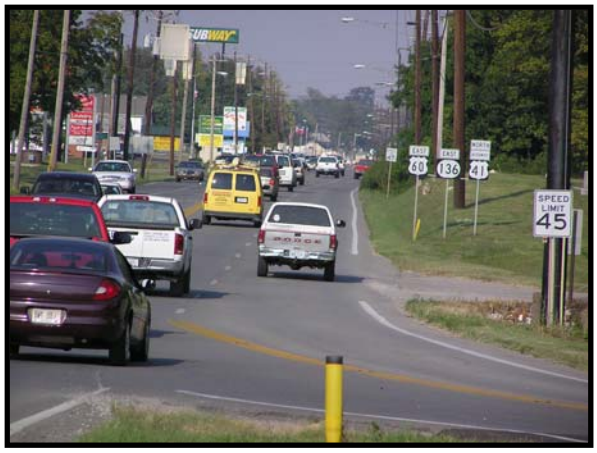
US 41A/Green Street

Scoping Study

Final Report

Item No. 2-140.00

Henderson County, Kentucky



Prepared for:

Kentucky Transportation Cabinet

Division of Planning

and

District-2, Madisonville, Kentucky

KENTUCKY TRANSPORTATION CABINET

Kentucky UNBRIDLED SPIRIT

Prepared by:

QK4

January 2010

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EXECUTIVE SUMMARY

Study Background and Purpose

The purpose of the *Scoping Study for US 41A (Green Street)* was to provide information to the Kentucky Transportation Cabinet (KYTC) so that it can investigate options to widen US 41A to provide a continuous, two-way left-turn lane from US 60 (mile point [MP] 13.235) to US 41 (MP 17.390), a distance of about 4.2 miles. A project team approach was used, consisting of representatives from the KYTC Central Office and District 2, the Green River Area Development District (GRADD), and Qk4. Public involvement activities included project team meetings, resource agency coordination, and a meeting with local officials and stakeholders. The study examines this improvement strategy to address both current and future needs of US 41A. This, in turn, will help KYTC make decisions regarding the need for roadway improvements, and to define potential improvements that would increase safety and better serve the Henderson County residents and the traveling public.

Funds for the scoping study were included in the *Enacted Six-Year Highway Plan, FY 2006-2012*, approved May 2006 (Project number 2-140.00). The project is not listed in the current *KYTC 2008 Highway Plan (FY 2008-2014)*.

Study Location and Limits

The study location on US 41A (Green Street) is a 4.2 mile (MP 13.235 – MP 17.390) state-maintained, urban principal arterial within Henderson County. It is located in the City of Henderson; and is on a shared alignment with US 60, west of US 41.

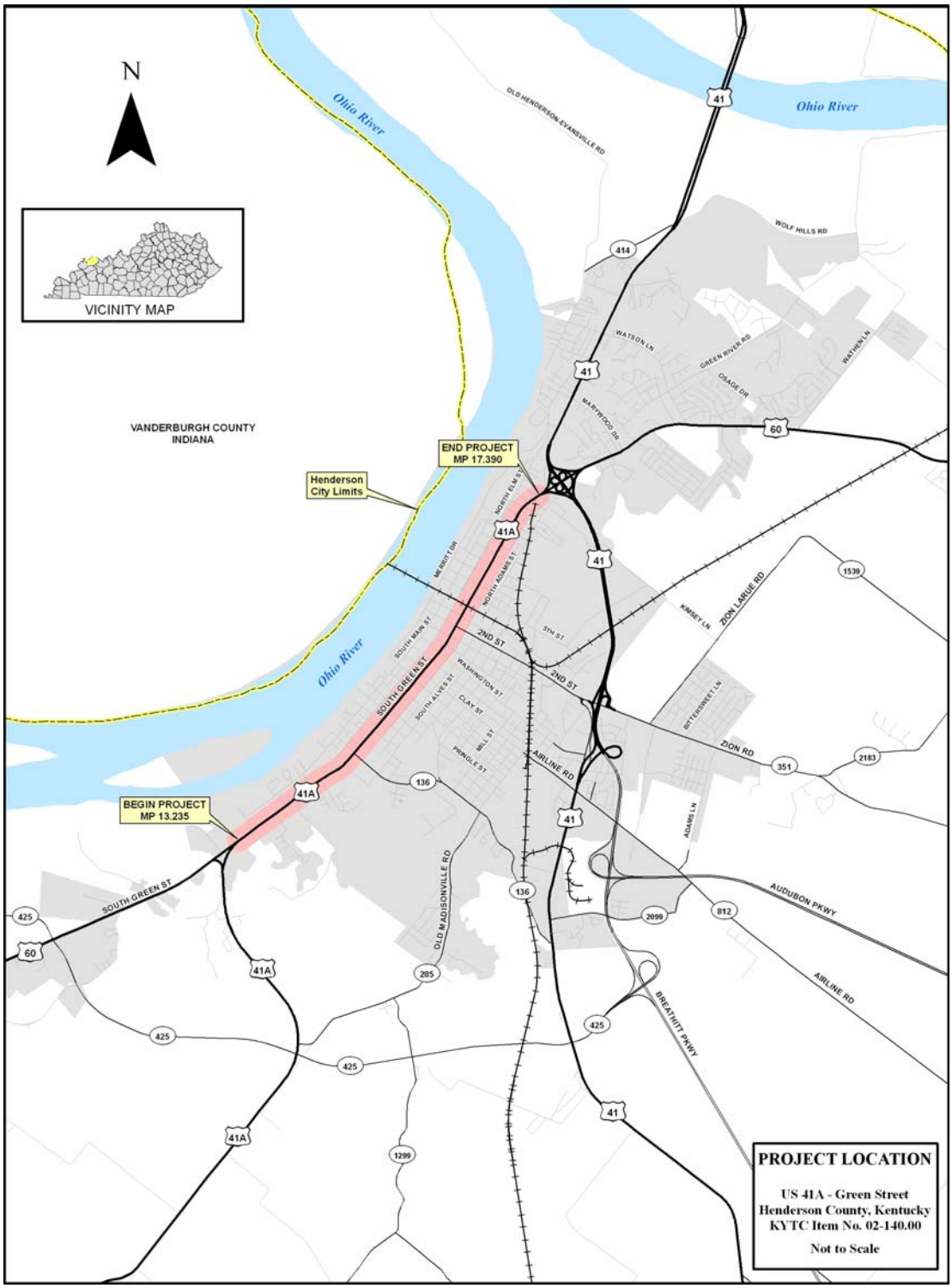

Figure ES 1: Project Location—City of Henderson, Henderson County, Kentucky

Project Issues and Goals

The issues for this project were defined as follows:

- US 41A is a highly congested highway that operates at a less than desirable level of service. Several intersections with US 41A including US 60, KY 136, KY 351, and others are not adequate due to safety deficiencies and congestion issues.
- 2007 average daily traffic (ADT) volumes ranged from 19,600 to 30,100 vehicles per day (vpd), with 9% trucks.
- In the study area, US 41A exhibits the characteristics of a high crash corridor, with two fatalities from 2003 to 2007.
- Many businesses, homes, and historic properties abut the existing rights-of-way.
- Many utilities are located adjacent to the existing rights-of-way. It was noted that, for Item 2-966, the utility relocation costs for this one intersection improvement totaled $1.1 million, which was more than the cost of construction.
- A railroad track overpass is a major choke point to be addressed.
- There are many misaligned intersections along the corridor in the study area.

The goals for this project are as follows:

- Address highway capacity, growth needs, and congestion in Henderson.
- Improve safety.

Conditions Analysis

Existing conditions on Green Street were compiled from several KYTC databases. Recent (2005-2007) traffic counts were conducted by KYTC at four locations along Green Street. This determined the four study area sections used in the analysis of the existing conditions. These four sections are shown in the figure below.

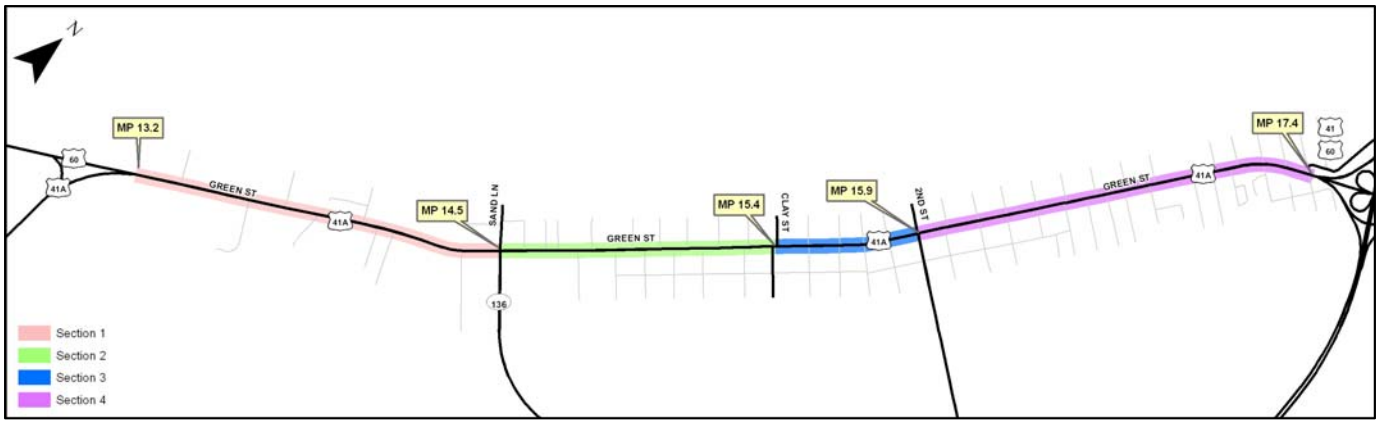

Figure ES 2: Existing Conditions Sections 1–4 of US 41A

Those KYTC counts and build-year projections indicate 2008/2030 ADT volumes, respectively, of:

- 19,600/22,600 vpd between US 60 and KY 136 (Sand Lane).
- 20,800/25,600 vpd from KY 136 near the intersection with Clay Street.
- 25,000/30,300 vpd near the intersection with KY 351 (2nd Street).
- 30,100/34,800 vpd at the junction with US 41 North and US 60 East.

