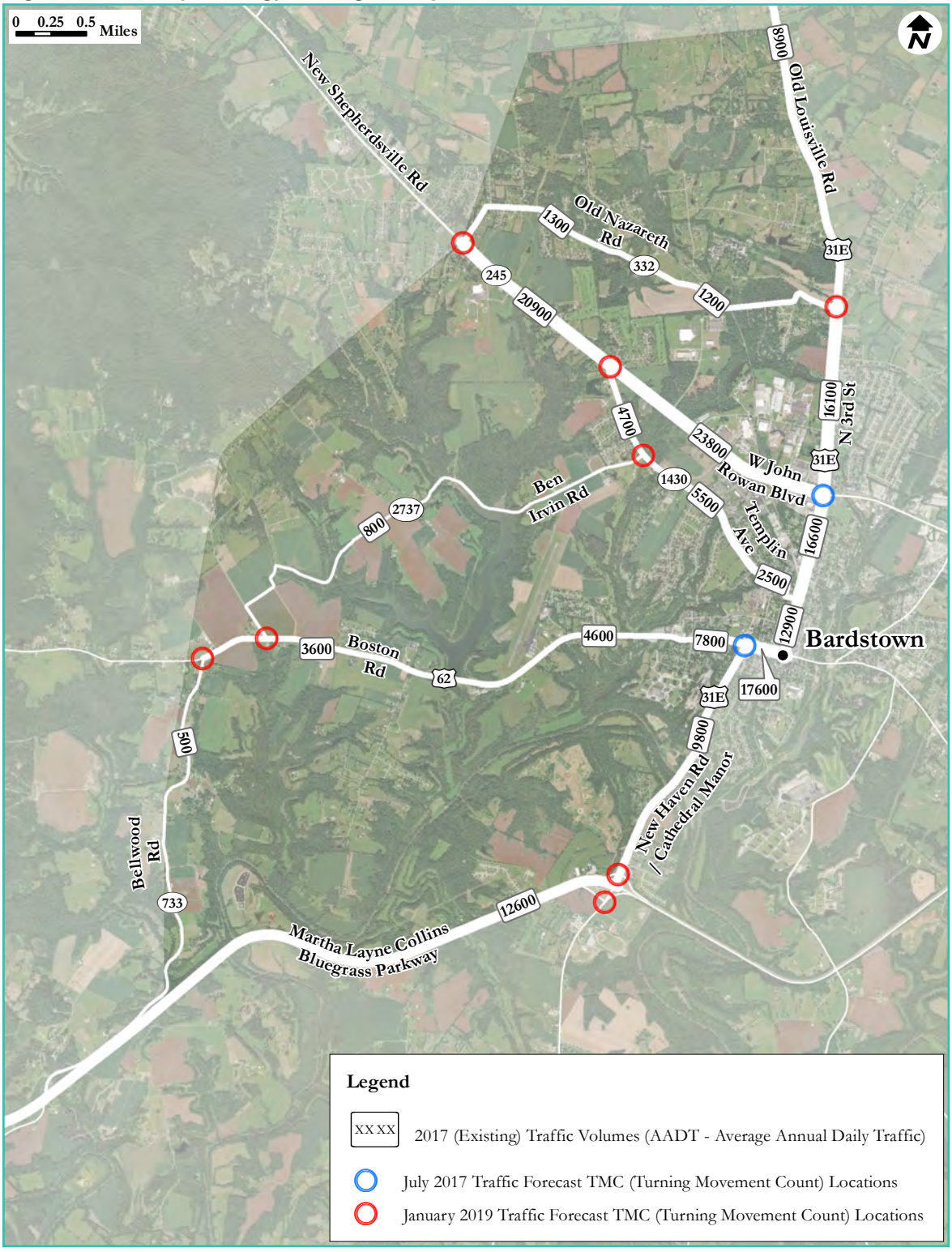
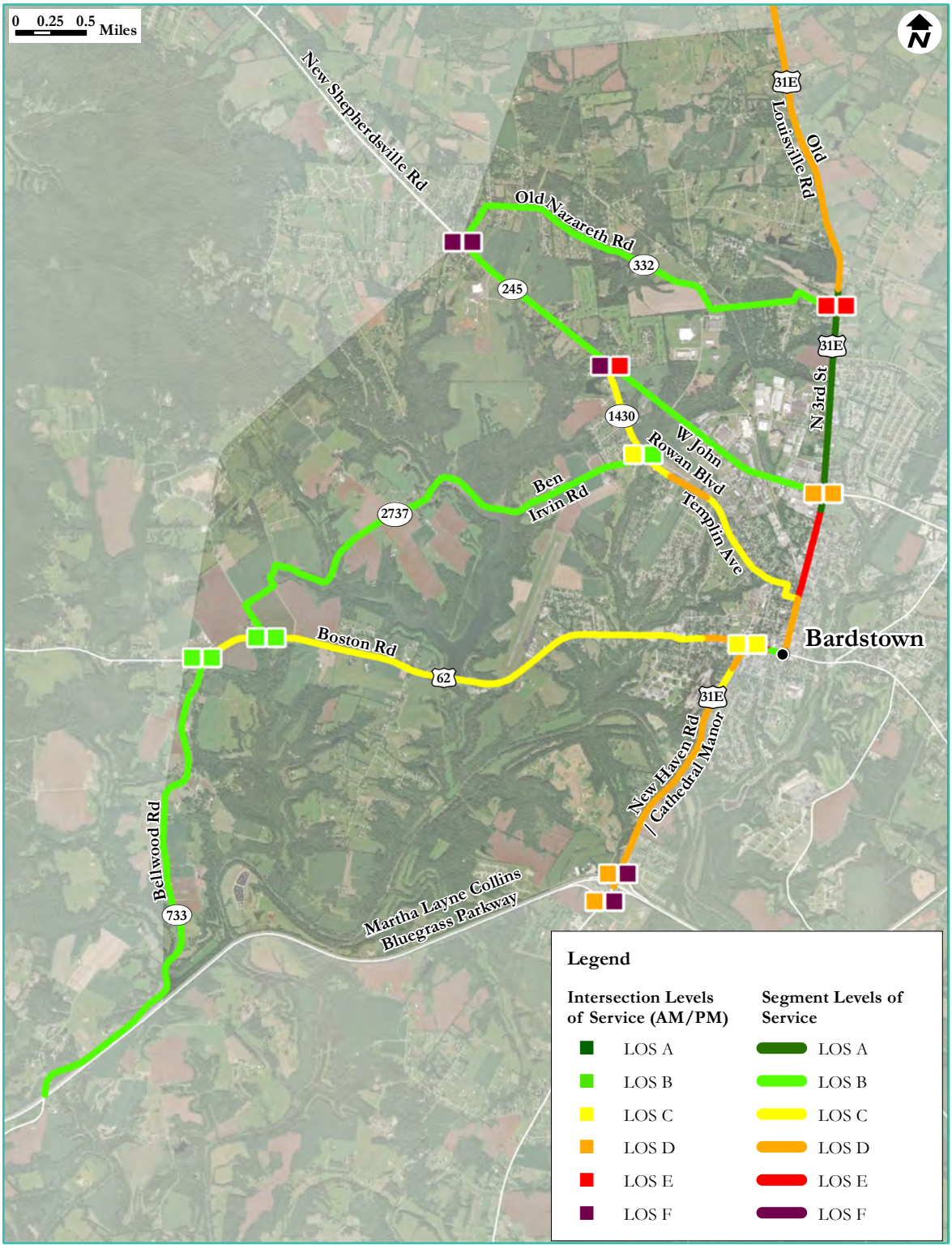


Table 4: LOS and V/C Ratio by Segments

Road Name	Begin Milepoint	End Milepoint	2017 (Existing) ADT	% Trucks & Buses	LOS	V/C[1]
KY 1430 (Templin Ave.)	0.000 (US 31 E in Bardstown)	0.390 (Westwind Trail)	2,500	N/A	C	0.53
KY 1430 (Templin Ave.)	0.390 (Westwind Trail)	1.050	5,500	5.5	C	0.53
KY 1430 (Templin Ave.)	1.050	1.352 (Sunset Dr.)	5,500	5.5	D	0.53
KY 1430 (Templin Ave.)	1.352 (Sunset Dr.)	2.297 (KY 245/Bardstown Bypass)	4,700	5.5	C	0.53
KY 245	3.342 (US 31E/ Bardstown-Mt. Washington Rd.)	3.910	23,800	14.1	B	0.39
KY 245	3.910	5.150 (KY 1430/Templin Ave./ Wedgewood)	23,800	14.1	B	0.35
KY 245	5.150 (Templin Ave./Wedgewood)	6.529 (KY 332/Nazareth-Stonehouse)	20,900	14.1	B	0.32
KY 2737	0.000 (US 62)	3.870 (KY 1430/Templin Ave.)	800	N/A	B	0.53
KY 332 (Old Nazareth Rd.)	0.000 (KY 425)	3.115 (US 31E)	1,300	N/A	B	0.53
KY 733	9.756 (Martha Collins Bluegrass Pkwy.)	13.543 (US 62)	500	N/A	B	0.53
US 31E	11.933 (Martha L. Collins Bluegrass Pkwy)	13.460	9,800	8.4	D	0.53
US 31E	13.460	13.742	9,800	8.4	C	0.53
US 31E	13.742	13.972 (Elizabethtown Rd.)	9,800	8.4	D	0.53
US 31E	13.972 (US 62 West/ Elizabethtown Rd.)	14.090	17,600	6.1	E	0.53
US 31E	14.090	14.195 (US 62 East/Courthouse Square)	17,600	6.1	B	0.24
US 31E	14.195 (US 62 E/Courthouse Sq.)	14.218	12,900	8.1	N/A[2]	N/A[2]
US 31E	14.218	14.612 (KY 1430/Beall Ave.)	12,900	8.1	D	0.53
US 31E	14.612 (KY 1430/Beall Ave.)	15.269	16,600	8.1	E	0.53
US 31E	15.269	16.729 (KY 332/Plum Run)	16,600	8.1	A	0.23
US 31E	16.729 (KY 332/Plum Run Rd.)	16.850	8,900	2.7	A	0.13
US 31E	16.850	20.536 (KY 509/Samuels-Fairfield Rd.)	8,900	2.7	D	0.53
US 62	10.168 (KY 733/Cravens-Bellwood Rd.)	13.921 (N Elm Grove Ave.)	4,600	9.2	C	0.53
US 62	13.921 (N Elm Grove Ave.)	14.274 (US 31E Junction)	7,800	9.2	D	0.53

[1] V/C ratio is calculated by HSC Software. For two-lane facilities the software returns maximum values of 0.53 for the directional analysis.
[2] This segment is governed by interrupted flow through the close spacing of intersections and therefore is evaluated based on intersections operations and not segment operations.

Figure 16: Intersection and Route LOS (Existing Conditions 2017)



Existing Safety Characteristics

A safety analysis was performed for the roadways in the study area to identify any statistically significant high crash rate areas. Historical crash records were obtained from the Kentucky State Police database for a three-year period between January 2014 to December 2016. The analysis was based on the methodology and rates developed by the Kentucky Transportation Center in *Analysis of Traffic Crash Data in Kentucky (2012-2016)* . **Figures 17 and 18** present summaries of the crashes in the study area. Crash type, severity, and any contributing factors were evaluated to help identify safety trends.

Part of this evaluation included the current standard practice of determining Critical Rate Factors (CRFs) for each roadway in the study area. The CRF method is used to compare crash rates at study segments or spots to that of similar facility types. If a segment or intersection has a crash rate of 1.00 or greater, it is considered a high crash location and it is likely that such crashes are not occurring at random. **Figure 19** displays the CRFs for the major segments in the study area with additional details, including crash types for the identified high crash rate segments.

Crash analysis methodology has been evolving, transitioning from the CRF method and increasingly relying upon Highway Safety Manual (HSM) procedures. HSM procedures allow for the ability to estimate potential crash frequency and severity on highway networks, and the potential effects of transportation decisions on crashes in a quantitative manner. Furthermore, the process enables economic appraisals of improvements to be conducted to prioritize projects. The Kentucky Transportation Center has been conducting data collection and research into the process and application and is developing Kentucky-specific safety performance functions (SPFs) for use in analysis procedures.

With emphasis on the downtown area of Bardstown, Expected Excess Crashes (EEC) values were calculated. The EEC is the difference between the adjusted observed number of crashes per the Empirical Bayes method and the predicted number of crashes based on a Kentucky-specific SPF. Positive values for EEC mean more crashes occurred than would be expected on that type of roadway. A negative value for EEC means fewer crashes occurred than would be expected. EEC values can be calculated for varying levels of severity. For this analysis, as there were no fatal collisions and low percentages of injury crashes, the EEC calculated reflects all crashes as shown in **Table 5**.

Table 5: Calculated EEC Values

Route	Begin Milepoint	End Milepoint	Length	2017 ADT	# of Fatal Crashes	# of Injury Crashes	Total Crashes	EEC
US 31E	13.972	14.090 (Fourth St.)	0.12	17,600	0	7	72	25.9
US 31E	14.090 (Fourth St.)	14.195 (US 62 East/ Courthouse Sq.)	0.11	17,600	0	0	31	4.23
US 31E	14.195 (US 62 E/Courthouse Sq.)	14.612 (KY 1430/Beall Ave.)	0.42	12,900	0	8	65	5.34
US 31E	14.612 (KY 1430/Beall Ave.)	15.400 (KY 245/Bardstown Bypass)	0.79	16,600	0	22	145	23.54
US 62	13.079 (Brookview Ln.)	13.921 (N Elm Grove Ave.)	0.84	4,600	0	2	6	-12.63
US 62	13.921 (N Elm Grove Ave.)	14.274 (US 31E Junction)	0.35	7,800	0	2	21	-0.84

This shows US 31E has sections with a number of collisions above the expected amount. Measures to reduce these numbers can translate to benefits as will be discussed in Chapter 10 when evaluating alternatives.

