INTERSTATE 65 CONCEPTUAL IMPROVEMENTS STUDY

Bullitt & Jefferson County
KYTC Item No. 5-550

November 2020

Kentucky Transportation Cabinet
Division of Planning and
Highway District 5

KENTUCKY TRANSPORTATION CABINET

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Executive Summary

The I-65 Conceptual Improvements Study (KYTC Item No. 5-550) was initiated by the Kentucky Transportation Cabinet (KYTC) to examine the need for and scope of improvements required to accommodate traffic demand along I-65 through Bullitt County and southern Jefferson County, from Preston Highway (KY 61) in Lebanon Junction to the Gene Snyder Freeway (I-265) in Louisville. The combination of high traffic volumes, poor pavement conditions, traffic impacts associated with incidents, and limited capacity along alternate routes creates operational issues for traffic flow and compromises safe and reliable interstate travel along the study area portion of I-65, shown in **Figure ES-1**.

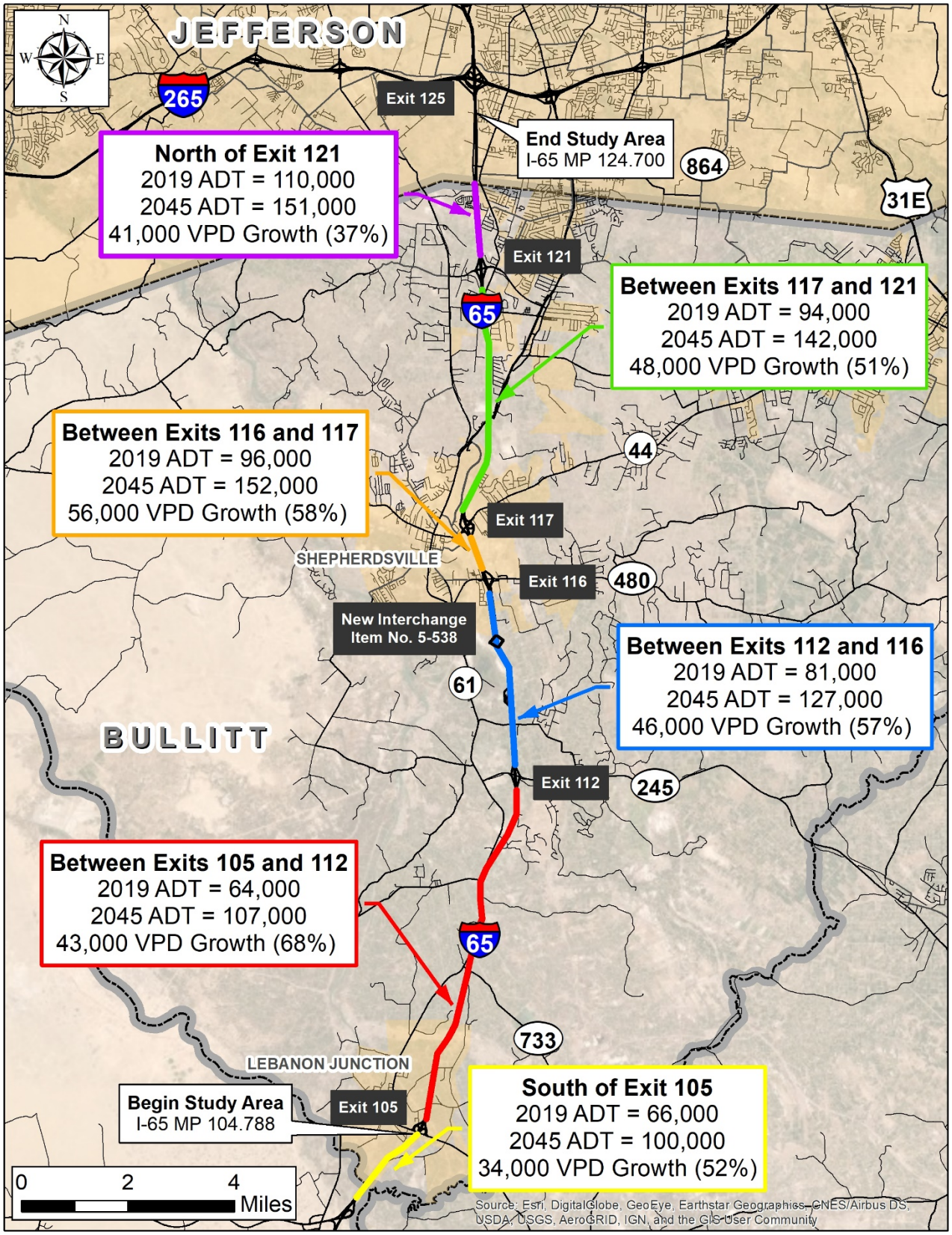
PROJECT NEEDS

Kentucky's interstate highway system provides access to national and global markets. Within Bullitt County, there are five I-65 interchanges and a sixth (Exit 115) is scheduled to open to traffic in the fall of 2020 that will increase access for manufacturing and logistics industries that currently employ more than 11,000 full-time employees. From the study area, I-65 provides one-day access to well over 60 percent of the major domestic markets[1]. Thus, the efficient movement of both people and freight on I-65 is critical to the U.S. economy. I-65 serves a tremendous volume of truck traffic - 22,000 trucks per day at the Bullitt/Jefferson County Line. Forecasts call for the number of trucks to continue to increase as the United States-Mexico-Canada Agreement (USMCA) continues to yield higher volumes of freight between Mexico and Canada. **In 2020, widening the study area portion of I-65 from six to eight lanes was ranked the 16th highest priority project of statewide importance by the Strategic Highway Investment Formula for Tomorrow (SHIFT).** SHIFT is KYTC's data-driven, objective approach to compare capital improvement projects and prioritize transportation funds.

From a local perspective, I-65 is a vital route connecting people to their places of work. Based on home-to-work commuting data from the U.S. Census Bureau, there are 50,000 person trips per day between Jefferson and Bullitt Counties. This number is expected to climb as development within Bullitt County continues to increase. Since 1990, Bullitt County's annual growth has averaged about two percent for population and about four percent for employment. These general trends of high growth are expected to continue, making travel time reliability on I-65 vital to the local and regional economy.

Historical KYTC traffic volumes show Annual Average Daily Traffic (AADT) on the study portion of I-65 ranges from 66,000 vehicles per day (VPD) near Lebanon Junction to 110,000 VPD in Louisville south of the Gene Snyder Freeway (I-265), with trucks representing 19 to 27 percent of that traffic. The combination of high truck traffic and the age of the existing pavement has led to very poor pavement conditions, compromising traffic operations and vehicle safety. By 2045, traffic along the corridor is anticipated to increase to between 107,000 and 152,000 VPD. Based on these traffic projections, without improvements, additional sections of northbound I-65 and most of southbound I-65 north of the Salt River will have undesirable traffic operations.

[1] KIPDA Comprehensive Economic Development Strategy 2018-2023



ES-1: Study Area Existing Traffic and Traffic Forecasts

IMPROVEMENT CONCEPTS

The Project Team examined strategies to address the long-term traffic needs of the corridor as well as more immediate needs related to localized traffic, safety, and operational concerns. Because the concrete pavement needs a full depth replacement, even if the recommendation were to "do nothing", KYTC will still need to rehabilitate the existing concrete pavement.

Short-Term – Existing operational issues were identified between the KY 480 (Exit 116) and KY 44 (Exit 117) interchanges. These interchanges are of particular interest for several reasons, including the relatively short distance separating them (about 0.5 miles separate the existing acceleration and deceleration lanes) and the high volume of local traffic that uses I-65 to cross the Salt River. Restriping the Salt River Bridge in both directions, as shown in **Figure ES-2**, from six to eight lanes (four lanes in each direction) by simply narrowing the inside and outside shoulders (from 10 feet to 4 feet) would allow for the extension of the existing auxiliary lanes to fully connect the interchange ramps at KY 44 and KY 480 without needing to widen the bridge. This portion of I-65 currently operates at Level of Service (LOS) E but would improve to an acceptable LOS C with the extension of the existing auxiliary lanes.

Figure ES-2: Restripe Salt River Bridge (both directions) to Extend Auxiliary Lanes on I-65 between the KY 480 (Exit 116) and KY 44 (Exit 117) Ramps

To better accommodate southbound exiting traffic at the KY 44 interchange, a dual lane off-ramp is recommended as shown in **Figure ES-3**. This would improve the diverge portion of I-65 from LOS E to LOS D. Most of the traffic turns right onto westbound KY 44 and then right again onto northbound Adam Shepherd Parkway. As a result, a new ramp split to Conestoga Parkway (CS 1170) is also proposed to eliminate the need for dual right turns at the KY 44 intersections with the southbound off-ramp and Adam Shepherd Parkway.

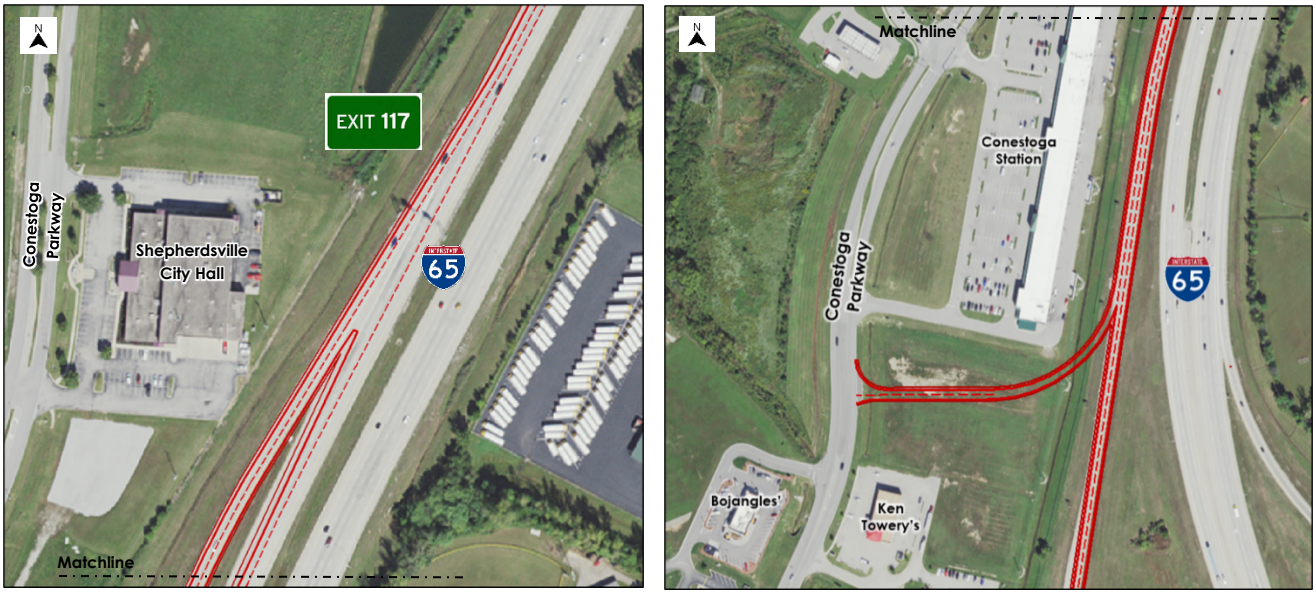


Figure ES-3: Southbound Dual Lane Off-Ramp and Ramp Split to Conestoga Pkwy

Long-Term – Based on a Highway Capacity Software (HCS) traffic analysis, it was determined that most of I-65 north of Exit 112 (KY 245/Clermont Road) would operate at an undesirable LOS E or F during the PM peak by year 2045. Based on this traffic analysis, it is evident that the six-lane portion of I-65 will need additional capacity in the future. A long-term option to increase capacity and reduce congestion is to widen I-65 from six to eight lanes inside the existing 60-ft depressed median, as shown in **Figure ES-4**.

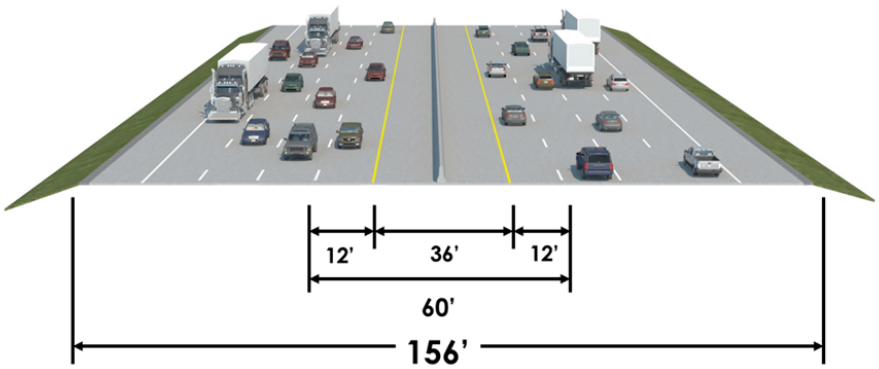


Figure ES-4: Proposed I-65 8-Lane Widening Typical Section Inside Existing Median

CONCLUSIONS

Based on an examination of technical analyses and public input, the Project Team identified priorities through 2030. Due to the high cost, widening I-65 from six to eight lanes would likely be completed in phased segments as funding is made available. Only mainline widening projects projected to be over capacity by 2030 are listed as a priority.

The improvements between the KY 480 and KY 44 interchanges and at the southbound exit ramp to KY 44 were determined to be highest priority because these concepts address existing congestion and safety issues, have a relatively low cost, and would improve the portion of the corridor with the worst existing pavement rating in the study area. From there, widening I-65 from six to eight lanes and/or replacing the existing pavement begins with the sections carrying the most traffic – moving from north to south. **Table ES-1** and **Figure ES-5** present the proposed prioritization of the improvement concepts and the associated evaluation results, including benefit-cost ratios. All of the existing pavement along the study area of I-65 will be replaced, auxiliary lanes between the ramps at Exit 116 (KY 480) and at Exit 117 (KY 44) will be added, and eight through lanes north of Exit 117 (KY 44) to Exit 125 (Gene Snyder Freeway) will be provided once these improvements are completed.

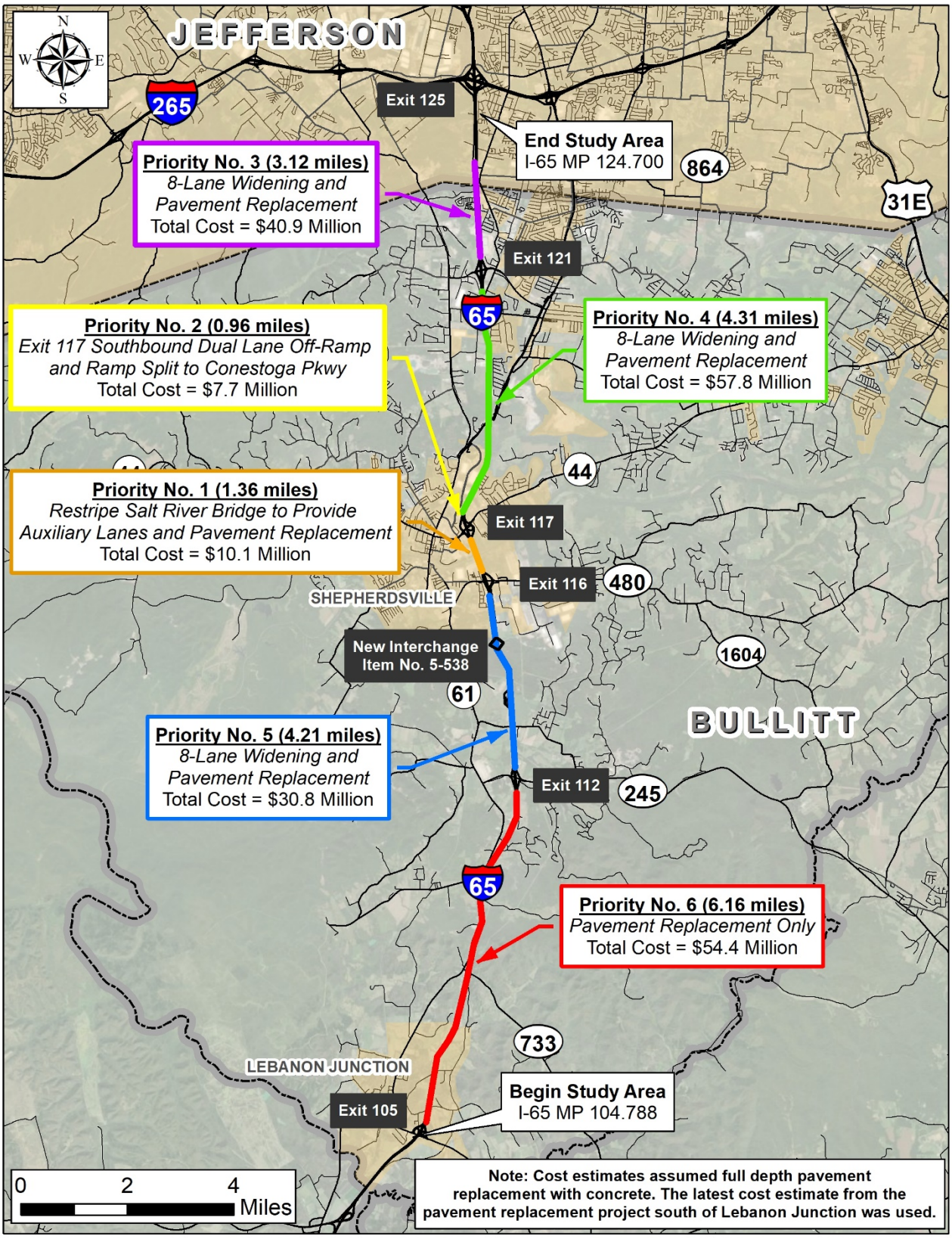
Table ES-1: Improvement Concept Prioritization and Evaluation Matrix

Overall Priority	Improvement Description	Length (mi.)	Year Traffic Demand Will Exceed Available Capacity*	Total Cost Estimate (2020 millions)	Benefit Cost Ratio
1	**Exit 116 to Exit 117** Full Depth Pavement Replacement + Restripe Salt River Bridge (both directions) to Extend Auxiliary Lanes on I-65 between the KY 480 (Exit 116) and KY 44 (Exit 117) Ramps	1.36	2021	$10.1	5.1
2	**Exit 117** Southbound Dual Lane Off-Ramp and Ramp Split to Conestoga Pkwy	0.96	2020	$7.7	--
3	**Exit 121 to Exit 125** 8-Lane Widening + Full Depth Pavement Replacement	3.12	2020	$40.9	2.4
4	**Exit 117 to Exit 121** 8-Lane Widening + Full Depth Pavement Replacement	4.31	2023	$57.8	1.9
5	**Exit 112 to Exit 116** Full Depth Pavement Replacement	4.21	2032	$30.8	3.6
6	**Exit 105 to Exit 112** Full Depth Pavement Replacement	6.16	2046	$54.4	2.6

*Calculated before the COVID-19 Pandemic

Additional funding sources outside of Kentucky's biennial Highway Plan could be considered to help fund these needed improvements. Possible funding sources include:

- Infrastructure for Rebuilding America (INFRA) Grant: The maximum grant amount for INFRA is $150 million. A grant of this size could allow KYTC to bundle all the construction sections (Total Cost = $214 million).
- Better Utilizing Investments to Leverage Development (BUILD) Grant: The maximum grant amount for BUILD is $25 million. A grant of this size would be ideal for bundling the I-65/KY 480 interchange reconstruction (KYTC Item No. 5-391.30) with restriping the Salt River Bridge to provide auxiliary lanes between KY 480 (Exit 116) and KY 44 (Exit 117) and full depth pavement replacement in Construction Section 3 (Study Priority No. 1). The total cost for these improvements would be $25.6 million and KYTC could request a BUILD Grant in the amount of $20.48 million or 80 percent of the cost.



ES-5: Improvement Concept Prioritization

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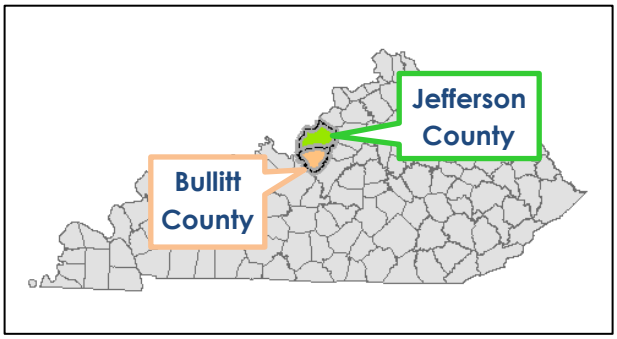
1.0 I-65 Conceptual Improvements Study

1.1 Project Description

The I-65 Conceptual Improvements Study was initiated by the Kentucky Transportation Cabinet (KYTC) to evaluate the need for and impacts of improvements on I-65 from KY 61 (Preston Highway) in Lebanon Junction to I-265 (Gene Snyder Freeway) in Bullitt and Jefferson Counties.



This study was performed utilizing Federal National Highway Performance Program (NHPP) funds allocated towards project development. Future phases for this project are not included in *Kentucky's FY 2020 – FY 2026 Highway Plan.*

1.2 Project Location

The study area includes I-65 from south of Preston Highway in Lebanon Junction (MP 104.788) to the Gene Snyder Freeway in Louisville (MP 124.7) as presented in **Figure 1**. I-65 is an essential route of national significance that stretches over 887 miles between Mobile, AL and Gary, IN. At the regional level, I-65 provides an interstate connection between Nashville, TN and Indianapolis, IN through Louisville. Within the study area, I-65 provides a growing Bullitt County population with access to employment opportunities in Jefferson County. Based on home-to-work commuting data from the U.S. Census Bureau there are 50,000 person trips per day between Jefferson and Bullitt Counties. This number is expected to rise as development within Bullitt County continues to increase.

1.3 Committed Projects

There are several other planned and committed projects within the study area listed in *Kentucky's FY 2020 – FY 2026 Highway Plan*:

- Item No. 5-538.00: Construct a new I-65 interchange between KY 480 and KY 245. Construction funds for this project were authorized in March 2019 and construction is underway.

- Item No. 5-391.30 – Improve operational performance of the I-65/KY 480 interchange including ramp improvements and turning lanes. Design, Right-of-Way, and Utility funds for this project were authorized in 2017. The 2020 Highway Plan also includes $9,490,000 in federal funds for the construction phase in fiscal year 2022.