The percentage of single unit and combination trucks in the traffic mix was moderate at 9% and is projected to remain unchanged in 2030.

Level of service (LOS) is a qualitative measure of expected traffic conflicts, delay, driver discomfort, and congestion. Levels of service are described according to a letter rating system ranging from LOS A (free flow, minimal or no delays – best conditions) to LOS F (stop and go conditions, very long delays – worst conditions). A level of service (LOS) of E exists in the northern portion of the study area, roughly from the intersection with Clay Street to the northern project area terminus at US 60. LOS increases to B in the southern portion of the study area from US 60 to Clay Street. This data is included in the table below.

Table ES-1: Current and Projected ADT and LOS

Beginning MP	Beginning Feature	Ending MP	Ending Feature	2007 ADT	2030 ADT	2007 LOS	2030 LOS
13.235	US 60	14.483	KY 136 (Sand Lane)	19,600	22,600	B	B
14.483	KY 136 (Sand Lane)	15.406	Clay Street.	20,800	25,600	B	D
15.406	Clay Street.	15.884	KY 351 (2nd Street)	25,000	30,300	E	E
15.884	KY 351 (2nd Street)	17.397	to US 41/US 60	30,100	34,800	E	F

The Critical Rate Factor (CRF) for the three-year period from January 1, 2005, to December 31, 2007, is 1.30 for the study area. KYTC defines CRF as the quotient showing the ratio of the crash rate for a roadway spot or segment divided by the critical crash rate for that roadway spot or segment based on roadway type, number of lanes, and median type. A CRF greater than 1.00 indicates that the segment of roadway has had a statistically significant number of crashes that likely had not occurred at random.

Alternatives Development and Evaluation

To better analyze the 4.0-mile section of US 41A in the prescribed study area, the corridor was broken down into five individual sections. These five sections differ from the four sections used to analyze the existing conditions data. The five sections were determined due to the existing roadway conditions, (i.e., five lane section between Washington Street and Third Street, and the railroad overpass between Third Street and Fifth Street). See the section descriptions below. An illustration and brief descriptions of the general conditions of each of the five sections are as follows:

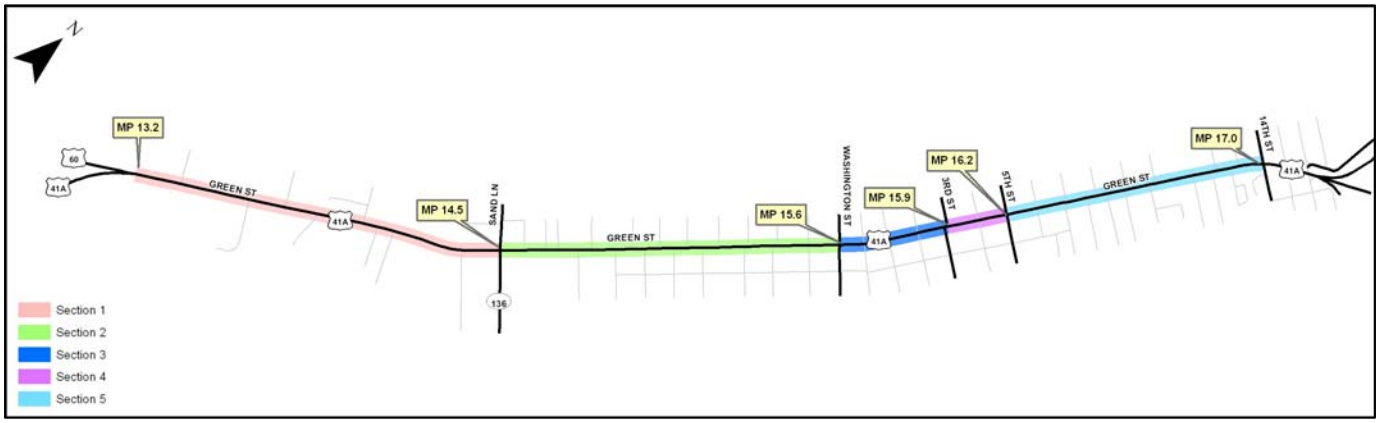

Figure ES 3: Alternatives Evaluation Sections 1–5 of US 41A

Section 1—This 1.3-mile section of US 41A extends from US 60 to KY 136 (Sand Lane) MP 13.2–MP 14.5). It comprises the southernmost section of the study area corridor and terminates at the new US 60 widening project. Right-of-way (ROW) width is 80 feet.

Section 2—KY 136 (Sand Lane) to Washington Street (MP 14.5–MP 15.6). ROW width is 60 feet.

Section 3—Washington Street to 3rd Street (MP 15.6–MP 15.9). This 0.3-mile section is currently a five-lane segment that does not require construction and is not a factor in the purpose of this study. ROW width is 60 feet.

Section 4—3rd Street to 5th Street (MP 15.9–MP 16.2). This 0.3-mile section contains the existing railroad overpass on the cross river CSX line that parallels 4th Street. The piers of the overpass are so close to the driving lanes of US 41A that the existing ROW is not wide enough to accommodate the addition of a center lane without reconstruction of the railroad overpass. The railroad overpass would have to be removed and rebuilt in order for the roadway to be widened in any capacity. ROW width is 60 feet.

Section 5—5th Street to 14th Street (US 60) (MP 16.2–MP 17.0). This 0.8-mile section exhibits some of the highest traffic volume of the study area. There is a lack of channelized access to properties within this section as well. ROW width is 60 feet.

While the portion of the roadway north of the intersection with Harding Avenue has an adequate lane width of approximately 12 feet, the segment southeast of that intersection is only 10 feet wide. Access control appears to be unregulated primarily in the northern segment of the study area.

The posted speed limit is 35 miles per hour (mph) between the intersection at Sand Lane and the intersection at 14th Street, and 45 mph at all other points. Right-of-way widths average 60 to 80 feet except near the interchange with US 41 and US 60, where the width is 250 feet. Sidewalks are present at some locations, but a 1.8-mile-long sidewalk extension between MP 13.2 and MP 15.0 has been proposed through the KYTC Statewide Transportation Planning process. There are seven signalized intersections in the study area.

Alternatives not advanced

In addition to the roadway widening, two other alternative concepts were considered but are not recommended for advancement: one-way couplets and a "road diet" (i.e., reducing the road from four lanes to three). The one-way couplets would require the conversion of Elm Street to a one-way facility. Elm Street is currently a divided roadway with a raised landscaped median through a residential area, and is offset at some intersections. For these reasons it would not provide an optimum configuration for a one-way street. Regarding the road diet, research indicates that only roads with a maximum volume of 850 vph have been successful in improving traffic flow after a reduction of lanes. For US 41A the approximate peak-hour volumes are 1,900 to 3,000 vph. Therefore this option is not recommended.

Recommendations

Recommended Alternatives

Three widening alternatives were identified to achieve the specified five-lane facility on US 41A. The alternatives are to widen to the left (west, towards the river), middle, and right (east). Each of these widening scenarios was reviewed for Section 1, Section 2, Section 4, and Section 5. Section 3 was not considered because it currently is a five-lane section with a center turning lane. The proposed typical section features an 86-foot-wide right-of-way with four 11-foot-wide travel lanes, a 12-foot-wide center turn lane, 2-foot-wide gutter, 2-foot-wide verge, 5-foot-wide sidewalk, and 6-foot-wide utility (see typical section below). Large maps were produced by section detailing each of the three widening scenarios at a 100-foot scale. **These are provided electronically on a compact disk (CD) accompanying this report**