Figure 17: Injury and Fatality Collisions

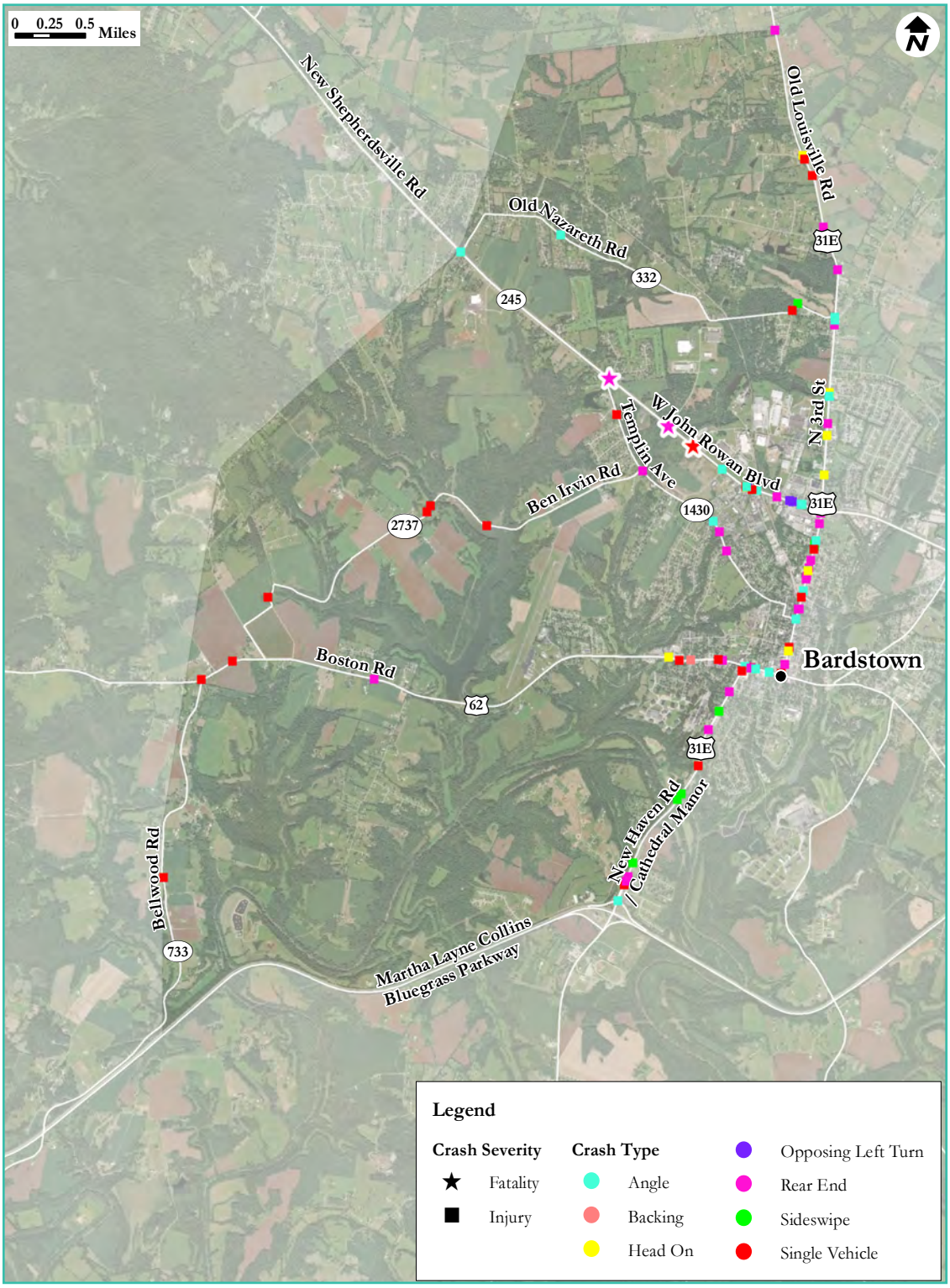


Figure 18: Property and Damage Collisions

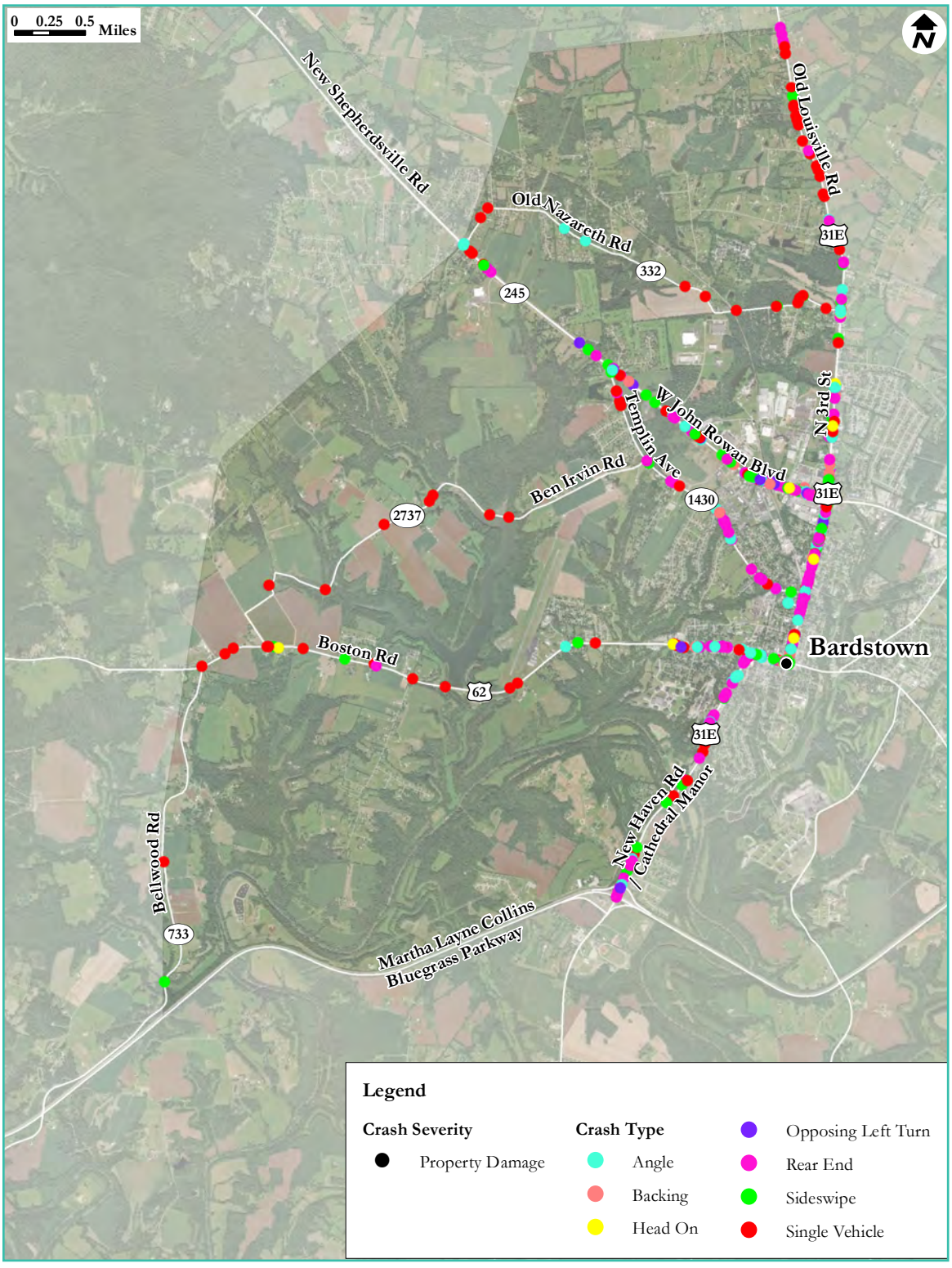
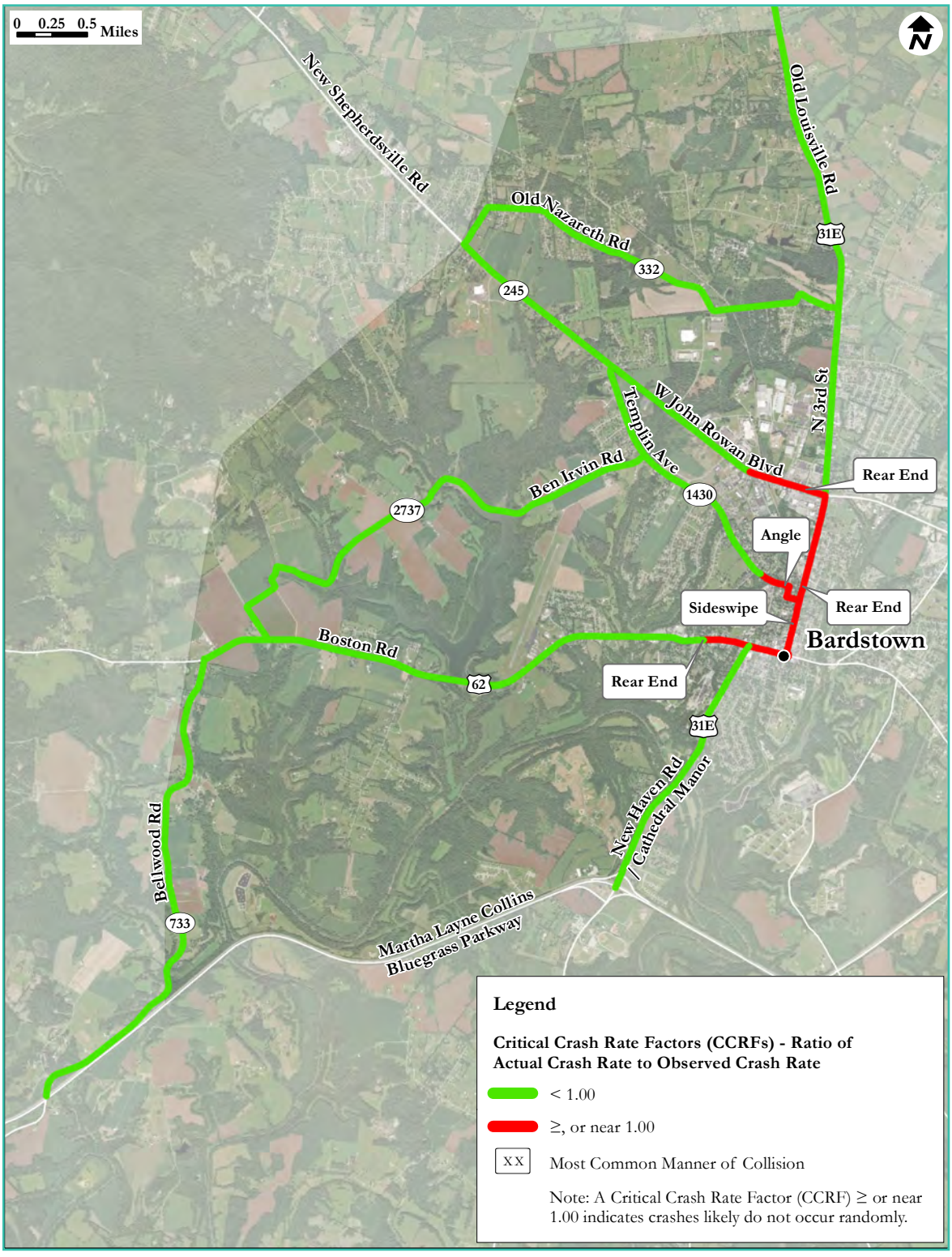


Figure 19: Critical Crash Rate Factors (CRFs)



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CHAPTER 4 — SOCIAL AND ENVIRONMENTAL ASSESSMENT

The social, natural, and built environment within the study area was evaluated using data published by KYTC, Lincoln Trail Area Development District (LTADD), the JCCPC of Nelson County, and other agencies. This information helps determine the natural and human environmental conditions of the area as well as shape the assessment of impacts relative to the development of alternatives. This chapter provides an overview of community features, land use, demographics, natural resources, and historic resources within the study area.

Social Environment

The socioeconomic environment of the study area focuses on existing community features, land use, and demographics. This assessment provides an understanding of the social environment so the area's transportation system can be fully integrated with its community's needs.

COMMUNITY FEATURES

Community features include public structures or places for gathering, such as schools, churches, libraries, hospitals, etc. In addition to facilities, community features also can include land that belongs to the community at large, such as parks, wetlands, and designated open space. Identification of these features helps guide the planning process to understand where people desire to go to/from and help to identify connectivity through travel patterns. Several large-scale community features are located in the middle of the study area, including Sympson Lake and Samuels Field Airport. Educational facilities such as public schools, private schools, adult education centers, or childcare facilities are located throughout the study area in addition to churches and hospitals. **Figure 20** details major features and identifies their locations.

LAND USE

Existing land use patterns and features were acquired through the JCCPC of Nelson County. Knowledge of area land use establishes context for assessing the transportation network and understanding its relationship to areas of residential, commercial, and industrial growth. The existing land use map for Nelson County is shown in **Figure 21**.

A Future Land Use plan (see **Figure 22**) was developed by the JCCPC of Nelson County concurrent but separate from this study to highlight areas of potential development, growth activity, or major land preservation. The revised future land use map was adopted by the JCCPC of Nelson County in November 2018 as an amendment to the 2035 Comprehensive Plan. With the eastern side of Bardstown already fully built-out, western Bardstown provides the most opportunity for growth dependent upon the infrastructure investments (i.e. roadways, natural gas, sewer, water, etc.). The land use plan states that approximately 800 additional acres are needed to accommodate projected industrial growth. The areas south of KY 245 and north and south of US 62 would satisfy about half of this need. Land use and transportation are intricately linked; elements of a transportation system affect the size, shape, density, and mix of land uses. For this reason, the JCCPC of Nelson County was consulted throughout the study to ensure their future land use and the transportation improvements will be complementary.

Figure 20: Community Features

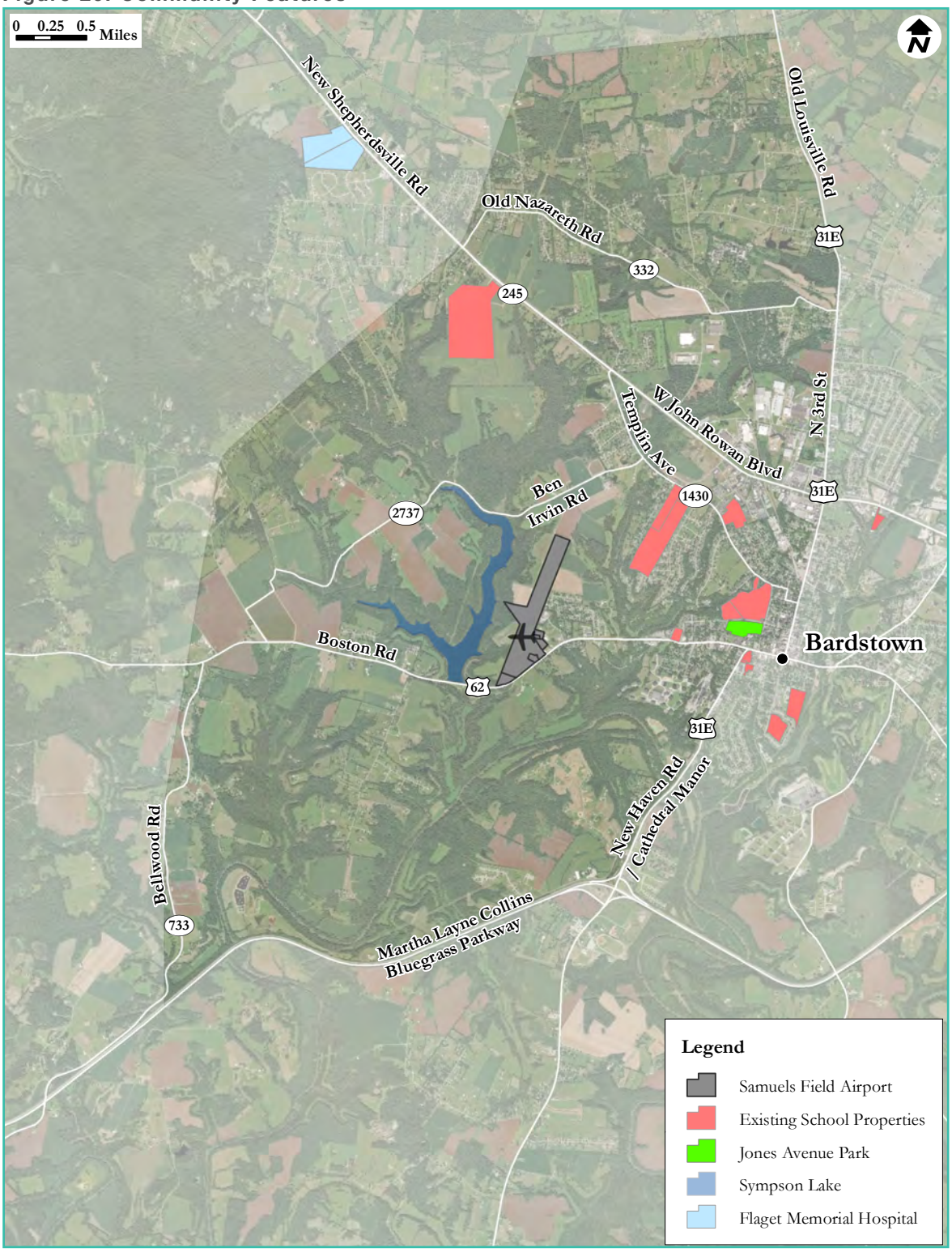


Figure 21: Nelson County 2035 Comprehensive Plan Existing Land Use

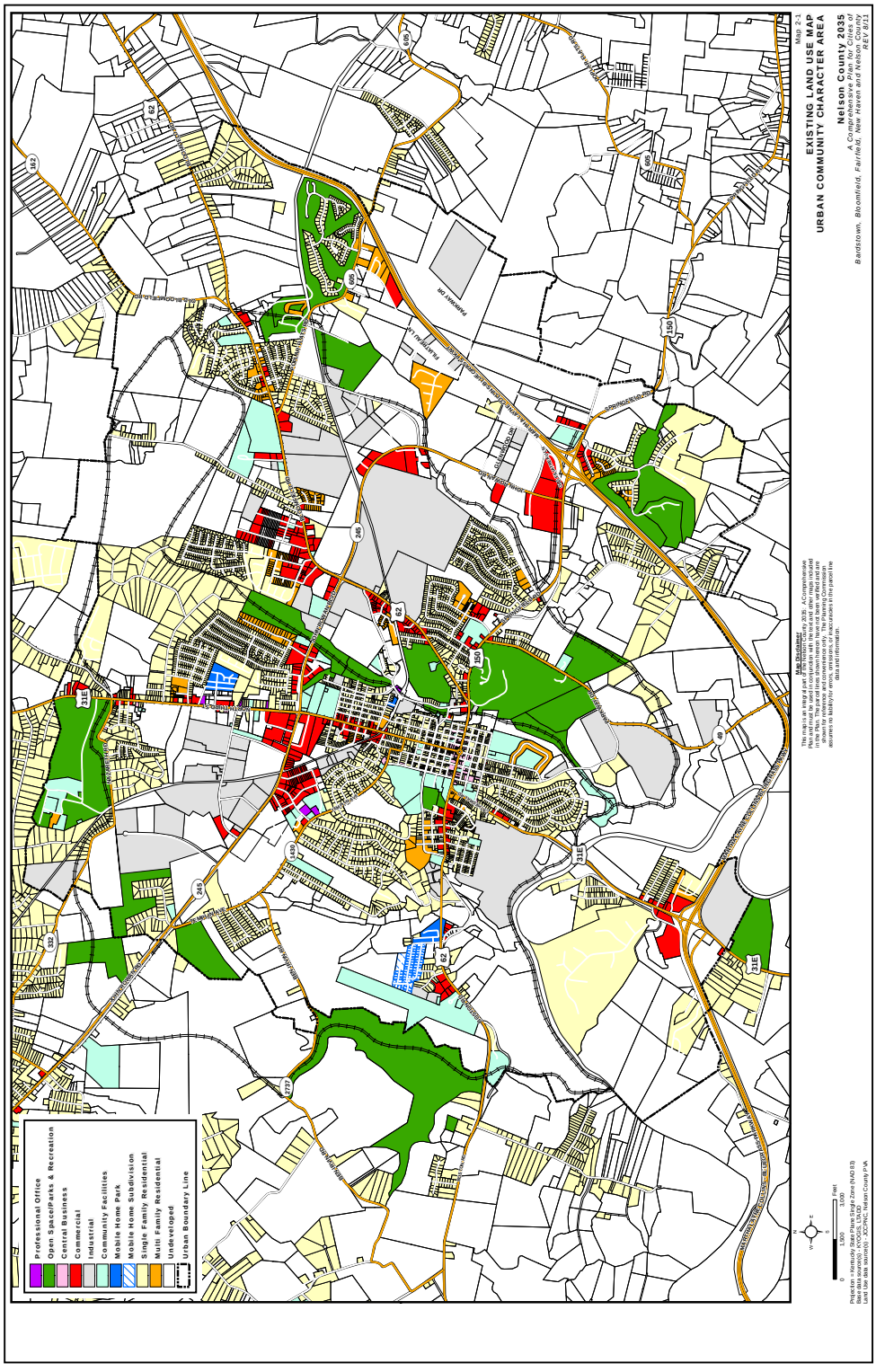
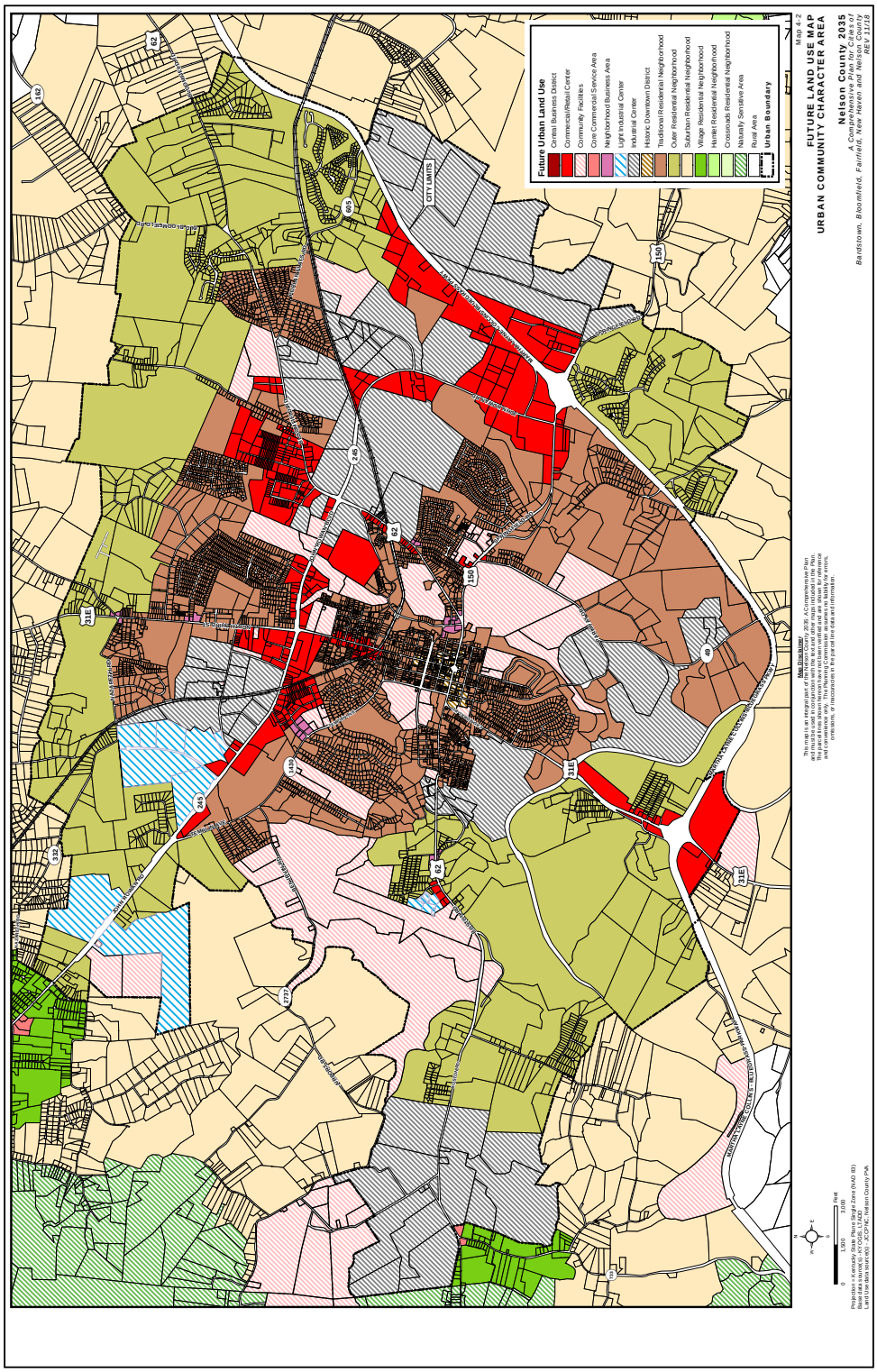


Figure 22: Nelson County 2035 Comprehensive Plan Future Land Use



SOCIOECONOMIC STUDY

The Western Bardstown Nelson County Bypass Socioeconomic Study was completed by the LTADD. The intent of this review is to assist decision makers in making informed and prudent transportation decisions in the study area, especially with regard to the requirements of Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (signed February 11, 1994). Statistics are provided on minority, low-income, elderly, disabled, and limited English proficiency. A summary of this information is provided in **Table 6**.

For this study the threshold established was the county (Nelson) percentage for each population. For Minority that is 9.1%, Poverty is 16.0%, Over 65 is 12.8%, Disability status is 16.6% and Limited English Proficiency is 1.0%. It was determined that at least one census tract block group was below the threshold in the minority category for each demographic category examined, and all block groups were over the threshold for disabled persons. While this initial review allowed the project team to identify areas of potential concern, during future phases of project development a more detailed analysis will be required when assessing the potential for adverse and disproportionate population impacts. Further details can be found in the *Western Bardstown Nelson County Bypass Socioeconomic Study* in **Appendix D**.

Table 6: Summary of Affected Populations by Census Tract and Block Group

Census Tract	Block Group	Total Pop.	Minority	Poverty	Over 65	Disability	LEP*
930600	1	3,081	4.89%	14.22%	12.35%	18.79%	0%
930301	1	5,303	14.02%	20.67%	11.01%	18.91%	3.90%
930400	2	3,409	5.16%	11.44%	13.55%	23.42%	0%
930301	2	5,303	7.89%	10.09%	29.84%	23.94%	2.50%
930200	3	7,800	3.50%	17.08%	16.58%	23.13%	0.80%
Nelson County		44,564	9.10%	16.00%	12.80%	16.60%	1.00%

**LEP = Limited English Proficiency*

Natural Environment

An overview of the natural environment of the study area includes water resources (streams, floodplains, and wetlands), and a farmland overview. These were completed by KYTC Department of Environmental Analysis staff and provided as reports and/or figures for this study.