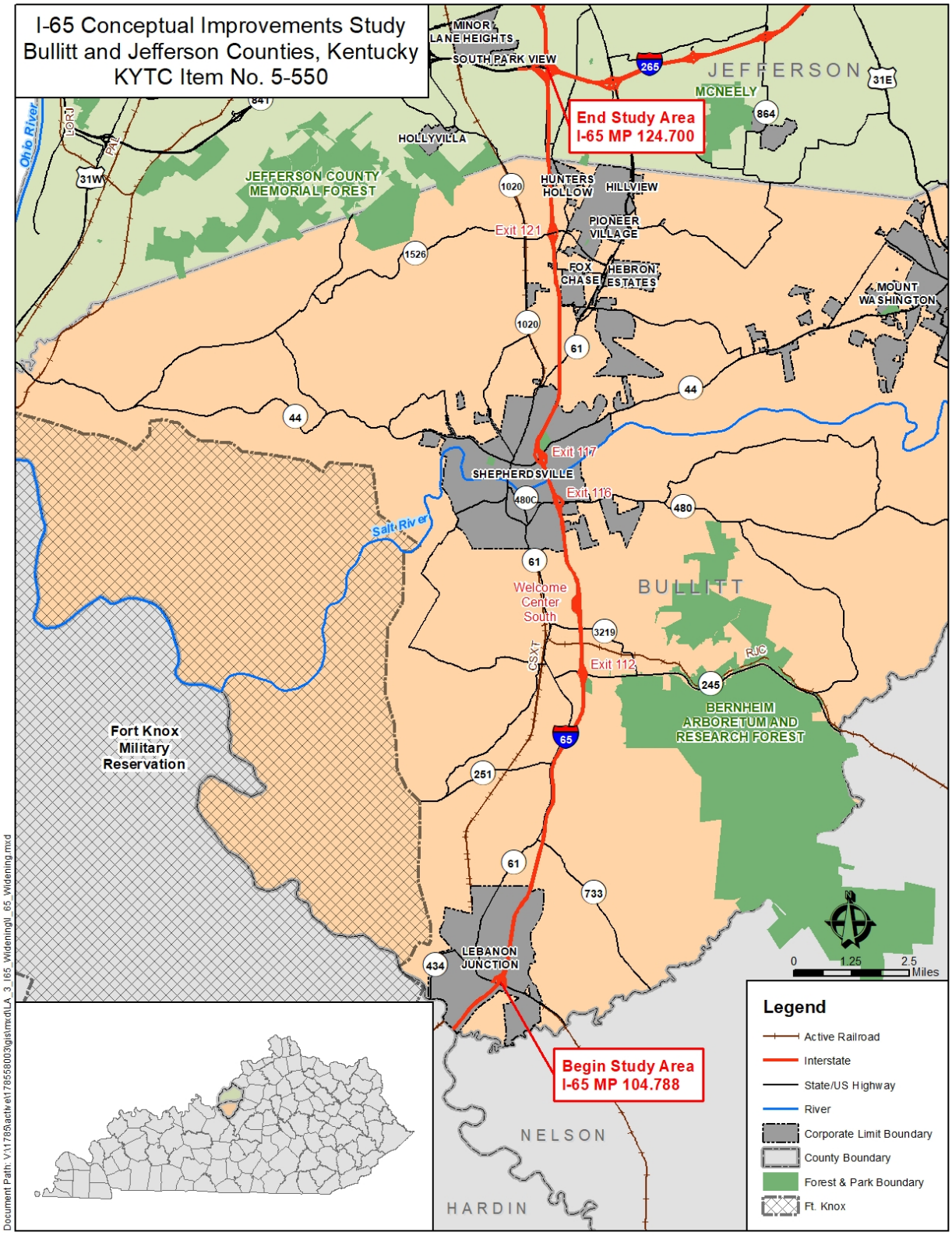


Figure 1. Study Area

- Item No. 5-8509.00: Widen KY 245 from Bernheim Forest to the community college. The 2020 Highway Plan includes $13,140,000 in federal funds for the construction phase in fiscal year 2022.

- Item No. 5-8856.00: Sound barriers on the east side of I-65 between MP 117.4 and MP 117.8. The 2020 Highway Plan includes $1,900,000 in state priority SPP funds for the construction phase in fiscal year 2021; however, due to over programming these funds are not likely to be available.

- Item No. 5-2088.00: Pavement rehabilitation on I-65 between Exit 102 (Joe Prather Highway) and Exit 127 (Outer Loop). *After further evaluation, KYTC's Pavement Management Division determined a full depth pavement replacement is needed along this stretch of I-65 instead of the pavement rehabilitation. Due to the increased cost for full replacement, the project limits have been reduced to I-65 between Exit 102 (Joe Prather Highway) and Exit 104 (KY 61 in Lebanon Junction). Construction funds have been awarded for this portion of I-65 with construction expected to being in Spring 2021. The study area portion of I-65 north of Exit 104 also needs a full depth pavement replacement, but there is no additional funding for this section in Kentucky's FY 2020 – FY 2026 Highway Plan.*

1.4 Project History

The study portion of I-65 was widened from four to six lanes in the early 1990's and a full depth pavement replacement was completed at that time. Underdrains were not constructed as part of the existing pavement replacement and widening. This omission has contributed to the regular occurrence of subgrade failures and a nearly constant need to address uneven surface inconsistencies and joint settlement issues. In addition to the poor subgrade, the age of the existing pavement and the high truck traffic (ranging from 19.4 percent in Shepherdsville to 27.3 percent north of Exit 105) has led to poor pavement conditions, compromising vehicle operations and travel time reliability. To address the poor pavement condition, five pavement rehabilitation projects have been performed through the study portion of I-65 since 2005, as listed below.

- Contract ID 061027: Pavement rehabilitation on I-65 between KY 245 and the KY 61 underpass. The project provided jointed plain concrete (JPC) repairs and diamond grinding. Construction funds included $7,193,373 for this project which were authorized in August 2006.

- Contract ID 091007: Pavement rehabilitation on I-65 between MP 118.58 and MP 123.18. Improvements include JPC repair, diamond grinding, saw and seal joints, traffic loops & guardrail on I-65. Project work began June 2009 and was completed April 2010 and included $3,434,090 in construction funds.

- Contract ID 091008: Pavement rehabilitation on I-65 between MP 123.18 and MP 127.56. Improvements included JPC repair, diamond grinding, saw and seal joints, traffic loops and guardrail. Project work began June 2009 and was completed by April 2010 and included $3,177,000 in construction funds.

- Contract ID 091009: Pavement rehabilitation on I-65 between MP 102.112 and MP 110.700. Improvements include JPC repair, diamond grinding, saw and seal joints, expansion dam repair-traffic loops and guardrail on I-65. Project work began June 2009 and was completed November 2009 and included $6,847,000 in construction funds.

- Contract ID 131216: 21 miles of pavement rehabilitation on I-65 between Elizabethtown and KY 44. Improvements included JPC repairs. Project work began March 2014 and was completed by August 2015 and included $21,176,499 in construction funds.

Additionally, two cable rail projects were constructed between 2011 and 2012 to reduce the possibility for median-crossover crashes.

- Contract ID 111319: Install cable barrier on I-65 beginning north of concrete barrier wall (MP 103.85) extending north of KY 733 overpass (MP 109.36), 5.51 miles.

- Contract ID 121311 - Install cable barrier on I-65 from KY 44 at Shepherdsville (MP 116.900) to the Jefferson County line (MP 123.180), 6.28 miles and from the Bullitt County Line (MP 123.180) extending north 0.72 miles (MP 123.900).

2.0 Existing Conditions

Conditions of the existing transportation network are examined in the following section. The information compiled includes current roadway facilities and geometrics, traffic volumes, and crash history within the study area. Data for this section were collected from the KYTC Highway Information System (HIS) database, KYTC's Traffic Count Reporting System, aerial photography, as-built plans, and field inspection.

2.1 Roadway Geometric Characteristics

As part of the study effort, a review of existing geometrics along the study area roadways was performed and compared against geometric guidelines in *AASHTO's A Policy on Geometric Design of Highways and Streets, 7th Edition, 2018*, commonly referred to as the "Green Book".

2.1.1 Roadway Geometry

Northbound at Exit 116

The study portion of I-65 is 19.912 miles in length between Preston Highway in Lebanon Junction to the Gene Snyder Freeway in Louisville. Existing typical sections are shown in **Figure 2**. The study portion of I-65 is a six-lane freeway with a posted speed limit of 70 miles per hour (mph) until just south of the Gene Snyder interchange, where it widens to eight lanes with a 65-mph posted speed limit. The majority of I-65 in the study area has a 60-foot depressed median with a cable barrier, except for the sections around Exits 116 and 117 in Shepherdsville (22.5-foot wide median with concrete barrier) and just south of the Gene Snyder Freeway (28-foot wide median with concrete barrier).

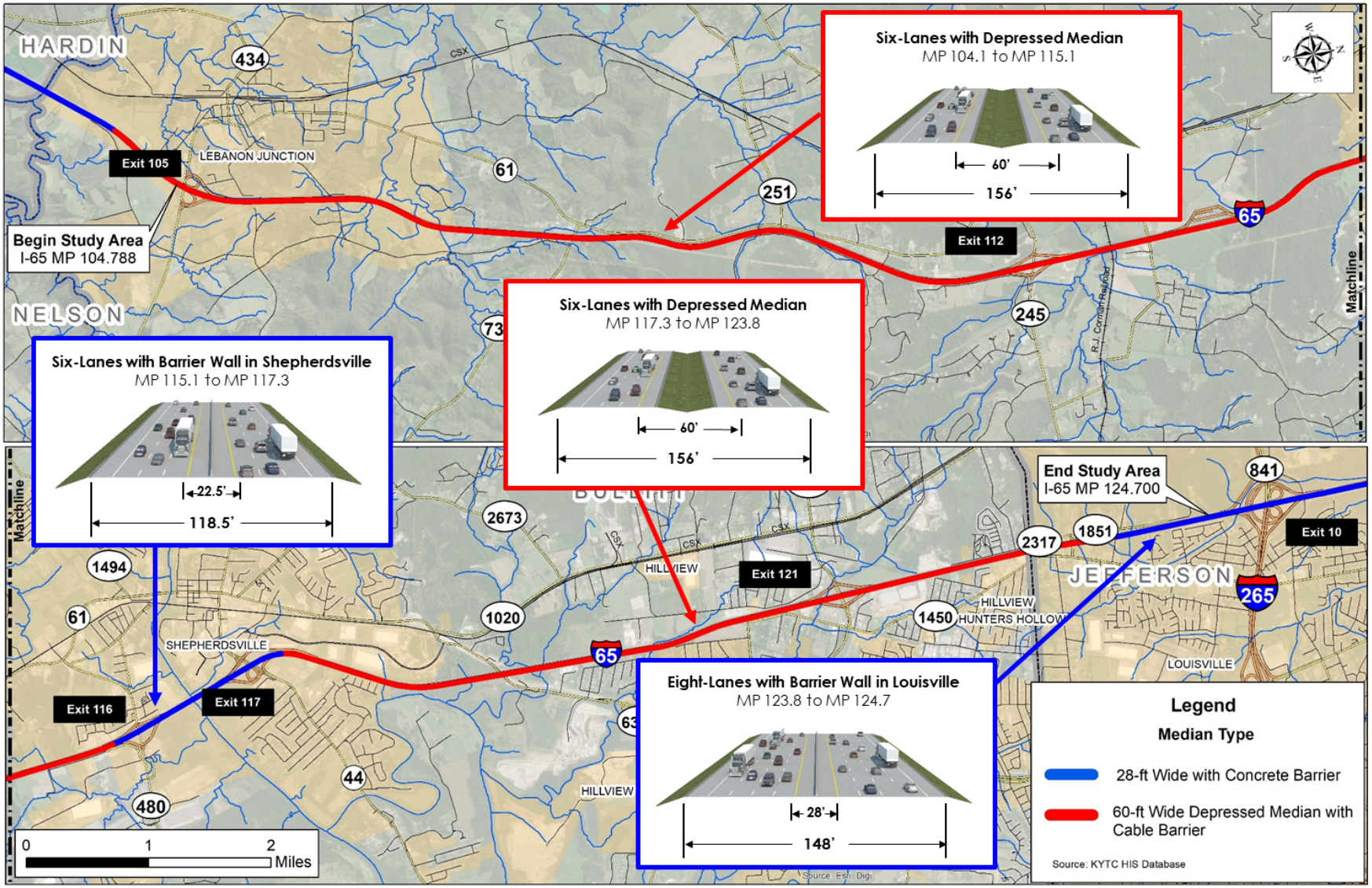


Figure 2. Typical Sections

A review of the record plans revealed no horizontal clearance, vertical clearance, cross slope, minimum radius, grade, or stopping sight distance deficiencies along the study portion of I-65. The rest area on-ramp located on southbound I-65 near MP 113 has an acceleration length of 870 feet and the rest area off-ramp has a deceleration length of 470 feet, both of which are lower than the recommended distance for interstate facilities which is 1,000 feet. On I-65 at milepoint 118.51 there is a sag vertical curve with a headlight stopping sight distance (HSSD) of 701 feet and at milepoint 119.07 there is a sag vertical curve with an HSSD of 706 feet, which are both lower than the recommended distance for interstate facilities which is 730 feet.

2.2 Pavement

As discussed in **Section 1.4**, the existing pavement on the study portion of I-65 was replaced in the 1990s and the design included 11 inches of non-reinforced concrete over six inches of dense grade aggregate (DGA) and a 24-inch rock roadbed. There are no underdrains to facilitate the movement of water away from the subgrade, which has contributed to the surface inconsistencies and joint issues. This can compromise vehicle operations and travel time reliability.

Example I-65 Pavement Repair

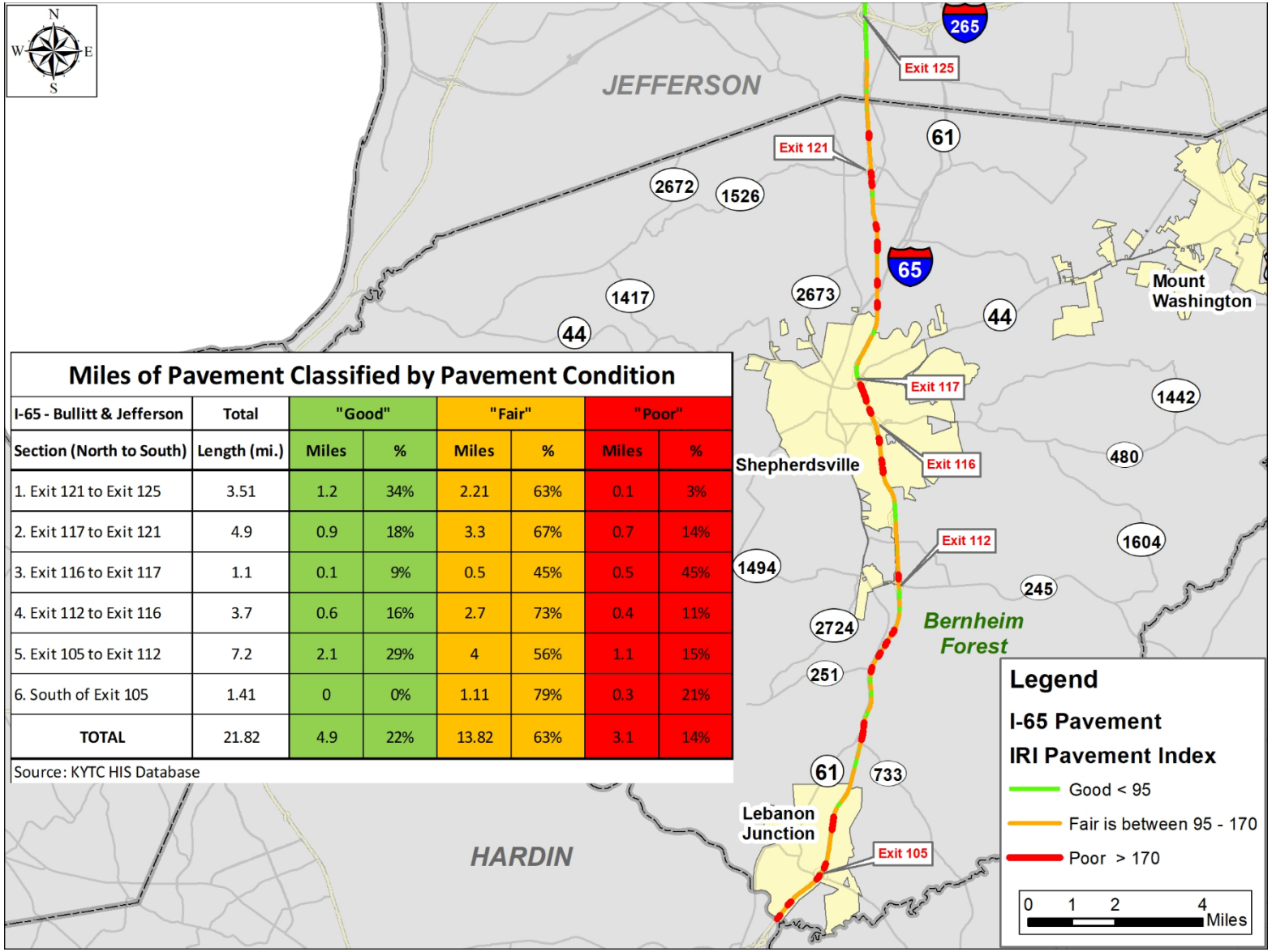
Due to its age and poor subgrade, most of the existing pavement is classified as being in 'fair' or 'poor' condition, as shown in **Figure 3**. The section of I-65 between Exit 116 and Exit 117 is in particularly bad condition, with 45 percent 'poor' and 45 percent 'fair' condition pavement.

2.3 Structures

Northbound at KY 733 Overpass

Existing bridge sufficiency ratings were identified from the National Bridge Inventory (NBI). This rating assigns individual bridges with a measure of "sufficiency" in which a rating of 100 percent indicates a bridge is entirely satisfactory and a rating of zero percent indicates a bridge is completely deficient. Bridges are eligible for federal funding for rehabilitation if they have a sufficiency rating below 80 percent. If a bridge has a rating below 50 percent, it is considered eligible for replacement funding.

There are 25 existing structures along the study portion of I-65, as shown in **Figure 4**. There is one structure with a sufficiency rating below 50, a concrete culvert at Crooked Creek with a rating of 43.4. All mainline bridges that carry I-65 traffic have a sufficiency rating of 86.7 or greater. The Federal Condition rating along with the most recent sufficiency ratings provided by KYTC are included in **Figure 4**.



Miles of Pavement Classified by Pavement Condition

I-65 - Bullitt & Jefferson	Total	"Good"		"Fair"		"Poor"	
Section (North to South)	Length (mi.)	Miles	%	Miles	%	Miles	%
1. Exit 121 to Exit 125	3.51	1.2	34%	2.21	63%	0.1	3%
2. Exit 117 to Exit 121	4.9	0.9	18%	3.3	67%	0.7	14%
3. Exit 116 to Exit 117	1.1	0.1	9%	0.5	45%	0.5	45%
4. Exit 112 to Exit 116	3.7	0.6	16%	2.7	73%	0.4	11%
5. Exit 105 to Exit 112	7.2	2.1	29%	4	56%	1.1	15%
6. South of Exit 105	1.41	0	0%	1.11	79%	0.3	21%
TOTAL	21.82	4.9	22%	13.82	63%	3.1	14%

Source: KYTC HIS Database

Figure 3. I-65 Pavement Condition

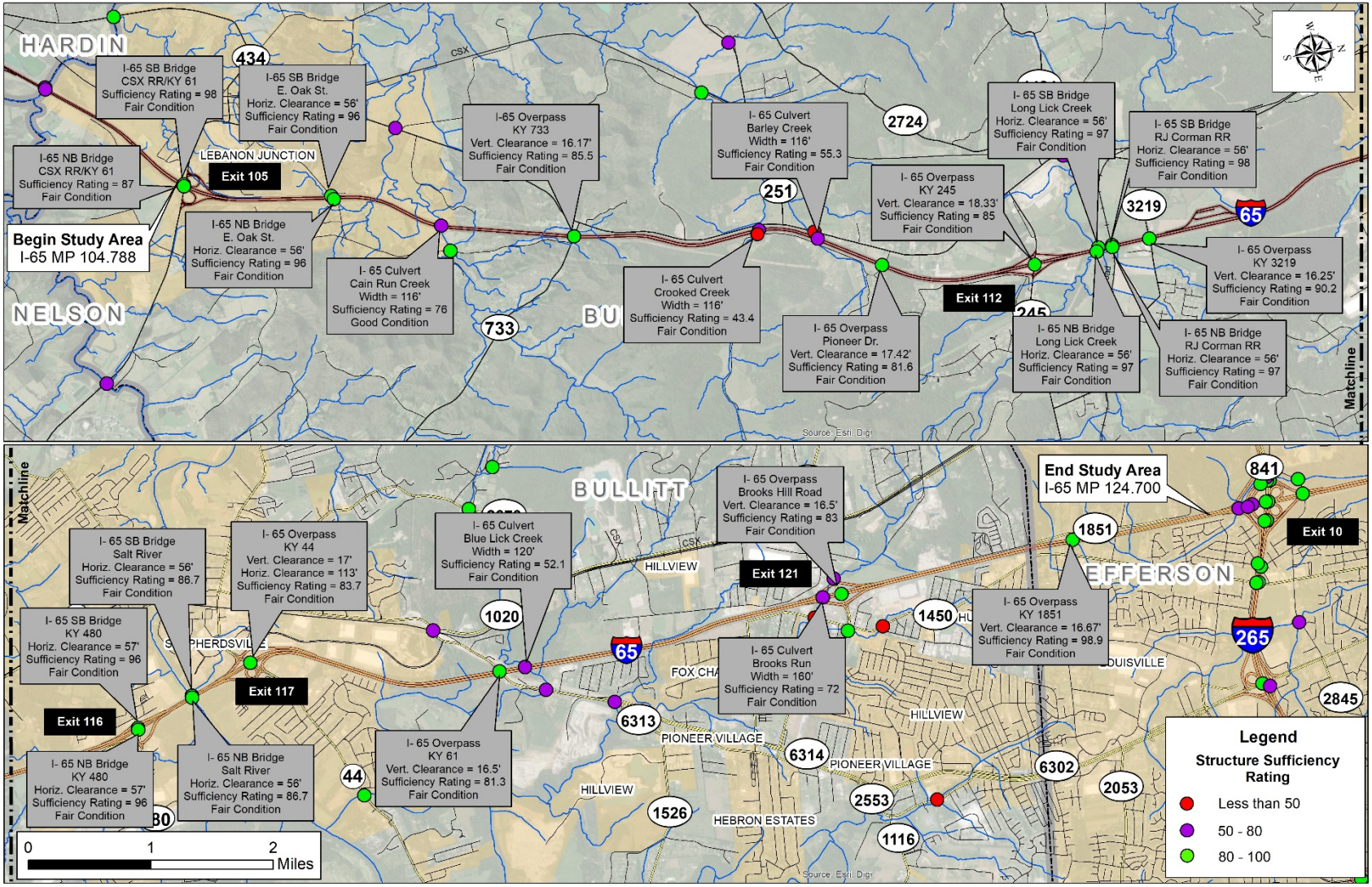


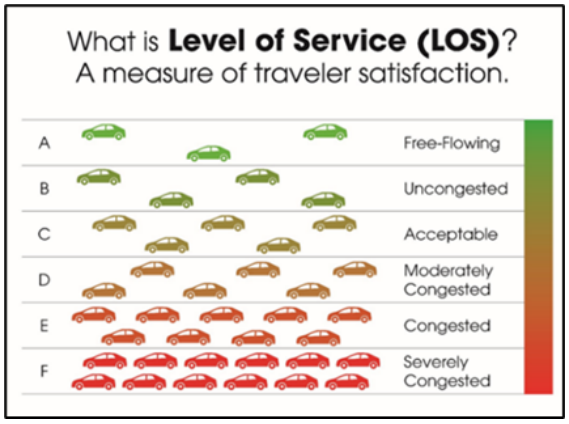
Figure 4. Existing Structures

The I-65 bridge over the Salt River is one of four bridges that cross the Salt River in Bullitt County (I-65, KY 61, US 31E, and Greenwell-Ford Road). This relatively few number of crossings forces local north-south travel onto a limited number of roadways, especially I-65, which is the only crossing west of US 31E in Mount Washington designated on the National Truck Network as able to carry commercial vehicles with increased dimensions. As a result, local traffic uses the interstate to cross the Salt River and travel between Exits 116 and 117. With only three other Salt River crossings in Bullitt County, local traffic uses I-65 as a collector route between KY 480 and KY 44, creating a weaving pattern between the on- and off-ramps. This increases congestion between Exits 116 and 117. The *KY 44 to KY 480 Connector Study (KYTC Item No. 5-8709.00)*[2] was completed in 2014 and it investigated ways to enhance the existing connectivity between these two corridors. The study looked at constructing an additional connection over the Salt River in Shepherdsville to keep local traffic off of I-65. Future phases for this project are not included in *Kentucky's FY 2020 – FY 2026 Highway Plan*.