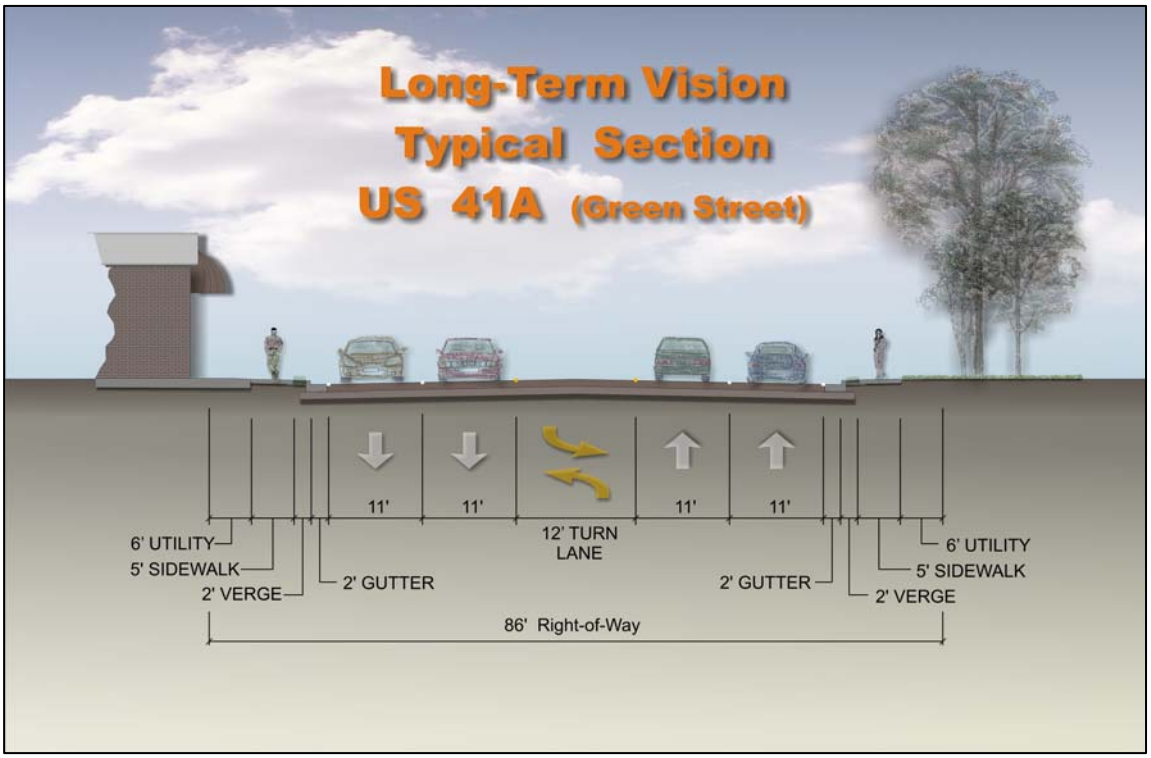

Figure ES 4: Recommended US 41A Typical Section

Phased planning cost estimates and right-of-way impacts were also identified for each widening alternative by section.

Table ES-2: US 41A Widening Alternatives and Cost Itemization

US 41A Widening Alternatives and Cost Itemization						
US 41A: from South to North	Length (Feet)	Construction Cost	R/W Cost	Utility Cost	Engineering Cost	Total Cost
Section 1 (US 60 to Sand Lane						
Alternative L	6780	$3,163,000	$161,000	$2,630,000	$696,000	$6,650,000
Alternative M	6780	$3,163,000	$164,000	$2,630,000	$696,000	$6,653,000
Alternative R	6780	$3,163,000	$162,000	$2,630,000	$696,000	$6,651,000
Section 2 (Sand Lane to Wash Street)						
Alternative L	5330	$2,486,000	$436,000	$2,342,000	$547,000	$5,811,000
Alternative M	5330	$2,486,000	$126,000	$2,441,000	$547,000	$5,600,000
Alternative R	5330	$2,486,000	$426,000	$2,261,000	$547,000	$5,720,000
Section 4 (3rd Street to 5th Street)						
Alternative L	2050	$8,258,000	$784,000	$1,084,000	$1,817,000	$11,943,000
Alternative M	2050	$8,258,000	$172,000	$1,123,000	$1,817,000	$11,370,000
Alternative R	2050	$8,258,000	$1,379,000	$1,003,000	$1,817,000	$12,457,000
Section 5 (5th Street to 14th Street/US 60)						
Alternative L	3900	$1,819,000	$76,000	$1,859,000	$400,000	$4,154,000
Alternative M	3900	$1,819,000	$661,000	$1,937,000	$400,000	$4,817,000
Alternative R	3900	$1,819,000	$2,465,000	$1,924,000	$400,000	$6,608,000

The combined sections comprising the entire project range in cost from $27.7 million to $31.5 million.

Specific widening alternatives (left, middle, and right) were not selected by the project team, as the purpose of this study is to determine the feasibility of reducing crashes, by widening US 41A, in terms of phased cost estimates and right-of-way impacts. However, the segments of US 41A were prioritized for reconstruction. They are listed below in order of priority:

1. **Section 5:** highest traffic volume, most commercial land uses, and high left-turn volume.
2. **Section 1:** provides logical terminus with the current reconstruction of US 60 and no restrictions due to the presence of historic properties.
3. **Section 2:** mostly residential land uses and there are historic property issues to be addressed.
4. **Section 4:** is the lowest priority due to the extremely high cost of the reconstruction of the railroad overpass that is necessary to widen US 41A beneath it.

Additional Considerations

- The rebuilding of the railroad overpass requires the construction of 2,900 feet of parallel track to the west of the existing track. This proposal provides an opportunity to reconstruct the railroad overpass that spans US 41A. This proposal also includes railroad overpasses over Ingram Street and Elm Street. Under this plan, the existing track would be abandoned once the construction of the new overpasses and track is complete. The total cost estimate for this project is $7.3 million.

- Currently, the reconstruction of US 60 south of this project is underway. During this project, previously unknown utilities have been discovered, resulting in a significant increase in project cost as well as added time delay. Because of this discovery, it is reasonable to assume that the possibility exists for a similar situation within the US 41A study area.

- The project team elected to not recommend bike lanes on the widened sections of US 41A for several reasons. Right-of-way is restricted; relocation and right-of-way costs would increase significantly if bicycle lanes were installed. High traffic volumes on this corridor, coupled with the uncontrolled access and numerous curb cuts, make bicycle activity hazardous. In addition, there is an ample parallel streets grid network with significantly less traffic volume that could better accommodate bicycle lanes. The Evansville Metropolitan Planning Organization[1] is the designated Metropolitan Planning Organization (MPO) for the Evansville, Indiana, and Henderson, Kentucky, Urbanized Area. The Evansville MPO produced a bike and pedestrian plan in June of 2003. The *Greater Henderson Bicycle and Pedestrian Plan* (included in Appendix I), identifies the recommended bike and pedestrian route networks for the short and long term. It does not recommend this section of US 41A as a bikeway network in either the short or long term.

[1] The Evansville MPO was formerly known as the Evansville Urban Transportation Study (EUTS).

1.0 INTRODUCTION

In 2004, the Evansville MPO completed a Congestion Management System Study (CMS) for the Evansville-Henderson Transportation Management Area (TMA) as initially required in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and subsequent federal transportation legislation. The purpose of that study was to identify congested areas and devise appropriate strategies to prevent or mitigate congestion. The CMS Study is provided in Appendix I. That study considered the US 41A (Green Street) corridor in Henderson, among others. Although a menu of possible congestion mitigation actions was listed, the study made no corridor-specific recommendations. An earlier Evansville MPO study (Green Street Corridor Study) had evaluated the 2.7-mile stretch of Green Street between US 41 and KY 136 (Sand Lane) and had made a series of recommendations, including one for a continuous, two-way, left-turn lane between 1st Street and 12th Street. The Green Street Corridor Study is provided in Appendix I.

Subsequent articulation of candidate project priorities through the KYTC Statewide Transportation Planning process confirmed the high importance placed by local officials on improvements to Green Street; this candidate improvement has been ranked as a "High" priority at the local, regional, and KYTC district level. The Kentucky *Enacted Six-Year Highway Plan FY 2006-2012* included a Scoping Study for widening Green Street to provide a continuous two-way, left-turn lane from its junction with US 60 West to its termination at the junction with US 41 North/US 60 East as Item No. 02-140.00. KYTC retained the consulting firm of Qk4 to conduct the study.

The purpose of the *Scoping Study for US 41A (Green Street)* was to provide information to KYTC so it can investigate options to widen US 41A to provide a continuous, two-way left-turn lane from US 60 (MP 13.24) to US 41 (MP 17.40), a distance of about 4.2 miles. A project team approach was used, consisting of representatives from the KYTC Central Office and District 2, the Green River Area Development District, and Qk4. Public involvement activities included project team meetings, resource agency coordination, and a meeting with local officials and stakeholders. The study examines this improvement strategy to address both current and future needs of US 41A. This, in turn, will help the KYTC make decisions regarding the need for roadway improvements, and to define potential improvements that would increase safety and better serve the Henderson County residents and the traveling public.

Funds for the scoping study were included in the *Enacted Six-Year Highway Plan FY 2006-2012*, approved May 2006 (Project number 2-140.00). The project is not listed in the current *KYTC 2008 Highway Plan, (FY 2008-2014).*

Other area projects in or near the study area are:

- KYTC Item # 2-126: Reconstruction of US 60 from KY 425 to US 41A in West Henderson to alleviate traffic flow problems. The project exhibits five lanes with 3-foot-wide bike lanes, curbs and gutters, and sidewalks. This northern end of this project terminates with the southern end of this US 41A study area.

- KYTC Item # 2-966: Widen US 41A at KY 136 (Sand Lane) for left-turn lane construction. This project is currently in the utility relocation phase and will address the turning movement issues on US 41A at KY 136.

1.1 Project Location and Study Area

The City of Henderson is located in northwestern Kentucky (see Figure 1), approximately 10 miles south of Evansville, Indiana. Henderson, the county seat of Henderson County, had an estimated 2007 population of 27,768, according to the Kentucky State Data Center at the University of Louisville, ranking it the eighth largest city in Kentucky. Henderson County's estimated 2007 population was 45,440. Major highways providing access to Henderson include the Audubon and Breathitt Parkways, US 41, and US 60. Figure 2 identifies the study area.