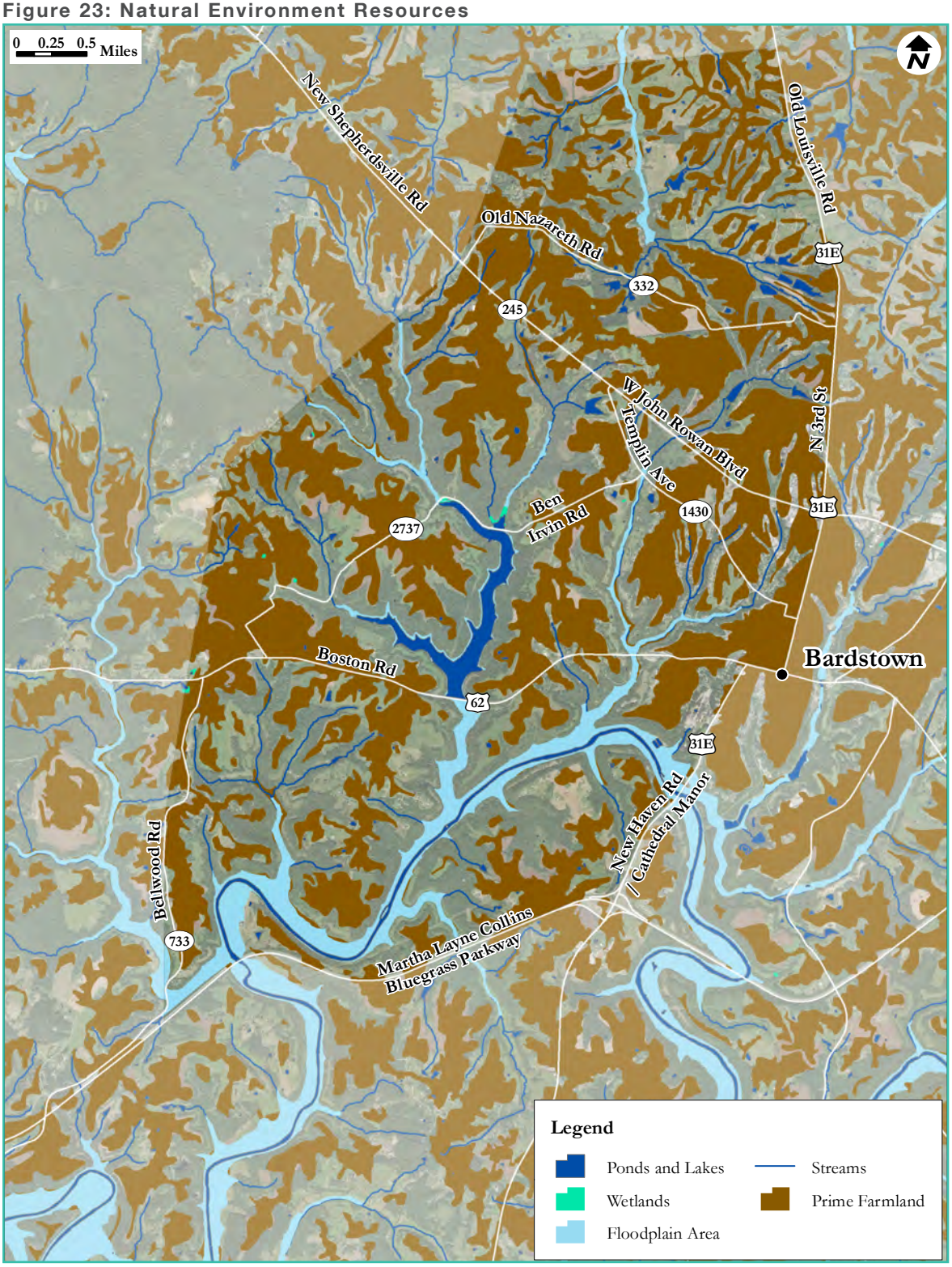
WATER RESOURCES

Water resources identified within the study area include wetlands, ponds, streams, and floodplains. This information was gathered using the National Wetlands Inventory (NWI) from the U.S. Fish and Wildlife Service and the United States Geological Survey (USGS). Features are identified in **Figure 23**. It should be noted that wetlands mainly occur where there are ponds and lakes. Therefore, these features are shown as overlapping on the Natural Environment Resources map.

PRIME FARMLAND

Prime farmland was identified within the study area using USDA Natural Resources Conservation Service (NRCS) Web Soil Survey data. An overview map of these locations can be seen in **Figure 23**.

Figure 23: Natural Environment Resources

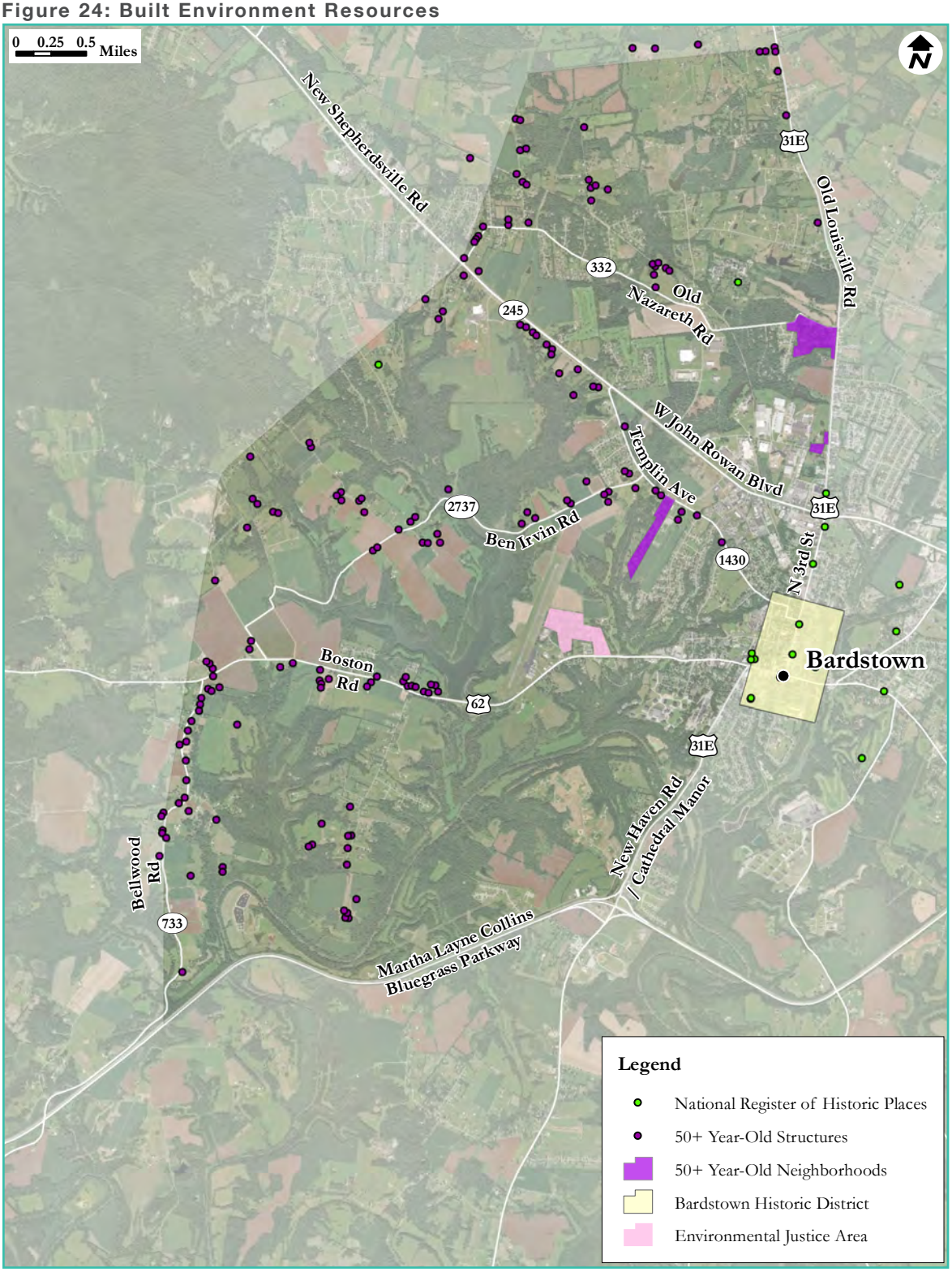


Built Environment

HISTORIC RESOURCES

As stated in the beginning of this report, Bardstown is the second-oldest city and Nelson county is the fourth-oldest county in Kentucky. Consequently, the study area has enduring history and many historic resources. **Figure 24** presents an overview of the historic resources in the study area, including structures listed on the National Register of Historic Places (NRHP), the Bardstown Historic District, structures and neighborhoods greater than 50 years old. Sites found through an archaeological survey have been identified through the study process but are not shown in this documentation due to sensitivity of information. Through early identification it is possible to avoid impacts to these features or at a minimum understand what impacts are to evaluate mitigation measures.

Figure 24: Built Environment Resources



CHAPTER 5 — DRAFT PURPOSE AND NEED

According to the Federal Highway Administration (FHWA), the purpose and need of a project is essential in establishing a basis for the development of the range of reasonable alternative and assist with the identification and eventual selection of a preferred alternative. This important step helps ensure that potential alternatives are focused, efficient, practical, and best serve the transportation needs of the study area. The purpose and need of this project were molded over the course of the study to reflect changing needs as discovered through technical evaluation and public engagement. Drafts of the purpose and need were presented to the project team and the public throughout the study with the refined version presented in this report.

PURPOSE

To improve transportation network connectivity to the west of Bardstown and reduce congestion as well as improve safety by reducing crash rates in the downtown area.

NEED

The City of Bardstown has experienced growth in vehicular traffic and local truck traffic that affects safety and mobility within the study area. The project need is revealed in deficiencies of system linkage, capacity, and safety.

System Linkage: There are few north-to-south routes in western Bardstown that provide an alternative to traveling through downtown for passenger car and local freight traffic. The existing route (KY 2737) exhibits poor horizontal and vertical geometry. An analysis of future land use by the Joint City-County Planning Commission of Nelson County (JCCPC) determined that at least 800 acres of industrial land will be required to provide employment for the population over the next 50 years. Existing locations along US 62 and KY 245 do not currently have access to transportation infrastructure capable of supporting this growth.

Capacity: Congestion is already prevalent in the study area, and traffic forecasts suggest that volumes will continue to increase in downtown Bardstown. Additionally, local and regional truck traffic will shift due to the relocation of a nearby quarry, asphalt plant, and concrete plant and may increase if the industrial growth cited in the Nelson County Land Use Plan is realized.

Specific areas of concern include:

- US 31E (North Third Street) between KY 1430 (Templin Avenue) and KY 245 (John Rowan Boulevard) operates at LOS E in the current year (2017).
- US 62 (Stephen Foster Avenue) between Elm Grove Street and US 31E (Cathedral Road) operates at LOS E in the current year (2017).
- The initial traffic forecast completed in July 2017 shows No-Build ADT on KY 245 (John Rowan Boulevard) between US 62 (Bloomfield Road) and US 31E (North Third Street) increasing from 29,900 vehicles per day to 37,600 vehicles per day in 2040. Under the build scenario, volumes increase to 42,000 vehicles per day in 2040. As such, this forecast suggests that congestion at the intersection of KY 245 (John Rowan Boulevard) and US 31E (North Third Street) will continue to increase.

Safety: Multiple high crash locations have been identified in the study area through safety analysis, including:

- East Beall Street at US 31E (North Third Street)
- KY 245 (John Rowan Boulevard) at US 31E (North Third Street)
- US 31E (North Third Street) at US 62 (Stephen Foster Avenue)
- The segment of US 31E from US 62 (Stephen Foster Avenue) to KY 245 (John Rowan Boulevard)

GOALS AND OBJECTIVES

To support the purpose and need of this project, a chief goal and objective was identified:

PROVIDE IMPROVEMENT ALTERNATIVES THAT MINIMIZE IMPACTS TO THE NATURAL AND BUILT ENVIRONMENT.

CHAPTER 6 — PHASE I PUBLIC ENGAGEMENT

The public, stakeholders, and local officials have had varied opinions on what the vision of transportation to the west of Bardstown should be. It was determined by the project team that public engagement would be a critical factor in determining the vision of transportation in the study area. Each round of public engagement included a meeting with local officials and stakeholders, a wide scale meeting notification mailing, an open-house public meeting, and an online survey. This multifaceted approach allowed for a wide range of feedback to be gathered and combined with technical analysis and evaluation when developing potential improvement options.

Project Team Meeting No. 1

The first project team meeting took place on February 13, 2018, at which representatives from KYTC, the LTADD, and the consultant primarily discussed findings from the existing conditions analysis and outlined the next steps in the study process to prepare for the first phase of public engagement. Key action items included the development of a final Public Engagement Plan (PEP), preparation of materials for the first public meeting, and establishment of alternatives development procedures. More details from the meeting can be found in **Appendix E**. The Public Engagement Plan is found in **Appendix F**.

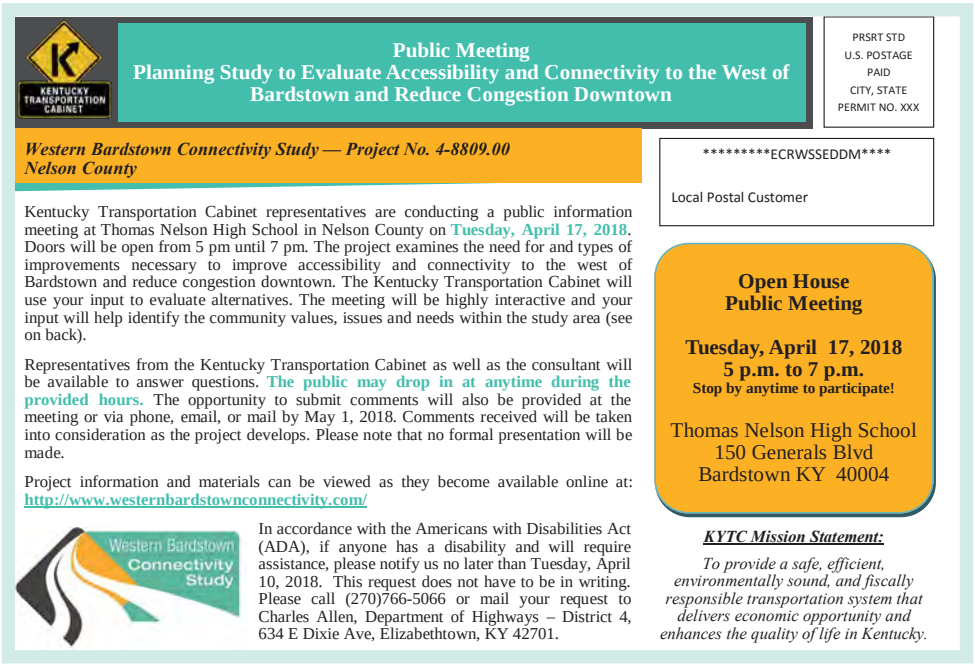
Local Officials and Stakeholders Meeting No. 1

Local officials/stakeholders (LO/S) meetings were held to provide a more targeted approach to help inform the process and encourage public participation. The attendee list was prepared by the LTADD and included local elected officials and stakeholders from the study area, including representatives from various jurisdictions, the local fire department, the local police department, EMS, local schools, and major employers in Bardstown and Nelson County. These local officials and stakeholders were invited to attend a meeting to introduce them to the study, discuss known issues, receive feedback about the project's purpose and need, begin the identification of potential improvements, and preview the public meeting to follow later that day.

The first LO/S meeting was held on April 17, 2018 at the Nelson County Civic Center and attended by 63 local officials and stakeholders. At the meeting, concerns were raised, questions were answered, and a feedback-seeking set of interactive activities were performed as a preview to the public meeting. More details from the meeting can be found in **Appendix F**.

Public Meeting No. 1

The first public meeting for the *Western Bardstown Connectivity Study* was held from 5 PM to 7 PM on April 17, 2018 and drew **241 people** to Thomas Nelson High School in west Nelson County to learn about the project and provide feedback. With a desire to focus on community feedback, the project team was intentional in ensuring the meeting was well-advertised by mailing a postcard to residents of western Bardstown (4,721 mailings) as well as using the local newspaper, Facebook, and variable message signs placed throughout Bardstown.



KENTUCKY TRANSPORTATION CABINET

Public Meeting
Planning Study to Evaluate Accessibility and Connectivity to the West of Bardstown and Reduce Congestion Downtown

PRSRT STD
U.S. POSTAGE
PAID
CITY, STATE
PERMIT NO. XXX

Western Bardstown Connectivity Study — Project No. 4-8809.00
Nelson County

*********ECRWSSEDDM****

Local Postal Customer

Kentucky Transportation Cabinet representatives are conducting a public information meeting at Thomas Nelson High School in Nelson County on **Tuesday, April 17, 2018**. Doors will be open from 5 pm until 7 pm. The project examines the need for and types of improvements necessary to improve accessibility and connectivity to the west of Bardstown and reduce congestion downtown. The Kentucky Transportation Cabinet will use your input to evaluate alternatives. The meeting will be highly interactive and your input will help identify the community values, issues and needs within the study area (see on back).

Representatives from the Kentucky Transportation Cabinet as well as the consultant will be available to answer questions. **The public may drop in at anytime during the provided hours.** The opportunity to submit comments will also be provided at the meeting or via phone, email, or mail by May 1, 2018. Comments received will be taken into consideration as the project develops. Please note that no formal presentation will be made.

Project information and materials can be viewed as they become available online at: http://www.westernbardstownconnectivity.com/

Open House
Public Meeting

Tuesday, April 17, 2018
5 p.m. to 7 p.m.
Stop by anytime to participate!

Thomas Nelson High School
150 Generals Blvd
Bardstown KY 40004

Western Bardstown Connectivity Study

In accordance with the Americans with Disabilities Act (ADA), if anyone has a disability and will require assistance, please notify us no later than Tuesday, April 10, 2018. This request does not have to be in writing. Please call (270)766-5066 or mail your request to Charles Allen, Department of Highways – District 4, 634 E Dixie Ave, Elizabethtown, KY 42701.

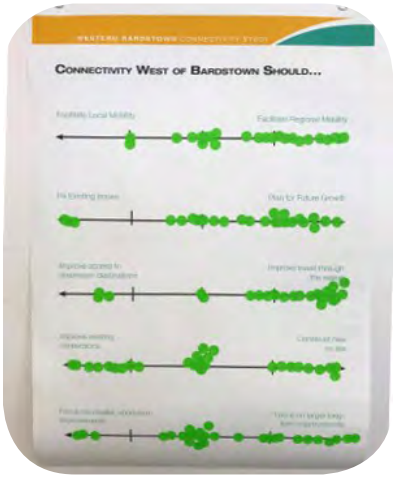
KYTC Mission Statement:

To provide a safe, efficient, environmentally sound, and fiscally responsible transportation system that delivers economic opportunity and enhances the quality of life in Kentucky.

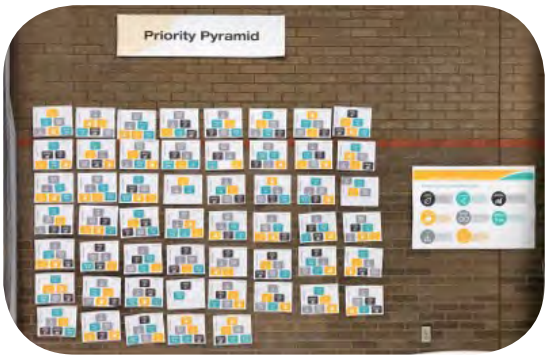
The public meeting was highly interactive and included a series of drop-in workshop stations designed to provide information to attendees and collect their feedback about various transportation needs and concerns in the study area. Through interactive exercise stations, 750 data points were collected and analyzed. The objectives of the meeting were to identify community values, educate the public on constraints and opportunities associated with connectivity in the study area, and gather feedback on potential tradeoffs. Activities at the meeting included:

» **One Word** – A simple activity that asked participants to describe transportation in the study area today in one word and their ideal vision for the study area in one word to gather broad views on the community's perception of the study area and their vision for its future.

» **Thought Wall** – An exercise allowing participants to provide open-ended feedback about the study area.



» **Tradeoffs** – An activity that introduced various tradeoffs to participants and tasked them to decide what they felt was most important.