2.4 Existing Traffic Analysis

Historical KYTC traffic volumes show an Annual Average Daily Traffic (AADT) on the study portion of I-65 between 66,000 vehicles per day (VPD) near Lebanon Junction and 110,000 VPD in Louisville south of the Gene Snyder Freeway. The latest average daily traffic (ADT) volumes from KYTC's traffic count stations are shown on **Figure 5**. Current truck percentages range from 19.4 to 27.3 percent.

Existing (2019) a.m. (7:00 AM – 8:00 AM) and p.m. (4:00 PM – 5:00 PM) peak hour capacity analyses were performed using the Highway Capacity Software (HCS) freeway facilities module. Level of service (LOS), a qualitative measure describing operational conditions, was used to evaluate the adequacy of the existing roadway. In rural areas, LOS C or better is desirable and in urban areas, LOS D or better is desirable. All study area portions of I-65 operate at an acceptable LOS during the AM peak period. During the PM peak hour, the southbound segment north of Exit 121 operates at LOS E. Volume-to-capacity (V/C) ratios were calculated based on results from the Kentuckiana Regional Planning & Development Agency (KIPDA) regional travel demand model. The target V/C ratio is 0.9 for rural areas and 1.0 for urban areas. A V/C ratio higher than 1.0 indicates that a roadway is operating above its theoretical capacity. Most of the study portion of I-65 operates with a V/C below 1.0, with the exception being the segment north of Exit 121. **Table 1** provides a summary of the existing daily and peak hour traffic operations on the study portion of I-65.



Maps depicting peak hour traffic operations can be found in **Appendix A**.

[2] https://transportation.ky.gov/Planning/Pages/Project-Details.aspx?Project=KY%2044%20to%20KY%20480%20Connector%20Study

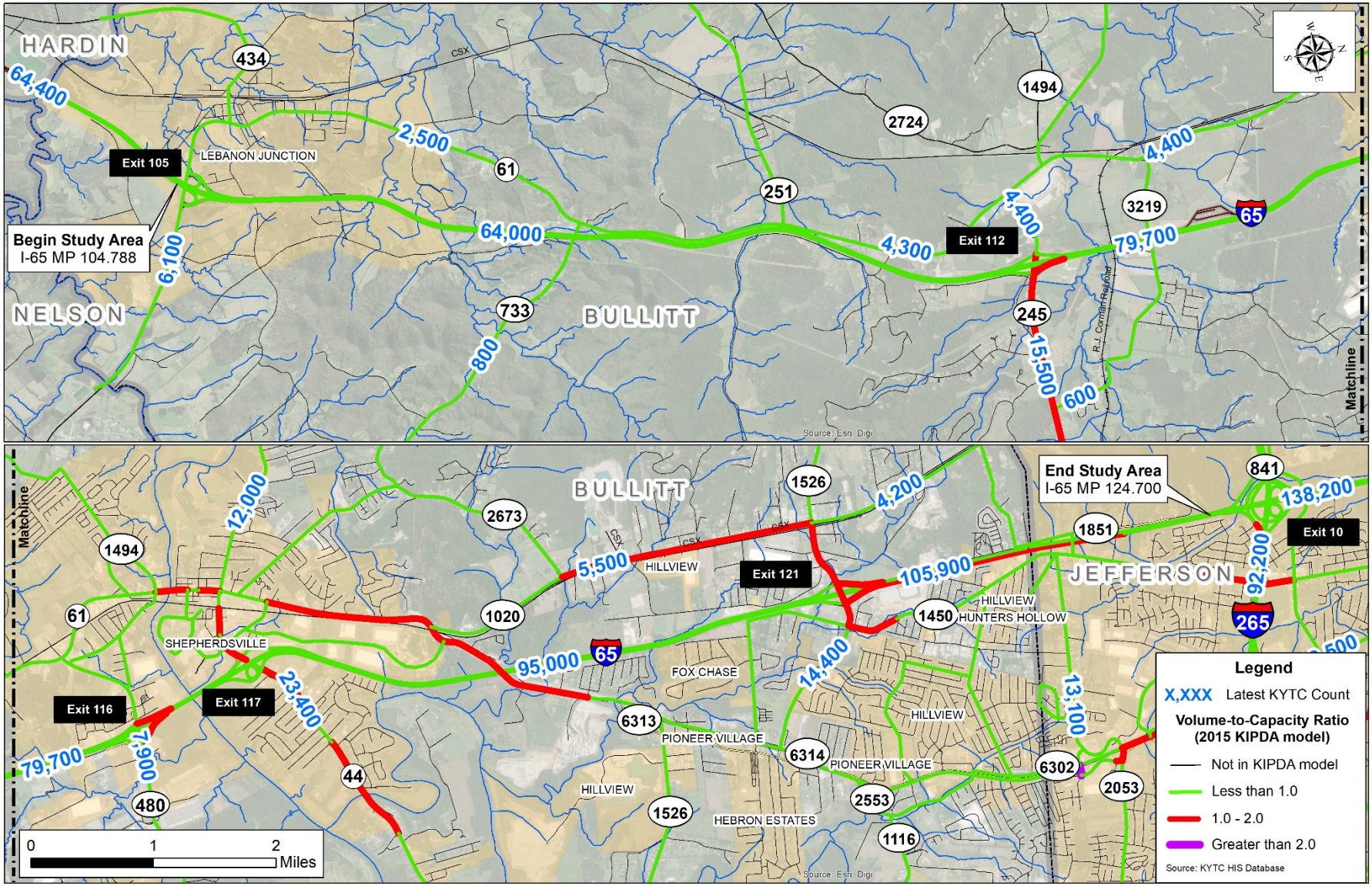


Figure 5. Average Daily Traffic (ADT) Volumes and V/C Ratios

Table 1. Existing (2019) Traffic Summary

Segment	ADT	Area Type	V/C	AM Peak				PM Peak			
				NB VPH	NB LOS	SB VPH	SB LOS	NB VPH	NB LOS	SB VPH	SB LOS
North of Exit 121	110,000	Urban	1.10*	4,700	D	2,600	B	3,700	C	5,250	E
Between Exits 117 & 121	94,000		0.94	3,550	C	2,300	B	3,450	B	4,350	D
Between Exits 116 & 117	96,000		0.96	2,900	C	2,250	C	3,450	C	4,000	D
Between Exits 112 & 116	81,000	Rural	0.79	2,650	B	1,600	B	2,750	B	3,200	C
Between Exits 105 & 112	64,000		0.63	1,700	A	1,250	A	2,300	B	2,250	B
South of Exit 105	66,000		0.65	1,400	A	1,250	A	1,950	A	2,050	B

*Capacity based on 3-lane section. VPH = vehicles per hour

2.5 Travel Time Reliability

Speed and travel time data from 2018 were analyzed using the National Performance Management Research Data Set (NPMRDS). NPMRDS is a vehicle probe-based travel time data set acquired by the Federal Highway Administration (FHWA) to estimate speed and travel time for over 200,000 miles of roadway in the United States. These anonymous location and movement data are supplied by millions of connected vehicles, trucks, and mobile devices. In examining these data for the I-65 corridor, the study area was divided into three segments:

1. **Segment 1: Between the Jefferson County Line and Exit 121** – This 1.3-mile segment of I-65 has the highest existing ADT with 110,000 VPD. In 2018, there were 42 crashes[3], eight of which were injury crashes.

2. **Segment 2: Between Exit 121 and Exit 117** – This four-mile segment of I-65 has an existing ADT of 94,000 VPD. There were 118 crashes in 2018, 24 of which were injury crashes.

3. **Segment 3: Between Exit 116 and Exit 117** – This one-mile segment of I-65 has an existing ADT of 96,000 VPD. There were 34 crashes in 2018, nine of which were injury crashes.

[3] Source: Kentucky State Police

Speed and travel time data were analyzed for the entire year of 2018 to provide a comprehensive summary of travel conditions. **Figure 6** and **Figure 7** provide graphical summaries of the average hourly speed between Exits 116 and 117 for both the northbound and southbound directions. While the speed on I-65 is generally between 60 and 70 miles per hour (mph), as shown by the thick blue line, travelers tend to remember the unexpected delays, or incidents, as shown by the extended blue lines. These incidents are abnormalities where the travel speed dropped significantly below the average. There are several possible causes for such slowdowns including crashes, stalled vehicles, debris in the road, and congestion, among others. It is evident that there are more incidents in the southbound direction on the study portion of I-65.

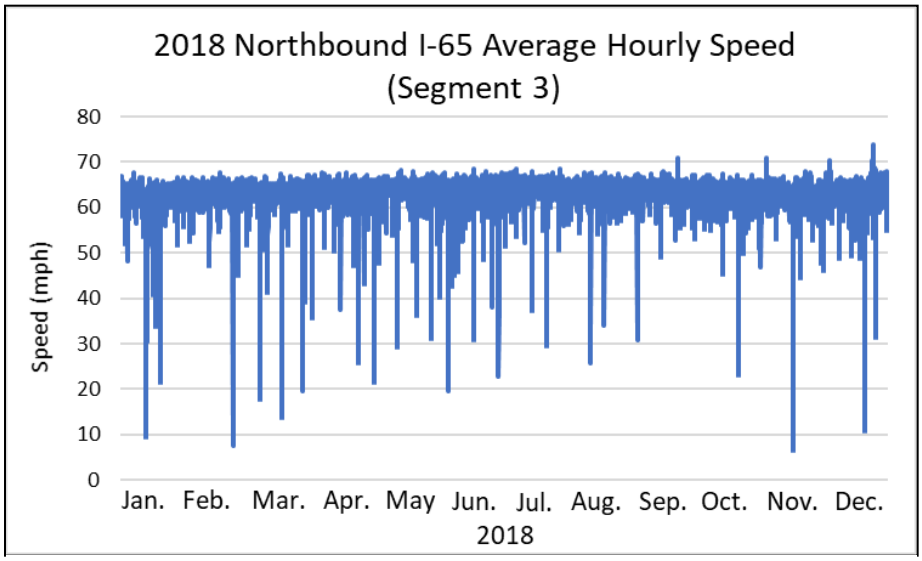


Figure 6. NB I-65 Average Hourly Speed (Segment 3)

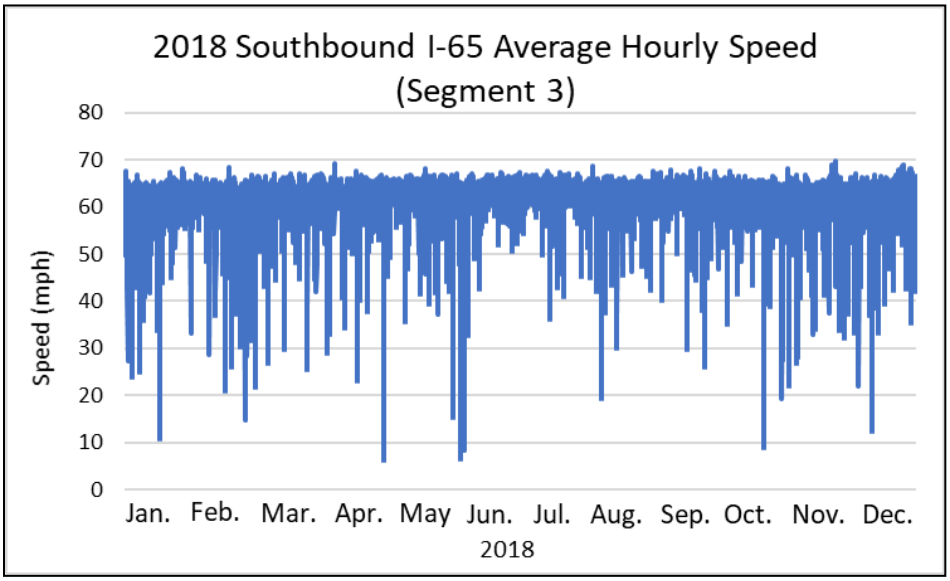


Figure 7. SB I-65 Average Hourly Speed (Segment 3)

As the severity of the incident increases, the average speed decreases and the duration of the traffic slowdown lengthens, extending the impact on travel time. **Table 2** presents a summary of incidents on three segments of the study area where the average hourly speed dropped below 25 mph for an extended period of at least one hour. This table also shows the percentage of incidents that occurred during the AM peak (6 AM – 9 AM) and PM peak (3 PM – 6 PM) periods. It is evident that the southbound direction not only has a higher number of occurrences, but also a higher percentage of incidents during the PM peak period for all three locations. This highlights the likely congestion issues on I-65 due to the high number of afternoon trips from Louisville to Bullitt County.

Table 2. Incidents When Average Travel Speeds Dropped Below 25 mph

Location	Direction	Incidents < 25 mph					
		Total	AM Peak	PM Peak	Total Crashes	Due to Crash	Avg. Duration
Segment 1 Between Exit 121 & the Jefferson County	NB	5	20%	60%	23	1	1.4 hours
	SB	17	6%	76%	17	5	1.8 hours
Segment 2 Between Exit 117 & Exit 121	NB	16	31%	38%	54	7	1.4 hours
	SB	22	9%	45%	52	8	1.4 hours
Segment 3 Between Exit 116 & Exit 117	NB	10	30%	60%	12	1	1.6 hours
	SB	18	28%	28%	17	7	1.4 hours

The date, time, and location of incidents were also compared to Kentucky State Police crash records to determine the number of traffic slowdowns potentially caused by crashes.

2.6 Base Year (2019) Simulation Model

A traffic simulation model was developed, using Caliper's TransModeler Version 5.0, for the portion of I-65 in Shepherdsville from south of Exit 116 (KY 480) to north of Exit 117 (KY 44), as shown in **Figure 8**. The model was used to evaluate improvement concepts related to the portion of the study area surrounding the KY 480 and KY 44 interchanges. These interchanges are of particular interest for several reasons, including the relatively short distance separating them (it is about 0.5 miles between the existing acceleration and deceleration lanes) and the high volume of local traffic that uses I-65 to cross the Salt River due to the limited number of river crossings available within Bullitt County.

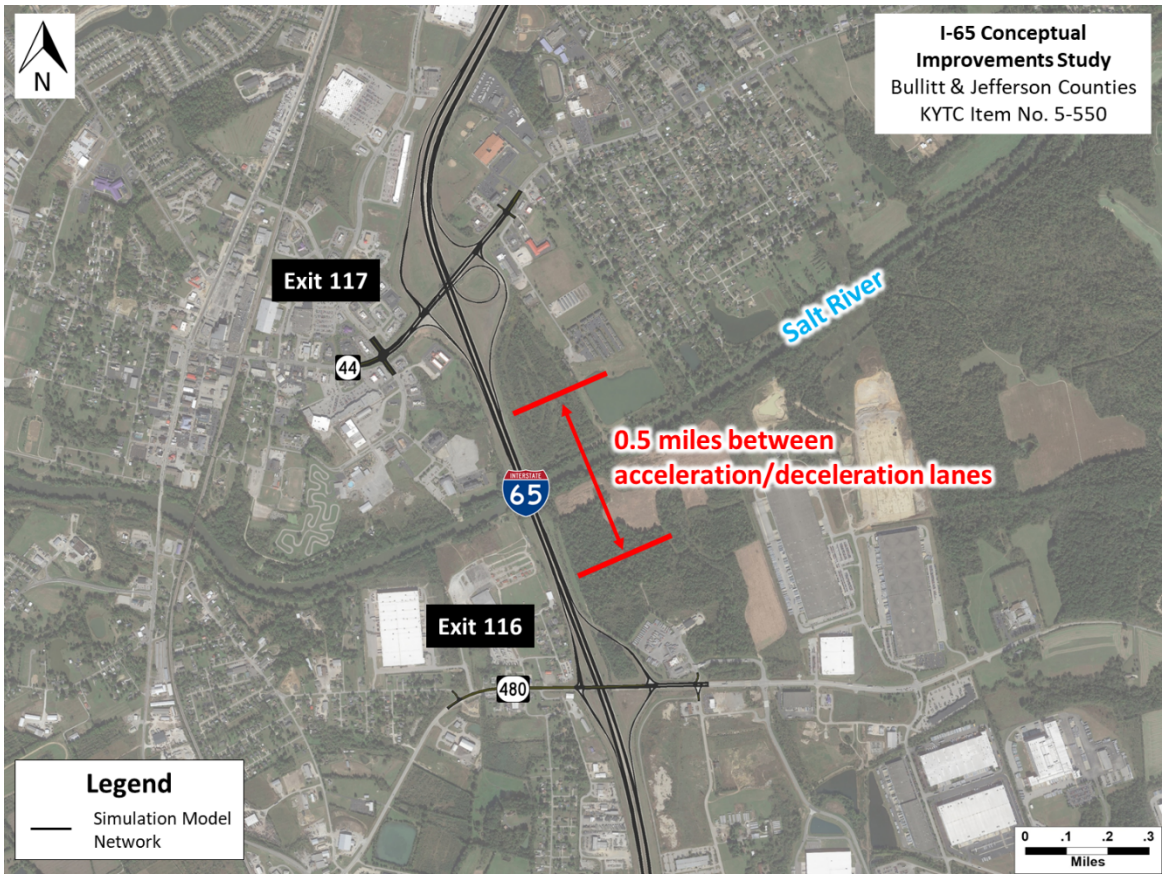


Figure 8. Simulation Model Study Area

2.6.1 Origin-Destination Data

Streetlight Insight ™ trip pattern data based on location data from smart phones and navigation devices in connected cars and trucks were used to quantify the number of pass through trips, local trips, and regional trips on I-65. This 2018 data was collected on I-65 at the Bullitt/Hardin County line, the Bullitt/Jefferson County line, and in Shepherdsville. It is estimated that 38 percent of auto trips (approximately 33,000 VPD) and 65 percent of truck trips (approximately 14,000 trucks per day, TPD) crossing the Salt River on I-65 are through traffic which pass completely through Bullitt County on I-65 without stopping. This equals approximately 49 percent of all trips that pass completely though Bullitt County. Approximately 45 percent of the trips were regional trips traveling between Jefferson and Bullitt counties. The remaining 6 percent (approximately 6,000 VPD) are local trips only accessing the interstate to cross the Salt River and travel between Exits 116 and 117, as shown in **Figure 9**. With only three other Salt River crossings in Bullitt County, local traffic uses I-65 as a collector route between KY 480 and KY 44, resulting in much slower traffic in the right lane and making it more difficult to exit.

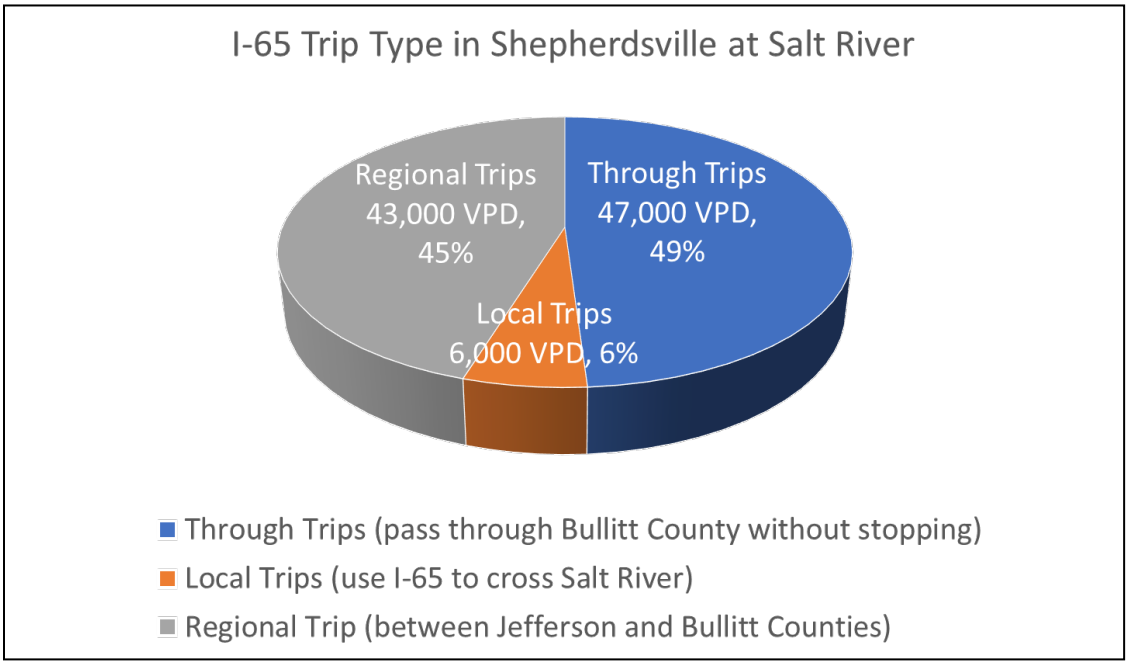


Figure 9. I-65 Trip Type at Salt River

2.6.2 2019 No-Build Simulation Model Results

Simulation model scenarios were created for the AM (7:30 AM – 8:30 AM) and PM (4:30 – 5:30 PM) peak hours taken from the existing traffic analysis. A more in-depth discussion of simulation model development including parameter adjustments can be found in **Appendix B**.

Results from the 2019 No-Build simulation model for the AM peak show most of the area surrounding the KY 480 and KY 44 interchanges including all signalized intersections operating at LOS C or better, as shown on **Figure 10**. The northbound weaving section on I-65 between Exits 116 and 117 has an undesirable LOS E in both the AM and PM Peak hours. During the PM Peak, the southbound diverging segment on I-65 at the Exit 117 off-ramp and the southbound intersection with KY 44 both operate at LOS E, as shown on **Figure 11**. Additionally, the southbound I-65 off ramp and Adam Shepherd Parkway intersections with KY 44, as well as the southbound I-65 off ramp intersection with KY 480 operate at LOS D.