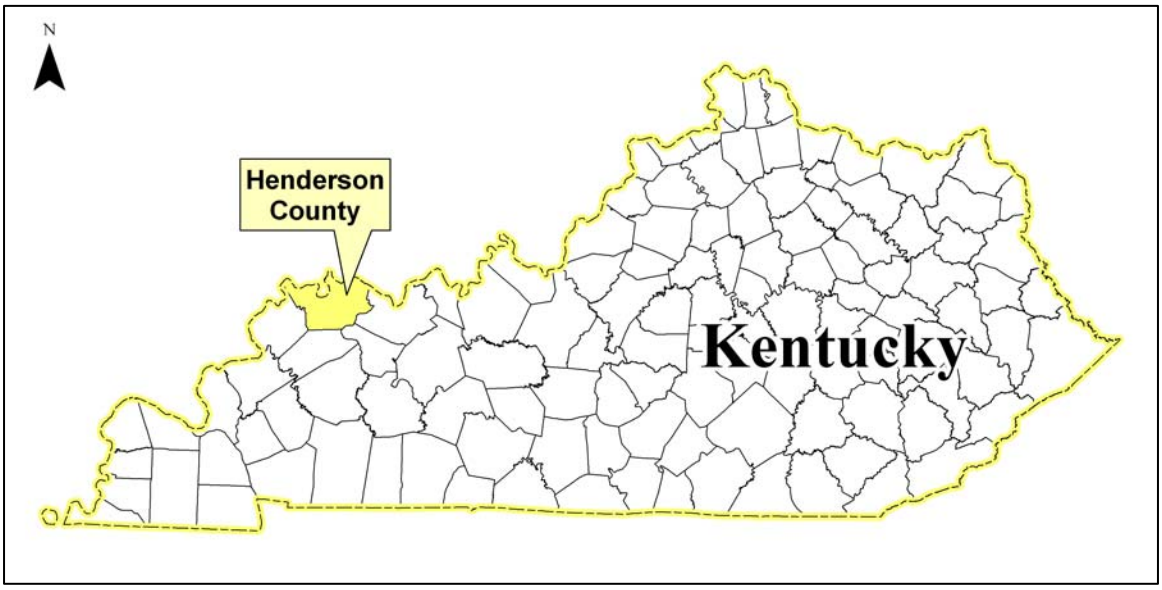

Figure 1: Project Location—Henderson County

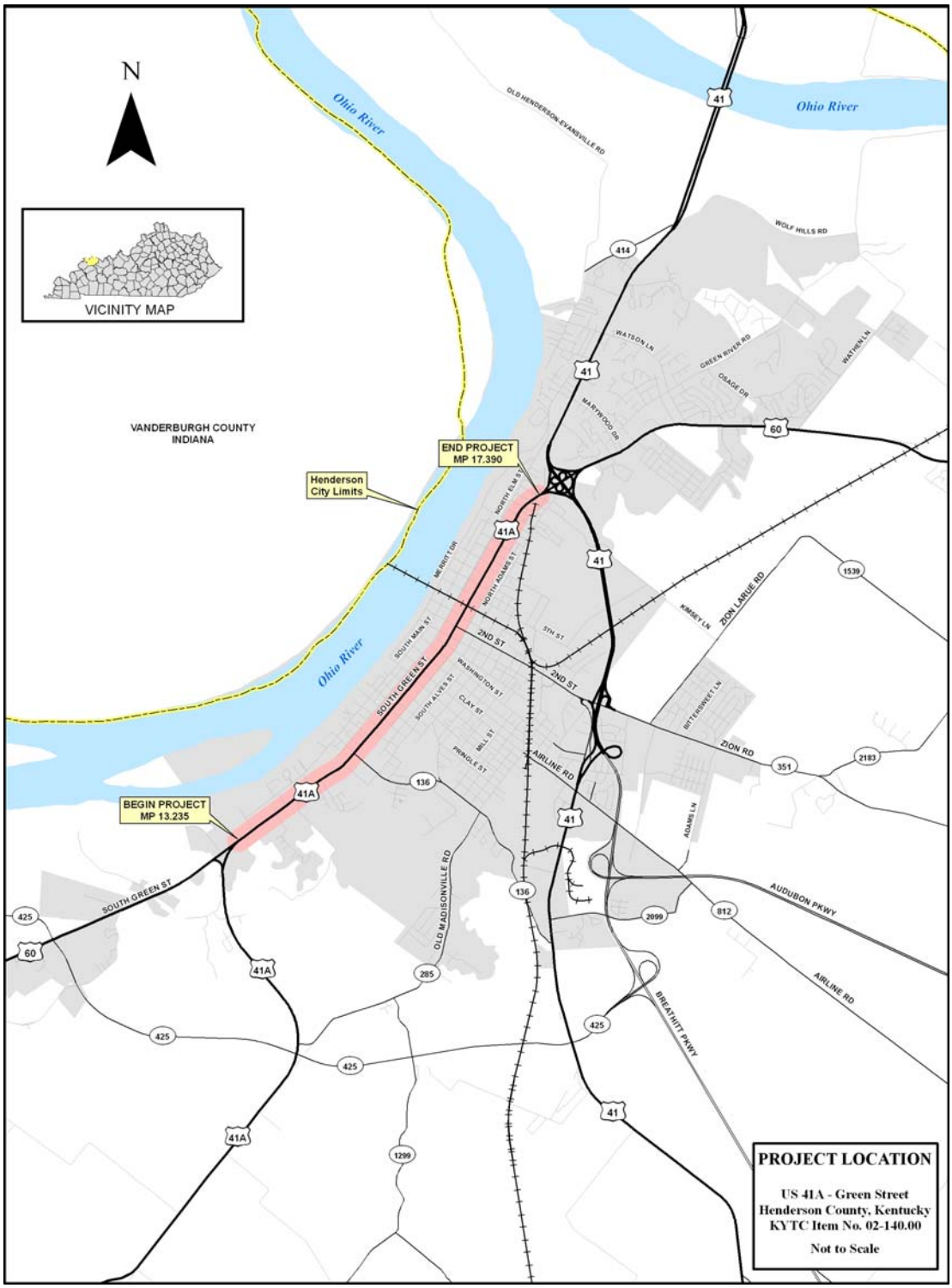

Figure 2: Project Location—City of Henderson, Henderson County, Kentucky

1.2 Study Process

As noted, a project team approach was employed for the *US 41A Scoping Study*, consisting of representatives from the KYTC Central Office and District 2, and the project consultant, Qk4. A total of three project team meetings were held: May 30, 2008; February 26, 2009; and August 5, 2009. The minutes for these meetings are included in Appendix C. In addition, a local officials' meeting was held on April 13, 2009 and the meeting minutes are included in Appendix D. The *Scoping Study for US 41A* in Henderson has consisted of four major steps:

- Define the study issues and goals.
- Identify and review existing conditions.
- Develop alternative solutions to the identified transportation issues that reflect the project goals.
- Evaluate the alternatives through discussions with a KYTC Project Team and local officials.
- Recommend alternative solutions.

The subsequent chapters in this report follow these steps.

2.0 STUDY ISSUES AND GOALS

2.1 Project Issues

Discussions were held with the Project Team during which a number of important issues were identified for consideration in examining Green Street. A summary of the issues follows:

- US 41A is a highly congested highway that operates at a less than desirable level of service. Several intersections with US 41A including US 60, KY 136, KY 351, and others are not adequate due to safety deficiencies and congestion issues.
- 2007 ADT ranged from 19,600 to 30,100, with 9% trucks.
- In the study area, US 41A exhibits the characteristics of a high crash corridor, with two fatalities from 2003 to 2007.
- Many businesses, homes, and historic properties abut the existing rights-of-way.
- Many utilities are located adjacent to the existing rights-of-way. It was noted that, for Item 2-966, the utility relocation costs for this one intersection improvement totaled $1.1 million, which was more than the cost of construction.
- A railroad track overpass is a major choke point to be addressed.
- There are many misaligned intersections along the corridor in the study area.

2.2 Project Goals

The project goals to be evaluated in the *Green Street Study* result from the project issues discussed above. These goals were also developed in consultation with the Project Team. The project goals are:

- **Address highway capacity, growth needs and congestion in Henderson County.**
- **Improve safety.**

3.0 EXISTING AND FUTURE NO-BUILD CONDITIONS

3.1 Highway and Traffic Characteristics

Existing conditions on Green Street were compiled from the KYTC Highway Information System (HIS) database and from KYTC crash records. Recent (2005–2007) traffic counts were conducted by KYTC at four locations along Green Street. Based on locations of these KYTC traffic counts, the study area was divided into four sections to analyze the existing conditions data.

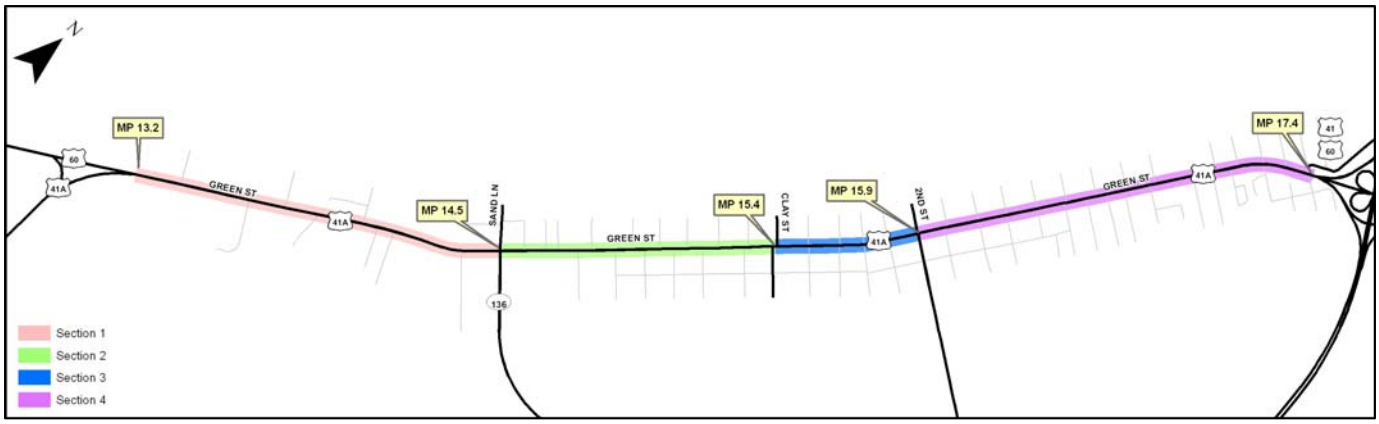

Figure 3: Existing Conditions Sections 1–4 of US 41A

The KYTC counts taken indicate ADT volumes in 2008 of:

- 19,600 vpd at a count station near the intersection with KY 136 (Sand Lane).
- 20,800 vpd near the intersection with Clay Street.
- 25,700 vpd near the intersection with KY 351 (2nd Street).
- 30,100 vpd at the junction with US 41 North and US 60 East.