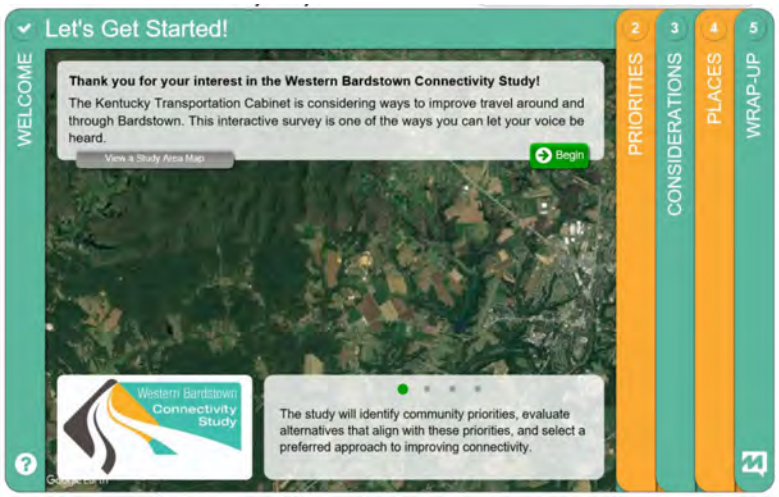
» **Priority Pyramid** – An activity that allowed participants to rank the transportation values they deem the most important from categories, such as safety, congestion, or minimizing disruptions.

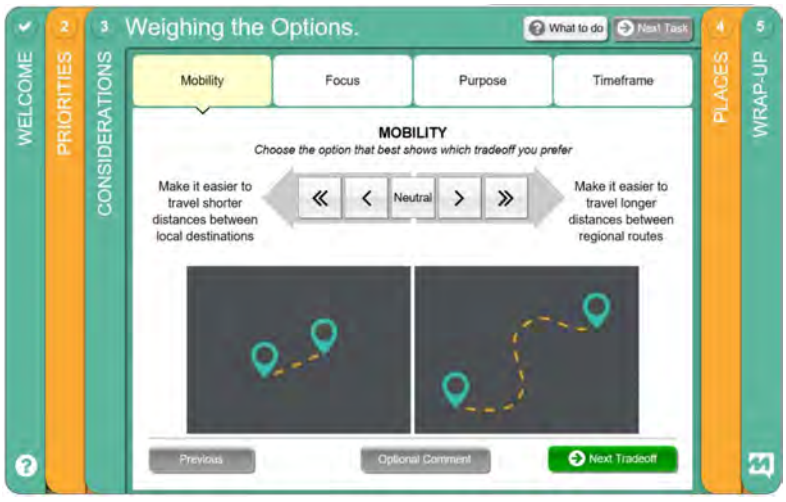
» **MetroQuest** – A station to showcase an online survey made for the project.

» **Strong Places/Weak Places** – An activity that let participants place markers to reflect areas of strength or weakness in the study area, such as community assets or dangerous locations and provide optional comments.

» **Information Wall** – A station with a scrolling presentation that helped explain the project and inform the participants of the existing conditions of the study area to better prepare them for input.

An online survey through MetroQuest was available that was meant to mimic activities at the public meeting. This provided an additional opportunity to participate in the study for those that were unable to attend the public meeting. It included five screens that took participants through various activities to seek the same types of input gathered from the public meeting and get suggestions on how to improve the public input process. The first survey had 357 participants during a two-week window.





Feedback collected through the public meeting and the online survey was combined with information received from the LO/S meeting to help guide the initial phase of the planning process.

Common themes among the individual thoughts included the following:

- Expanding the road network by connecting important corridors.
- Preserving the natural resources in the area, including the rural atmosphere and water resources.
- Reducing congestion from recent growth and development along key corridors.
- Minimizing the disruptions to properties in the study area.
- Improving safety wherever possible for traffic, school zones, and bicycle/pedestrian facilities.

Furthermore, public input throughout the study deemed several locations to have safety concerns in some way.

- The US 31E (Cathedral Manor) and US 62 (Stephen Foster Avenue) intersection was highlighted as a safety concern, due to a lack of signalization and limited sight distance. In the past three years, 103 crashes have occurred at this location, seven of which resulted in injuries.
- The KY 332 and KY 245 intersection was identified as not having sufficient opportunity with the current traffic control for left-turning traffic. Safety analysis revealed a high frequency of rear-end crashes at this location.
- Local freight traffic was mentioned as a safety concern both downtown and on KY 2737, given limited connectivity between major employers and truck routes.
- Pedestrian safety in the downtown area and in school zones was said to be a concern due to heavy traffic.

A detailed summary of the first phase of public involvement and results is provided in **Appendix E** for reference.

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CHAPTER 7 — DEVELOPMENT AND EVALUATION OF ALTERNATIVES

This chapter serves as a summary of the alternatives development process, during which initial segments were developed, evaluated, and reduced to a set of four corridors. Existing conditions analysis, public input, and coordination with local officials and stakeholders informed and guided the development and evaluation of segments for the study.

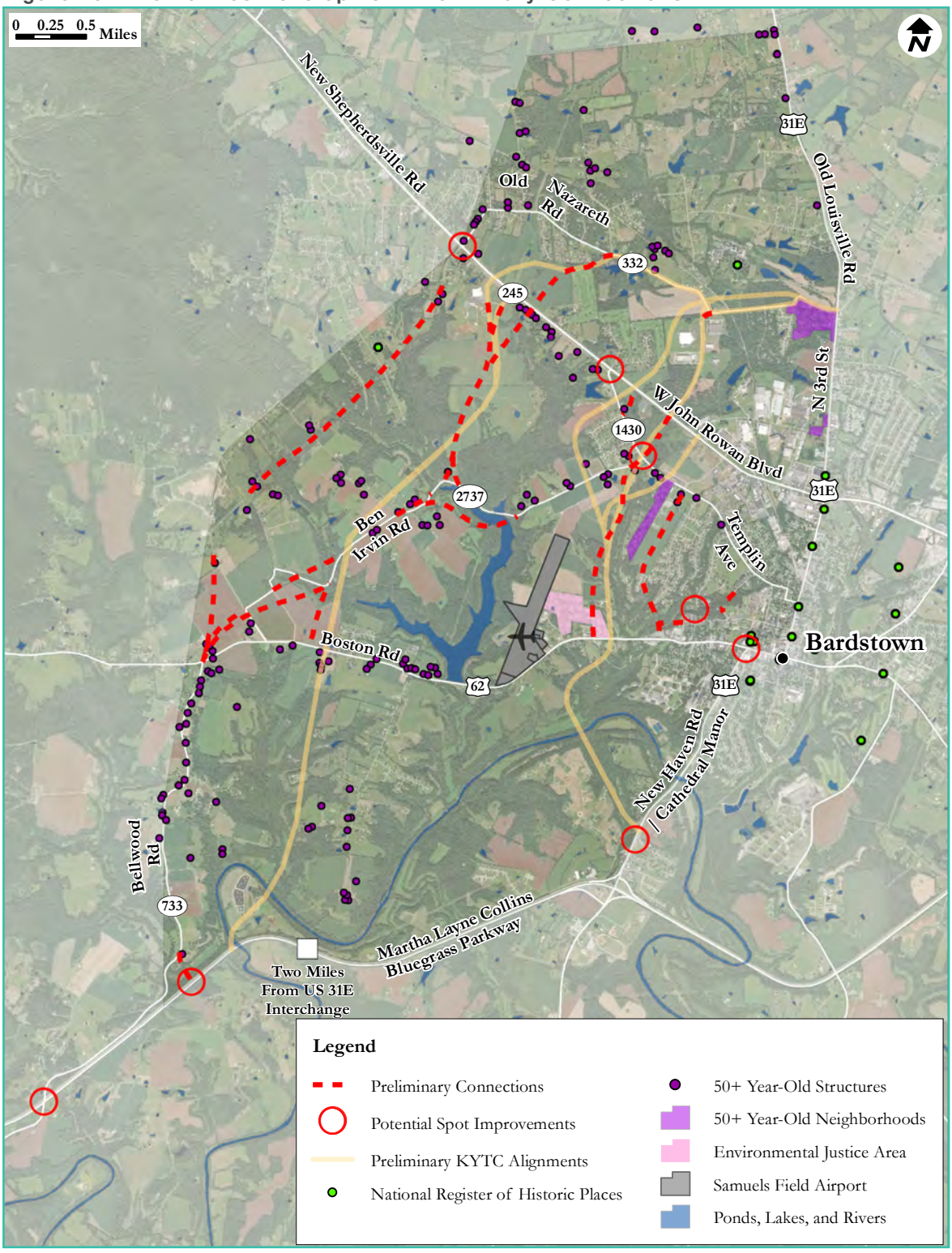
PRELIMINARY CONNECTIONS

To reach the ultimate goal of delivering a set of refined transportation alternatives, a series of individual connections were initially created to serve as a base for analysis and evaluation. These connections were developed with the intention of serving two purposes: (1) providing local connectivity and short-term improvement to safety and operations and (2) providing regional connectivity to the west of Bardstown and addressing the long-term purpose and need of the project.

The community's vision was heard through the public meeting and online survey and was a significant factor in defining the goals of these connections. The public prioritized key transportation values (e.g., safety, connectivity, minimizing disruptions) and, through the Strong Places/Weak Places activity, provided the location of community assets, traffic concerns, and areas to be avoided when developing alternatives.

This feedback was considered as the preliminary connections were developed. Technical knowledge of existing conditions, such as locations of historic resources, water resources, environmental justice areas, and the Samuels Field Airport, was considered and placed on the map before developing the initial connections. Conceptual corridors from previous planning efforts also were placed on the map for the initial alternative development. Overall, application of design standards was required and considered to develop the initial set of connections. As an example, this ensured that the required interchange spacing for urban areas (1 mile) and rural areas (2 miles) was applied for the new connection to the Bluegrass Parkway. The preliminary connections development is shown in **Figure 25**.

Figure 25: Alternatives Development Preliminary Connections



Project Team Meeting No. 2

After the first phase of public involvement and development of initial alternatives, a second project team meeting was held on June 4, 2018 to review the results of the public meeting and online survey and see how the results translated to the initial connection development. Agenda items included an overview of Public Meeting No. 1, MetroQuest online survey phase 1, LO/S Meeting No. 1, festival participation, and alternatives development. More details from the meeting can be found in **Appendix E**.

At the team meeting, it was noted that there was a large turnout at the LO/S meeting. The community's interest and participation show what an important project this is for them. However, the ability to have interaction and dialogue with the group declines with the higher attendance. To help further understand community needs and work with the JCCPC of Nelson County, the project team decided to meet directly with the JCCPC of Nelson County prior to the next project team meeting.

JOINT CITY-COUNTY PLANNING COMMISSION OF NELSON COUNTY MEETING

Project team leads met with the director and planning commission members of the Joint City-County Planning Commission (JCCPC) of Nelson County on July 10, 2018 to answer questions about the study and gather input from the county perspective. Objectives identified by the JCCPC were presented and discussed at the meeting which include:

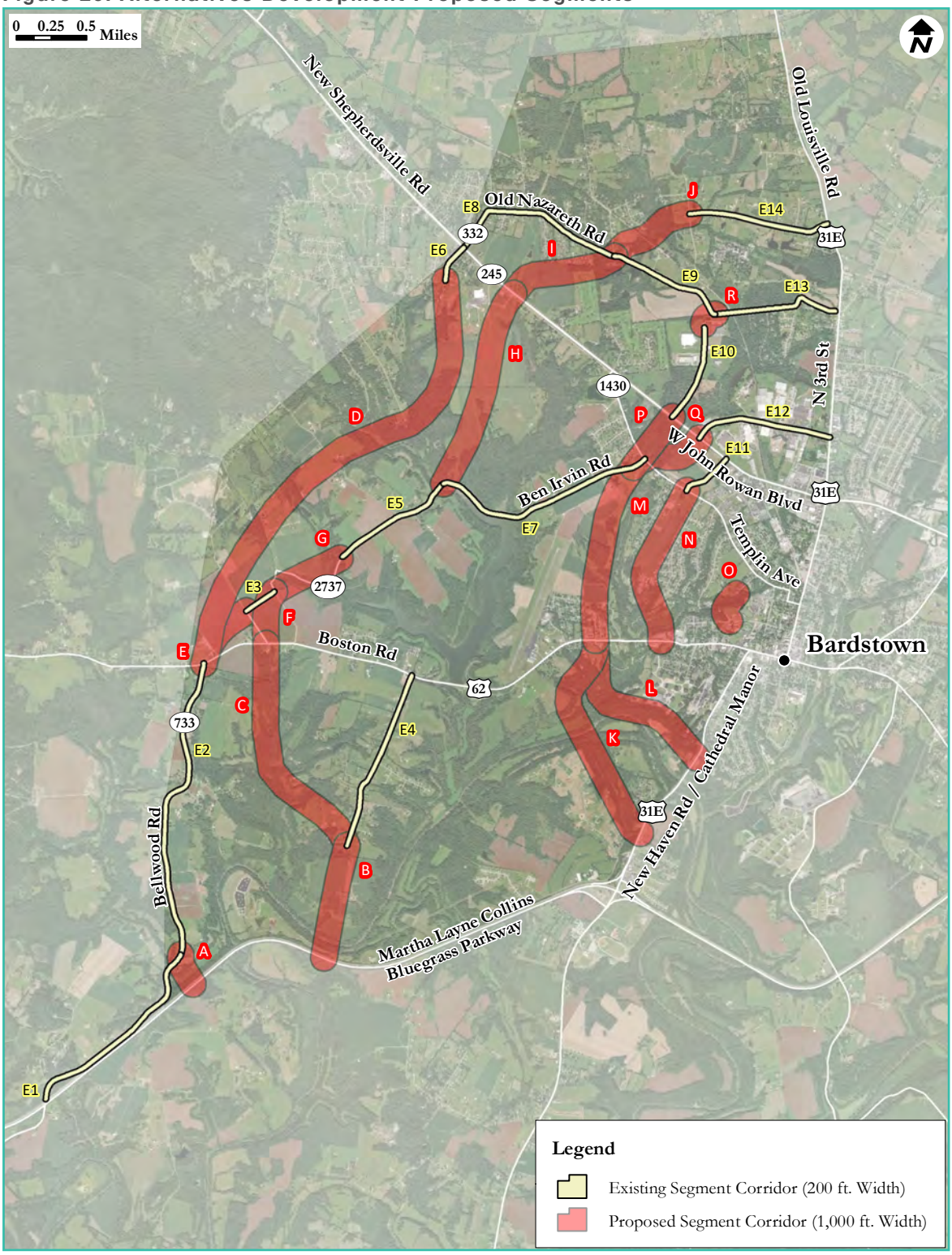
- Fuel economic growth
- Improve safety
- Reduce congestion
- Spend tax dollars wisely
- Preserve existing infrastructure

Focus was additionally centered on projected growth areas, including new school locations and industrial development parcels/locations. More details from the meeting can be found in **Appendix E**.

PROPOSED SEGMENTS

The preliminary connections were revised based on additional review and evaluation from the previously held meetings. This included adding another northern connection from KY 245 to US 31E and another southern connection from US 62 to US 31E. These preliminary segments were combined with existing roadway segments to produce a total of 32 segments—18 new and 14 along existing roadways. Each segment was given a label to assist with segment evaluation. **Figure 26** shows the identified segments.

Figure 26: Alternatives Development Proposed Segments



Segment Evaluation

The 32 proposed segments were evaluated using both qualitative and quantitative metrics. Each new segment was assigned a letter (A through R, from south to north) as an evaluation identification. The existing roadway segments were given the prefix E (Existing) with an assigned number (again, from south to north) for identification purposes. While the final design may include areas outside of those specified by these segments, it was necessary to provide enough detail to perform technical evaluations. Since this is a planning-level study, potential new segments were examined using a 1,000-foot buffer—500 feet on either side of the centerline—to ensure potential impacts were fully realized and allow for flexibility during the design phase. Segments along existing roadways were analyzed using a 200-foot buffer—100 feet on either side of the centerline—because if they are selected to be used in a new corridor, their impacts will likely not extend much beyond the existing footprint. Such segments were selected to minimize construction costs where possible and provide improvements to roadways that currently exhibit poor horizontal and vertical geometry.

Segment characteristics were evaluated by their impact to the natural and built environments as well as benefits to traffic and community assets. These impacts and benefits were quantified where features intersected with the buffers mentioned previously. Based on the outcome of this analysis, segments were scored in each impact and benefit category and ranked against the remaining segments. A brief description of each evaluation category is provided.

NATURAL ENVIRONMENT IMPACTS

Existing natural resources were analyzed for each segment, including wetlands, streams, ponds, lakes, floodplains, and prime farmland. **Table 7** lists the specific impacts and **Table 8** provides a comparative ranking.

Table 7: Natural Environment Impacts

Category	Eval. ID	Segment Length (mi.)	Wetland Area (acres)	Length of Streams Impacted (LF)	Ponds/ Lakes Impacted (acres)	Floodplain Area (acres)	Prime Farmland Impacted (acres)
Proposed Segments	A	0.2	1.0	1,088	-	10.8	9.7
	B	0.8	5.0	1,445	3.7	18.9	62.9
	C	1.7	4.8	7,968	1	2.1	58.8
	D	3.5	8.3	8,809	2.2	7.1	242.8
	E	0.5	0.6	-	0.1	-	66.4
	F	0.4	0.1	275	-	-	50.5
	G	0.5	0.8	1,082	0.1	-	29.8
	H	1.5	3.9	2,830	1.9	5.1	118.7
	I	0.8	5.8	3,166	2.9	-	54.2

Table 7: Natural Environment Impacts (Cont'd.)

Category	Eval. ID	Segment Length (mi.)	Wetland Area (acres)	Length of Streams Impacted (LF)	Ponds/ Lakes Impacted (acres)	Floodplain Area (acres)	Prime Farmland Impacted (acres)
Proposed Segments	J	0.6	7.0	5,753	3.3	3.3	26.3
	K	1.6	6.9	7,643	2.9	27.1	51.4
	L	1.2	9.5	4,790	5.3	42.9	45.3
	M	1.3	1.9	656	0.9	1.4	75.4
	N	1.2	1.3	1,098	-	3.1	101.1
	O	0.2	0.7	1,666	-	3.3	16.3
	P	0.5	2.1	3,669	-	3.2	7.1
	Q	0.5	0.9	1,632	0.1	2.8	29.1
	R	0.1	-	-	0.1	-	22.3
Existing Connections and Improvements	E1	1.5	0.6	1,092	-	4.6	0.3
	E2	2.2	0.4	-	0.2	-	27.7
	E3	0.2	-	-	-	-	6.6
	E4	1.3	0.3	-	0.1	-	27.9
	E5	0.9	0.5	223	0	1.1	10.1
	E6	0.3	0.5	1,007	-	-	0.9
	E7	1.6	7.9	685	3.4	7.5	13.1
	E8	1.3	0.5	331	0.1	-	14.4
	E9	0.9	1.1	998	0.6	-	14.7
	E10	0.7	-	-	-	-	9.9
	E11	0.4	-	-	-	-	7.9
	E12	1.0	-	-	-	-	19.4
	E13	0.9	-	-	-	-	18
	E14	1.0	0.1	515	-	-	11.4

Table 8: Natural Environment Impact Ranking*

ID	Wetland Area	Stream Length	Ponds/Lakes	Floodplain Area	Prime Farmland	Total	Overall Rank
F	2	4	1	1	17	25	1
G	6	8	6	1	7	28	2
E	4	1	7	1	16	29	3
M	5	3	11	6	8	33	4
N	3	5	1	9	15	33	4
R	1	1	12	1	18	33	4
C	10	14	9	7	3	43	7
D	8	9	10	8	11	46	8
P	14	17	1	13	1	46	8
Q	7	10	8	12	9	46	8
A	12	13	1	18	6	50	11
H	9	7	13	10	14	53	12
I	16	12	15	1	10	54	13
O	11	16	1	14	12	54	13
K	13	15	14	15	2	59	15
L	17	11	16	17	4	65	16
B	15	6	17	16	13	67	17
J	18	18	18	11	5	70	18

**1 = least impact, 18 = highest impact*

BUILT ENVIRONMENT IMPACTS

The existing built environment resources presented earlier were analyzed by comparing potential impacts to historic structures, historic neighborhoods, environmental justice areas, land parcels, major employers, and other community interests, such as schools, parks, and hospitals. **Table 9** lists the specific impacts and **Table 10** provides a comparative ranking. Archaeological impacts were assessed but are not presented in this table due to the sensitivity of this information.