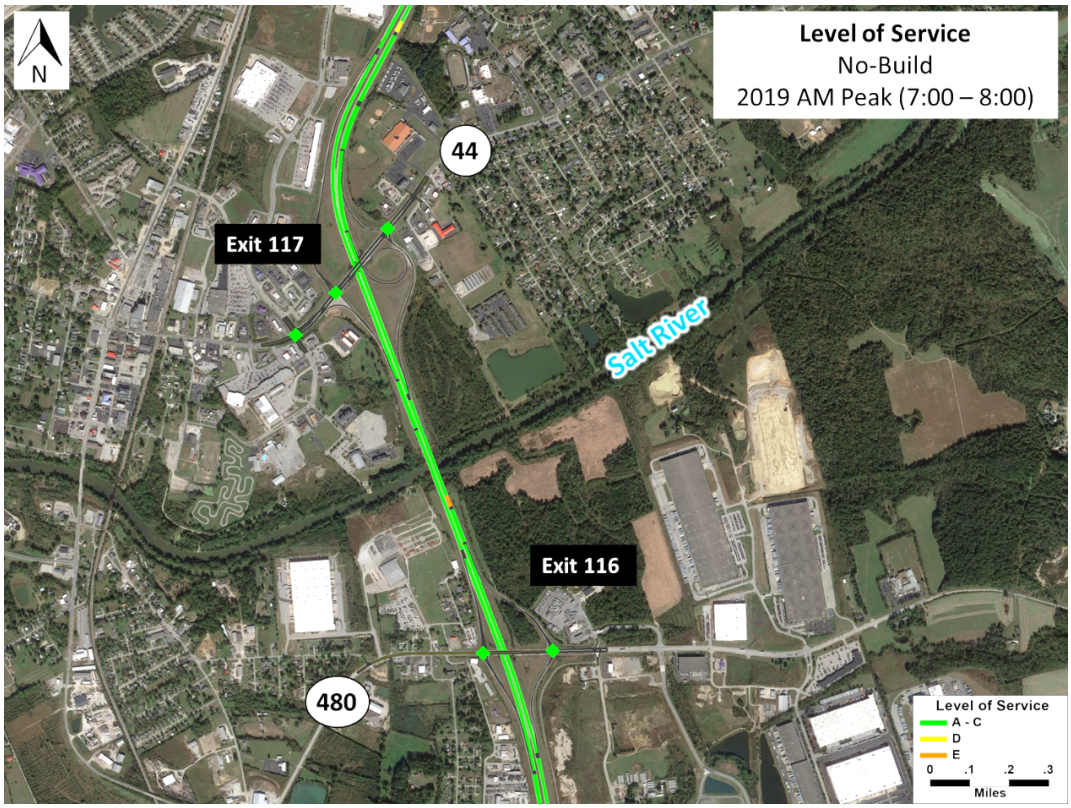


Figure 10. Existing AM Peak Simulation Model Level of Service

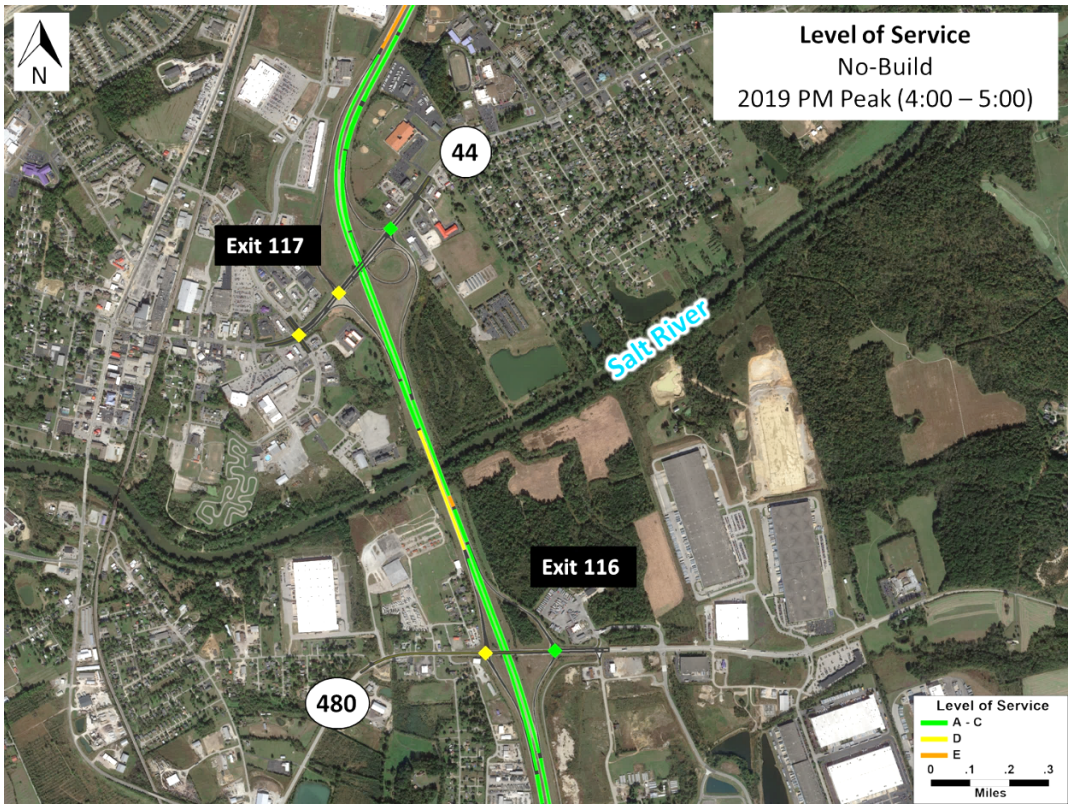


Figure 11. Existing PM Peak Simulation Model Level of Service

2.7 Crash History

A crash analysis was performed for the time period between January 1, 2016 – December 31, 2018 using data from the Kentucky State Police crash database. Over this three-year period, a total of 1,045 crashes were reported along the study portion of I-65. The crash records are included in **Appendix C**.

2.7.1 Crash Severity

Of the 1,045 reported crashes over the three-year period, nine (one percent) were fatal and 197 (19 percent) resulted in an injury. **Figure 12** summarizes the distribution of crashes by severity and **Figure 13** shows the location of crashes with crash severity shown.

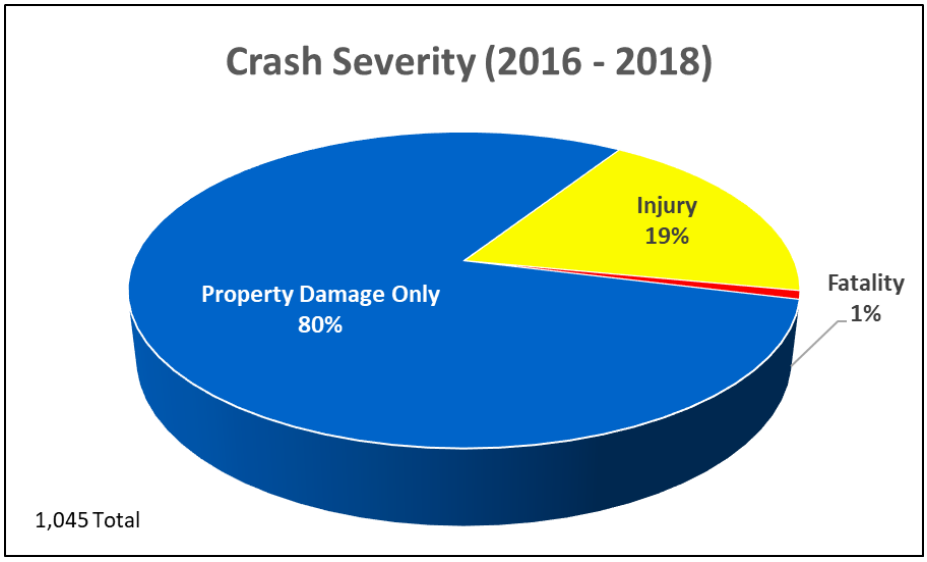


Figure 12. Crash Severity (2016 - 2018)

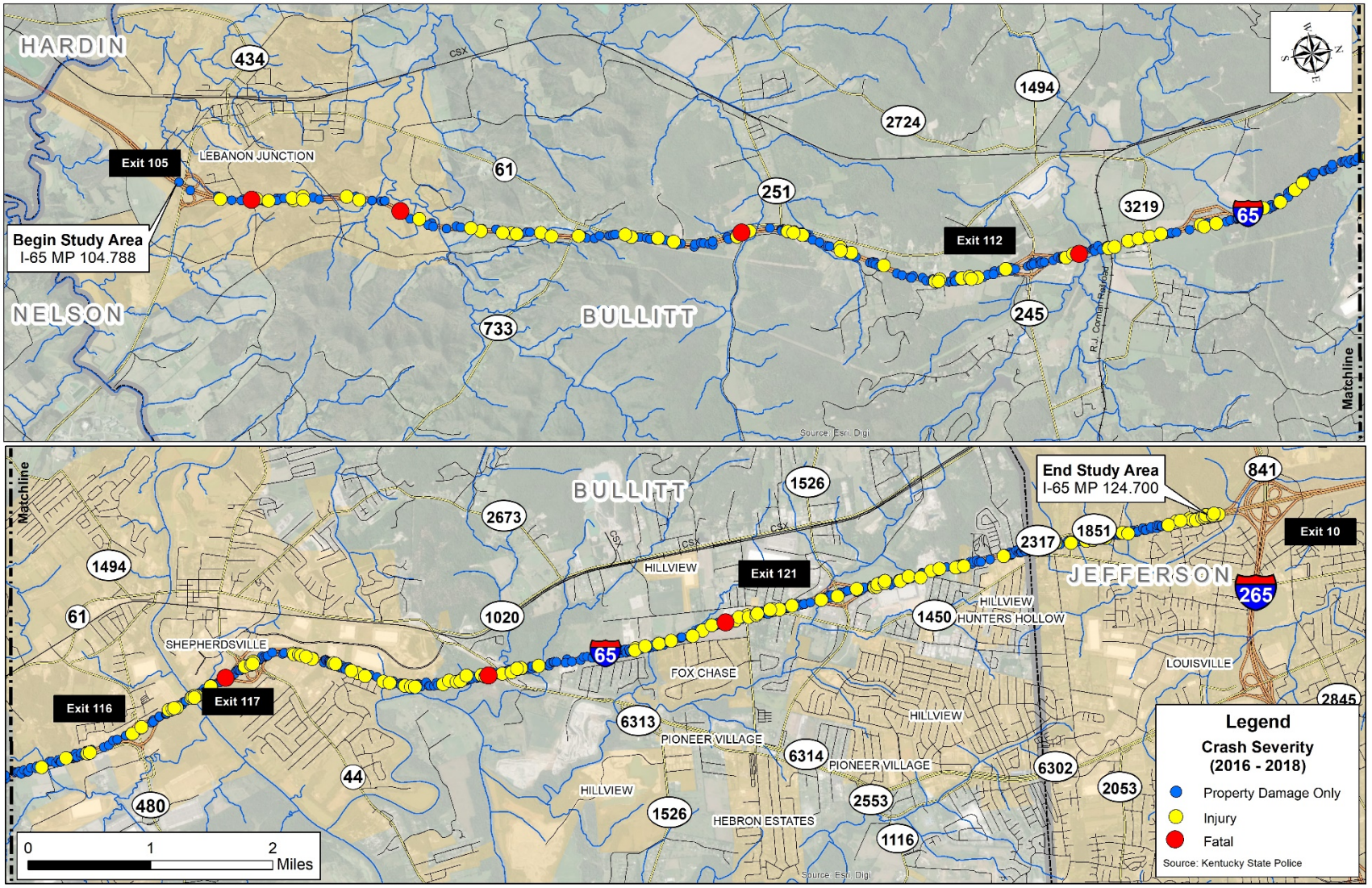


Figure 13. Distribution of Crash Severity by Location

2.7.2 Crash Type

Of the 1,045 crashes, the most prominent crash types were single vehicle (375 crashes, 36 percent) and rear ends (323 crashes, 31 percent), as shown in **Figure 14**. The locations of the study area crashes by type are shown in **Figure 15**.

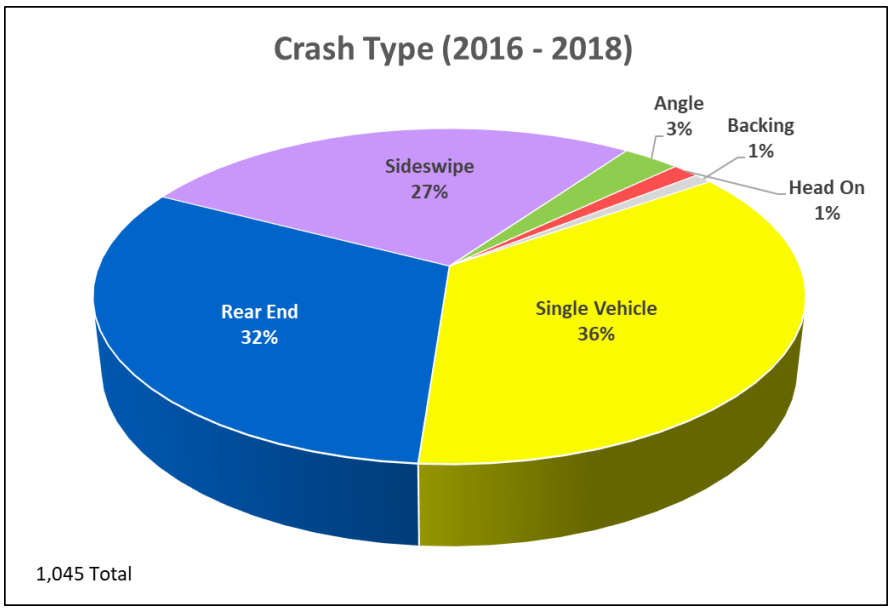


Figure 14. Crash Type (2016 - 2018)

2.7.3 Excess Expected Crashes (EEC)

The number of excess expected crashes (EEC) at a location is a measure of the crash frequency at the site compared to what is expected based on roadways with similar characteristics (geometrics, traffic, etc.) using methodology defined in the *Highway Safety Manual*[4]. A positive EEC indicates more crashes are occurring than should be expected. Results from this analysis show there are fewer crashes than expected occurring on the study portion of I-65. A summary of the EEC analysis is shown in **Table 3**. The overall number of crashes, crash rate, and crash severity are generally lower than other interstate roadways with similar traffic volumes across Kentucky. However, an examination of daily traffic conditions from 2018 found that events such as crashes and stalled vehicles can have a dramatic impact on travel conditions and result in unexpected delays, as previously discussed in **Section 1.9**.

[4] American Association of State Highway and Transportation Officials (AASHTO), 2014. The Highway Safety Manual.

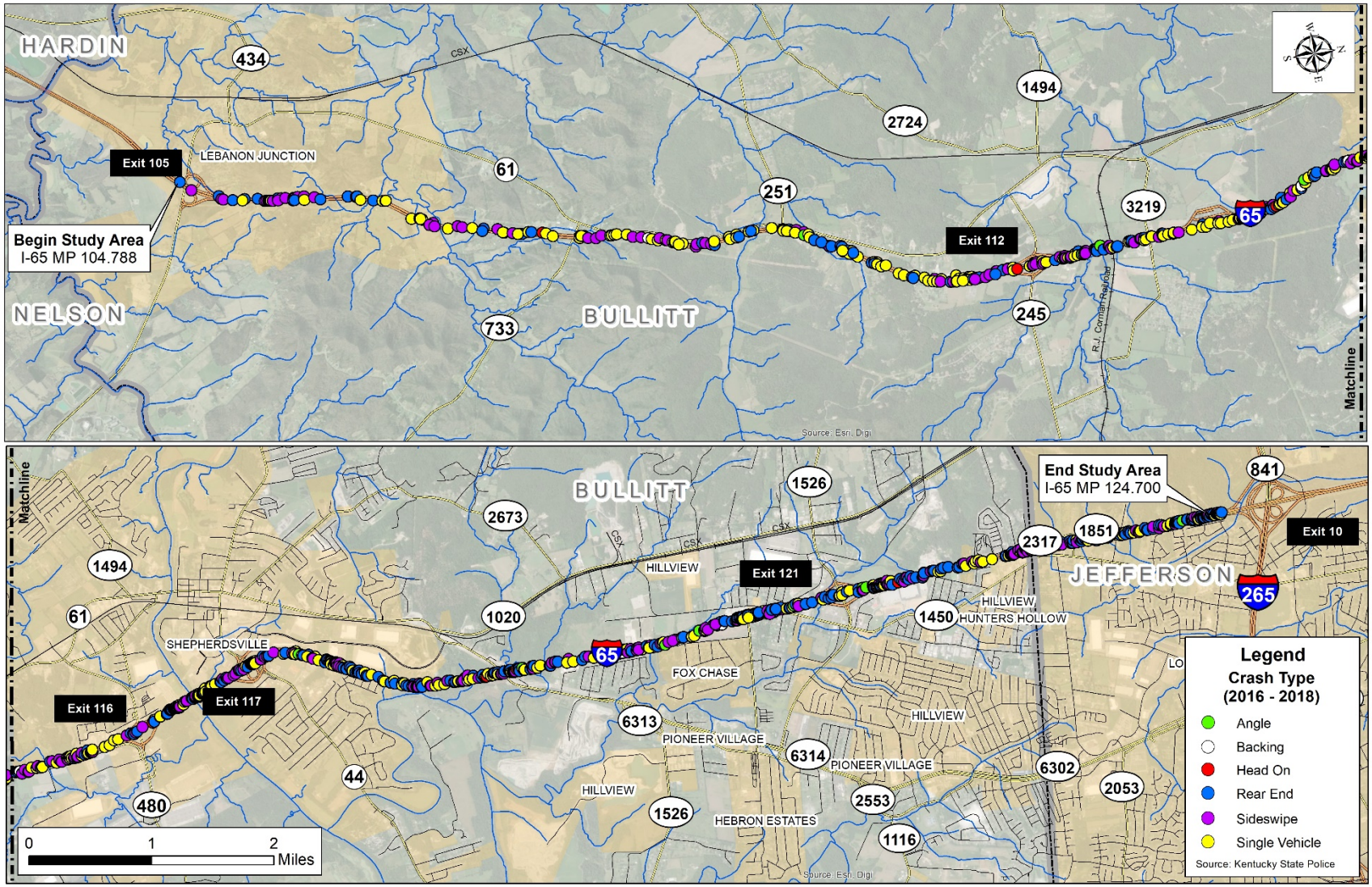


Figure 15. Distribution of Crash Type by Location

Table 3. I-65 Excess Expected Crashes (EEC) Summary

Segment	County	Type	Beg MP	End MP	Existing AADT	3-year Observed Crashes	KY SPF*	Estimate of Expected Crashes	Excess Expected Crashes
North of Exit 121	Jefferson	Urban	121	124.7	110,103	250	352	255	-5
Between Exits 117 & 121	Bullitt	Urban	117	121	94,062	257	310	262	-5
Between Exits 116 & 117	Bullitt	Urban	116	117	95,760	91	37	91	0
Between Exits 112 & 116	Bullitt	Rural	112	116	81,054	244	128	247	-3
Between Exits 105 & 112	Bullitt	Rural	105	112	64,018	197	182	208	-11
South of Exit 105	Bullitt	Rural	103.3	105	65,779	37	45	40	-3

*KTC SHIFT Safety Performance Functions (SPFs) and Adjustment Factors

3.0 Purpose and Need

The purpose and need statement establishes why KYTC is proposing to advance a transportation improvement and drives the process for improvements, alternatives consideration, analysis, and selection.

I-65 is an essential route of national significance that stretches over 887 miles between Mobile, AL and Gary, IN, providing access to national and global markets. Within the study area, I-65 provides a growing Bullitt County population with access to employment opportunities in Jefferson County. Based on home-to-work commuting data from the U.S. Census Bureau there are 50,000 person trips per day between Jefferson and Bullitt Counties. This number is expected to increase as development within Bullitt County continues to increase.

The majority of this 19.912-mile segment has a 60-foot depressed median with a cable barrier, except for the sections around Exits 116 and 117 in Shepherdsville (22.5-foot wide median with concrete barrier) and just south of the Gene Snyder Freeway (28-foot wide median with concrete barrier). Historical KYTC traffic volumes show Annual Average Daily Traffic (AADT) on the study portion of I-65 ranges from 66,000 VPD near Lebanon Junction to 110,000 VPD in Louisville south of the Gene Snyder Freeway, with trucks representing 19 to 27 percent of that traffic. Traffic operations are anticipated to worsen as travel demand through the corridor increases, as will be discussed in Chapter 4.

While the average speed on I-65 is generally between 60 and 70 miles per hour (mph) travelers tend to remember the unexpected delays, or incidents, that cause traffic to slow. These incidents are abnormalities where the travel speed drops significantly below the average due to crashes, stalled vehicles, debris in the road, and congestion, among others. In 2018, there were 26 incidents causing the average northbound I-65 speed to drop below 25 mph, an average of one every 18 days, and 38 incidents causing the average southbound speed to drop below 25 mph, an average of one every 10 days.

The purpose of the project is to reduce congestion, enhance existing connectivity, and improve travel time reliability along I-65 from Preston Highway (KY 61) in Lebanon Junction to the Gene Snyder Freeway (I-265) in Louisville. The combination of heavy traffic volumes, poor pavement condition, traffic impacts associated with incidents, and limited capacity along alternate routes creates operational issues for traffic flow and compromises safe and reliable interstate operations. A more efficient interstate system is necessary to accommodate the existing and future truck and automobile traffic projected for this high growth area. This study will look at options for increasing capacity on I-65 and will evaluate operational and safety improvements that will improve travel time reliability.

4.0 Future Conditions

It is necessary to estimate future conditions to evaluate the prospective effectiveness of potential transportation improvement concepts. The following chapter summarizes the anticipated future conditions within the study area. A more detailed discussion of the development of traffic forecasts can be found in the I-65 Traffic Forecast Technical Memorandum provided in **Appendix D**.

4.1 Traffic Forecast Development

Over the past 40 years, Bullitt County has experienced tremendous population growth, with 43,346 residents in 1980 growing to 80,284 residents in 2017[5]. Based on projections from the Kentucky State Data Center, Bullitt County is expected to see continued growth to 98,245 residents in 2040, which corresponds to an annual growth rate of 0.88 percent per year from 2017 to 2040.

As the population in Bullitt County has grown, employment has grown at an even faster rate. Based on estimates from the Bureau of Economic Analysis (BEA), there were 7,768 jobs in Bullitt County in 1980 and 32,942 jobs in 2017. Additionally, according to the U.S Census Bureau, there are 50,000 people per day commuting to workplaces between Jefferson and Bullitt counties. This number is expected to increase as development within Bullitt County continues to increase.

Traffic forecasts were developed based on data from the Kentuckiana Regional Planning & Development Agency (KIPDA) regional travel demand model, historical population and household growth from the State Data Center, and historical employment growth from the BEA. Data from these sources were used to inform annual growth rates along I-65, which were in turn used to develop forecasts for a No-Build scenario in 2045, as shown in **Table 4**.