The percentage of single unit and combination trucks in the traffic mix was moderate (9%). In 2030, ADT volumes at these four count stations are projected to be 22,600, 25,600, 30,300, and 34,800 vpd, respectively.

Some noteworthy points regarding the base data of US 41A are listed below, followed by Table 1, which summarizes Green Street's roadway characteristics.

- Lane widths are adequate at 12 feet wide north of Harding Avenue to the terminus of the study area at the US 60 interchange (MP 17.4). In contrast, the lane widths in the majority of the study area, from US 60 (MP 13.2) to Harding Avenue (MP 16.9) are between 10 and 11 feet wide.
- Access control in the study area is by permit only.

- The posted speed limit is 35 mph between the intersection at Sand Lane and the intersection at 14th Street, and 45 mph at all other points.

- Right-of-way widths average 60 to 80 feet except near the interchange with US 41 and US 60, where the width is 250 feet.

- Sidewalks are present at some locations, however, a 1.8-mile-long sidewalk extension between MP 13.2 and MP 15.0 has been proposed through the KYTC Statewide Transportation Planning process.

- There are seven signalized intersections in the study area.

Table 1: US 41A Roadway Characteristics

Roadway Characteristics	Begin MP 13.235 to End MP 14.483	Begin MP 14.483to End MP 15.406	Begin MP 15.406 to End MP 15.884	Begin MP 15.884 to End MP 17.397
	US 60 to KY 136 (Sand Lane)	KY 136 (Sand Lane) to Clay Street	Clay Street to KY 351 (2nd Street)	KY 351 (2nd Street) to US 41/US 60 Interchange
Driving Lanes	3-4	4	4-5	4-5
Lane Width	10-11	10	10	10-12
Shoulder Type	Paved	Curbed	Curbed	Curbed
Shoulder Width	2	0	0	9
2007 ADT	19,600	20,800	25,700	30,100
Posted Speed Limit	45	35	35	35-45
Average R/W Width	80	60	60	60-250
Type Road	Undivided Highway	Undivided Highway	Undivided Highway	Undivided Highway before Hardin Avenue
Median	None	None	None	Raised Median after Harding Avenue
Functional Class	Urban Principal Arterial Street	Urban Principal Arterial Street	Urban Principal Arterial Street	Urban Principal Arterial Street
State Primary Road System	State Primary	State Primary	State Primary	State Primary
National Hwy System	YES	YES	YES	YES
National Truck Network	NO	NO	NO	NO
Truck Weight Class	AAA	AAA	AAA	AAA
Terrain	Flat	Flat	Flat	Flat

3.2 Intersection Level of Service and Delay

Morning and afternoon (AM and PM) peak-hour traffic operating conditions for both current and future (2030) years were calculated. For each intersection, average vehicle delays were calculated as well as the resulting levels of service.

Level of service (LOS) is a qualitative measure of expected traffic conflicts, delay, driver discomfort, and congestion. Levels of service are described according to a letter rating system (similar to school grades) ranging from LOS A (free flow, minimal or no delays – best conditions) to LOS F (stop and go conditions, very long delays – worst conditions). For intersections the Highway Capacity Manual defines levels of service based on the average delay due to the signal or stop control. LOS C is often considered the threshold for desirable traffic conditions in smaller cities such as Henderson. In this study, levels of service below this threshold are noted as undesirable and warrant improvement. LOS C corresponds to less than 35 seconds of delay per vehicle at a signalized intersection and less than 25 seconds of delay at an unsignalized intersection.

Traffic projections were developed for the year 2030 to determine how Green Street would function if no improvements (beyond normal maintenance) were made during that time period. This scenario is referred to as the No-Build Scenario.

Table 2: Current and Projected ADT and LOS

Beginning MP	Beginning Feature	Ending MP	Ending Feature	2007 ADT	2030 ADT	2007 LOS	2030 LOS
13.235	US 60	14.483	KY 136 (Sand Lane)	19,600	22,600	B	B
14.483	KY 136 (Sand Lane)	15.406	Clay Street	20,800	25,600	B	D
15.406	Clay Street	15.884	KY 351 (2nd Street)	25,000	30,300	E	E
15.884	KY 351 (2nd Street)	17.397	to US 41/US 60	30,100	34,800	E	F

3.3 Crash Analysis

The Critical Rate Factor (CRF) for the three year period from January 1, 2005 to December 31, 2007 is 1.30 for the study area. KYTC defines CRF as the quotient showing the ratio of the crash rate for a roadway spot or segment divided by the critical crash rate for that roadway sport or segment based on roadway type, number of lanes, and median type. A CRF greater than 1.00 indicates that the segment of roadway has had a statistically significant number of crashes that likely had not occurred at random. Critical rate factors within the US 41A study area between MP 13.1 and MP 17.3 are listed in the table below. CRF rates greater than 1.00, which indicate a high crash area, are highlighted in yellow.

Table 3: Corridor / Segment Crash Analysis

Beginning MP	Ending MP	Total Number of Crashes	Crash Rate	Critical Crash Rate	Critical Rate Factor
Corridor					
13.100	17.300	1,357	2.01	1.62	1.30
0.3 Mile Spot					
13.100	13.400	43	1.16	1.17	1.00
13.400	13.700	42	1.14	1.80	0.63
13.700	14.000	64	1.73	1.80	0.96
14.000	14.300	21	0.57	1.80	0.32
14.300	14.600	128	2.94	1.76	1.67
14.600	14.900	18	0.41	1.76	0.24
14.900	15.200	57	1.31	1.76	0.74
15.200	15.500	142	3.01	1.74	1.73
15.500	15.800	169	3.58	1.74	2.06
15.800	16.100	150	2.75	1.71	1.61
16.100	16.400	163	2.99	1.71	1.75
16.400	16.700	56	1.03	1.71	0.60
16.700	17.000	237	4.35	1.13	3.84
17.000	17.300	67	1.23	1.13	1.08

Crash Data 2005 – 2007

Yellow highlight indicates a high crash area (CRF greater than 1.00).

The CRF of 3.84 from mile points 16.700 to 17.000 prompted the data for the area to be re-analyzed in closer detail. Of the 324 total crashes, only 17 were single-vehicle crashes. Nearly half (46.6%) were rear end, 16.1% opposing left turn, and 16.0% angle collision (each typical of an urban environment with uncontrolled side access). 13.9% were sideswipe type crashes and 5.6% involved a vehicle entering/leaving entrance. Approximately 72.5% occurred during the daytime which seems to reflect when most traffic is on the road. These CRF patterns appear typical for a heavily traveled type of urban facility with possible stop-and-go traffic characterized by frequent signals, uncontrolled side access, and the lack of a left-turn lane. In addition, it was noted during field visits that the average running speed (in off peak hours) was somewhat higher than the posted speed limit.

4.0 HUMAN ENVIRONMENT OVERVIEW

4.1 Environmental Justice

The *Environmental Justice and Community Impact Issues US 41A, Green Street in Henderson Six Year Plan Item No. 2-140* was prepared for the *Alternatives Planning Study for US41A/Green Street* by the Green River Area Development District (GRADD). The full report is included in Appendix G and is summarized in this chapter.

An *Environmental Justice and Community Impact Report* (EJ Report) is an assessment of community demographics within the study area and a comparison of these demographics with those of the surrounding area, particularly regarding low income, minority, and elderly populations. The goal of such an effort is to ascertain if any of these populations might be disproportionately impacted by improvements to the Green Street corridor.

The defined study area encompasses portions of 10 Block Groups within 8 Census Tracts. The Census Tracts and Block Groups are listed below:

Henderson County

Census Tract: 201 Block Group: 1	Census Tract: 205 Block Group: 2
Census Tract: 202 Block Group: 1	Census Tract: 206.01 Block Group: 2 & 3
Census Tract: 203 Block Group: 1	Census Tract: 206.02 Block Group: 1
Census Tract: 204 Block Group: 1 & 2	Census Tract: 209 Block Group: 3

Comparison of the demographic characteristics of the Block Groups representing the study area to the Block Groups surrounding the study area and to state and national averages revealed the following:

- Minority Population: The percentage of minority populations in Henderson County is below both state and national averages. However, there are six Census Tracts and eight Block Groups within the study area that indicate higher percentages of minority populations than the national, state, and county levels.
- Low-Income Population: Henderson County's poverty level is lower than both the national and state percentages. However, there are six Census Tracts and seven Block Groups within the study area that have higher percentages of the population with income below the poverty level that exceeds county, state, and national averages.
- Population Age 65 and Older: Henderson County's population age 65 and over is higher than the state and national averages. Consequently, seven of the eight Census Tracts have higher percentages than county, state, and national levels.

Based on the minority population percentages and the high percentages of persons 65 and over, a high degree of community cohesion may be present. A subsequent review of data within the affected Census Tracts should be undertaken to determine if particular populations exist in the study area; and if so, proactive measures should be undertaken to insure that these groups are not disproportionately affected by any projects.