Table 9: Built Environment Impacts and Benefits

Category	Eval. ID	Seg. Length (mi.)	Potential Historic Structures Impacted[1]	Historic Neighborhood Area Impacted (acres)	Environmental Justice Area Impacted (acres)	Land Parcels Impacted	Major Employers Within Corridor (# Employees)[2]	Other Community Interests Within Corridor[2]
Proposed Segments	A	0.2	1	-	-	9	-	-
	B	0.8	5	-	-	15	-	-
	C	1.7	4	-	-	32	-	-
	D	3.5	9	-	-	68	-	1
	E	0.5	5	-	-	17	-	-
	F	0.4	-	-	-	11	-	-
	G	0.5	-	-	-	11	-	-
	H	1.5	1	-	-	14	-	1
	I	0.8	-	-	-	38	-	2
	J	0.6	1	-	-	35	-	-
	K	1.6	-	-	4.4	84	-	2
	L	1.2	-	-	4.4	48	1 (392)	3
	M	1.3	3	-	18.7	79	-	2
	N	1.2	2	1.6	-	104	-	3
	O	0.2	-	-	-	35	-	5
	P	0.5	3	-	-	15	-	-
	Q	0.5	-	-	-	14	-	2
	R	0.1	-	-	-	15	2 (344)	-

Table 9: Built Environment Impacts and Benefits (Cont'd.)

Category	Eval. ID	Seg. Length (mi.)	Potential Historic Structures Impacted[1]	Historic Neighborhood Area Impacted (acres)	Environmental Justice Area Impacted (acres)	Land Parcels Impacted	Major Employers Within Corridor (# Employees)[2]	Other Community Interests Within Corridor[2]
Existing Connections and Improvements	E1	1.5	1	-	-	25	-	-
	E2	2.2	3	-	-	71	-	1
	E3	0.2	3	-	-	4	-	-
	E4	1.3	2	-	-	77	-	-
	E5	0.9	2	-	-	17	-	-
	E6	0.3	1	-	-	25	-	-
	E7	1.6	4	-	-	27	-	-
	E8	1.3	2	-	-	65	-	-
	E9	0.9	3	-	-	28	-	-
	E10	0.7	2	-	-	12	4 (574)	-
	E11	0.4	1	-	-	10	-	-
	E12	1.0	1	2.3	-	31	6 (1092)	-
	E13	0.9	1	5.2	-	32	-	-
	E14	1.0	1	-	-	49	-	-

[1]All structures > 50 years old were considered.

[2]It was assumed that most local businesses and other community interests would benefit from the enhanced exposure or access provided by a new corridor.

Table 10: Built Environment Impact Ranking

ID	Potential Historic Structures	Historic Neighborhoods	Env. Justice Area	Archaeological Sites	Land Parcels	Total	Overall Rank
G	1	1	1	1	5	9	1
F	1	1	1	1	6	10	2
H	9	1	1	1	1	13	3
I	1	1	1	1	12	16	4
C	13	1	1	1	3	19	5
D	14	1	1	1	4	21	6
O	1	1	1	1	18	22	7
Q	1	1	1	15	7	25	8
J	10	1	1	1	14	27	9
P	17	1	1	1	8	28	10
A	15	1	1	1	11	29	11
E	18	1	1	1	9	30	12
B	16	1	1	16	2	36	13
R	1	1	1	18	17	38	14
K	1	1	16	14	13	45	15
L	1	1	17	17	10	46	16
M	12	1	18	12	15	58	17
N	11	18	1	13	16	59	18

COMMUNITY AND TRAFFIC BENEFITS

Analysis of community and traffic benefits included employers, community interests, travel speed, total intersecting average daily traffic (ADT), and future ADT. **Table 11** provides the specific information and **Table 12** provides the rankings.

Table 11: Traffic Impacts

Category	Eval. ID	Segment Length (mi.)	Estimated Travel Speed (mph)	Estimated Segment Travel Time (min.)	Intersecting Roadways (ADT)	Estimated Segment ADT (2040)
Proposed Segments	A	0.2	55	0.3	KY 733 (470), Bluegrass Pkwy. (12620)	3080 - 4220
	B	0.8	55	0.9	Hubbards Lane (N/A), Bluegrass Pkwy. (12620)	3080 - 4220
	C	1.7	55	1.8	Hubbards Ln. (N/A), KY 2737 (760), US 62 (3560)	3080 - 4220
	D	3.5	55	3.8	Stonehouse Rd. (N/A), KY 733 (470), US 62 (3560)	3080 - 4220
	E	0.5	55	0.6	KY 733 (470), KY 2737 (760), US 62 (2230)	3080 - 4220
	F	0.4	55	0.4	KY 2737 (760), US 62 (3560)	3080 - 4220

Table 11: Traffic Impacts (Cont'd.)

Category	Eval. ID	Segment Length (mi.)	Estimated Travel Speed (mph)	Estimated Segment Travel Time (min.)	Intersecting Roadways (ADT)	Estimated Segment ADT (2040)
Proposed Segments	G	0.5	55	0.6	Barnes Rd. (N/A), KY 2737 (760)	3080 - 4220
	H	1.5	55	1.6	KY 2737 (760), KY 245 (20860)	3080 - 4220
	I	0.8	55	0.9	KY 332 (1350), KY 245 (20860)	3080 - 4220
	J	0.6	55	0.7	KY 332 (1350), Abbey Ridge (N/A)	3080 - 4220
	K	1.6	45	2.1	US 62 (4580), US 31E (9850)	5380
	L	1.2	45	1.7	US 62 (4580), US 31E (9850)	5380
	M	1.3	45	1.7	KY 2737 (760), US 62 (4580)	5380
	N	1.2	45	1.6	US 62 (4580), KY 1430 (5520)	5380
	O	0.2	35	0.4	Hillcrest Dr. (N/A), West Broadway St. (N/A)	5380
	P	0.5	45	0.6	KY 2737 (760), KY 1430 (4650), KY 245 (23790)	5380
	Q	0.5	45	0.6	KY 2737 (760), KY 1430 (4650), KY 245 (23790)	5380
	R	0.1	35	0.2	Wilson Pkwy. (N/A), KY 332 (1250)	5380
Existing Connections and Improvements	E1	1.5	53	1.7	KY 733 (470), Bluegrass Pkwy. (12620)*	3080 - 4220
	E2	2.2	53	2.5	KY 733 (470), US 62 (3360)	3080 - 4220
	E3	0.2	51	0.3	KY 2737 (760)	3080 - 4220
	E4	1.3	35	2.2	US 62 (4580)	3080 - 4220
	E5	0.9	51	1.1	KY 2737 (760)	3080 - 4220
	E6	0.3	35	0.5	KY 332 (1350), KY 245 (20860)	3080 - 4220
	E7	1.6	51	1.9	KY 2737 (760), KY 1430 (4650)	3080 - 4220
	E8	1.3	32	2.5	KY 332 (1250), KY 245 (20860)	3080 - 4220
	E9	0.9	32	1.6	KY 332 (1250)	3080 - 4220
	E10	0.7	35	1.2	KY 245 (23790)	3080 - 4220
	E11	0.4	35	0.6	KY 1430 (5520), KY 245 (23790)	5380
	E12	1.0	35	1.7	US 31E (16130), KY 245 (23790)	5380
	E13	0.9	32	1.7	KY 332 (1250)	3080 - 4220
	E14	1.0	35	1.7	US 31E (8850)	3080 - 4220

**If a new interchange is built*

Table 12: Community and Traffic Benefits Ranking

ID	Employers	Community Interests	Travel Speed	Total Intersecting ADT	Estimated ADT	Total	Overall Rank
I	3	7	1	3	9	20	1
L	1	2	11	5	1	20	1
Q	3	3	11	1	1	20	1
K	3	3	11	5	1	24	4
H	3	7	1	4	9	25	5
N	3	3	11	9	1	26	6
P	3	10	11	1	1	26	6
A	3	10	1	7	9	30	8
M	3	3	11	11	1	30	8
B	3	10	1	8	9	31	10
O	3	1	17	9	1	31	10
C	3	10	1	12	9	35	12
D	3	7	1	14	9	35	12
F	3	10	1	12	9	35	12
E	3	10	1	15	9	38	15
J	3	10	1	16	9	39	16
G	3	10	1	18	9	41	17
R	2	10	17	17	1	47	18

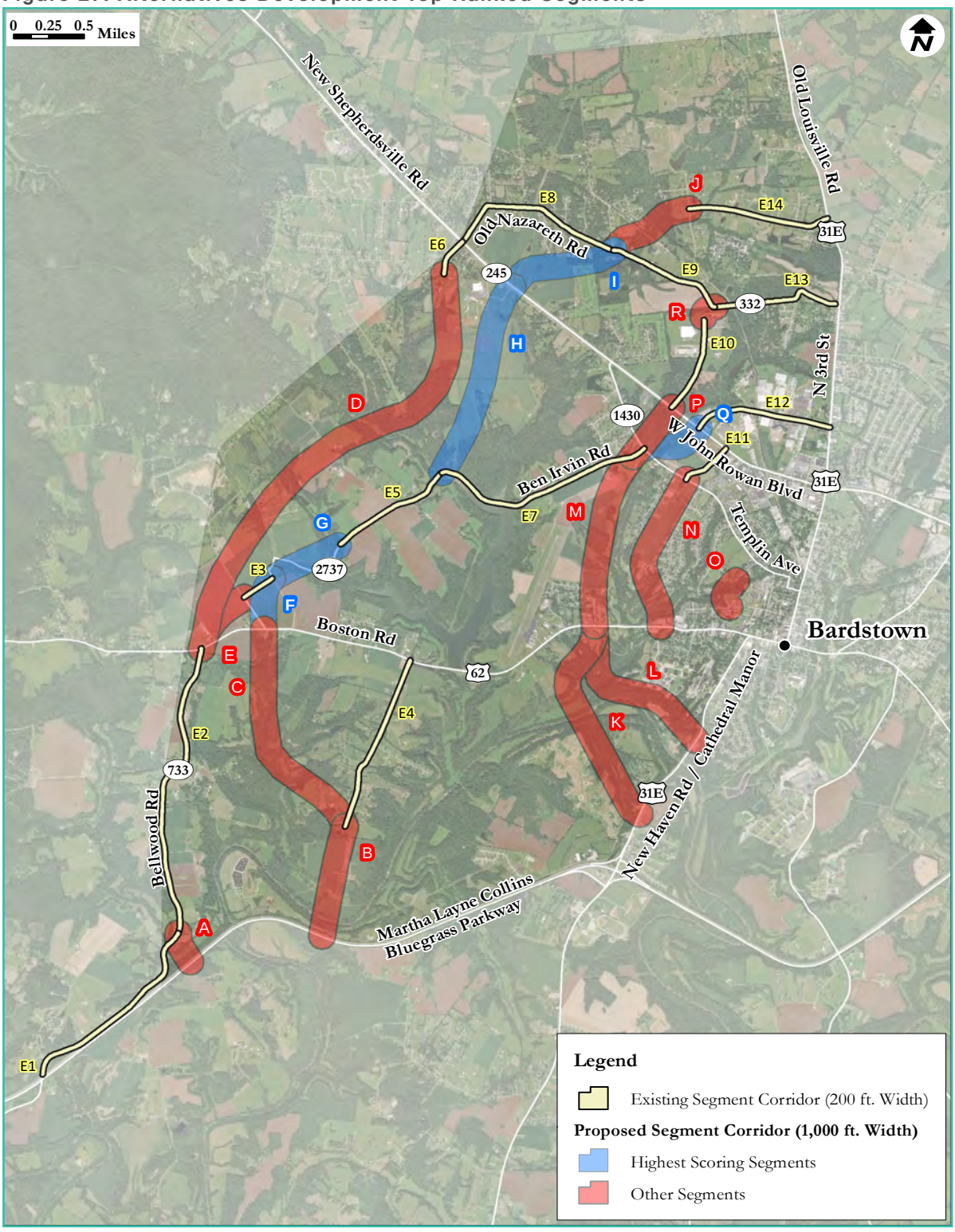
SUMMARY OF HIGHEST SCORING SEGMENTS

After performing the initial evaluations for each evaluation group, segment scores were averaged to provide a combined overall ranking. This ranking allowed for direct comparison between segments and facilitated refinement of these segments to full corridors. **Table 13** lists the summary of rankings and **Figure 27** depicts all segments with the top five highlighted.

Table 13: Summary Ranking of Segments

ID	Segment Length (mi.)	Natural Env. Impacts Ranking	Built Env. Impacts Ranking	Community and Traffic Benefits Ranking	Avg. Ranking
F	0.4	1	2	12	5.0
Q	0.5	8	8	1	5.7
I	0.8	13	4	1	6.0
G	0.5	2	1	17	6.7
H	1.5	12	3	5	6.7
C	1.7	7	5	12	8.0
P	0.5	8	10	6	8.0
D	3.5	8	6	12	8.7
N	1.2	4	18	6	9.3
M	1.3	4	17	8	9.7
A	0.2	11	11	8	10.0
E	0.5	3	12	15	10.0
O	0.2	13	7	10	10.0
L	1.2	16	16	1	11.0
K	1.6	15	15	4	11.3
R	0.1	4	14	18	12.0
B	0.8	17	13	10	13.3
J	0.6	18	9	16	14.3

Figure 27: Alternatives Development Top Ranked Segments



Preliminary Corridors

Proposed new and existing improvement segments were evaluated through the technical assessment described in the previous section, public feedback, and project team feedback and were combined to provide a collection of segments that leveraged the least impacts and most benefits to form a set of four preliminary corridors. These four corridors were selected to include short-term, lower-cost options that provide local connectivity and long-term, higher-cost solutions that provide regional connectivity while also alleviating existing safety and operations issues. Each corridor represents a different concept for transportation in western Bardstown based on the goals for the study outcomes.

The Aqua Corridor represents a regional connection in the outer portion of western Bardstown from Martha Layne Collins Bluegrass Parkway to US 31E to the north. The Yellow Corridor represents a local connection between US 62 and KY 245. It aligns with the Aqua Corridor from US 62 to KY 245..

The Orange Corridor represents a regional connection in western Bardstown closer to the city center from US 31E to the south, through US 62 and KY 245, and US 31E to the north. The Pink Corridor represents a local connection between US 62 and KY 245 that aligns for the most part with the inner segment of the Orange Corridor. **Figure 28** shows these four corridors in the context of the study area.

FUTURE TRAFFIC OPERATIONS

A future-year (2040) corridor traffic forecast was conducted by KYTC and incorporated into the evaluation process. The forecast projected traffic volumes and turning movements for each of the four corridor scenarios and allowed for analysis and comparison of traffic impacts, including intersection delay, travel time, and safety. Analysis scenarios included No-Build and the four build scenarios—Aqua, Yellow, Orange, and Pink.

Traffic Volumes and Operations

Traffic volumes for the year 2040 were projected by KYTC, building upon the initial Traffic Forecast Technical Report, July 2017 and the turning movement counts conducted for this study. The volumes were requested for each corridor in segments to assist with performing short- and long-term utility, travel time, and safety analyses for each corridor. Both segments and intersections were evaluated for each of the four corridors and the No-Build. The following six intersections were included that may be affected by the corridor alternatives:

- KY 245 at KY 1430
- US 31E at KY 245
- US 31E at KY 332
- US 31E at Bluegrass Parkway EB Ramp
- US 31E at Bluegrass Parkway WB Ramp
- US 31E at US 62

The 2040 turning movement forecasts were used to analyze traffic operations at each of these intersections using methods from the Highway Capacity Manual (HCM). Signal timings were optimized for these future scenarios with the assumption that signal timing changes would be made to account for future traffic conditions. The following maps and table (**Figures 29-30 and Table 14**) show projected corridor volumes and highlight operational differences between each corridor option. For further detail, see the *Traffic Forecast Technical Report, January 2019* in **Appendix C**.