[5] http://ksdc.louisville.edu/data-downloads/projections/

Table 4. 2045 I-65 Daily Traffic Forecasts

Location	Type	2019 ADT	Annual Growth Rate	2045 ADT
North of Exit 121	Urban	110,000	1.21%	151,000
Between Exits 117 & 121	Urban	94,000	1.59%	142,000
Between Exits 116 & 117	Urban	96,000	1.77%	152,000
Between Exits 112 & 116	Rural	81,000	1.74%	127,000
Between Exits 105 & 112	Rural	64,000	2.01%	107,000
South of Exit 105	Rural	66,000	1.62%	100,000

Traffic analyses were then performed using HCS for the 2045 No-Build scenario. Results from the analysis indicate that much of northbound I-65 north of Exit 117 will operate at LOS D during the AM peak, and most of I-65 north of Exit 112 (KY 245/Clermont Road) will operate at an undesirable LOS E or F during the PM peak.

4.2 Future Traffic Analysis

Future traffic analyses were also performed for the Shepherdsville area using the TransModeler simulation model for the 2045 Existing plus Committed (E+C) Network during the AM and PM peak hours. The E+C Scenario includes the proposed double crossover diamond (DCD) interchange at KY 480 (KYTC Item No. 5-391.30). **Table 5** presents a summary of the 2045 E+C traffic operations on I-65.

Table 5. 2045 E+C Traffic Summary

Segment	2045 ADT	V/C	AM Peak				PM Peak			
			NB VPH	NB LOS	SB LOS	SB LOS	NB VPH	NB LOS	SB VPH	SB LOS
North of Exit 121	151,000	1.51*	5,700	D	3,300	B	4,700	D	7,050	F
Between Exits 117 & 121	142,000	1.42	4,700	D	3,400	B	4,650	D	6,750	F
Between Exits 116 & 117	152,000	1.52	4,050	E	3,550	C	4,800	F	6,350	F
Between Exits 112 & 116	127,000	1.25	3,400	C	2,900	B	3,700	C	5,300	E
Between Exits 105 & 112	107,000	1.05	2,550	B	2,650	B	3,350	C	4,300	D
South of Exit 105	100,000	0.98	2,050	B	2,700	B	2,850	B	3,950	C

During the AM peak hour, portions of northbound I-65 are expected to operate at an undesirable LOS in the weaving section between exits and north of Exit 117, as shown on **Figure 16**. During the PM peak hour, southbound I-65 will operate at LOS F, with several portions of northbound I-65 also operating at an undesirable LOS E and F, as shown on **Figure 17**.

Figure 16. 2045 E+C Simulation Model Level of Service

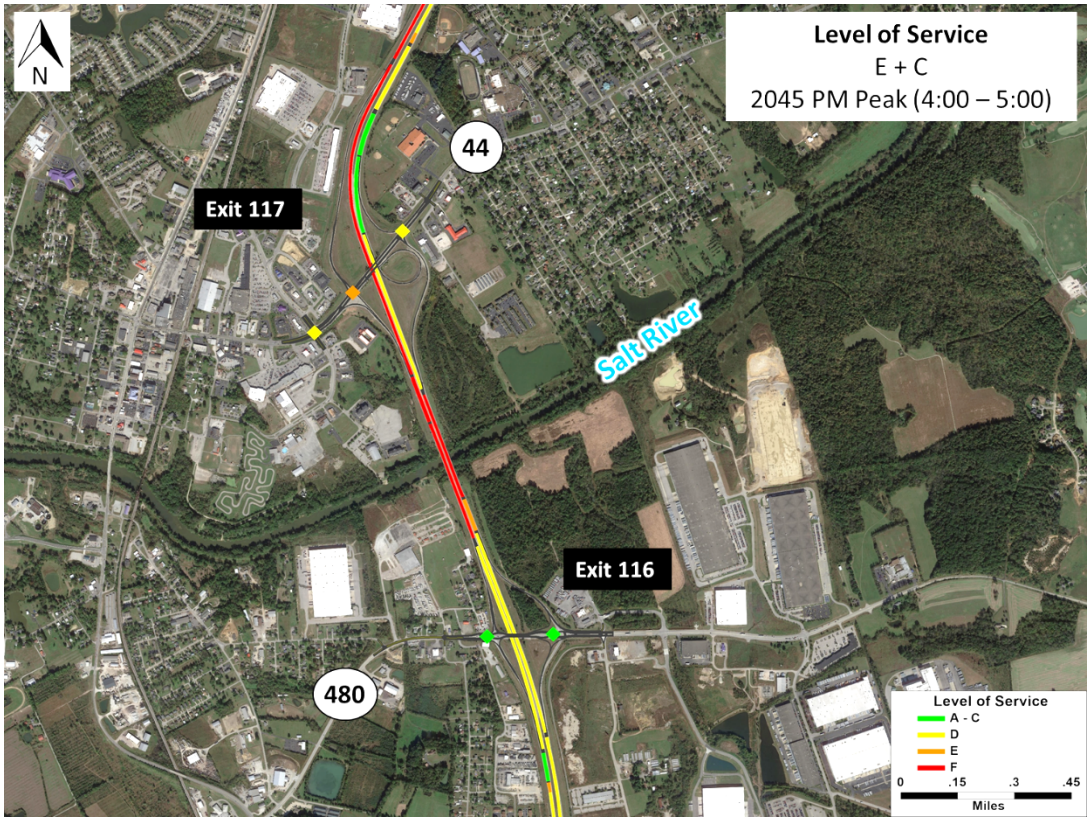


Figure 17. 2045 E+C Simulation Model Level of Service

5.0 Environmental Overview

An Environmental Overview was performed to identify environmental resources of significance, potential jurisdictional features, and other environmental areas of concern that should be considered during project development. Natural and human environmental resources within the study area were identified from secondary sources.

More detailed environmental studies may be required as individual projects are further developed. If a future project is federally funded, the National Environmental Policy Act (NEPA) requires that potential environmental impacts regarding jurisdictional wetlands, archaeological sites, cultural historic sites, and federally endangered species must be avoided if feasible and prudent. If not, then impact minimization efforts are required. Mitigation for unavoidable impacts may also be necessary.

It is anticipated that proposed widening and improvements to I-65 will occur within the existing right-of-way except for the portion through Shepherdsville. The following provides a summary of the potentially impacted environmental resources in this area. The complete document, including a discussion of all potentially impacted resources in the study area, is in **Appendix E.**

5.1 Natural Environment

Natural environment resources include surface streams, floodplains, wetlands, ponds, groundwater, threatened, endangered, and special concern species and habitat, woodland and terrestrial areas, and parks. Through a literature/database review and field reconnaissance, potentially sensitive resources that affect the natural environment were identified in the study area and are discussed below. A full discussion of potentially impacted natural environment resources, including a discussion of species, is included in **Appendix E**.

The Salt River and several United States Geological Survey (USGS) unnamed streams are located near Shepherdsville, as shown in **Figure 18** and **Figure 19**. One unnamed intermittent stream runs from the Salt River to Conestoga Parkway and could be impacted by I-65 widening and improvements to Exit 117 (KY 44). One National Wetlands Inventory (NWI) wetland is mapped near the unnamed stream, west of Conestorga Parkway and north of Norton Healthcare. The Salt River Watershed covers the Shepherdsville area.

Based on review of Flood Emergency Management Agency (FEMA) National Flood Hazard Layer, the area around Exits 116 (KY 480) and 117 is a FEMA 100-year Flood Zone, with the Salt River considered a FEMA designated floodway.

There are eight oil or gas wells mapped within or near the study area, including one in the northeast quadrant of Exit 117.

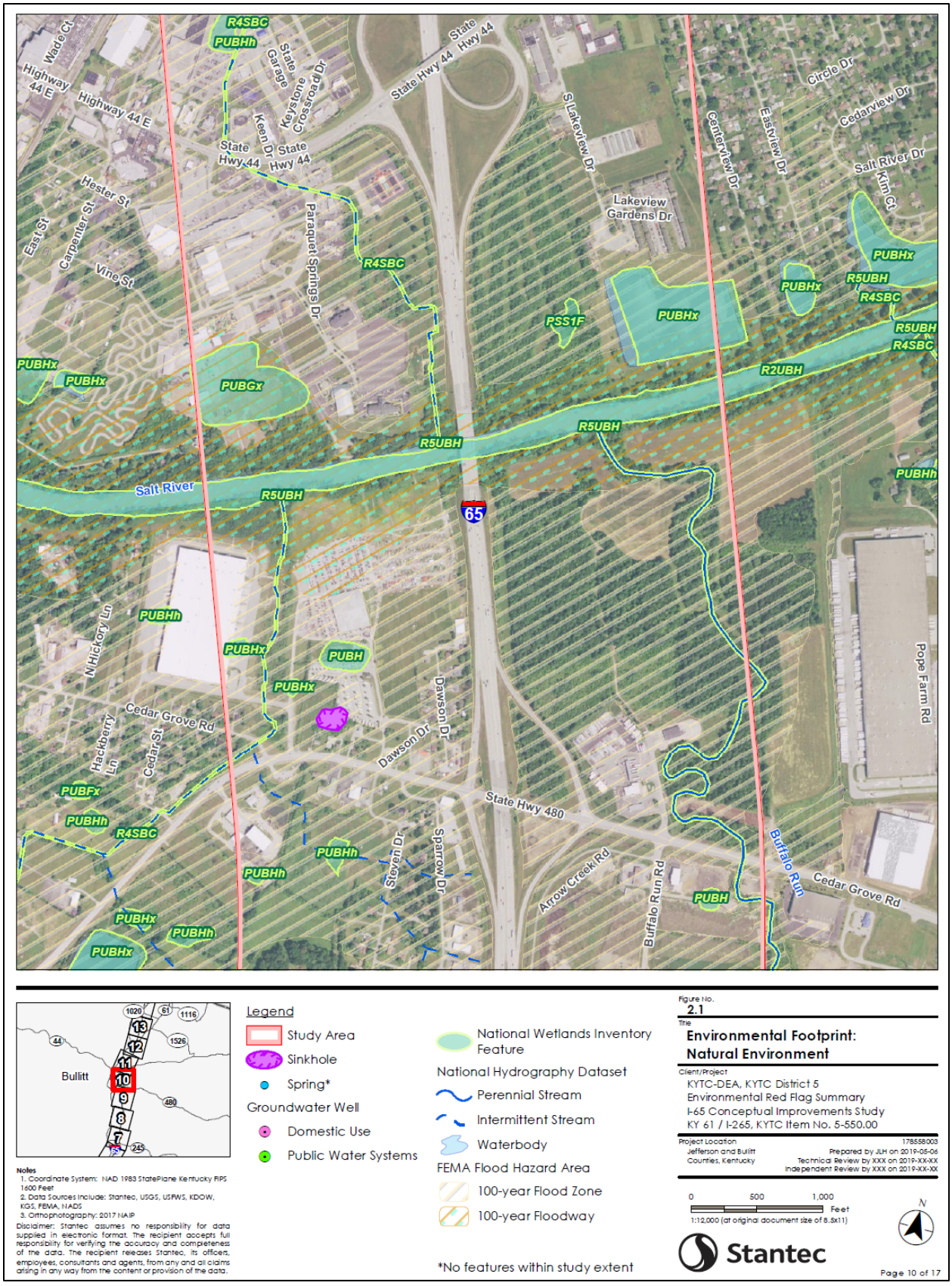


Figure 18. Natural Environment - Salt River Crossing

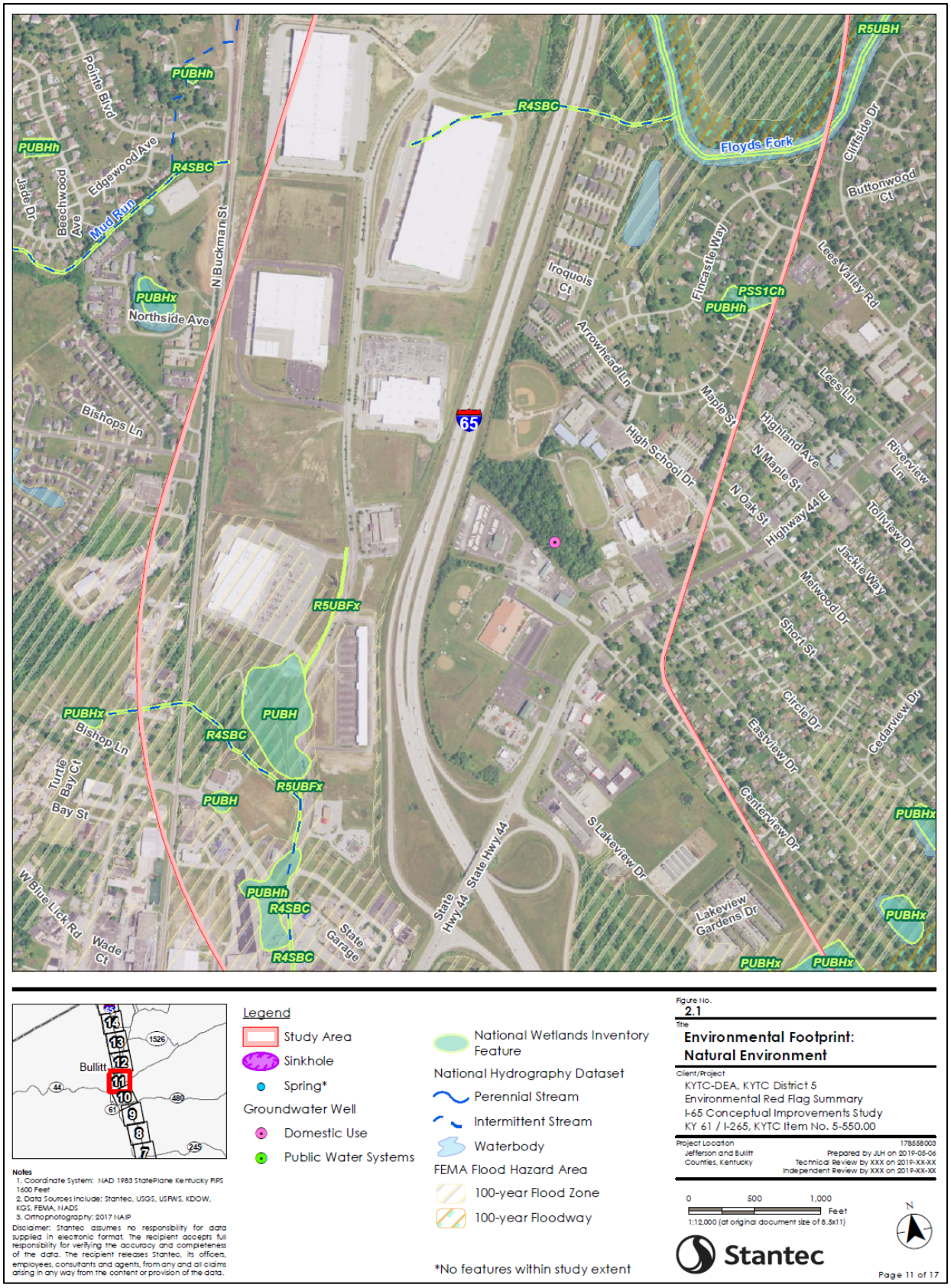


Figure 19. Natural Environment - Exit 117

5.2 Human Environment

Human environment is defined as what we live in and around and what we have built. Through review of secondary source information and field reconnaissance, potentially sensitive resources that affect the human environment were identified in the impacted study area and are discussed below.

A complete summary of the socioeconomic conditions in Bullitt and Jefferson Counties based on 2013 – 2017 American Community Survey (ACS) statistics can be found in **Appendix E**. The following summarizes the socioeconomic conditions around Shepherdsville:

- A total of 14.3 percent of Bullitt County's population is over the age of 65. The block groups just north of Exit 117 and south of Exit 116, both west of I-65, have over 20 percent of their populations over the age of 65.
- Bullitt County's poverty rate is 10.2 percent. Of the block groups near Shepherdsville, the two covering the western portion of Exit 116 have poverty rates above 10 percent.
- Bullitt County's population has a disability rate of 18.5 percent. Of the block groups near Shepherdsville, the block groups north of Exit 117 and south of Exit 116 have disability rates above 20 percent.
- A total of 0.3 percent of Bullitt County's population has Limited English Proficiency (LEP). None of the block groups near Shepherdsville have LEP rates above 1.0 percent.

Commercial development in the study area is concentrated around the interchanges along I-65 and especially in the vicinity of Shepherdsville. There are two public service and utility facilities located near Shepherdsville, including the Shepherdsville City Police Department and the Shepherdsville City Fire Department.

Based on a review of the Kentucky Heritage Council (KHC) Site Check response, there are 70 previously recorded historic architectural resources in the study area, 21 of which are located at Exits 116 and 117, as shown in **Figure 20** and **Figure 21**. Most of these are residential houses and outbuildings (barns, sheds, garages, privies, etc.). Maraman Cemetery is located on the south side of Cedar Grove Road (KY 480).

Two hazmat records and several noise sensitive receptors are located between Exits 116 and 117 and would be impacted if I-65 is widened across the Salt River. Additionally, improvements to Exit 117 may impact the noise sensitive receptors in the commercial area of the northwest quadrant.

There are no expected impacts to existing railroad lines, transmission lines, or pipelines.

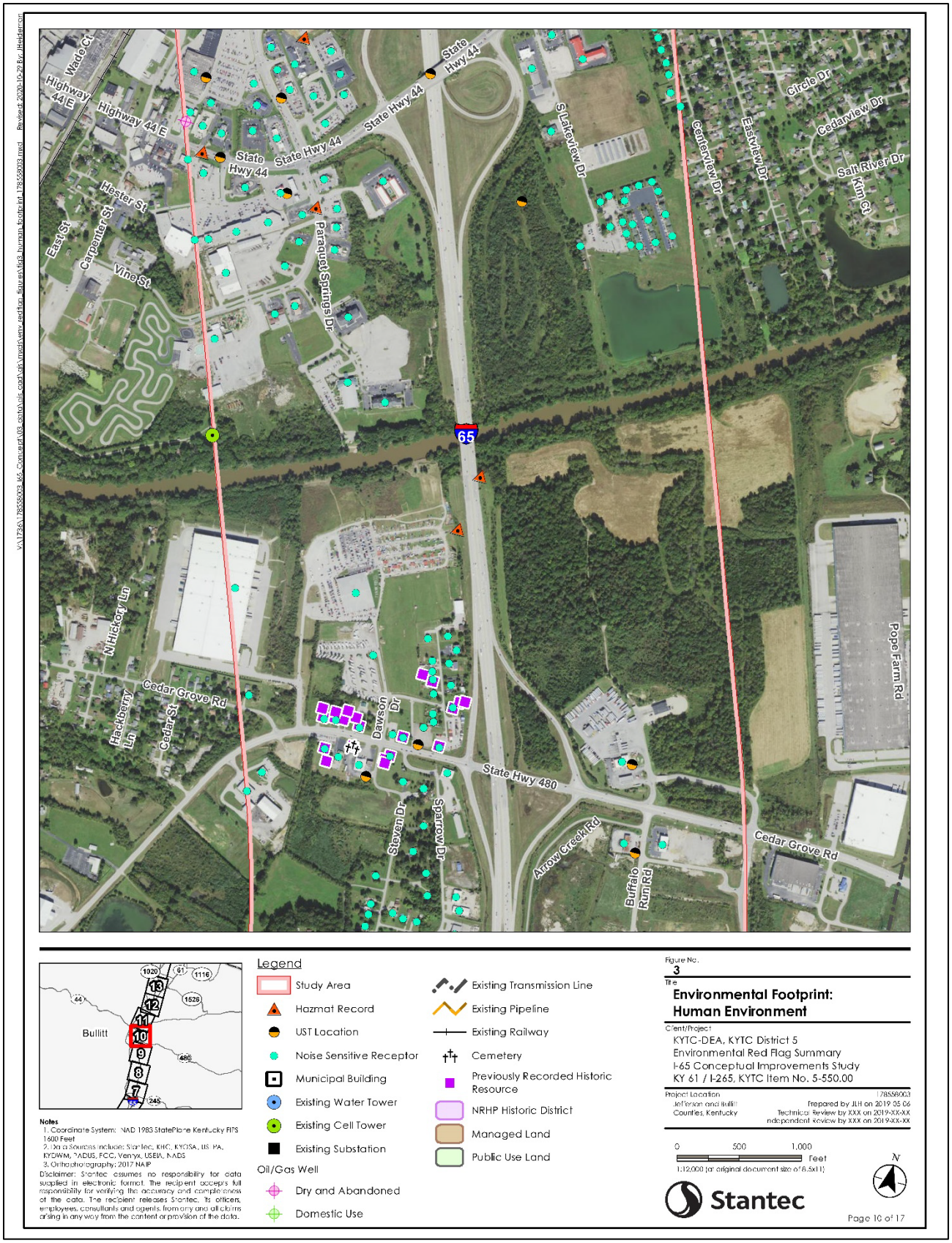


Figure 20. Human Environment - Salt River Crossing

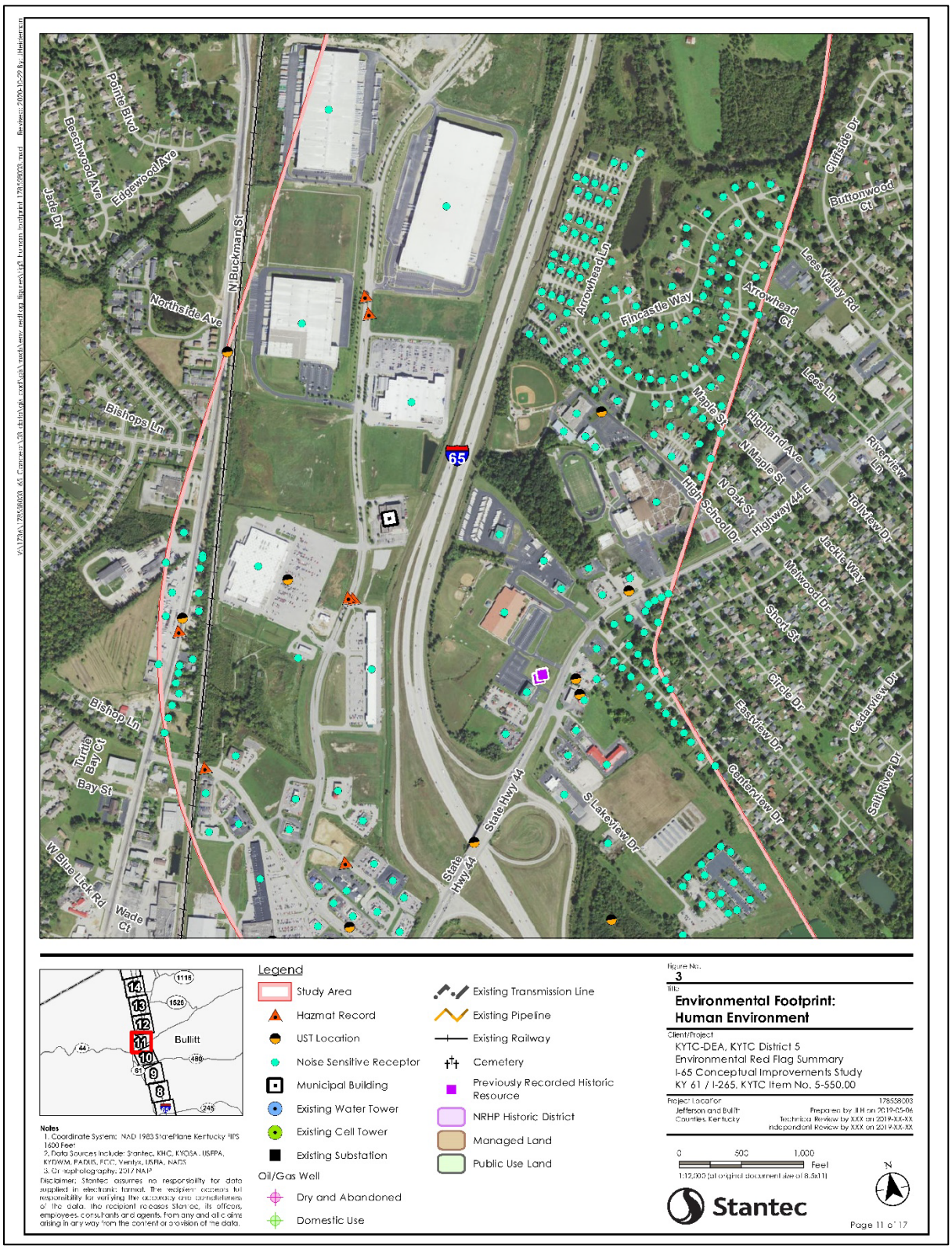


Figure 21. Human Environment - Exit 117

5.3 Geotechnical Overview

A geotechnical overview of the study area was completed based upon research of available published data and experience with highway design and construction within the region. The purpose of the overview is to provide a general summary of the bedrock, soil, and geomorphic features likely to be encountered in the study area and to identify geotechnical features that may have an adverse impact on the project alignment. The complete document is included in **Appendix F**. The overview, mapped on **Figure 22**, concluded:

- The potential exists for acid drainage within the I-65 corridor. The Borden Formation and New Albany Shale are present and are known acidic stratums. Particular attention should be given to the design of new or widening of existing cut slopes and embankments near where these formations exist. Cuts and embankments within these shale formations will require special design considerations.