4.2 Underground Storage Tanks/Hazardous Materials

The Underground Storage Tank Branch (USTB) of the Division of Waste Management (DWM) of the Department for Environmental Protection (DEP) of the Kentucky Energy and Environment Cabinet (EEC) identified 29 facilities with a total of 99 registered underground storage tanks. Of the 99 registered underground storage tanks, 77 have been closed, 18 are active, and 2 are listed as abandoned. There are 8 facilities currently undergoing corrective actions within the project area due to soil and/or groundwater contamination. The 18 active tanks are at five separate sites: Fast Fuel/Country cupboard # 6, 1773 S. Green Street; Swifty Gas Station # 231, 1605 S. Green Street; Dodge's Store, 301 S. Green Street; Chuckles Food Mart # 32, 202 N. Green Street; and Thornton's Oil # 86, 940 N. Green Street.

4.3 Cultural Archeological and Historic Resources

Archaeological Resources

The *Archaeological Resource Overview Report* prepared for the study noted that three archaeological surveys have been conducted within the study area and an additional twelve surveys have been identified within a 1.24-mile buffer around the study area. One of the three archaeological surveys identified an archaeological and cultural historic site in the study area: The Mt. Zion Cemetery (15HE864/He-67). The Mt. Zion Cemetery is an African-American cemetery dating to the early twentieth century. The cemetery is considered eligible for listing on the National Register of Historic Places (NRHP). No other archaeological sites have been identified within the study area. The full report is in Appendix E.

Cultural Historic Resources

The *Cultural Historic Resource Overview* prepared for this study identified two historic districts listed on the National Register of Historic Places (NRHP), six individual properties listed on the National Register and nineteen properties that appear to have potential to be listed on the National Register. The two historic districts that fall within the boundaries of the study area are the South Main and South Elm Streets Historic District, which was listed in 1992; and the Henderson Commercial Historic District, which was listed in 1989. The two historic districts, six properties, and the nineteen potential properties are identified on Exhibit # in Appendix A, and in the large maps provided electronically on CD. The six individual National Register listed structures are identified in detail below.

1. Stewart House, 827 S. Green Street (Site Z, HEH-224)
Built in 1951, The house embodies the distinctive characteristics of a type of prefabricated construction, marketed by the Lustron Corporation after World War II as a response to the housing shortage. It developed a mass-produced house with pre-fabricated framing, roof and ceiling panels, with interior and exterior walls made of porcelain enamel-finished steel.

2. Furman House, 334 Powell Street (Site QQ, HEH-119)
This home is a contributing element in the South Main and South Elm Streets Historic District. This was home to Lucy Furman, an author and lecturer, who was born here in 1870. Her first book was published in 1897. She taught in the Hindman Settlement School in Knott County from 1907 until 1927. The house is a two-story, brick, hipped roof dwelling which has an asymmetrical plan.

3. Craig House, 329 Powell Street (Site RR, HEH-432)
This home is a contributing element in the South Main and South Elm Streets Historic District. This house is a one-and-one-half-story, brick bungalow with a shed roofed dormer. The full-width porch is supported by brick posts atop a brick porch railing.

4. St. Paul's Episcopal Church, 338 Center Street (Site YY, HEH-418)
Built in 1859-1860, and a contributing element in the South Main and South Elm Streets Historic District, this Gothic Revival church is based on the cruciform plan. The main facade facing Center Street features a steeply pitched wall gale that is pierced by an equilateral arch window with a low-relief stone hood molding. The main entrance is in a square bell tower on the northwest corner of the building. The tower contains a Tudor arch doorway and is surmounted by an eight-sided spire. The church sanctuary is seven bays deep with buttresses as the only major interruptions of its smooth walls that are stuccoed brick.

5. Wolf's Tavern, 31 N. Green Street (Site BBB, HEH-219)
Built in 1878, and a contributing element in the Henderson Commercial District, it is a two-and-one-half-story, three-bay, brick commercial building. It retains some Mesker steel components including the only surviving elaborate metal cornice pediment in the Henderson Commercial Historic District. Other metal elements include the gabled hood moldings above the windows on the second floor and a metal cornice with side piers.

6. John McAllister House, 839 N. Green Street (Site JJJ, HEH-175)
Built in 1867, is a two-story, three-bay, central passage, brick dwelling with brackets along the eaves of its hipped roof. The McAllister House displays elements from the Greek Revival and Italianate styles.

The nineteen properties that appear to have potential to meet National Register criteria and listed below and identified on Exhibit 2 in Appendix A:

1. Mt. Zion Cemetery (Site D, HEH-523)
2. 1563 S. Green Street (Site K, HEH-513)
3. St. Louis Cemetery (Site O, HEH -507)
4. 1425 S. Green Street (Site P, HEH-510)
5. Turner House, 1005 S. Green Street (Site U)
6. 1002 S. Green Street (Site W)
7. 818 S. Elm Street (Site AA)
8. 702 S. Green Street (Site BB)
9. 338 S. Green Street (Site JJ)
10. 222 S. Green Street (Site NN, HEH-118)
11. 200 S. Green Street (Site PP, HEH 116)
12. 138 S. Green Street (Site SS)
13. 132 S. Green Street (Site TT, HEH-115)
14. 119 S. Green Street (Site VV, HEH-120)
15. 115 S. Green Street (Site WW)
16. 36 S. Green Street (Site ZZ)
17. First United Methodist Church, 338 Third Street (Site CCC-2)
18. L&N Railroad Ohio River Bridge Approach (Site FFF)
19. McClain House, 804 N. Green Street (Site III, HEH-174)

The *Cultural Historic Resource Overview* also identified buildings in and around the study area that would be documented in a baseline study but appear to be ineligible to meet National Register criteria, as well as structures previously documented but no longer standing. The entire report is included in Appendix F.

4.4 Land Use and Zoning

Within the project corridor, there is a mix of commercial, residential, and institutional land uses. In the northern end of the study area, land use is primarily high-density commercial, which transitions to more residential land uses as the corridor traverses to the south. In addition, some older residences have been converted to commercial uses. There is also limited, less dense commercial development located in the southern section of the study area.

Along the corridor there are several churches, the larger ones of which include Church of Christ, First United Methodist Church, St. Paul's Episcopal Church, and New Race Creek Baptist Church. There are three cemeteries located along the project corridor between US 60 and KY 1136: Fairmont, Mt. Zion, and St. Louis cemeteries.

Appendix B contains selected photographs showing the roadway and land uses along the Green Street study corridor from US 60 to US 60.

5.0 NATURAL ENVIRONMENT OVERVIEW

5.1 Aquatic Ecology

No aquatic macro invertebrate, fishes, or water quality sampling was completed for this ecological overview. The Kentucky Department of Fish and Wildlife Resources (KDFWR) recommended that, should any recommended improvement be implemented, erosion control measures be developed and utilized during any construction to minimize siltation into nearby waterways. Such erosion control measures may include, but are not limited to silt fences, staked straw bales, brush barriers, sediment basins, and diversion ditches. Erosion control measures will need to be installed prior to construction and should be inspected and repaired regularly as needed (See Appendix H).

5.2 Terrestrial Ecology and Threatened & Endangered Species

The U.S. Fish and Wildlife Service was invited to comment on the project and no comment was received. Table 4 identifies the following endangered, threatened, or candidate species as potentially occurring or having known occurrences in Henderson County. The data was obtained from the website provided by the U.S. Fish and Wildlife Service.

Table 4: Federally Protected Species of Henderson County

Federally Protected species that may potentially occur in Henderson County:		
Common Name	**Species**	**Status**
Orangefoot pimpleback	*Plethobasus cooperianus*	Federally endangered
Sheepnose	*Plethobasus cyphyus*	Federal candidate
Clubshell	*Pleurobema clava*	Federally endangered
Rough pigtoe	*Pleurobema plenum*	Federally endangered
Federally Protected species that have known occurrences in Henderson County:		
Common Name	**Species**	**Status**
Indiana Bat	*Myotis sodalis*	Federally endangered
Purple catspaw pearlymussel	*Epioblasma o. obliquata*	Federally endangered
Fanshell	*Cyprogenia stegaria*	Federally endangered
Fat Pocketbook	*Potamilus capax*	Federally endangered
Pink Mucket	*Lampsilis abrupta*	Federally endangered
Ring Pink	*Obovaria retusa*	Federally endangered
Bald Eagle	*Haliaeetus leucocephalus*	Federally threatened
American burying beetle	*Nicrophorus americanus*	Federally endangered

6.0 RESOURCE AGENCY COORDINATION

One agency mailing was prepared during this study. Dated July 31, 2009, the mailing was prepared and distributed after preliminary improvement options had been identified and agreed to by the Project Team. A copy of the mailing and the list of recipients are included in Appendix H for reference.

Responses were received from a variety of agencies. Many of the responses indicated that their agency did not anticipate any significant project-related issues in the study area. Others outlined standard requirements and guidance related to project planning, design, and construction. A third set of agencies expressed specific concerns or identified issues to be considered in the study. A summary of the substantive responses received is provided below. Similarly, all agency correspondence received is included in Appendix H.