Figure 28: Alternatives Development Preliminary Corridors

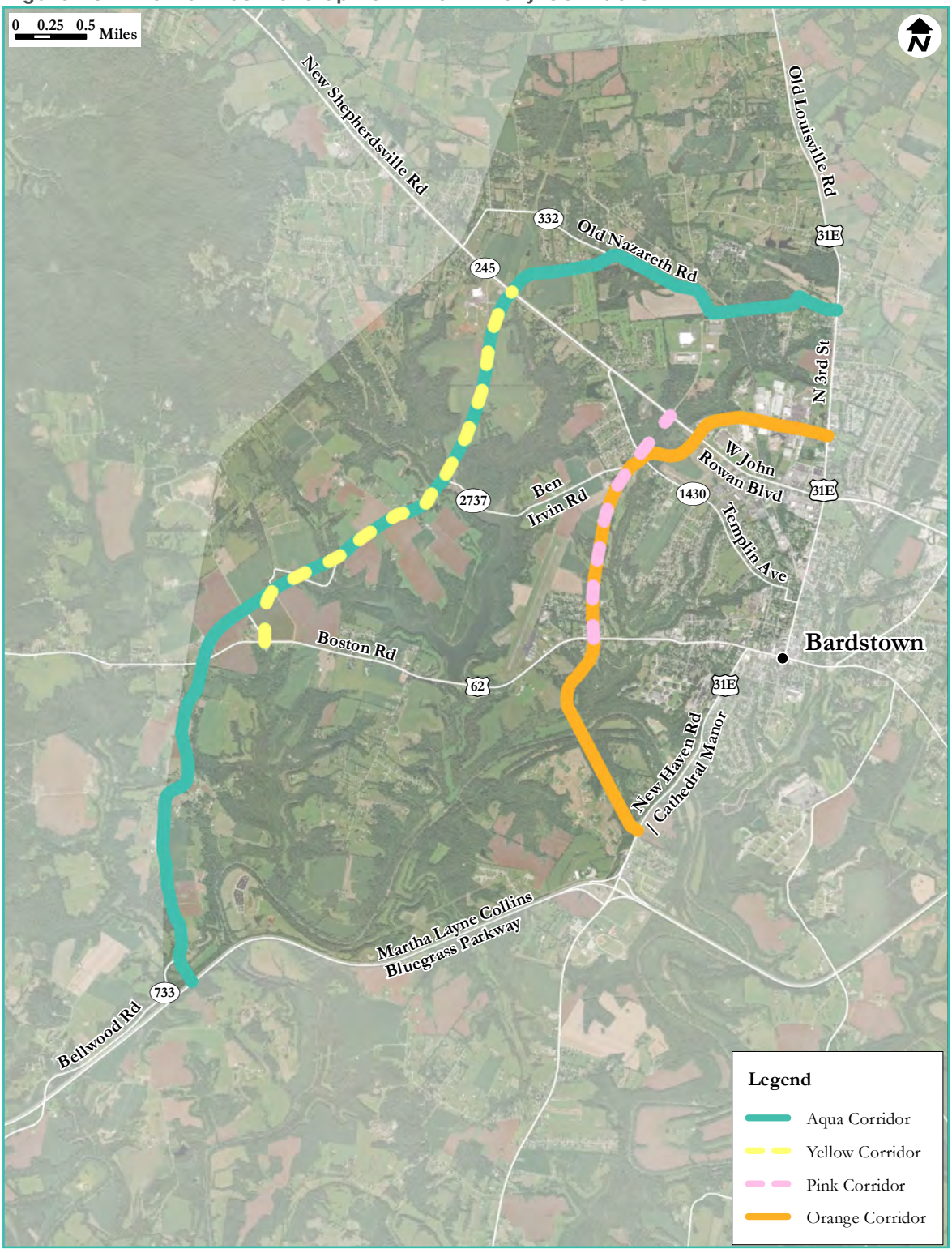


Figure 29: 2040 Traffic Forecast Volumes and AM Peak Period Operations

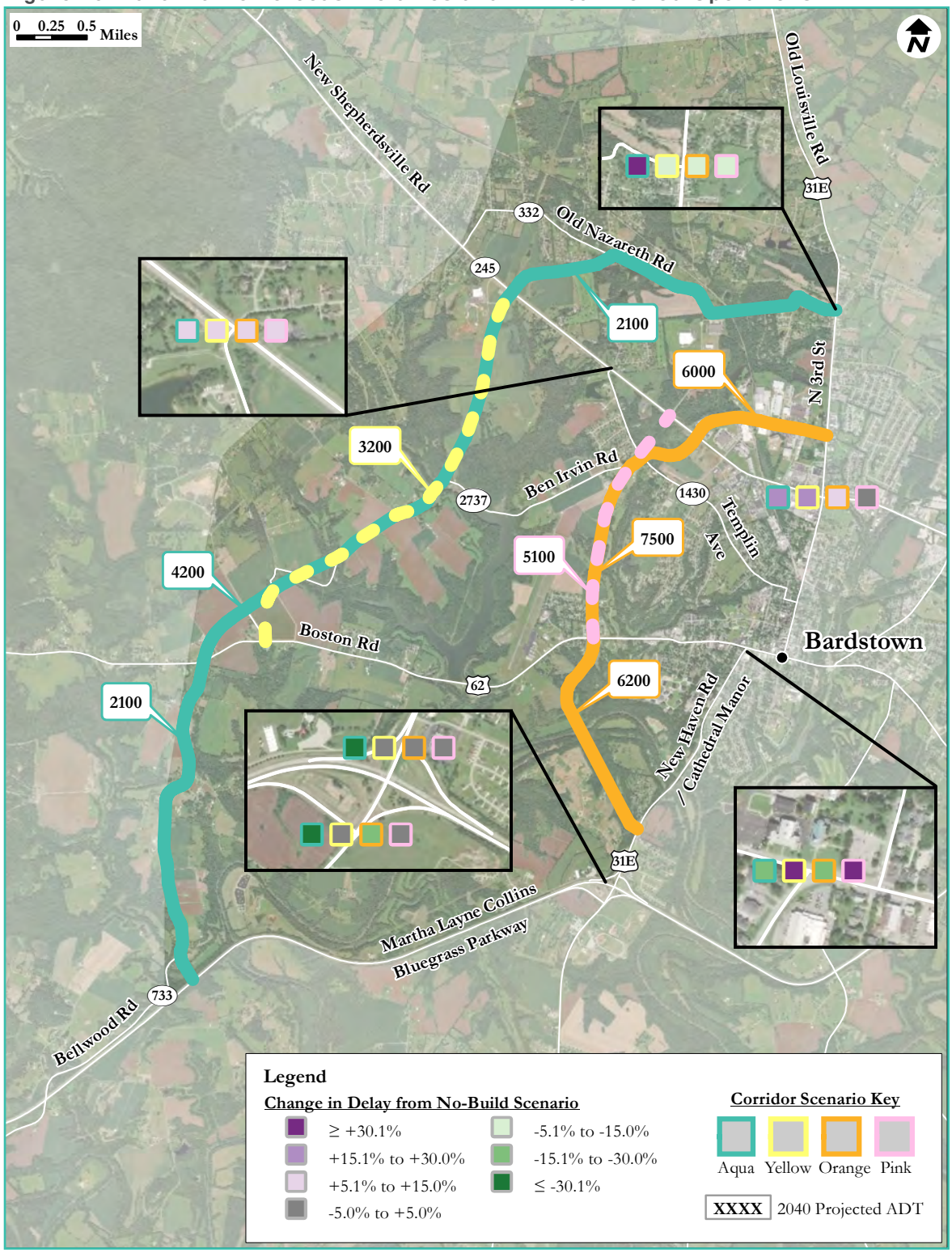


Figure 30: 2040 Traffic Forecast Volumes and PM Peak Period Operations

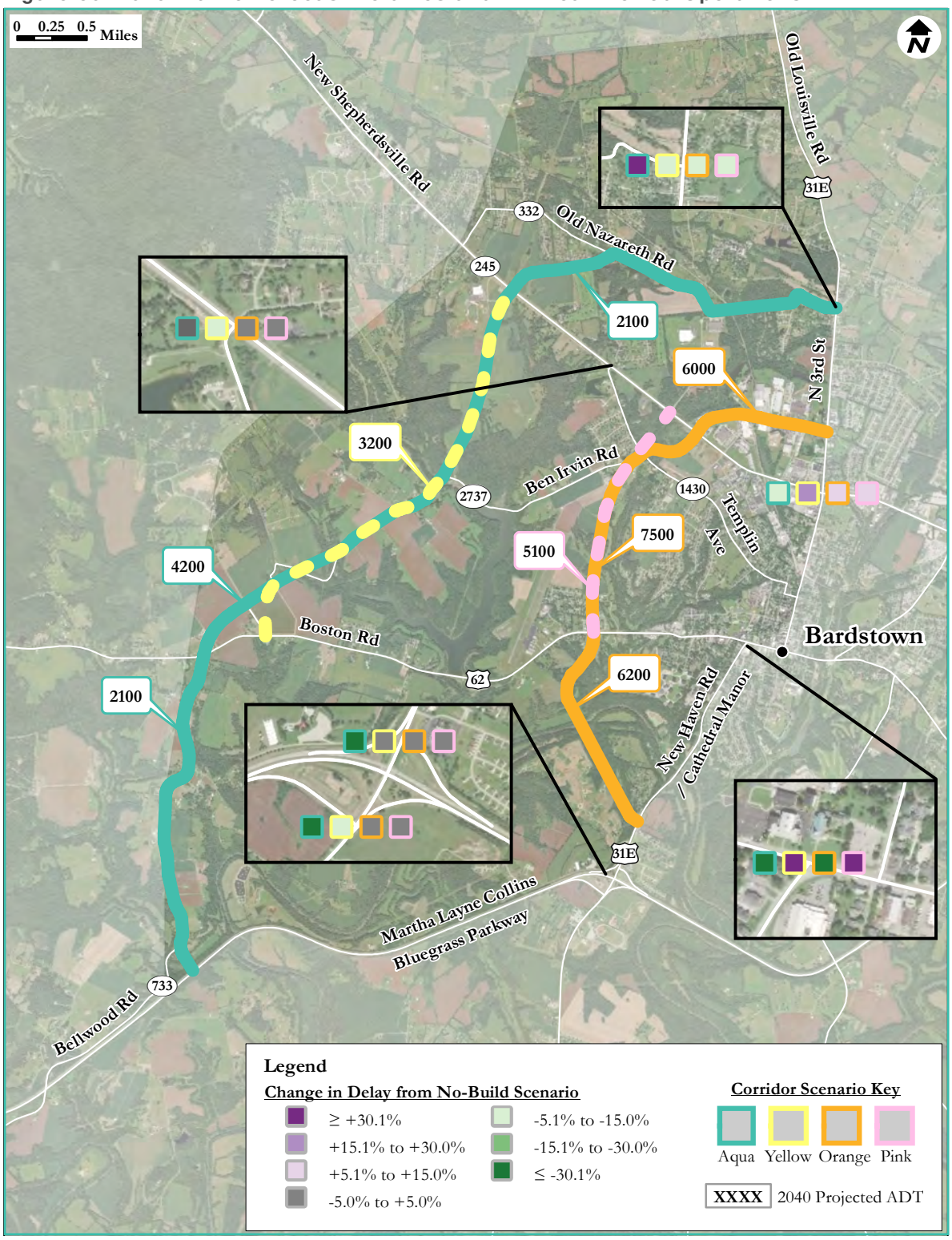


Table 14: Corridor Traffic Operations Summary

Intersection	Peak Hour	2040 Corridor Scenario Approach LOS and Intersection LOS (delay in seconds)				
		No-Build	Aqua	Yellow	Orange	Pink
KY 245 at KY 1430	AM	Approach: EB – C (22.1) WB – C (28.9) NB – B (14.6) SB – B (13.8) Int. – B (15.8)	Approach: EB – C (22.4) WB – C (29.1) NB – B (16.1) SB – B (14.2) Int. – B (16.6)	Approach: EB – C (22.1) WB – C (29.0) NB – B (17.4) SB – B (15.7) Int. – B (17.7)	Approach: EB – C (22.1) WB – C (28.9) NB – B (17.6) SB – B (14.1) Int. – B (17.1)	Approach: EB – C (22.1) WB – C (30.4) NB – B (16.9) SB – B (15.5) Int. – B (17.7)
	PM	Approach: EB – C (23.8) WB – C (28.9) NB – B (12.8) SB – B (13.3) Int. – B (14.8)	Approach: EB – C (24.6) WB – C (29.7) NB – B (13.2) SB – B (12.9) Int. – B (14.8)	Approach: EB – C (24.8) WB – C (29.2) NB – B (10.5) SB – B (10.8) Int. – B (12.6)	Approach: EB – C (24.0) WB – C (28.9) NB – B (13.6) SB – B (13.8) Int. – B (15.4)	Approach: EB – C (24.4) WB – C (29.4) NB – B (12.4) SB – B (12.9) Int. – B (14.6)
US 31E at KY 245	AM	Approach: EB – D (45.2) WB – D (37.6) NB – D (39.8) SB – D (38.4) Int. – D (39.9)	Approach: EB – D (41.3) WB – D (37.9) NB – E (63.7) SB – D (46.3) Int. – D (45.2)	Approach: EB – D (49.8) WB – D (34.4) NB – F (82.7) SB – D (46.9) Int. – D (48.7)	Approach: EB – D (42.5) WB – C (29.3) NB – E (68.3) SB – D (48.7) Int. – D (43.0)	Approach: EB – D (35.5) WB – C (29.0) NB – E (63.6) SB – D (49.9) Int. – D (41.1)
	PM	Approach: EB – F (85.9) WB – F (83.8) NB – F (149.0) SB – D (96.1) Int. – F (99.7)	Approach: EB – E (77.0) WB – F (84.2) NB – F (148.6) SB – F (137.8) Int. – F (103.1)	Approach: EB – F (104.2) WB – F (120.8) NB – F (162.3) SB – F (163.2) Int. – F (131.8)	Approach: EB – F (96.5) WB – F (93.2) NB – F (141.5) SB – F (131.0) Int. – F (108.3)	Approach: EB – F (110.7) WB – F (88.9) NB – F (194.8) SB – E (55.2) Int. – F (107.3)

Table 14: Corridor Traffic Operations Summary (Cont'd.)

Intersection	Peak Hour	2040 Corridor Scenario Approach LOS and Intersection LOS (delay in seconds)				
		No-Build	Aqua	Yellow	Orange	Pink
US 31E at KY 332	AM	Approach: EB – C (28.4) WB – C (24.0) NB – B (14.0) SB – B (14.1) Int. – B (16.8)	Approach: EB – C (26.4) WB – C (33.9) NB – D (53.5) SB – C (30.0) Int. – D (36.8)	Approach: EB – C (28.0) WB – C (24.5) NB – B (10.6) SB – B (11.7) Int. – B (14.6)	Approach: EB – C (28.0) WB – C (24.5) NB – B (10.6) SB – B (11.7) Int. – B (14.6)	Approach: EB – C (28.7) WB – C (24.4) NB – B (10.2) SB – B (11.2) Int. – B (14.2)
	PM	Approach: EB – C (30.8) WB – C (27.6) NB – A (8.7) SB – A (7.3) Int. – B (11.0)	Approach: EB – C (31.1) WB – D (36.7) NB – D (38.8) SB – B (12.2) Int. – C (29.4)	Approach: EB – C (27.9) WB – C (27.4) NB – A (7.4) SB – A (6.5) Int. – A (9.9)	Approach: EB – C (27.9) WB – C (27.4) NB – A (7.4) SB – A (6.5) Int. – A (9.9)	Approach: EB – C (28.0) WB – C (27.1) NB – A (7.7) SB – A (6.7) Int. – B (10.2)
US 31E at Bluegrass Pkwy. EB Ramp	AM	Approach: EB – F (140.4) SB – A (3.4)	Approach: EB – E (46.9) SB – A (1.1)	Approach: EB – F (145.7) SB – A (3.1)	Approach: EB – F (110.4) SB – A (3.2)	Approach: EB – F (137.4) SB – A (3.3)
	PM	Approach: EB – F (>180.0) SBL – A (2.3)	Approach: EB – F (>180.0) SBL – A (0.8)	Approach: EB – F (>180.0) SBL – A (1.8)	Approach: EB – F (>180.0) SBL – A (2.3)	Approach: EB – F (>180.0) SBL – A (2.3)
US 31E at Bluegrass Pkwy. WB Ramp	AM	Approach: WB – F (119.0) NB – A (0.6)	Approach: WB – F (66.8) NB – A (0.5)	Approach: WB – F (121.0) NB – A (0.6)	Approach: WB – F (119.0) NB – A (0.6)	Approach: WB – F (119.0) NB – A (0.6)
	PM	Approach: WB – F (>180.0) NB – A (0.4)	Approach: WB – F (>180.0) NB – A (0.8)	Approach: WB – F (>180.0) NB – A (0.8)	Approach: WB – F (>180.0) NB – A (0.4)	Approach: WB – F (>180.0) NB – A (0.4)
US 31E at US 62	AM	Approach: WB – A (5.5) NB – F (>180.0)	Approach: WB – A (5.3) NB – F (>180.0)	Approach: WB – A (4.4) NB – F (>180.0)	Approach: WB – A (3.8) NB – F (69.4)	Approach: WB – A (4.1) NB – F (>180.0)
	PM	Approach: WB – F (56.7) NB – F (>180.0)	Approach: WB – D (17.9) NB – F (>180.0)	Approach: WB – E (25.6) NB – F (>180.0)	Approach: WB – C (9.4) NB – F (131.5)	Approach: WB – D (14.7) NB – F (>180.0)

COST ESTIMATES

Initial cost estimates were prepared prior to the second public meeting for each of the four corridor alternatives for the right-of-way, utility, and construction phases based on the potential constructed footprint of each corridor. Based on projected 2040 traffic volumes, estimates for all corridors are based on a two-lane typical section. Orange and Pink are assumed to be urban (curb and gutter) with Aqua and Yellow rural (shoulder). The typical sections will be further refined in the next phase of design. Average KYTC unit cost information, property information from the Nelson County Property Valuation Administrator (PVA), and an analysis of utility impacts were used to determine potential costs.

Table 15: Preliminary Corridor Cost Estimates

Phase	Alternative			
	Aqua	Yellow	Orange	Pink
Right-of-Way	$1,000,000	$600,000	$400,000	$200,000
Utility	$5,300,000	$900,000	$4,100,000	$400,000
Construction	$45,100,000	$16,100,000	$24,300,000	$5,200,000
Total	$51,400,000	$17,600,000	$28,800,000	$5,800,000

ENVIRONMENTAL ANALYSIS

The environmental impact of each of the four corridors was assessed using the same methodology applied during the segment evaluation process. These impacts were quantified and used to compare the relative impact of each of the four corridors on a per-mile basis. The same methods used to evaluate the segments during the segment evaluation process were used to analyze each of the refined corridors' environmental impact. Environmental impacts were combined from each individual segment used to develop each of the refined corridors. Each corridor was then compared based on their overall environmental impacts.

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CHAPTER 8 — PHASE II PUBLIC ENGAGEMENT

Project Team Meeting No. 3

After the four preliminary corridors were developed, a third project team meeting was held on August 2, 2018. The purpose of this meeting was to describe the segment development and evaluation process, present the preliminary corridors for discussion, and prepare for the second phase of public engagement. Agenda items included a review of the meeting with the JCCPC of Nelson County, segment development and evaluation, and public involvement.

Some modifications were proposed to further refine the four identified corridors. This included shortening the longer inner corridor to be a shorter option between KY 245 and US 62. With that, there is one full-length corridor from the north to the south near downtown and further out as well as one shorter corridor connecting KY 245 and US 62. Any curves that follow the existing roadway will be evaluated and straightened as part of the upgrade process within the corridor band.

In lieu of attending a festival, it was determined the better option would be to expand the public meeting mailer distribution and get people to attend the meeting. Increased postcard distribution would ensure that thousands of people in the community were informed about the project, even without access to commodities like newspaper subscriptions, internet, or other media outlets.

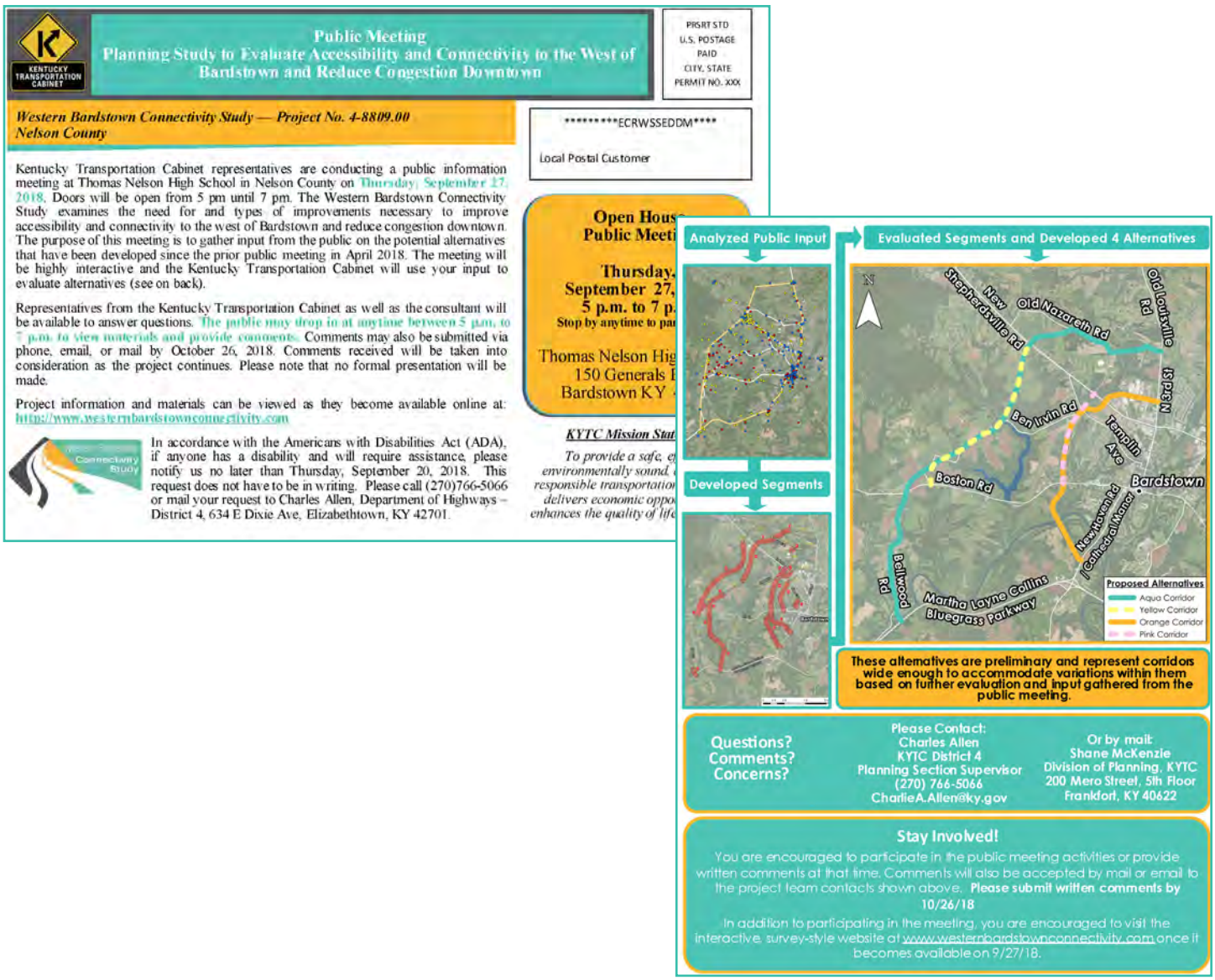
More details from the meeting can be found in **Appendix E**.

Local Officials and Stakeholders Meeting No. 2

The second LO/S meeting was held on September 27, 2018 at Thomas Nelson High School. Its purpose was to update local officials and stakeholders on the status of the project and gather their feedback prior to the public meeting to be held later that day. Attendees were given the opportunity to express their opinions and ask questions about results from the first phase of public involvement, segment development and evaluation, and corridor refinement. There were 43 local official and stakeholder representatives in attendance, each of whom was able to view the information and activity stations to be presented at the subsequent public meeting. **Appendix E** includes the meeting minutes for reference.

Public Meeting No. 2

The second public meeting for the *Western Bardstown Connectivity Study* was held on September 27, 2018 and drew 240 people to Thomas Nelson High School. The purpose of this meeting was to share the results of the first round of public engagement, inform attendees of the planning process used to develop and evaluate the segments, and gather feedback on the four corridor alternatives and their segments. The relatively high attendance at the first public meeting was successfully met again by using similar advertising strategies, including newspaper ads, social media ads, portable message signs, and a mailed postcard. To reach even more citizens, 6,150 postcards were mailed for the second public meeting.