Existing Roadside cut next to KY 245 I-65 SB Entrance Ramp

- Cuts in acid producing shale will require the cut slope to be flattened and over-excavated a minimum of 4.5 feet and covered with clay soil or non-durable shale to prevent production of acidic run-off. Embankments that contain acid producing shales will also require encasement. A minimum of 4 feet of clay soil or non-durable shale should be placed on the top of the embankment to control corrosion of guard rail and 2.5 feet of material should be placed on side slopes.
- Geotechnical drilling will be required for any new bridge or reinforced concrete box culvert structures as well as any necessary retaining walls. In widening or replacement situations, additional geotechnical explorations may be necessary to supplement information for existing structures. It is anticipated that conventional spread footing and/or pile foundation systems can be utilized for bridge structures.

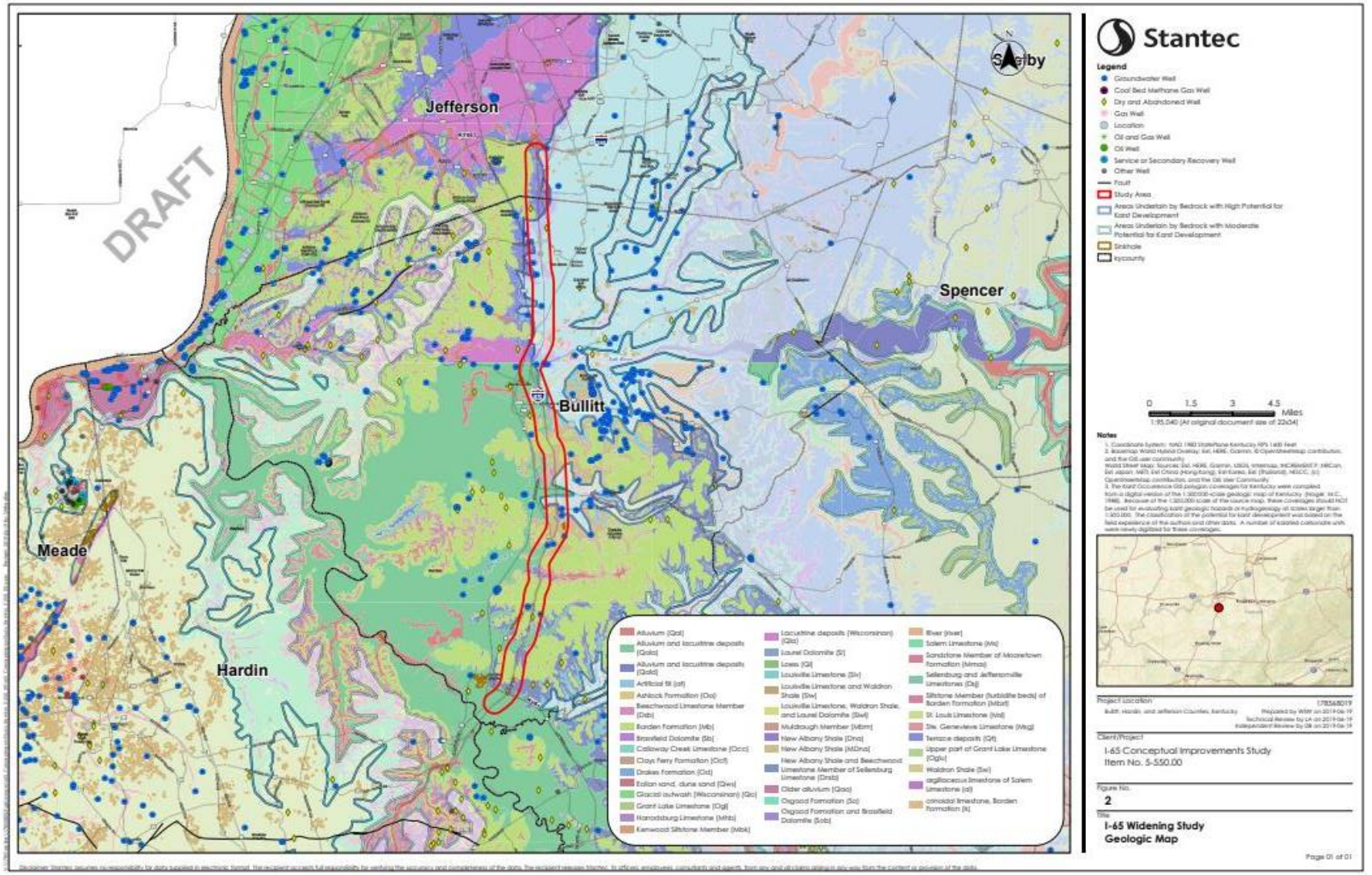


Figure 22. Geotechnical Overview Map

- Based upon previous construction of existing I-65, it is anticipated that a two-foot rock roadbed may be the most effective subgrade platform for construction within the median of I-65.
- Any saturated, soft, or unstable areas encountered within new embankment or subgrade limits should be drained and stabilized utilizing non-erodible granular embankment or durable limestone from roadway excavation. The rock platform shall be underlain with geotextile fabric. Additional rock may be required to stabilize soft soils and to maintain positive drainage.
- For new connecting roadways and at tie-in locations, pavement structure and California Bearing Ratio (CBR) information on existing pavement should be obtained to assist the design team. It should be anticipated that chemically or mechanically stabilized roadbed will be required on most new roadway construction because CBR values are expected to be six or less.
- Water wells, monitoring wells and springs exist along/near the study area for the I-65 corridor improvements. The design team should inventory and survey active wells and springs. If impacted during construction, special construction will be required to close the wells, and spring boxes and/or granular material may be required in the vicinity of springs.
- The subsurface bedrock conditions within the subject I-65 study area vary from low to high in karst potential. If any open sinkholes or other karst activity are encountered within any areas of roadway construction, then treatment should be performed in accordance with Section 215 of the current edition of the *Standard Specifications for Road and Bridge Construction*.

5.3.1 Karst

The project area is predominantly underlain by bedrock with limited or no potential for karst development. Although, a small area underlain by bedrock with high potential for karst development occurs in the central portion of the study area. **Figure 23** shows the karst areas within Bullitt County.

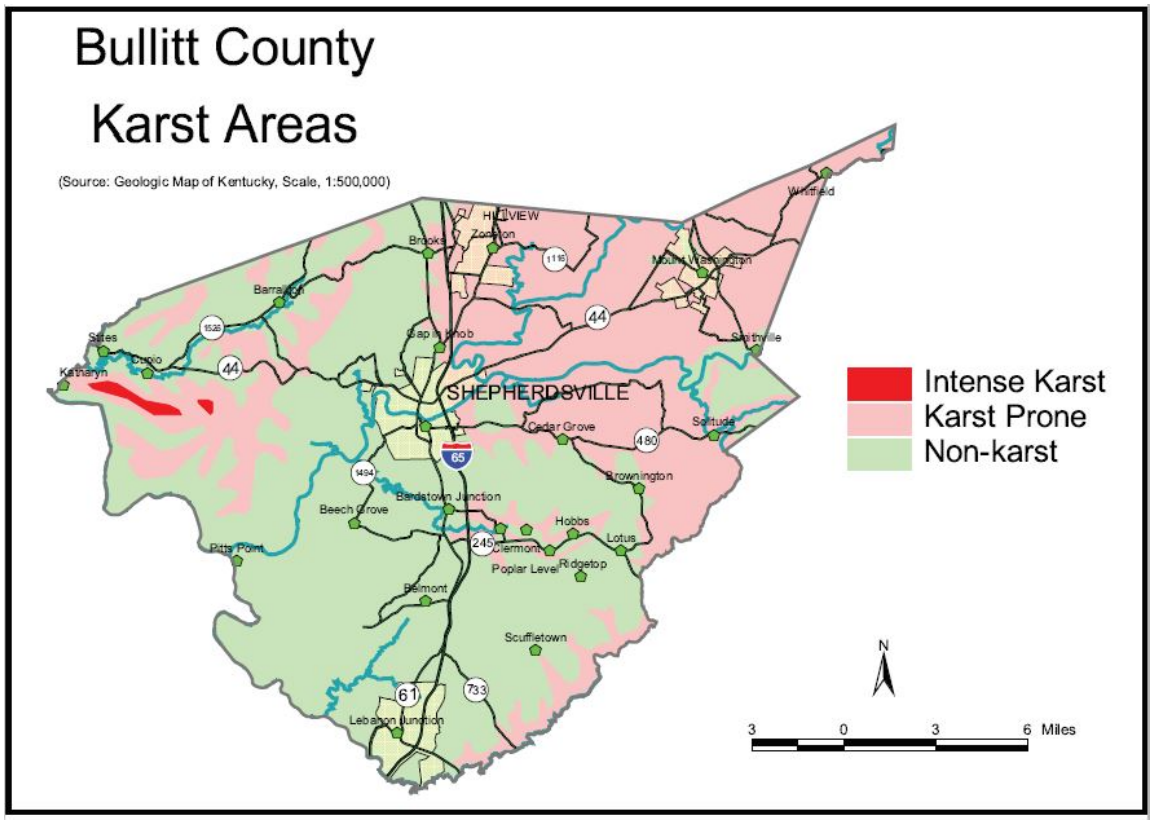


Figure 23. Bullitt County Karts Areas

Sixteen sinkholes are scattered around the middle portion of the study area, with one located west of Exit 116. No cave entrances are known within study area.

6.0 Initial Project Team and Stakeholders Coordination

Over the course of the study, the project team held three meetings to coordinate on key issues. The project team consisted of representatives from KYTC Central Office, KYTC District 5, FHWA, KIPDA, and the consultant, Stantec. The project team also reached out to stakeholders and local officials for input. Detailed summaries of each meeting are presented in **Appendix E**.

6.1 Project Team Meeting No. 1

The first Project Team Meeting for the subject project was held at the KYTC District 5 Office in Louisville, Kentucky on July 8, 2019. The purpose of the meeting was to present the results of the existing conditions analysis and to get feedback from the project team on potential improvement concepts. Key discussion items included the following:

- Stantec is working with KYTC on an I-65 pavement rehabilitation project in Bullitt County between milepoint 102.295 and milepoint 127.57. Because of ongoing subgrade failures, current recommendations include full depth pavement

replacement between Exit 102 and Exit 105 and using URETEK concrete pavement lifting between Exit 105 and the Gene Snyder Freeway.

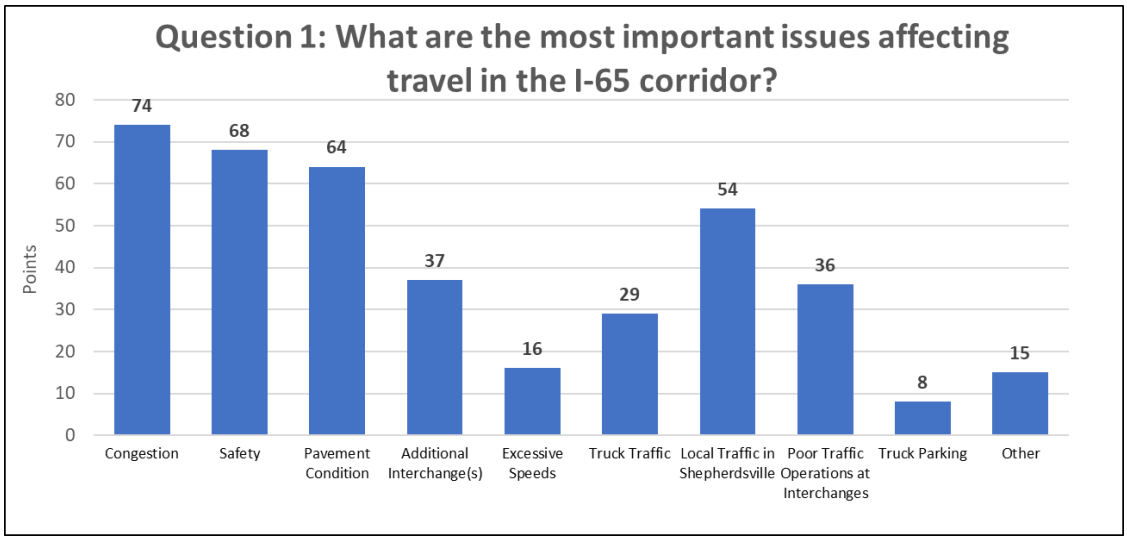
- The existing pavement was designed to have 11 inches of non-reinforced concrete over six inches of dense-graded aggregate (DGA) and a 24-inch rock roadbed. The Kentucky Transportation Center (KTC) took four pavement cores in 2018 showing DGA depths between 5.75 to 6.875 inches and a possible shale bedrock subgrade. Additional borings and geotechnical analysis are needed for the subgrade analysis.
- There was a discussion of potential diversion of traffic once the I-69 corridor is complete. With a new interstate connection, trips traveling from Nashville may use I-69 instead of I-65 to reach Indianapolis.
- An EEC analysis was performed using safety performance functions (SPFs) developed by the KTC. Results from this analysis are consistent with the Critical Crash Rate Factor (CRF) analysis, showing that there are fewer crashes than expected occurring on this portion of I-65. Based on these results, "improve safety" was removed from the Purpose and Need Statement and instead made a project goal.
- Preliminary improvement concepts were discussed. Several concepts are being considered, including the following: spot improvements, eight-lane widening between Exit 112 and the existing eight-lane section in Jefferson County, additional auxiliary lanes between Exit 116 and Exit 117 in Shepherdsville, reversible lane in median and new interchange at Preston Highway and Active Transportation Demand Management (ATDM) concepts.

6.2 Local Officials/Stakeholders Meeting No. 1

The project team reached out to local government representatives and other community groups early in the planning process. The first Local Officials/Stakeholders Meeting for the I-65 Conceptual Improvements Study was held at the Shepherdsville City Hall on July 24, 2019 at 2:00 p.m. Because some stakeholders were unable to attend the July 24th meeting, a second opportunity was provided at the KYTC District 5 Office in Louisville, Kentucky on August 2, 2019 at 2:00 p.m. The same information was presented at both meetings. In addition to the project team, representatives from the Bullitt Chamber of Commerce, the City of Shepherdsville, the City Council Planning Commission, Bernheim Forest, Greater Louisville Inc., and Bullitt County Schools, among others, were in attendance. The purpose of the meeting was to discuss the project purpose and history, the results of the existing conditions analysis, design considerations, and to solicit input on the need for improvement concepts.

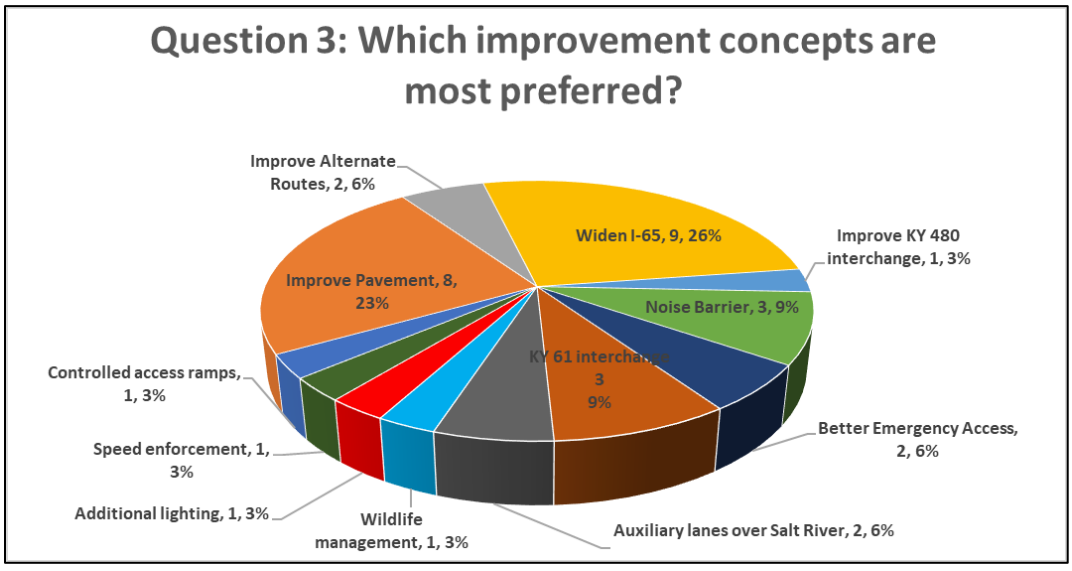
During the meetings, attendees were asked to fill out a survey. The results are as follows:

- The first question asked respondents to rank issues affecting travel on I-65 in order of importance, where one is the highest priority and six is the lowest priority. Six points were given to first place votes, five points for second, four points for third, three points for fourth, two points for fifth, and one point for sixth. The resulting scores are shown below. Congestion, safety, and pavement condition received the most votes.



- Question two asked if improvements are needed along I-65. 23 respondents indicated that improvements are needed now, and one respondent indicated that improvements are needed in 10-15 years.

- Question three asked respondents which improvement concepts they prefer. Widening I-65 and improving the existing pavement were the most common responses.



7.0 Initial Improvement Concept Development

Improvement concepts were developed based on a combination of input from project stakeholders and the project team, a review of existing conditions, simulation model traffic analyses, and field reconnaissance. Over the course of the study, the project team worked to determine which improvement concepts proved to be the most cost effective. These concepts were carried forward for further evaluation. Traffic operations for the improvement concepts were analyzed using HCS and/or the traffic simulation model. Along with the No-Build / No Action concept, this study examined several other types of improvements discussed below.

Improvement Concepts

- No-Build: Pavement Replacement
- Spot Improvements
- I-65 8-Lane Widening
- Auxiliary Lanes
- New interchange at Preston Highway
- Active Transportation Demand Management (ATDM) Concepts

7.1 No-Build

Early in the concept development process, the project team determined that regardless of what additional improvements are recommended, a full-depth pavement replacement is needed along the entire study area. Pavement replacement was therefore considered the "No-Build" and was used as a basis of comparison for other concepts.

7.2 Spot Improvements

Spot improvements are lower cost strategies focused on locations with localized operational and/or safety issues. Initial spot improvements are shown in **Figure 24** and include:

Spot Improvement 1 – Exit 105 Southbound Exit Ramp

Spot Improvement 1 provides congestion relief and removes decelerating traffic off mainline I-65. This location was noted to have congestion issues at the first Local Officials/Stakeholder Meeting, with exiting traffic causing slowdowns on I-65. Between 2016 and 2018 there were five sideswipe and four rear end crashes on the diverging segment of I-65, indicating possible conflicts between through traffic and vehicles slowing to exit. An improvement option is to construct a parallel deceleration ramp to improve operations and remove decelerating traffic off mainline I-65.

Spot Improvement 2 – Southbound Rest Area Entrance Ramp

The existing 870-foot acceleration length of the southbound I-65 Rest Area entrance ramp is less than the AASHTO design guidelines for interstate facilities of 1,000 feet. Spot Improvement 2 extends the existing parallel on ramp to improve operations and provide a more adequate distance for vehicles to accelerate before merging onto I-65.