1. U.S. Fish and Wildlife Service, was invited to comment and no comment was received. The data for this report was obtained on the website provided by the agency.
2. Department of Military Affairs: No issues or concerns indicated; the roadway improvements may have a positive impact on the movement of military material.
3. U.S. Coast Guard: No jurisdiction and no permit required.
4. Federal Aviation Administration (FAA): No impacts to the Henderson City-County Airport.
5. U.S. Department of Housing and Urban Development (HUD): Under review of HUD environmental protection specialist.
6. U.S. Department of Agriculture, Natural Resource Conservation Service: No comments regarding this project.
7. Kentucky State Police: The proposed construction is greatly needed in this area.
8. Kentucky Airport Zoning Commission: No adverse effect to air navigation. However, if construction equipment exceeds 200 feet above ground level, a permit will be required.
9. Kentucky Division of Forestry: Does not believe any tree issues would negatively impact the need to correct highway safety concerns. Recommends that KYTC make an effort to replace street trees where possible after the project is complete.
10. Kentucky Department of Fish and Wildlife Resources: Does not expect impacts to listed species due to the location and nature of the project. KDFWR recommends that erosion control measures be developed and utilized during any construction to minimize siltation into nearby waterways.
11. Kentucky State Nature Preserves: No comments regarding potential impacts on rare species and communities.
12. KYTC Division of Operations: Noted that congestion is an issue and that a road diet is an alternative that should be reviewed.
13. KY Education and Workforce Development Cabinet: No comments.
14. Kentucky Energy and Environment Cabinet, Department for Environmental Protection (EEC-DEP), Division of Water (DOW): Best management practices shall be used to reduce runoff from the project.
15. EEC-DEP, Division for Air Quality: Identified two administrative regulations that apply to this project and indicated that this project must meet the conformity requirements of the Clean Air Act.

16. EEC-DEP, Division of Waste Management (DWM): All solid waste generated by this project must be disposed of at a permitted facility.
17. EEC-DEP-DWM, Superfund Branch: Provided a list of superfund sites in Henderson County.
18. EEC-DEP-DWM, Underground Storage Tank Branch: Provided a table that identified 29 facilities with a total of 99 registered underground storage tanks and their status (see Section 4.2, herein).
19. EEC-DEP-DWM, Solid Waste Branch: Attached a map showing the known waste areas of solid waste landfills related to Henderson City; none of which are in the study area.
20. EEC, Department for Natural Resources: Indicated areas of existing mining within the project area as a seam of coal 190 feet below the surface in the vicinity of the US 41A and KY 136 intersection.
21. Kentucky Geological Survey: Indicated that none of the observed geologic features in the field area would preclude improvements on US 41A.
22. Evansville MPO: Supports the necessary improvements that will increase safety and efficiency along the corridor and provided several recommendations.
23. Henderson City-County Planning: This project is addressed in the City-County Comprehensive Plan.
24. Henderson County Schools: Provided comments regarding potential construction concerns.
25. City of Henderson: Agrees with the project goals and needs and assorted suggestions.
26. Henderson Water Utility: There will need to be coordination with HWU.

7.0 ALTERNATIVES DEVELOPMENT AND EVALUATION

7.1 Analysis Sections

To better analyze design options in the 4.0-mile section of US 41A, the corridor was broken down into five individual sections. These five sections differ from the four sections used to analyze the existing conditions data. The five sections were determined due to the existing roadway conditions, (i.e., five lane section between Washington Street and Third Street, and the railroad overpass between Third Street and Fifth Street). See the section descriptions below. An illustration and brief descriptions of the general conditions of each of the five sections are as follows:

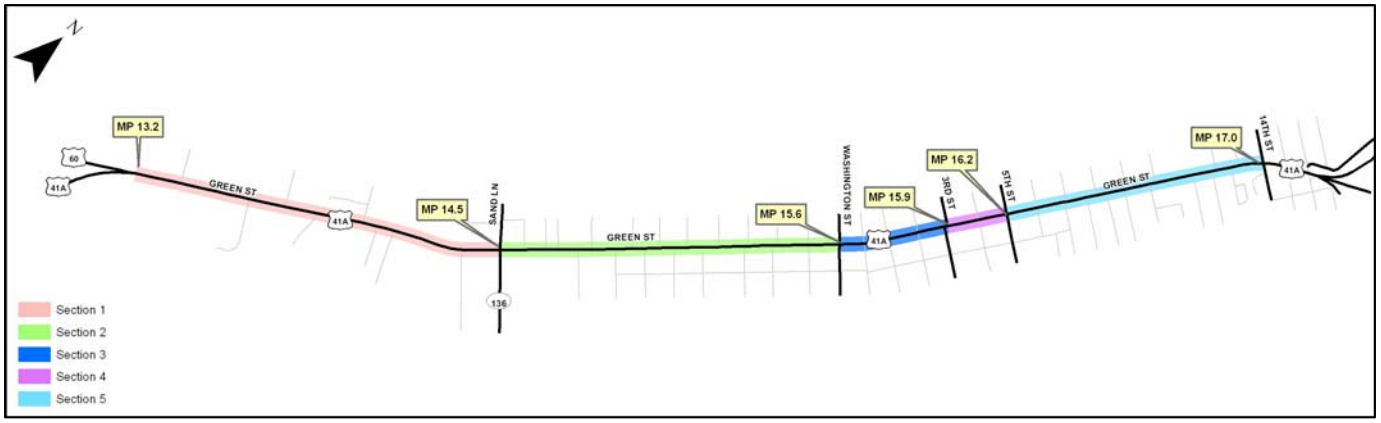

Figure 4: Alternatives Evaluation Sections 1–5 of US 41A

Section 1—This 1.3-mile section of US 41A extends from US 60 to KY 136 (Sand Lane) MP 13.2–MP 14.5). It comprises the southernmost section of the study area corridor and terminates at the new US 60 widening project. Right-of-way (ROW) width is 80 feet.

Section 2—KY 136 (Sand Lane) to Washington Street (MP 14.5–MP 15.6). ROW width is 60 feet.

Section 3—Washington Street to 3rd Street (MP 15.6–MP 15.9). This 0.3-mile section is currently a five-lane segment that does not require construction and is not a factor in the purpose of this study. ROW width is 60 feet.

Section 4—3rd Street to 5th Street (MP 15.9–MP 16.2). This 0.3-mile section contains the existing railroad overpass on the cross river CSX line that parallels 4th Street. The piers of the overpass are so close to the driving lanes of US 41A that the existing ROW is not wide enough to accommodate the addition of a center lane without reconstruction of the railroad overpass. The railroad overpass would have to be removed and rebuilt in order for the roadway to be widened in any capacity. ROW width is 60 feet.

Section 5—5th Street to 14th Street (US 60) (MP 16.2–MP 17.0). This 0.8-mile section exhibits some of the highest traffic volume of the study area. There is a lack of channelized access to properties within this section as well. ROW width is 60 feet.

7.2 Alternatives Not Advanced

In addition to the roadway widening, two other alternative concepts were considered but are not recommended for advancement: one-way couplets and a "road diet" (i.e., reducing the road from four lanes to three). The one-way couplets would require the conversion of Elm Street to a one-way facility. Elm Street is currently a divided roadway with a raised landscaped median through a residential area, and is offset at some intersections. For these reasons it would not provide an optimum configuration for a one-way street. Regarding the road diet, research indicates that only roads with a maximum volume of 850 vph have been successful in improving traffic flow after a reduction of lanes. For US 41A the approximate peak-hour volumes are 1,900 to 3,000 vph. Therefore this option is not recommended.

8.0 RECOMMENDATIONS

8.1 Recommended Alternatives

Three widening alternatives were identified to achieve the specified five-lane facility on US 41A. The alternatives are to widen to the left (west, towards the river), middle, and right (east). Each of these widening scenarios was reviewed for Section 1, Section 2, Section 4, and Section 5. Section 3 was not considered because it currently is a five lane section with a center turning lane. The proposed typical section features an 86-foot-wide right-of-way with four 11-foot-wide travel lanes; a 12-foot-wide center turn lane, 2-foot-wide gutter, 2-foot-wide verge, 5-foot-wide sidewalk, and 6-foot-wide utility strip (see typical section below). Large maps were produced by section detailing each of the three widening scenarios at a 100-foot scale. **These are provided electronically as an element of Appendix A, on a compact disk (CD) accompanying this report.** A snapshot of these exhibits is inserted on the next page for illustrative purposes.