Feedback was gathered using “drop-in” style stations where participants were asked to complete a worksheet that encapsulated each station’s goals. These stations included:

Information Stations

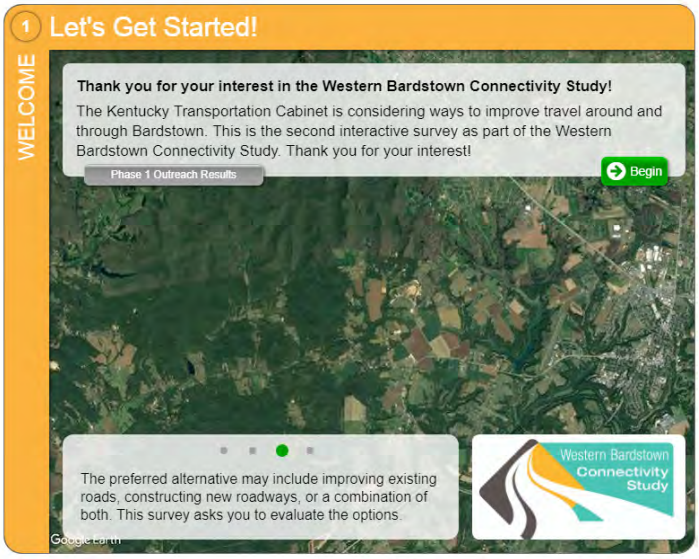
- **Scrolling Slideshow** – an informative scrolling presentation placed at the entrance to the public meeting for those less familiar with the project.
- **Information Wall** – a series of maps detailing the segment development and evaluation process.
- **What We Heard** – a summary of input from the first round of public engagement.

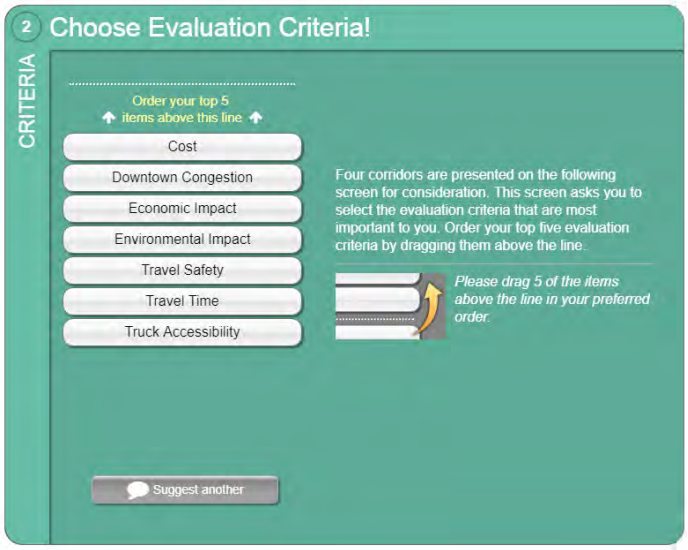
Interactive Stations

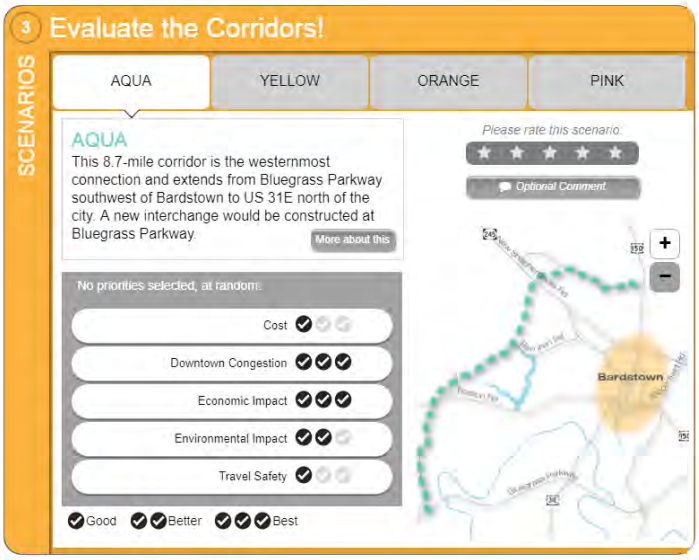
- **Corridors** – maps of each of the four corridor alternatives.
- **Segments** – maps of the individual segments that make up each corridor.
- **MetroQuest** – a preview of the MetroQuest survey that was available online during and after the meeting.

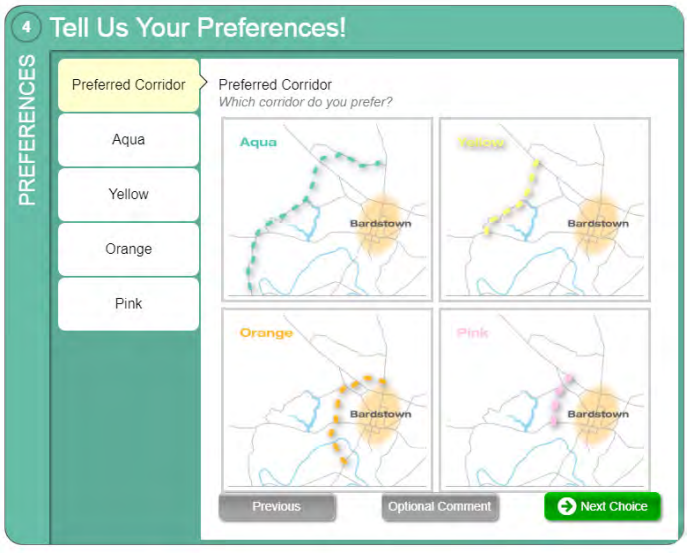
To encourage participation in each activity, participants were entered into a drawing for a prize if they visited each station. We did this to encourage attendees to visit each station and participate. In total, **2,093 data points and 116 comments** were collected and analyzed from the public meeting and allowed for community input to inform final recommendations. The meeting provided input about what the community thought about each corridor and individual segments of each corridor.

Given the success of the first online survey, a second MetroQuest survey was made available to the public from September 27, 2018 to October 26, 2018. MetroQuest activities mirrored the Public Meeting activities to allow the input to be compared. This also allowed for wider participation for people who were not able to attend. Reminders were sent out by KYTC to spur participation while the survey was open. Overall, there were **426 participants** who provided **5,002 data points** and **287 comments** for analysis. A detailed summary of the second phase of public involvement and results is provided in **Appendix E**.









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CHAPTER 9 — ADDITIONAL CORRIDOR INFORMATION

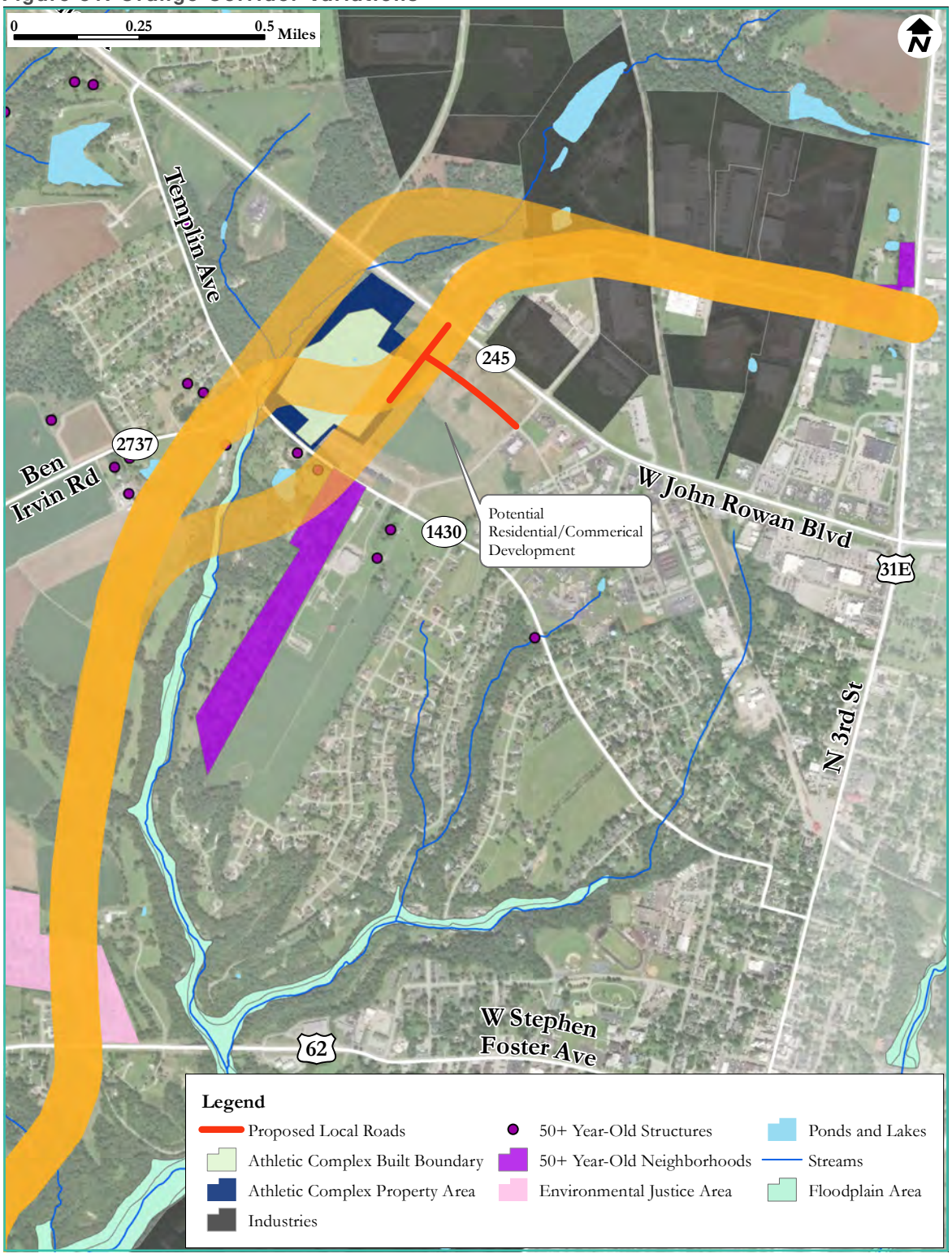
After the conclusion of the second public meeting and MetroQuest survey, a final analysis that combined all prior analyses detailed in this report as well as new information gained after the second public meeting was conducted. New information was gathered and included to adjust the four corridor alternatives and assist with forming study recommendations.

CORRIDOR ADJUSTMENTS

After the second public meeting, new information emerged that supported the need for adjustments to some of the corridors. Most notably, it was discovered that an athletic complex was to be built between KY 245 and KY 1430, an area that intersects the Orange Corridor and is adjacent to the Pink Corridor. Using site plans for the athletic complex, new variations for the Orange Corridor that pass to the east and west of the complex area were developed for evaluation. These new variations are shown in **Figure 31**. The eastern option avoids the athletic complex with a new S-curve that would relocate the Orange Corridor's intersection with Templin Avenue to the east, then intersect with KY 245 across to Withrow Court. The western option follows the Pink Corridor's current alignment by intersecting with Templin Avenue and Ben Irvin Road, then connecting to KY 245 across from Wilson Parkway, with a new location segment intersecting back to Withrow Court.

Next, analysis of the constructability and feasibility of these options showed that the eastern alternative connecting to Withrow Court would not be viable. It was discovered through a technical analysis that this option would require a 25-mph S-curve and would have an inconsistent cross-section template with that of the proposed local road it would share through this section. Further review is recommended to address the variation for the Orange Corridor if selected as part of the study recommendation.

Figure 31: Orange Corridor Variations



GEOTECHNICAL ASSESSMENT

A preliminary geotechnical assessment was conducted by KYTC to provide the general geotechnical concerns for the study area and the suitability of soils and bedrock for embankment construction in the study area. It was found that soils in the study area are generally suitable for embankment construction, and bedrock formations are suitable for most construction. However, it was noted that potential issues during construction could arise. For example, the bedrock has a potential to be karst, and difficult formations could be encountered that require mitigation. Corridors in low-lying areas may encounter springs, ponds, or saturated areas. Each corridor was examined for its geotechnical impacts, and it was determined that although having this information will be important during design and construction, it was not appropriate for recommending one corridor over another. More information can be found in **Appendix G**.

RESOURCE AGENCY COORDINATION

To help with early identification of potential construction impacts or mitigation needs, the KYTC Division of Planning asked several agencies to provide comments, concerns, or supplemental information by letter based on the project's purpose and need, goals, location, and corridor alternatives. Twelve responses were received from the following agencies and are presented in the order as they were received:

- Kentucky Airport Zoning Commission: Their response included information on permitting.
- Kentucky Education and Workforce Development Cabinet: No issues.
- Kentucky Heritage Council – State Historic Preservation Office: No comments at this time but requested additional information as it becomes available.
- Kentucky State Police: Their response expressed concern for safety and congestion regarding truck traffic.
- Kentucky Division of Forestry: Their response included information about tree farms in the study area but did not have issues at this time.
- Kentucky Division of Conservation: Their response provided mapping information about agricultural districts.
- Kentucky Department for Environmental Protection (Division for Air Quality, Division of Waste Management, and Division of Water): Their response provided guidance from all divisions on future phases of this project.
- Kentucky Department of Parks: As part of their response, the Department requested to maintain positive impact on travel to and from My Old Kentucky Home State Park.
- Basilica of Saint Joseph Proto-Cathedral: Their response expressed concern for safety and congestion regarding truck traffic near their facilities.
- City of Bardstown, Kentucky: In their response, support was expressed for the Pink Corridor (inner connectivity) as an immediate need.
- Kentucky Department of Agriculture: No issues.
- United States Fish and Wildlife Service: Their response provided information on obtaining species lists.

No significant issues were presented within the project area that needed to be considered for alternative analysis. However, information was provided that will be necessary to consider during the design stage, and information about the procedures required by the agencies was given. The KYTC Division of Planning noted they received more responses than typical, showing a potentially higher interest in this study that should be considered. All responses are included in **Appendix H** for additional information.

Project Team Meeting No. 4

The final project team meeting was held on November 14, 2018. The goal of this meeting was to update the project team on all project matters occurring since the third project team meeting and to seek an agreement on direction for a final recommendation for the study. The following items were presented and discussed:

- The results of the second public involvement phase
- Adjustments made to the corridors leading up to the meeting
- A review of the corridor impacts and benefits as well as additional corridor information gained
- The recommendations and outcomes from the study
- The next steps, including study documentation and the final local officials' presentation

At the meeting, it was noted that right-of-way cost estimates were based on the acreage intersected by each corridor, with the land use determined by code from the Nelson County PVA. Dollar values per acre, per land use type were provided by KYTC District 4 and applied to the estimates. It was discussed at the meeting that the estimates seemed low and should be evaluated prior to finalizing the cost estimates.

Another discussion focused on design flexibility within the corridors. For maximum design flexibility, the variations shown for the Orange Corridor will be shown as a wider swath to allow for alignment determinations to be made during the preliminary and final design phases.

More details from the meeting can be found in **Appendix E**.

After the final project team meeting, additional changes to the project were requested to support the decision-making process. This additional information included a detailed benefit-cost (B/C) analysis. Potential crash reduction determination for each corridor and travel time savings per travel demand model output was included as part of the evaluation to formulate a benefit-cost ratio for each corridor. The schedule was adjusted accordingly to provide for this additional level of analysis.

CHAPTER 10 — BENEFIT-COST ANALYSIS DISCUSSION

Benefits of a transportation investment measure the direct and positive effects of that project over a specified period of time. A benefit-cost (B/C) analysis can be leveraged as one of many tools to consider alternatives and support decisions for infrastructure investment. There are three primary areas of project benefit that can be translated into monetary values. These include:

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

Costs for this planning stage are focused on capital costs—the total investment required to prepare a highway improvement for service. Maintenance costs are not included as the initial benefit-cost time period focuses on the initial benefit of construction. All monetary values are in constant (2018 dollars). Discounting (the process of converting the costs and benefits that take place in different years into a common year) is not included for this high-level of analysis.

Some adjustments were made to the cost estimates following Project Team Meeting No. 4. Specifically, all right-of-way costs were reviewed. Upon further investigation into some specific land uses, all costs were increased. The Orange Corridor showed the largest increase due to classification type of some commercial property. A higher value was assigned to the associated acreage for this property to be conservative. The revised right-of-way costs were further reviewed by KYTC District 4 with additional adjustments made. The final design (D), right-of-way (R), utilities (U), and construction costs (C) are shown in **Table 17**.

Table 17: Final Planning-Level Cost Estimates

Phase	Alternative			
	Aqua	Yellow	Orange	Pink
Design	$4,500,000	$1,600,000	$2,400,000	$600,000
Right-of-Way	$4,600,000	$1,910,000	$4,830,000	$1,100,000
Utilities	$5,300,000	$900,000	$4,100,000	$400,000
Construction	$45,100,000	$16,100,000	$24,300,000	$5,200,000
Total	$59,500,000	$20,510,000	$35,630,000	$7,300,000

Travel Time Savings

A desired result of new transportation investments can be improving the efficiency of a larger system, ultimately reducing travel times and improving flow. Comparing a new alternative route (in this case, an outer western connector) to the baseline (existing route) produces the change in VHT within a defined area. The process for determining the VHT differential for each of the four alternative corridors first began with using the Hardin-Meade County MPO travel demand model (TDM) to determine county wide VHT per each scenario (No-Build, Aqua Corridor, Yellow Corridor, Pink Corridor, Orange Corridor). The model is a time-of-day model and processes information based on multiple time periods. As such, VHT output is divided into four time periods (AM, PM, Mid-Day, and Off-Peak) as well as by vehicle type (auto or truck) by time period. The resulting values are provided in **Table 18**.

Table 18: Nelson County VHT Comparison

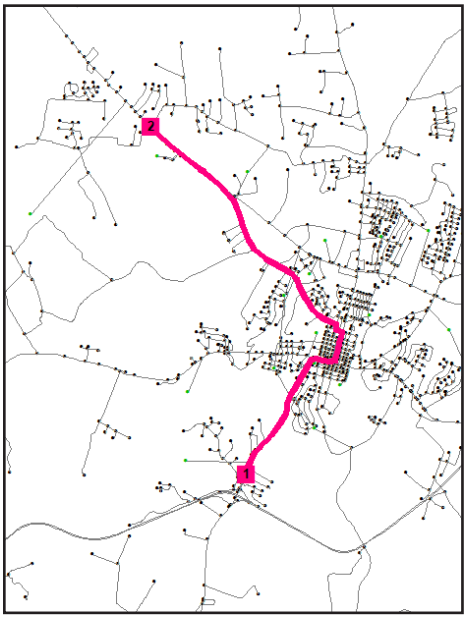
Alt.	Vehicle Hours Traveled										
	Auto				Truck				Auto	Truck	Total
	AM	PM	Mid-Day	Off-Peak	AM	PM	Mid-Day	Off-Peak	Daily	Daily	Daily
NB	5,290	8,030	11,840	10,290	710	790	1,350	1,450	35,450	4,300	39,750
Aqua	5,290	8,030	11,850	10,300	710	790	1,350	1,450	35,470	4,300	39,770
Yellow	5,290	8,030	11,850	10,300	710	790	1,350	1,450	35,470	4,300	39,770
Orange	5,270	8,000	11,800	10,260	700	780	1,350	1,440	35,330	4,270	39,600
Pink	5,280	8,010	11,810	10,270	700	780	1,350	1,440	35,370	4,270	39,640

The model results show no appreciable differences between the No-Build and Aqua and Yellow Corridors. There are slight decreases in VHT for the Orange and Pink Corridors. This data shows that at the county level there is no discernible identification of reductions in travel time for the outer corridors—rather, the opposite occurs. With increased connectivity, the model results show more vehicles are traveling, and the benefit is increased mobility. From a benefit-cost comparison, increased mobility does not translate well to monetary savings. Therefore, at the county-level, VHT benefits cannot be assigned to a monetary basis for the Aqua and Yellow Corridors. The Orange and Pink were further evaluated to determine benefit value from a monetary perspective.

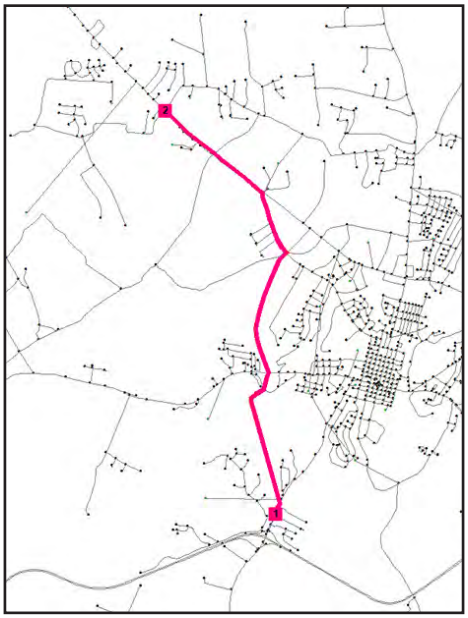
To determine if there is an appreciable difference at a more local scale, the results area was modified from the entire county to just the traffic analysis zones that comprise the study area. The resulting data showed increases in VHT for all scenarios. The increase can be qualified as an increase in mobility, but like the previous evaluation, it does not translate to monetary travel time savings.