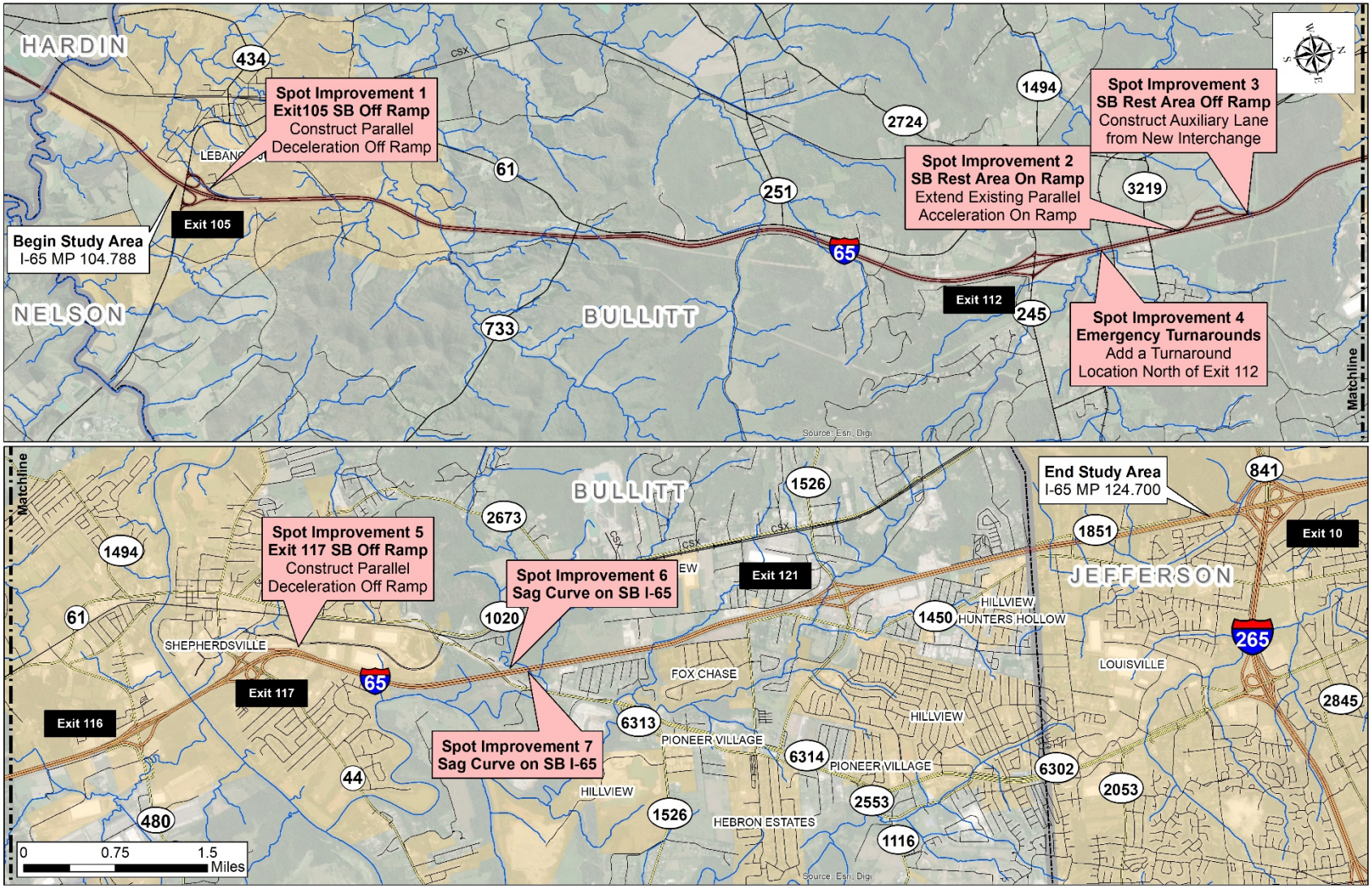


Figure 24. Initial Spot Improvements

Spot Improvement 3 – Southbound Rest Area Exit Ramp

The existing 470-foot deceleration length of the southbound I-65 Rest Area exit ramp is less than the AASHTO design guidelines for interstate facilities of 1,000 feet. Based on the design plans for the interchange under construction between KY 480 and KY 245 (KYTC Item No. 5-538), there is approximately 1,000 feet between the proposed southbound entrance ramp and the existing southbound Rest Area exit ramp. Spot Improvement 3 improves operations and removes decelerating traffic from I-65 by providing an auxiliary lane between the two ramps.

Spot Improvement 4 – Emergency Turnarounds

At the first Local Officials/Stakeholder meeting, it was suggested that there are not enough emergency turnaround locations within the median. There are currently six emergency turnarounds on the study portion of I-65 (three paved, three unpaved). KYTC's general guidance recommends providing emergency turnarounds every five miles in more densely populated areas such as this and interchanges are considered an emergency turnaround location. Between the existing interchanges and the paved emergency turnarounds, the five-mile maximum spacing recommendation is currently met. As a result, this recommendation only needs to be considered as part of the eight lane-widening improvement concept where a barrier wall will be installed.

Spot Improvement 5 – Exit 117 Southbound Exit Ramp (MP 117.2 – 117.5)

The diverging segment of I-65 north of the Exit 117 southbound exit ramp to KY 44 currently operates at an undesirable LOS E because traffic from the ramp backs up onto the mainline. Additionally, there were nine rear end crashes and four sideswipes between 2016 and 2018, suggesting that the congestion on the ramp may contribute to safety issues on mainline I-65. Spot Improvement 5 involves constructing a parallel deceleration ramp to improve traffic operations and provide a desirable LOS D.

Exit 117 Southbound Exit Ramp

Spot Improvement 6 – Sag Curve on Southbound I-65 (MP 118.43 – 118.58)

The headlight stopping sight distance (HSSD) at the sag curve between milepoints 118.43 and 118.58 on southbound I-65 is 701 feet, which is less than the AASHTO design guideline for interstate facilities of 730 feet. HSSD is a recommendation which does not require a design exception if not achieved. For all practical purposes, the recommended HSSD is achieved at this location.

Spot Improvement 7 – Sag Curve on Southbound I-65 (MP 119.02 – 119.12)

The HSSD at the sag curve between milepoints 119.02 and 119.12 on southbound I-65 is 706 feet, which is less than the AASHTO design guideline for interstate facilities of 730 feet. HSSD is a

recommendation which does not require a design exception if not achieved. For all practical purposes, the recommended HSSD is achieved at this location.

7.3 Long-term option: I-65 Eight-Lane Widening

Based on traffic analyses performed using HCS for the 2045 Existing plus Committed (E+C) Network, it was determined that most of I-65 north of Exit 112 (KY 245/Clermont Road) would operate at an undesirable LOS E or F during the PM peak by year 2045. Based on this traffic analysis, it is evident that the six-lane portion of I-65 will need additional capacity in the future. A long-term option to increase capacity and reduce congestion is to widen I-65 from six- to eight-lanes. **Figure 25** shows an eight-lane interstate typical section. This concept, consistent with the current eight-lane section that begins south of I-265 in Jefferson County, assumes widening into the median (where there is a 40-foot depressed median) and providing full inside and outside shoulders.

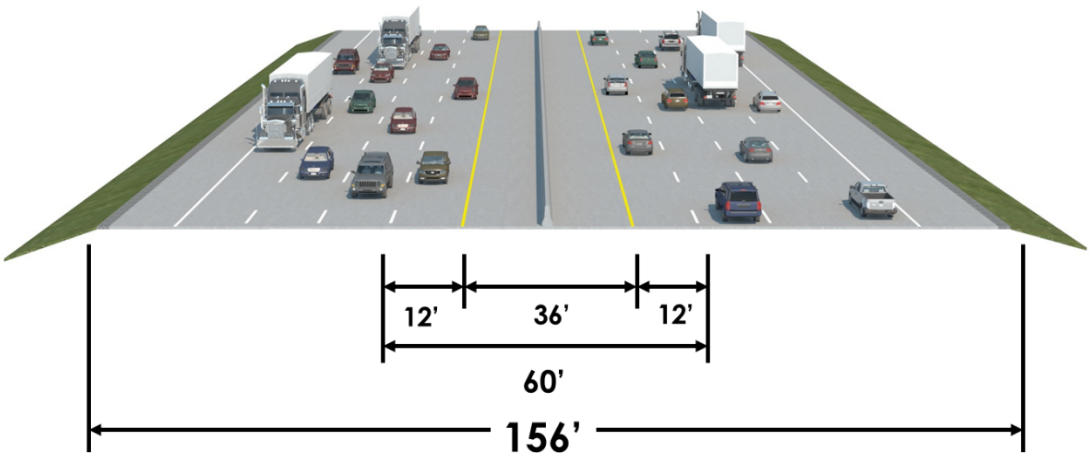


Figure 25. I-65 8-Lane Typical Section

Due to the high cost, widening I-65 from six to eight lanes would likely be completed in phased segments, with the sections carrying the highest traffic volumes constructed first. The highest existing traffic volume is the three-lane section north of Exit 121, which has a 2019 PM southbound LOS E and a 2019 AM northbound LOS D (See Table 1). Widening to four lanes in each direction would result in an improvement of traffic operations and LOS C and B, respectively. Construction Sections for the eight-lane widening could then continue from north to south to achieve 2045 desirable operations. The 2045 traffic analysis shows that the eight-lane widening can end at Exit 116 (KY 480) and still maintain desirable operations through year 2032 as shown in **Figure 26**.

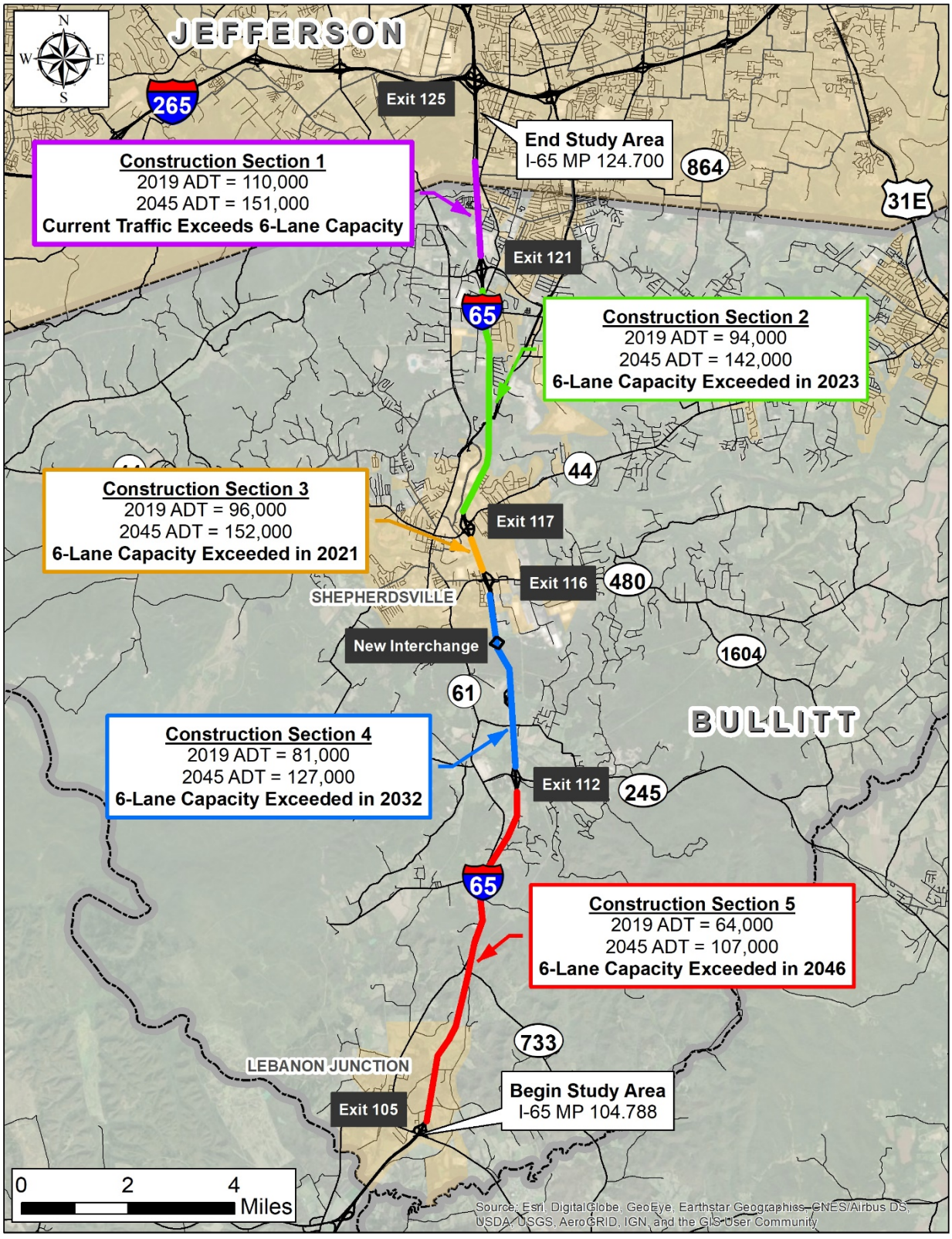


Figure 26. I-65 Potential Widening Construction Sections

7.4 Long-term option: New Interchange at Preston Highway

This is a long-term option to construct a new interchange at I-65 and KY 61 (Preston Highway), north of KY 44 (Exit 117). The project is listed in KIPDA's Metropolitan Transportation Plan (MTP) as a regional priority with an estimated open to public year 2039. Based on results from the KIPDA Regional Travel Demand Model, ramps on this new interchange would have a 2040 ADT between 7,600 and 9,000 VPD which could reduce traffic on the Exit 117 ramps by up to 3,000 VPD, as shown in **Figure 27**. It does not appear, however, to have a significant effect on reducing traffic demand and resulting congestion at Exit 121.

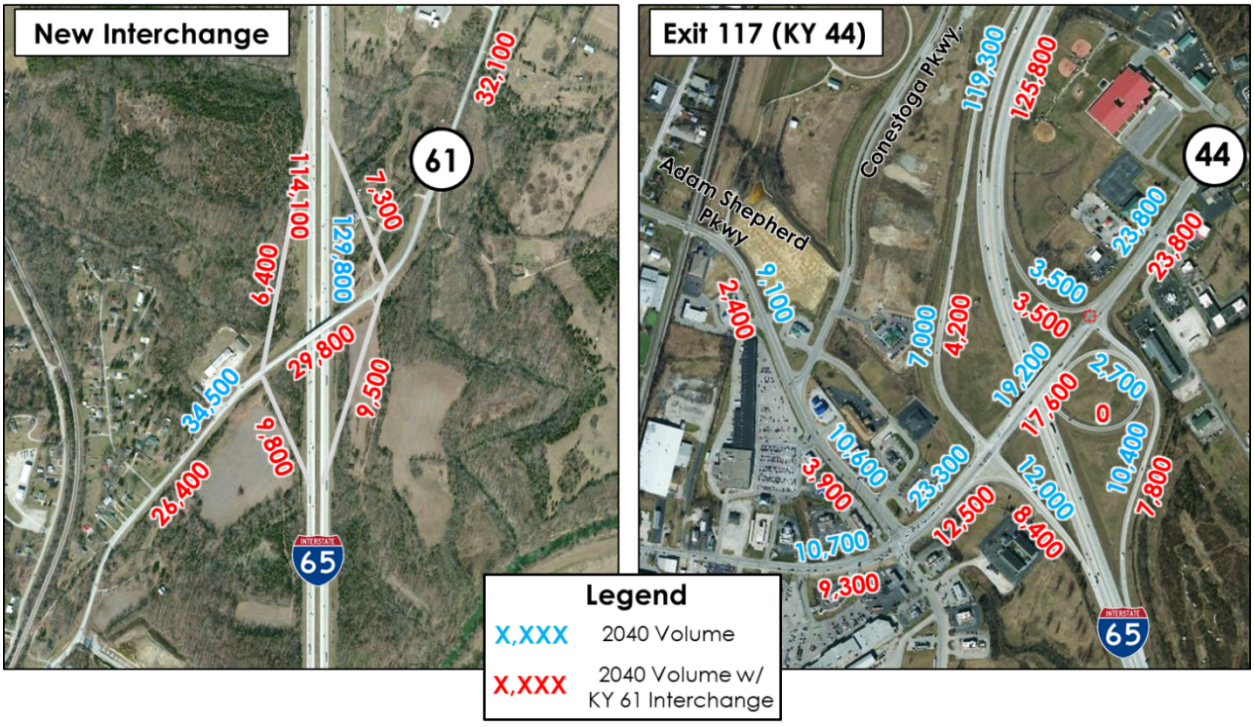


Figure 27. 2040 Traffic Forecasts for Potential New Interchange at Preston Highway

7.5 Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) would provide travel time reliability improvements throughout the study area. **Figure 28** presents the Traffic Response and Incident Management Assisting the River City (TRIMARC) suggested locations for ITS improvements on the study portion of I-65. TRIMARC recommends two, new overhead dynamic message signs (DMS) and ten cameras on the study portion of I-65.

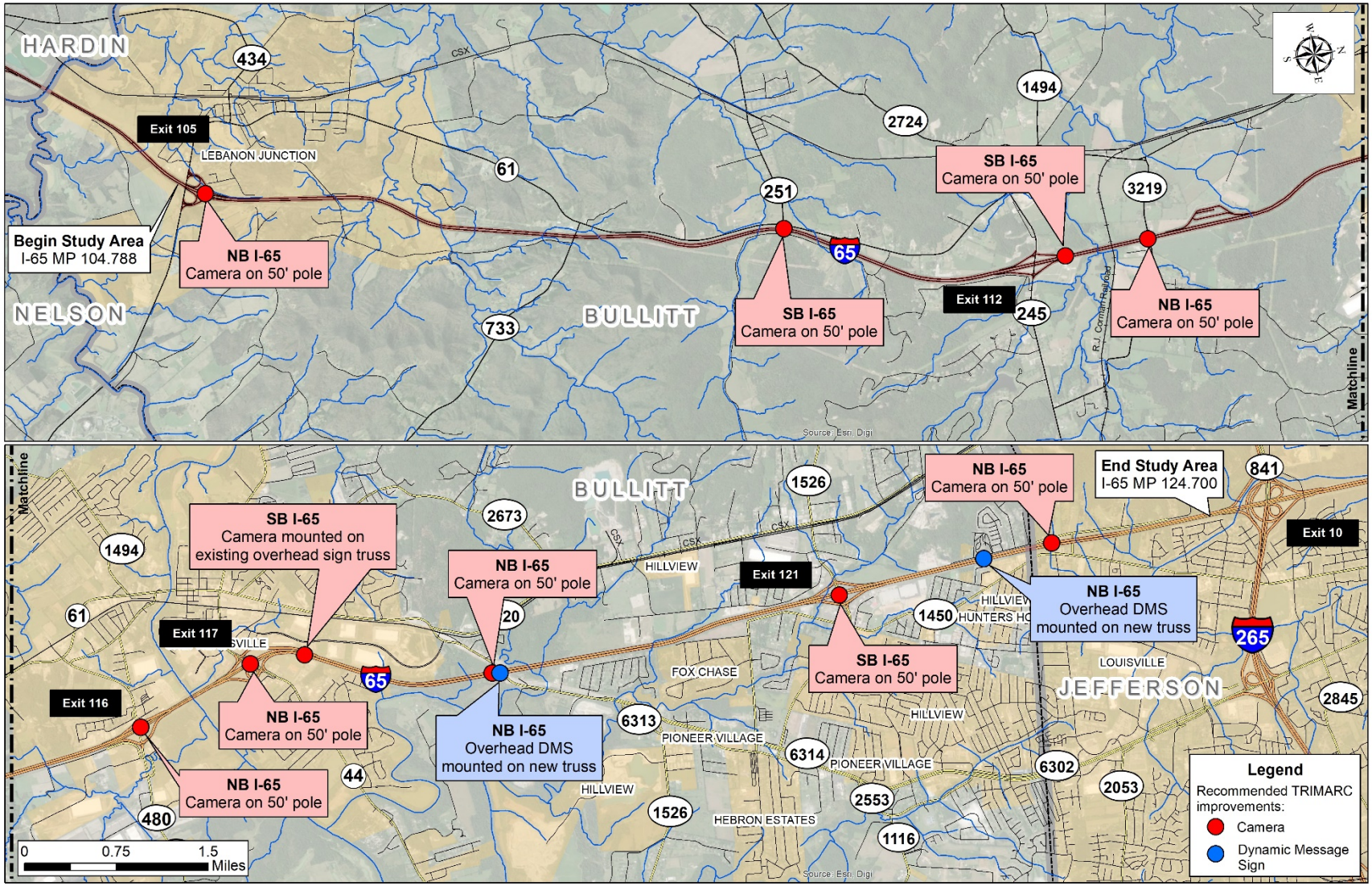


Figure 28. TRIMARC Recommended ITS Locations

7.6 Active Transportation Demand Management

Active Transportation Demand Management (ATDM) options include:

- High-occupancy vehicle (HOV) Lanes – HOV lanes are managed facilities that are reserved for use by vehicles carrying at least two passengers (a driver plus at least one additional person).
- High-occupancy toll (HOT) Lanes – Operates the same as an HOV lane but allows single occupancy vehicles to use the lanes by paying a toll. The toll can be a variable fee that is adjusted as a response to demand.
- Ramp Metering at Exit 116 and Exit 117 in Shepherdsville – Ramp metering would include a traffic signal (red and green only) that regulates the flow of traffic entering freeways according to current traffic conditions.
- Inside Shoulder Lanes – Drivers may use the designated inside shoulder as an additional lane during peak traffic flow or times with heavy congestion.
    - It was noted that the designated driving times could be the AM and PM peak hours with fines for driving on the shoulder during off-peak hours. The shoulders would not be available during an incident or if a car broke down on the shoulder. Dynamic signs as well as static signs would manage access.
- Dynamic speed limits – Speed limits that change according to real-time traffic, road, or weather conditions.

8.0 Second Project Team and Stakeholders Meetings

Following the development of the initial improvement concepts, the project team met with local officials and stakeholders again. During the meeting, improvement concepts were presented, and attendees were asked to provide feedback regarding their concerns and priorities. Summaries for all meetings are found in **Appendix E**.

8.1 Project Team Meeting No. 2

The project team met at the KYTC District 5 Office in Louisville, Kentucky on October 22, 2019. The purpose of the meeting was to discuss the preliminary improvement concepts and get feedback from the project team on changes that should be considered. Key discussion items included the following:

- The preliminary improvement concepts presented in **Chapter 7** were discussed.
- The project team recommended Spot Improvement 5 – Exit 117 Southbound Exit Ramp (MP 117.2 – 117.5) be further developed as a standalone project because it currently operates at an undesirable LOS E. Additionally, there were nine rear end crashes and

four sideswipes between 2016 and 2018, suggesting that the congestion on the ramp may contribute to safety issues on mainline I-65.

- In practical terms, the recommended HSSD is achieved at Spot Improvements 6 and 7. The project team decided not to move either project forward for further consideration.

- The project team discussed the existing pavement condition in detail. It was decided that regardless of what additional improvements are recommended as part of this study, a full depth pavement replacement is needed along the entire study area. This matches the recommendation made by KYTC for the pavement rehabilitation project on I-65 between Exit 102 and Exit 127 (Item No. 5-2088). KYTC's Pavement Management Division determined a full depth pavement replacement was needed along this stretch of I-65 instead of the planned pavement rehabilitation. Due to the increased cost for full replacement, the project limits were reduced to I-65 between Exit 102 (Joe Prather Highway) and Exit 104 (KY 61 in Lebanon Junction). Currently there is no additional funding for pavement replacement in the study area portion of I-65 north of Lebanon Junction.

- The remaining Spot Improvements, summarized below, were recommended to be considered during the design phase as part of the long-term pavement replacement and/or widening projects.
    - Spot Improvement 1 – Exit 105 Southbound Exit Ramp: construct a parallel deceleration ramp to improve operations and remove decelerating traffic off mainline I-65.
    - Spot Improvement 2 – Southbound Rest Area Entrance Ramp: extend the existing parallel on ramp to improve operations and provide a more adequate distance for vehicles to accelerate before merging onto I-65.
    - Spot Improvement 3 – Southbound Rest Area Exit Ramp: construct an auxiliary lane between the new interchange south the new interchange under construction (KYTC Item No. 5-538) and the existing southbound Rest Area exit ramp.
    - Spot Improvement 4 – Emergency Turnarounds: provide emergency turnarounds as part of the eight lane-widening improvement concept where barrier wall will be installed. KYTC's general guidance recommends providing emergency turnarounds every five miles in more densely populated areas such as this. Interchanges are considered an emergency turnaround location.