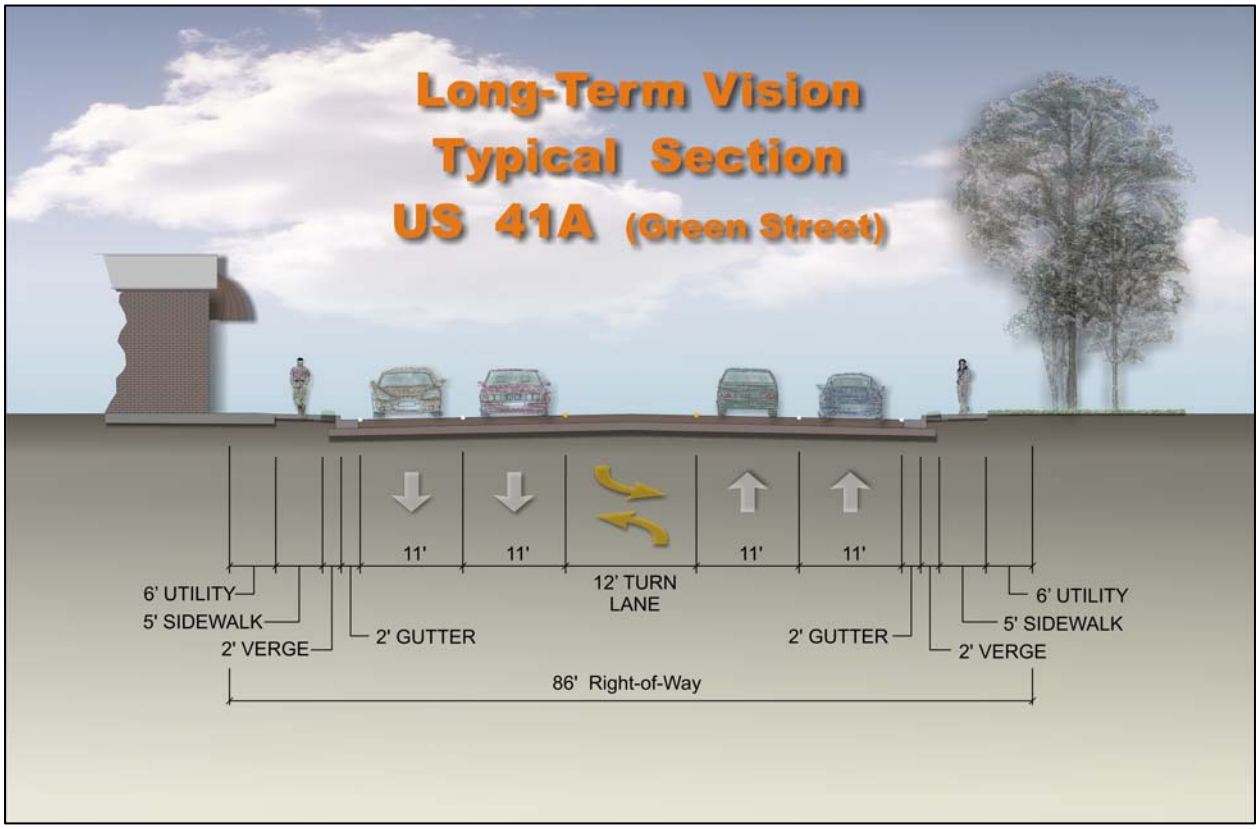

Figure 5: Recommended US 41A Typical Section

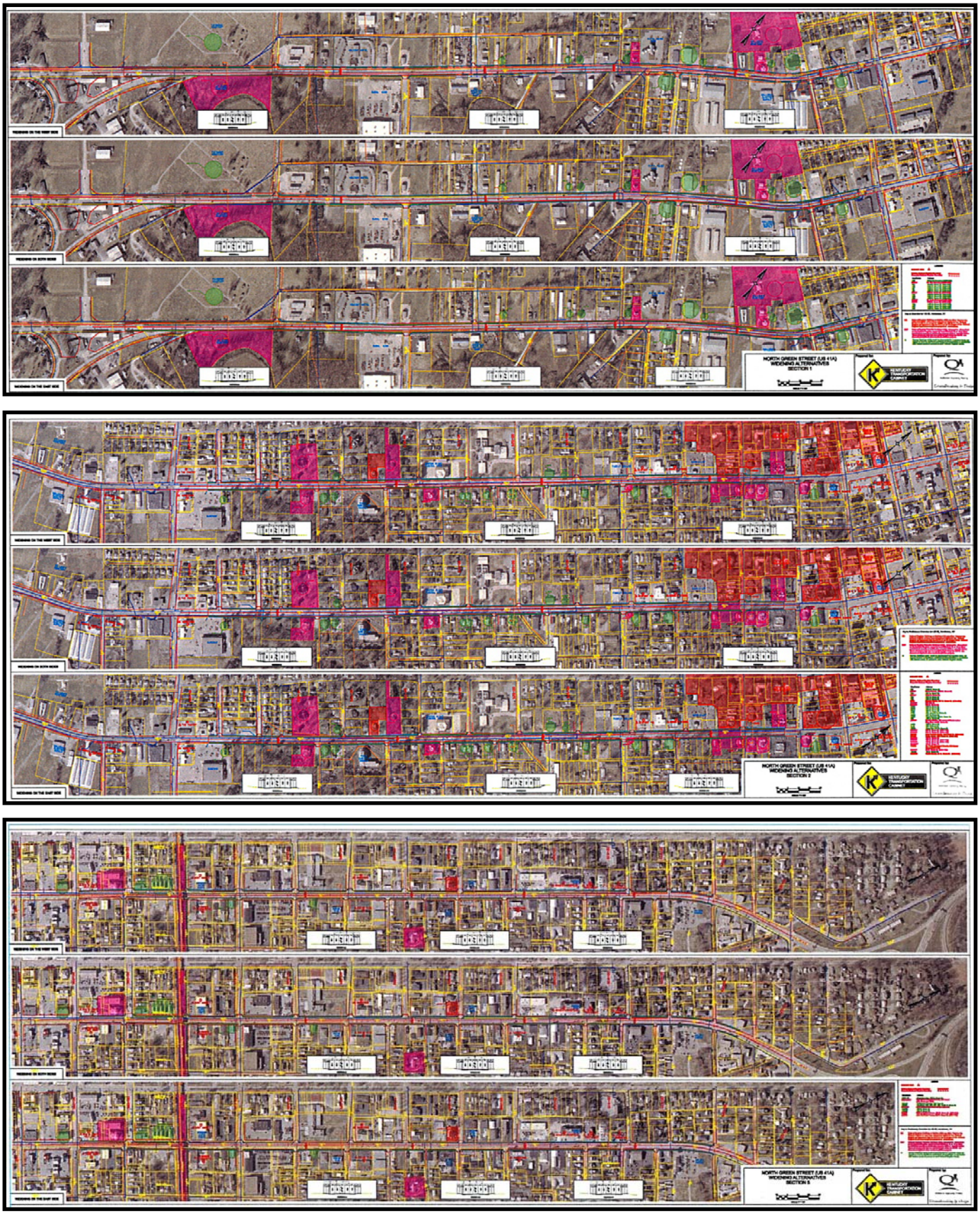

Figure 6: US 41A Widening Alternative Maps provided electronically

Phased planning cost estimates and right-of-way impacts were also identified for each widening alternative by section. This table is included as Exhibit 4 in Appendix A. Table 5 below shows the phased planning level cost estimates, by section, for widening to the left, middle, and right side of the existing alignment.

Table 5: US 41A Widening Alternatives and Cost Itemization

US 41A Widening Alternatives and Cost Itemization						
US 41A: from South to North	Length (ft.)	Construction Cost	R/W Cost	Utility Cost	Engineering Cost	Total Cost
Section 1 (US 60 to Sand Lane)						
Alternative L	6780	$3,163,000	$161,000	$2,630,000	$696,000	$6,650,000
Alternative M	6780	$3,163,000	$164,000	$2,630,000	$696,000	$6,653,000
Alternative R	6780	$3,163,000	$162,000	$2,630,000	$696,000	$6,651,000
Section 2 (Sand Lane to Wash Street)						
Alternative L	5330	$2,486,000	$436,000	$2,342,000	$547,000	$5,811,000
Alternative M	5330	$2,486,000	$126,000	$2,441,000	$547,000	$5,600,000
Alternative R	5330	$2,486,000	$426,000	$2,261,000	$547,000	$5,720,000
Section 4 (3rd Street to 5th Street)						
Alternative L	2050	$8,258,000	$784,000	$1,084,000	$1,817,000	$11,943,000
Alternative M	2050	$8,258,000	$172,000	$1,123,000	$1,817,000	$11,370,000
Alternative R	2050	$8,258,000	$1,379,000	$1,003,000	$1,817,000	$12,457,000
Section 5 (5th Street to 14th Street/US 60)						
Alternative L	3900	$1,819,000	$76,000	$1,859,000	$400,000	$4,154,000
Alternative M	3900	$1,819,000	$661,000	$1,937,000	$400,000	$4,817,000
Alternative R	3900	$1,819,000	$2,465,000	$1,924,000	$400,000	$6,608,000

The combined sections comprising the entire project range in cost from $27.7 million to $31.5 million.

Specific widening alternatives (left, middle, and right) were not selected, as the purpose of this study is to determine the feasibility of widening US 41A, in terms of phased cost estimates and right-of-way impacts. However, the segments of US 41A were prioritized for reconstruction. They are listed below in order of priority:

1. **Section 5:** highest traffic volume, most commercial land uses, and high left-turn volume.
2. **Section 1:** provides logical terminus with the current reconstruction of US 60 and no restrictions due to the presence of historic properties.
3. **Section 2:** mostly residential land uses and there are historic property issues to be addressed.
4. **Section 4:** is the lowest priority due to the extremely high cost of the reconstruction of the railroad overpass that is necessary to widen US 41A underneath.

8.2 Additional Considerations

- In Section 4, the rebuilding of the railroad overpass requires the construction of 2,900 feet of parallel track to the west of the existing track. This proposal provides an opportunity to reconstruct the railroad overpass that spans US 41A. This proposal also includes railroad overpasses over Ingram Street and Elm Street. Under this plan, the existing track would be abandoned once the construction of the new overpasses and track is complete. The total cost estimate for this project is $7.3 million.

- Currently, the reconstruction of US 60 south of this project is underway. During this project, previously unknown utilities have been discovered, resulting in a significant increase in project cost as well as added time delay. Because of this discovery, it is reasonable to assume that the possibility exists for a similar situation within the US 41A study area.

- The project team elected to not recommend bike lanes on the widened sections of US 41A for several reasons: 1) Right-of-way is restricted; relocation and right-of-way costs would increase significantly if bicycle lanes were installed. 2) High traffic volumes on this corridor, coupled with the numerous curb cuts, make bicycle activity hazardous. 3) There is an ample grid network of parallel streets with significantly less traffic volume that could better accommodate bicycle lanes. The Evansville MPO produced the *Greater Henderson Bicycle and Pedestrian Plan* in June of 2003, (included in Appendix I), which identifies the recommended bike and pedestrian route networks for the short and long term. It does not recommend this section of US 41A as a bikeway network in either the short or long term. The Evansville Metropolitan Planning Organization[2] is the designated Metropolitan Planning Organization (MPO) for the Evansville, Indiana and Henderson, Kentucky, Urbanized Area.

[2] The Evansville MPO was formerly known as the Evansville Urban Transportation Study (EUTS).