The final evaluation related to travel time was to directly compare travel time for a specific route using model output data. The route points selected include a point on KY 245 near Thomas Nelson High School and a point at the Bluegrass Parkway/US 31E interchange. Travel times were calculated for each of the four build scenarios plus the No-Build. The results are shown in **Figure 32**. The Orange and Pink Corridors result in reductions of 2.9 and 1.1 minutes respectively. The Aqua and Yellow Corridors were found to not be a factor in travel time savings for this route choice as the model output showed vehicles continuing to use the existing route as opposed to the new travel segments.

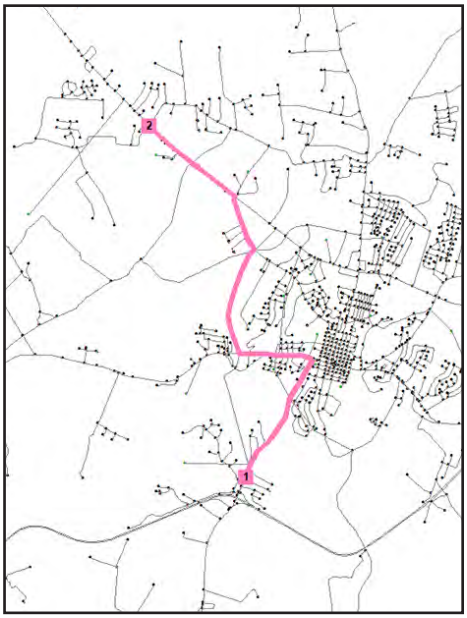
Figure 32: Individual Route Travel Time Comparison – Thomas Nelson High School to Bluegrass Parkway



2040 No-Build PM Peak: 8.0 Minutes



2040 Orange PM Peak: 5.1 Minutes



2040 Pink PM Peak - 6.9 Minutes

Note: Aqua and Yellow Corridors are not shown as the shortest path for these point locations continues to be the existing routes through downtown.

The next step involved assigning a cost value per hour of savings for the Orange and Pink Corridors. The *Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis*, prepared by the US Department of Transportation, provides hourly costs based on median household income information from the US Census Bureau and salary information from the Bureau of Labor Statistics National Occupational Employment and Wage Estimates. The latest data published uses 2017 estimates, as shown in **Table 19**.

Table 19: Recommended Hourly Values of Travel Time Savings (2017)

Auto Travel	Surface Mode Value
Personal	$14.20
Business	$26.50
All Purposes	$14.80
Other	
Truck Cost	$28.60

To determine the breakdown of how these rates apply to Nelson County vehicle trips, the first breakdown is between auto and truck traffic. This is already prepared through the travel time savings analysis; therefore, the differential in VHT between the alternative and the No-Build is applied directly to the truck cost. The guidance notes that values for business travel do not include commuting travel, which should be valued at the personal travel rate. Therefore, the two rates applied to this analysis include the Personal rate and the Truck rate. Average occupancy rates were determined from the Federal Highway Administration Highway Statistics 2016 and found to be 1.39 persons per vehicle for passenger vehicles and 1.0 for trucks. Applying the occupancy factor yields the following hourly value of cost, which can be found in **Table 20**.

Table 20: Hourly Value of Person Hour Cost

Category of Travel	Surface Mode Value	Occupancy	Cost
Personal	$14.20	1.39	$19.74
Truck	$28.60	1	$28.60

These hourly values for auto and truck were applied to the hourly per day VHT savings as calculated from the TDM by comparing the difference between the No-Build and each corridor. The values were then extrapolated by week (per best practices guidance applied to the business week to be conservative), year, and ultimately 20-year design life. **Table 21** shows these results.

Table 21: Travel Time Savings

Corridor	Vehicle Class	VHT Reduction Per Day	Cost Per Hour	Savings Per Day	Savings Per Week	Savings per Year	Savings per 20 Years	Travel Time B/C
Orange	VHT - Auto	120	$19.74	$2,369	$11,842	$615,826	$12,316,512	0.5
	VHT - Trucks	30	$28.60	$858	$4,290	$223,080	$4,461,600	
Pink	VHT – Auto	80	$19.74	$1,579	$7,895	$410,550	$8,211,008	1.7
	VHT - Trucks	30	$28.60	$858	$4,290	$223,080	$4,461,600	

Vehicle Operating Costs

The process for determining the VMT differentials for each of the four alternative corridors follows a similar process as determining the VHT differentials. The process first began with the Hardin-Meade County MPO TDM to determine county-wide VMT per each scenario (No-Build, Aqua Corridor, Yellow Corridor, Pink Corridor, Orange Corridor). The model is a time-of-day model and processes information based on multiple time periods. As such, VMT output is divided into four time periods (AM, PM, Mid-day, and Off-Peak) as well as by vehicle type (auto or truck) by time period. The resulting values are provided in **Table 22**.

Table 22: Nelson County VMT Comparison

Alt.	Vehicle Miles Traveled										
	Auto				Truck				Auto	Truck	Total
	AM	PM	Mid-Day	Off-Peak	AM	PM	Mid-Day	Off-Peak	Daily	Daily	Daily
NB	210,640	325,310	477,390	414,960	27,210	31,760	53,550	55,520	1,428,300	168,040	1,596,340
Aqua	211,170	326,140	478,520	415,950	27,280	31,830	53,680	55,660	1,431,780	168,450	1,600,230
Yellow	210,930	325,710	477,990	415,480	27,260	31,800	53,640	55,610	1,430,110	168,310	1,598,420
Orange	211,900	327,110	479,940	417,210	27,380	31,930	53,870	55,870	1,436,160	169,050	1,605,210
Pink	211,120	326,010	478,490	415,930	27,300	31,850	53,720	55,710	1,431,550	168,580	1,600,130

From the model output, the VMT increases for all corridors for both auto and truck compared to the No-Build. Like the VHT findings, it appears that vehicles are driving more miles. With all values higher than the No-Build, there is no calculable monetary benefit from this metric. Therefore, it is not included in the overall B/C ratio development. However, the increases in VMT show increased mobility within the study area and can be identified as a benefit in that respect.

Safety Benefits

A quantifiable way to measure safety benefits as a result of constructing a new corridor employs an analysis of predicted crash rates per Highway Safety Manual (HSM) methods for downtown Bardstown roadway segments only. This methodology considers traffic volume changes resulting from construction of each corridor and compares the effect on the predicted crash values compared to the No-Build for the downtown segments. Monetary values can be assigned for reductions in crashes and severity per corridor through an application of crash costs for highway safety analysis. Comparing the benefit value per corridor to the corridor cost estimate yields the B/C ratio.

The first step in this process was to determine the Safety Performance Function (SPF) predicted crash value for the No-Build and Build scenarios. The focus area is downtown Bardstown, including US 62 from just west of the Orange/Pink intersection to US 31E (Cathedral Manor) and US 31E from Cathedral Manor to 3rd Street and then north to KY 245. While the same crash data reviewed earlier in this report was applied to this analysis, this was a different methodology to assess crash history for a segment or intersection compared to the Critical Rate Analysis presented as part of the initial existing conditions in this study. This methodology enables estimates to be calculated regarding potential crash frequency and the ability to conduct economic appraisals of improvements to prioritize projects. SPF values and adjustment factors specific to the functional classification types evaluated were provided by the Kentucky Transportation Center (KTC). The predicted crashes using 2040 projected volumes are shown in **Table 23**.

Table 23: Predicted Crashes for Downtown Bardstown Segments

Route	Begin Milepoint	End Milepoint	No-Build	Aqua	Yellow	Orange	Pink
US 31E	13.972 (US 62 West/ Elizabethtown Rd.)	14.090 (Fourth St.)	7.61	7.43	7.08	6.26	6.81
US 31E	14.090 (Fourth St.)	14.195 (US 62 East/ Courthouse Sq.)	10.88	10.49	9.77	8.15	9.23
US 31E	14.195 (US 62 E/ Courthouse Sq.)	14.612 (KY 1430/Beall Ave.)	45.86	35.56	35.56	34.06	34.49
US 31E	14.612 (KY 1430/Beall Ave.)	15.4 (KY 245/Bardstown Bypass)	52.92	44.54	44.54	43.26	43.63
US 62	13.079 (Brookview Ln.)	13.921 (N Elm Grove Ave.)	33.26	29.97	37.09	30.19	39.58
US 62	13.921 (N Elm Grove Ave.)	14.274 (US 31E Junction)	13.94	12.56	15.55	12.66	16.59

Crash data was further evaluated for severity by the KABCO scale where:

K = Fatal Injury

A = Suspected Serious Injury

B = Suspected Minor Injury

C = Possible Injury

O = No Apparent Injury

Source: Crash Costs for Highway Safety Analysis, US Department of Transportation, Federal Highway Administration (January 2018)

No fatal crashes were identified during the crash history period originally analyzed for this study. Many of the segments had at least one injury crash reported. With this being a high-level planning study, detailed crash report data was not obtained. As a result, injury crashes were not analyzed and able to be broken into the A, B, and C scale. As a result, the weighted average cost for the full KABCO range was applied. This is $94,609 per crash. This value is based on data analysis per the Crash Costs for Highway Safety Analysis, adjusted for Kentucky data. It includes both the economic costs (tangible costs, including wage loss, medical expense, administrative costs, property damage, and employer costs) as well as a measure of value of lost quality of life associated with deaths and injuries, or referred to as the Comprehensive Cost.

Subtracting the corridor predicted crash value from the No-Build predicted crash value provided the change in crashes equated to a per year basis. The downtown segments evaluated were summed and multiplied by the weighted average cost. The resulting one-year and 20-year period of cost savings per corridor are shown in **Table 24**. Comparing the benefit (cost savings) to the cost estimate yields the B/C ratio for the safety analysis component.

Table 24: Safety Benefits

Route	Aqua	Yellow	Orange	Pink
Per Year Savings Associated with Crash Reduction	$2,262,700	$1,407,269	$2,828,781	$1,338,279
20 Year Savings Associated with Crash Reduction	$45,253,992	$28,145,375	$56,575,618	$26,765,587
Corridor Cost Estimate	$59,500,000	$20,510,000	$35,630,000	$7,300,000
B/C Ratio	0.8	1.4	1.6	3.7

Summary

The analysis presented has shown several measures that can be used to determine the benefits of constructing one of the four corridor alternatives (Aqua, Yellow, Orange, Pink) compared to the cost. A summary of the B/C ratios for travel time and safety are presented in **Table 25**. Also included is the combined B/C ratio per corridor for all benefits assessed. While VMT shows higher values for each corridor compared to the No-Build, this measure does not translate to a monetary benefit and is not included in the table. However, higher VMT values do show an increase in mobility in the county. The safety benefits analysis does show the potential for reductions in crashes along the existing downtown route, which is translated to B/C ratios. Overall, looking at the quantifiable benefits compared to the costs, all but the Aqua Corridor show a B/C ratio greater than 1. Pink has the highest return on investment for both travel time savings and safety. Orange does have a return on investment over 1 when combining the travel time savings and safety. This assessment clearly shows the Pink Corridor to be the most beneficial from a B/C analysis with additional benefit to be realized by constructing the overall Orange Corridor.

Table 25: Benefit-Cost Ratio Summary

	Aqua	Yellow	Orange	Pink
Cost	$59,500,000	$20,510,000	$35,630,000	$7,300,000
20 Year Travel Time Savings (VHT)	$0	$0	$16,778,112	$12,672,608
B/C Ratio	N/A	N/A	0.5	1.7
20 Year Savings Associated with Crash Reduction	$45,253,992	$28,145,375	$56,575,618	$26,765,588
B/C Ratio	0.8	1.4	1.6	3.7
Combined Benefit	$45,253,992	$28,145,375	$73,353,730	$39,438,196
Combined B/C Ratio	0.8	1.4	2.1	5.4

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CHAPTER 11 — RECOMMENDATIONS

This chapter provides the recommendations to be carried forward for future development as part of the *Western Bardstown Connectivity Study*. These recommendations are based on the project's purpose and need, supported by technical analysis, public input, and project team coordination. A summary of the information compiled relative to each of the four corridors is provided in **Table 26**.

Table 26: Summary Evaluation Matrix

Corridor	Environmental Rankings		2040 Projected Traffic Volumes			# Reduction in Crashes Per Year (Compared to No-Build)	Meet Purpose and Need	Public Input (Ranked 1st)	Cost Estimate	B/C Ratio
	Natural Env.	Built Env.	Auto ADT	Truck ADT	% Reduction of Downtown ADT					
Aqua	2	3	4,200	500	20%	-24	Yes	152	$59,500,000	0.8
Yellow	1	1	3,200	400	20%	-15	Yes	57	$20,510,000	1.4
Orange	2	3	7,500	1,100	23%	-30	Yes	90	$35,630,000	2.1
Pink	1	2	5,100	650	22%	-14	Yes	70	$7,300,000	5.4

Note: Environmental Rankings are shown for the entire corridor by a ranking of 1-4; a lower number = less impacts

All corridors meet the purpose and need of the project to varying degrees as all improve network connectivity, reduce congestion, and have identified potential for safety improvements in the downtown area of Bardstown. All public information meetings have been well attended (200+ attendees) and this number alone shows the level of need and desire of the public for additional connectivity—whether it be nearer to or further from Bardstown. The final component of this study focused on using available tools to provide a comparative look at quantifiable benefits relative to overall cost. The results of this analysis show the greatest benefit for the cost is the Pink Corridor. Based on this information, the following are the recommendations from this study:

- **Short-Term Corridor:** Orange Corridor with a phased approach focusing on the Pink Corridor as a subset of the overall connectivity plan
- **Long-Term Corridor:** Aqua Corridor

In the context of this study, the nomenclature of short-term indicates a more immediate need with long-term referring to future need in a larger-scale regional perspective.

Figure 33 displays these recommendations in context with community features/resources. For flexibility in transitioning to the next phase of project development, the corridor bands have been widened. The larger areas will allow for future design decisions to be made for known areas identified as part of the additional corridor information and allow flexibility for design decisions to be made that are the most beneficial with least impact.

Based on projected 2040 traffic volumes, all recommended corridors are presented as a two-lane typical section. The Orange and Pink Corridors are considered as urban (curb and gutter) with Aqua as rural (shoulders). Further refinement of the typical section will occur during the next phase of design.

SHORT-TERM

The Orange Corridor provides a full connection from US 31E south of Bardstown to north of Bardstown on the west side. Within this corridor, the Pink Corridor is identified as the highest priority. This section connects US 62 and KY 245. The estimated planning-level cost estimates for both the Orange Corridor and Pink subset are given in **Table 27**.

Table 27: Short-Term Planning Corridor Cost Estimates

Phase	Alternative	
	Orange	Pink
Design	$2,400,000	$600,000
Right-of-Way	$4,830,000	$1,100,000
Utilities	$4,100,000	$400,000
Construction	$24,300,000	$5,200,000
Total	$35,630,000	$7,300,000

Additional considerations for future development of this recommendation include:

- Development of Phase I design plans related to initial termini at US 62 and KY 245 that enable the continuation of the corridor to the north and south.
- Evaluation of the connection/initial termini at US 62 as it relates to minimizing impacts to the identified Environmental Justice Area.
- Evaluation of the connection/initial termini at KY 245 as it relates to the identified Bethlehem High School Athletic Complex.
- Evaluation of potential adjustment of the northern Orange segment between KY 245 and US 31E using Wilson Parkway to Old Nazareth Road through further review of the Bardstown Industrial Development Corporation Trust.
- Evaluation of the existing US 62/US 31E intersection and potential improvements on US 62 between this intersection and the new connector.

LONG-TERM

The Aqua Corridor provides a far western connection from Martha Layne Collins Bluegrass Parkway to US 31E to the north. The estimated planning-level cost estimate for the Aqua Corridor is given in **Table 28**.

Table 28: Long-Term Planning Corridor Cost Estimates

Phase	Alternative
	Aqua
Design	$4,500,000
Right-of-Way	$4,600,000
Utilities	$5,300,000
Construction	$45,100,000
Total	$59,500,000

Current growth patterns and associated projected use does not justify the cost of the Aqua Corridor at this time. If needs change in the future or growth outpaces what is currently projected, re-evaluation of this as a near-term need may be warranted. At this time, it remains a viable long-range plan transportation element.

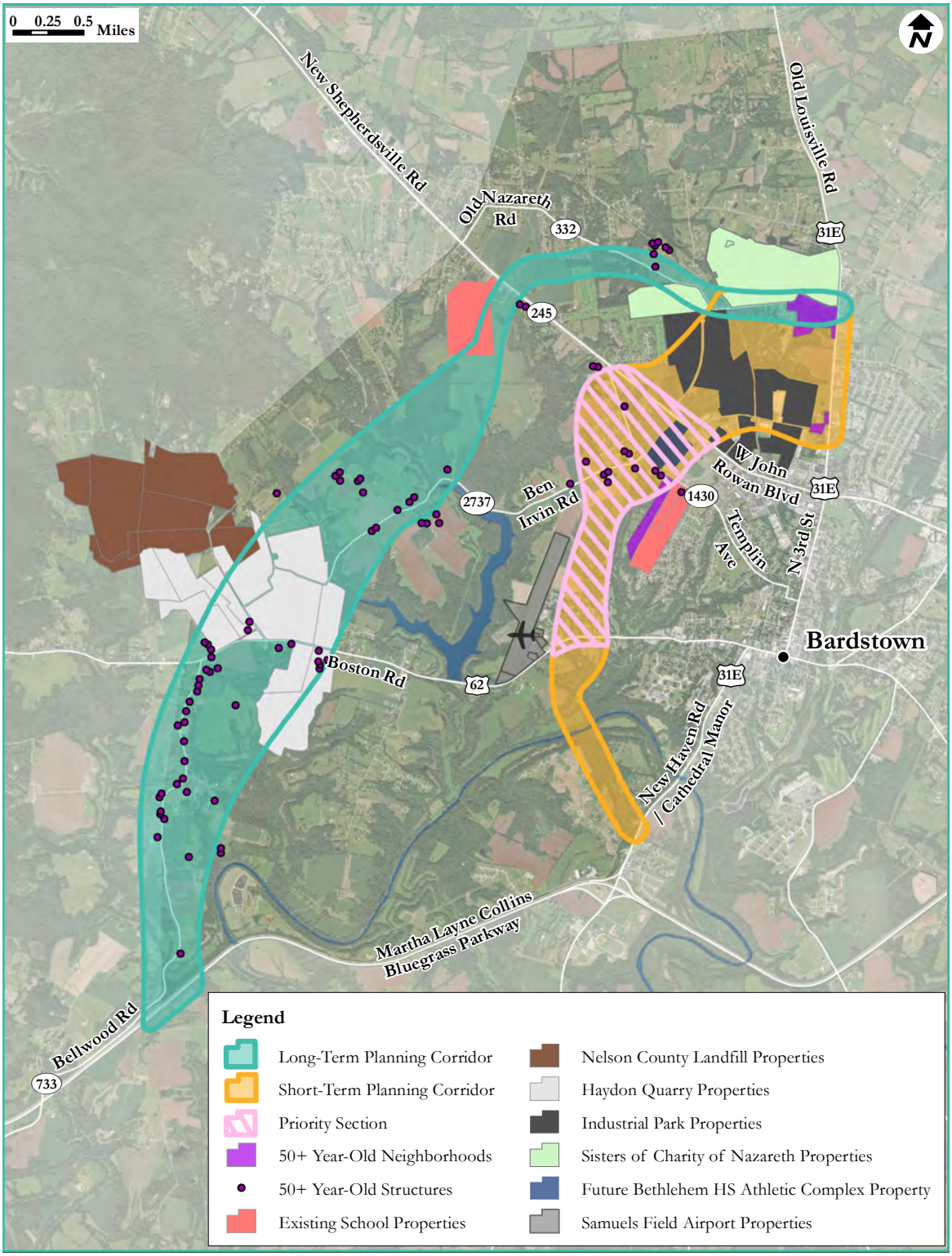
NEXT STEPS

The next phase for the project is Phase 1 Design (Preliminary Engineering and Environmental Analysis) to further define the Orange Corridor and provide design plans for the Pink Corridor priority section. Kentucky's FY 2018-FY 2024 Highway Plan has $500,000 identified for the design phase in the year 2020. Subsequent project phases will be evaluated by Kentucky's Strategic Highway Investment Formula for Tomorrow (SHIFT) program which is a data-driven, objective approach to compare capital improvement projects and prioritize transportation spending.

CONTACTS

Written requests for additional information should be sent to the KYTC Division of Planning Director, 200 Mero Street, Frankfort, Kentucky 40622. Additional information regarding this study can be obtained from the District 4 Project Manager at (270) 766-5066 or by mail at 634 E Dixie Avenue, Elizabethtown KY 42701.

Figure 33: Final Recommendations



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