- The project team discussed an additional Spot Improvement for future consideration: restripe the Salt River Bridge in both directions to provide extended auxiliary lanes between the ramps at KY 44 and KY 480. This concept, which will provide eight lanes between Exit 116 and Exit 117 with minimal new construction, is discussed further in **Chapter 9** as part of the revised improvement concepts.

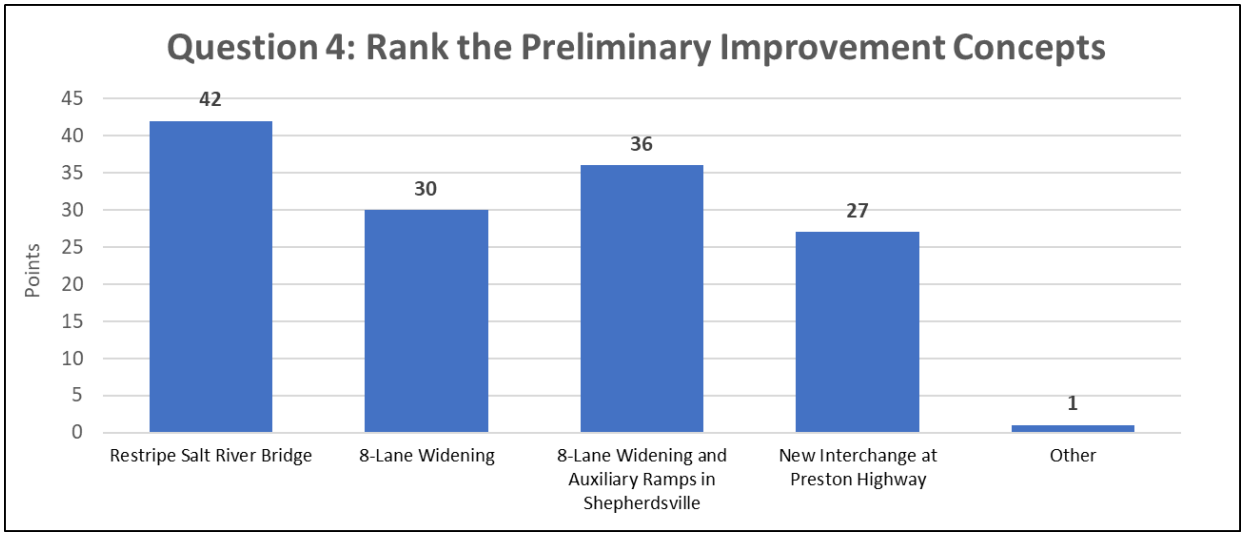
8.2 Local Officials/Stakeholders Meeting No. 2

The project team met with key stakeholders and local officials for a second time on December 3, 2019. This meeting was held at the Shepherdsville City Hall and it began at 2:00 p.m. The purpose of the meeting was to present the conceptual improvement strategies and solicit feedback from local officials and stakeholders. Stakeholders were also asked to fill out a questionnaire to help the project team prioritize improvement concepts, and the results are summarized below.

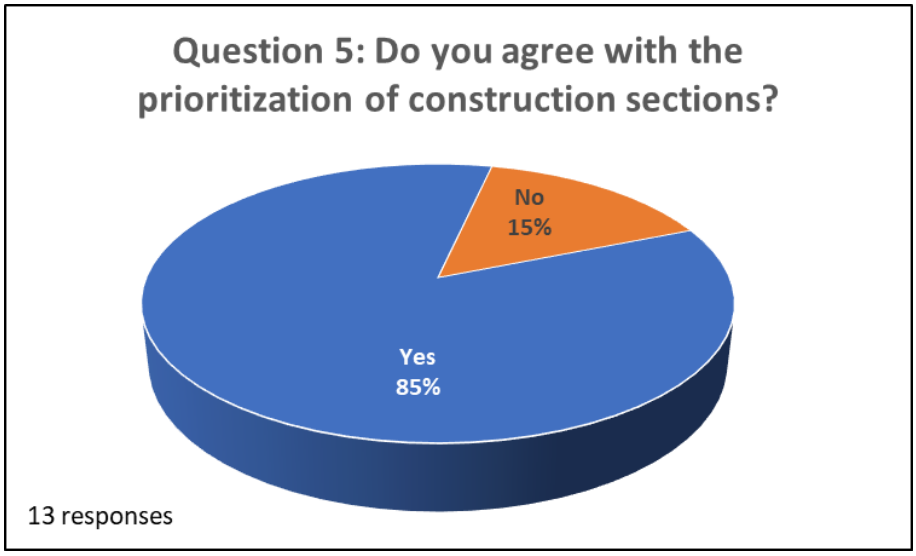
- When asked if improvements are needed on I-65, 13 (93 percent) indicated that improvements are needed now, and one (seven percent) indicated improvements are needed in 10-15 years. Respondents were then asked if the existing pavement needs to be repaired and/or replaced and all 14 indicated the pavement needs to be repaired and/or replaced.

- The next question asked if improvements are needed at the KY 44 (Exit 117) southbound exit ramp, which option is preferable. Ten respondents (71 percent) preferred constructing a split ramp to connect to Conestoga Parkway, three respondents (21 percent) preferred intersection improvements at the ramp intersection with KY 44 and at Adam Shepherd Parkway, and one respondent indicated that the signals at Adam Shepherd and the I-65 exit-ramp should be better coordinated.

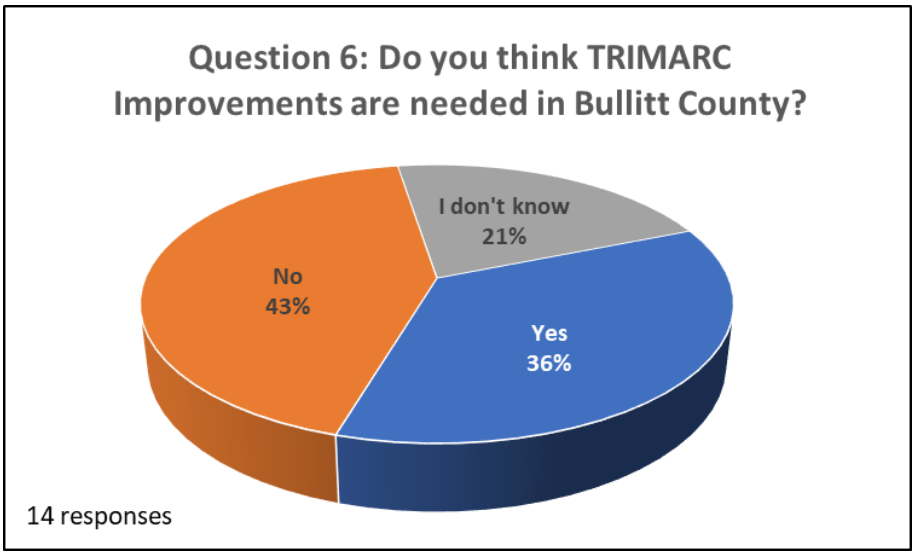
- Question four asked respondents to rank the preliminary improvement concepts in order of importance, where one is the highest priority and four is the lowest priority. Four points were given to first place votes, three points for second, two points for third, and one point for fourth. The resulting scores are shown below. Restriping the Salt River Bridge was the highest priority with eight-lane widening and adding auxiliary lanes in Shepherdsville the second highest. One respondent indicated that a second lane is needed on the southbound off-ramp at Exit 112.



- The next question asked if attendees agree with the prioritization of construction sections starting at the north end of the study area (near the Jefferson County line where traffic demand is highest) and continuing south. 11 respondents (85 percent) agreed with the prioritization while two respondents (15 percent) indicated that the Salt River section should be prioritized first, followed by sections from north to south.

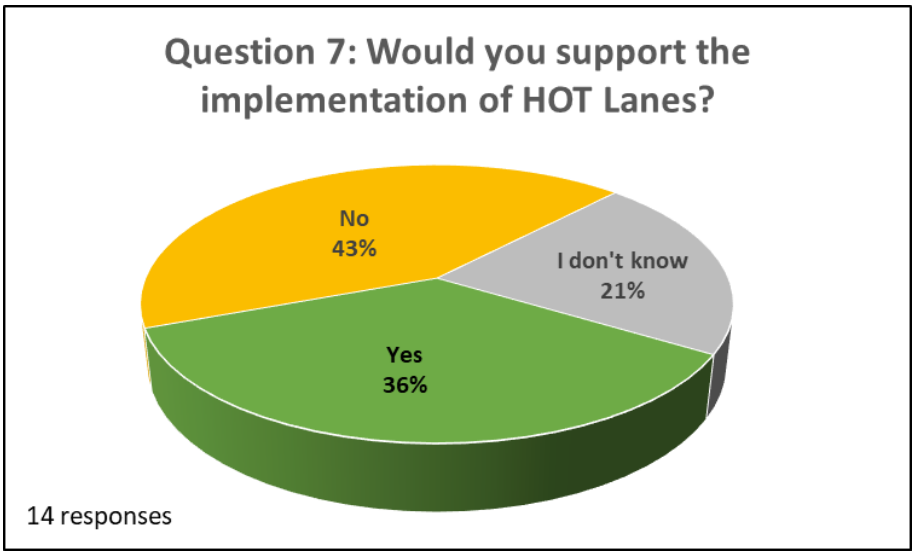


- Question six asked respondents if TRIMARC improvements, including overhead message signs and additional cameras, are needed in Bullitt County now. Six respondents (43 percent) indicated that these improvements are not needed now, five (36 percent) indicated that the improvements are needed, and three (21 percent) were unsure.



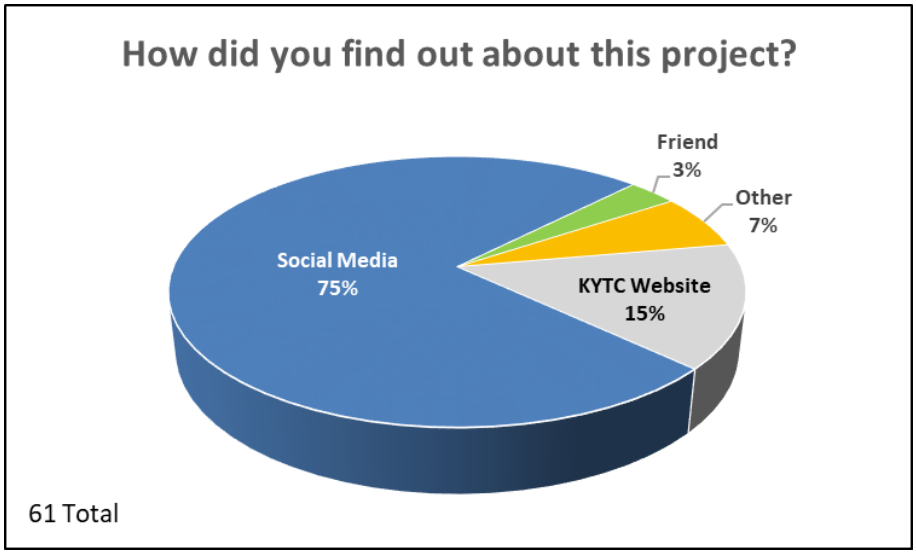
- Question 7 asked if attendees would potentially support the implementation of High-Occupancy Toll (HOT) lanes to both increase capacity and also help pay for the project.

Six respondents (43 percent) indicated they would not support HOT lanes, five (36 percent) indicated they would support HOT lanes, and three (21 percent) did not know.



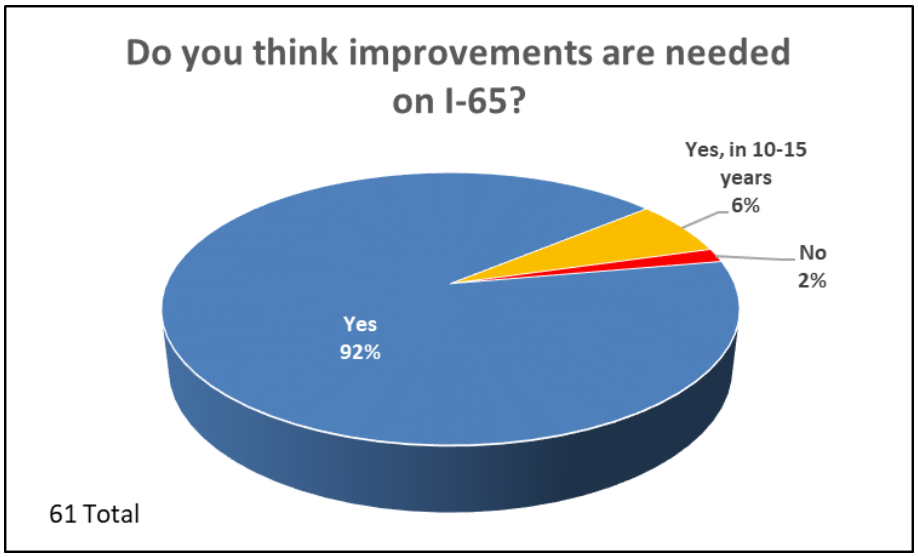
8.3 Public Involvement

An online StoryMap was developed to provide information on the project and solicit input from the general public. The StoryMap included a survey, which was made available from March 18 to May 1, 2020 and received 61 responses. The following is a summary of the survey results:

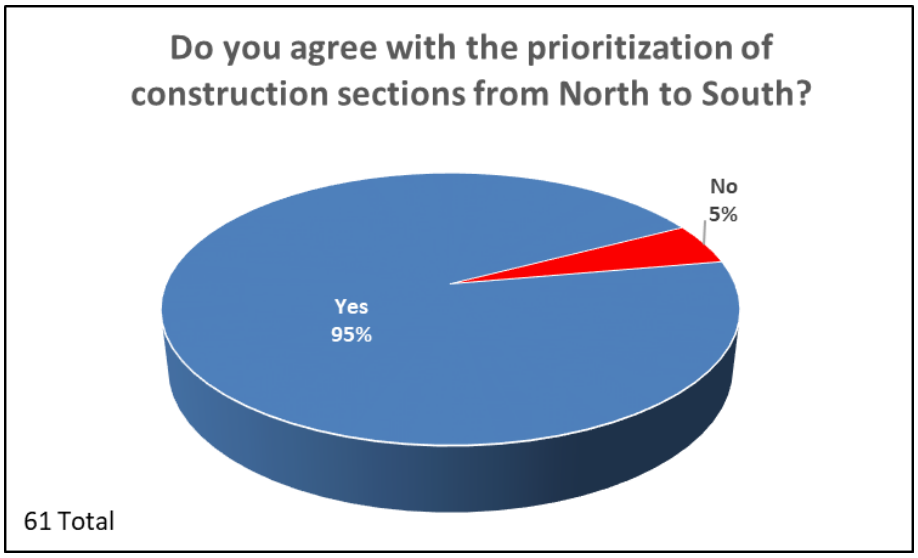


Of the 61 respondents, 42 (72 percent) found out about the study through social media posts. KYTC posted links to the online StoryMap and survey on the District 5 Facebook page on March 27th, April 13th, and April 29th.

- When asked if improvements are needed on I-65, 56 (92 percent) indicated that improvements are needed now, four (six percent) indicated improvements are needed in 10 to 15 years, and one (two percent) indicated that improvements are not needed. Additionally, 97 percent of respondents indicated that the existing pavement needs to be replaced or repaired.

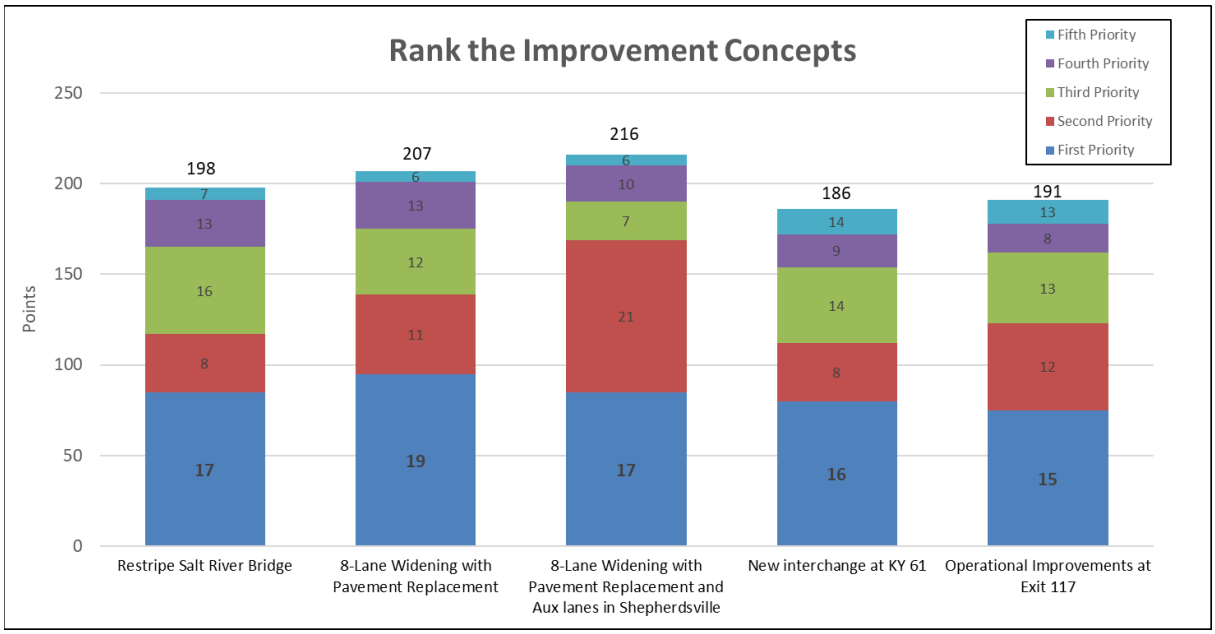


- Question four asked if respondents agreed with the prioritization of construction sections from north to south. 58 (95 percent) agreed with the prioritization and three disagreed. Two respondents indicated that the sections should be prioritized from south to north and one respondent thought the first priority should the Shepherdsville construction section.



- Respondents were asked to rank the improvement concepts from 1 to 5 with 1 being the most critical to implement. These rankings were then assigned point values with a rank of

one receiving five points, two receiving four points, and so on. Widening to eight lanes with pavement replacement and auxiliary lanes in Shepherdsville received the most total points with 216, while eight-lane widening with pavement replacement received the most first place votes with 19.



8.4 Resource Agency Mailing

KYTC mailed Resource Agency letters on March 9, 2020 to solicit feedback. Of the 11 responses, most comments were already addressed in the study's Environmental Overview. A full collection of the Resource Agency Mailing responses can be found in **Appendix H.** Kentuckians for Better Transportation (KBT) noted maintaining the present Level of Service (LOS) during construction would be critical toward minimizing impacts to traffic. KBT believes the widening alternative can be built with relatively little interruption to facility capacity by widening in the median and shifting traffic through phased construction. By contrast, the pavement rehab as part of the No-Build alternative would surely result in reduced capacity as one lane is rebuilt, resulting in significant user costs. By accounting for the resulting user costs, the study would arrive at a truer cost to compare the various improvement alternates. KBT also encouraged consideration of bundling the construction segments as that could result in lower costs.

Based on the Federal Highway Administration (FHWA) QuickZone spreadsheet, the user costs of converting I-65 from three lanes in each direction to two lanes in each direction would total approximately $300 million per nine-month construction season for a pavement replacement only project. QuickZone is a sketch-planning tool for analyzing work zone mobility impacts such as traffic delays, queuing, and associated delay costs.

9.0 Revised Improvement Concepts

After the second round of coordination, the initial improvement concepts were revised based on feedback received. The revised improvement concepts were analyzed to determine the safety and operational benefits in the study area.

9.1 Revised Improvement Concepts

Based on feedback received at the second round of meetings, the project team decided to remove Spot Improvements 6 and 7 from further consideration, as previously discussed in Section 8.1. Additionally, instead of being considered as standalone projects, the project team recommended the following improvement concepts be considered during the design phase of the widening and/or pavement replacement projects:

- Exit 105 Southbound Exit Ramp: construct a parallel deceleration ramp to improve operations and remove decelerating traffic off mainline I-65.
- Southbound Rest Area Entrance Ramp: extend the existing parallel on ramp to improve operations and provide a more adequate distance for vehicles to accelerate before merging onto I-65.
- Southbound Rest Area Exit Ramp: construct an auxiliary lane between the new interchange south of KY 480 (KYTC Item No. 5-538) and the existing southbound Rest Area exit ramp.
- Intelligent transportation systems (ITS)
    - Incident management cameras in Bullitt County
    - Dynamic message signs in Bullitt County
- Emergency turnarounds in the median barrier wall where barrier wall is constructed.
- Sound barriers (where feasible and reasonable based upon noise analyses)
- Active transportation demand management (ATDM)
    - Express lanes/HOT lanes
        - No access to local interchanges
    - Peak hour shoulder lanes north of KY 1526 / John Harper Highway (Exit 121)
        - The 2045 southbound PM peak hour is expected to operate at LOS E even with the eight-lane widening.

9.1.1 Additional Spot Improvement: Salt River Bridge

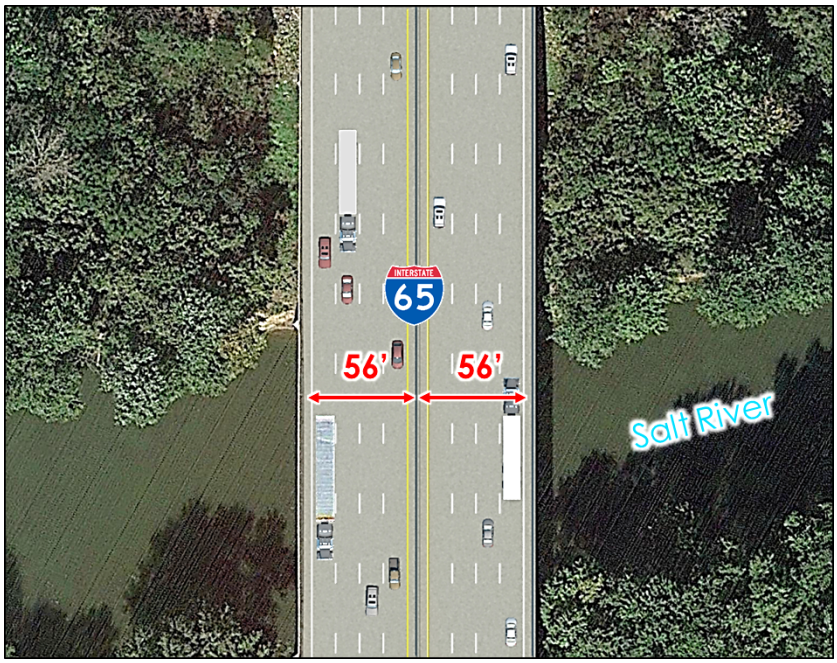


Figure 29. Proposed Restriping of the Salt River Bridge

As noted previously, existing operational issues were identified between the KY 480 (Exit 116) and KY 44 (Exit 117) interchanges. The relatively short distance separating the interchanges (about 0.5 miles separate the existing acceleration and deceleration lanes) and the high volume of local traffic that uses I-65 to cross the Salt River creates a weaving pattern between the on- and off-ramps. A Performance Based Flexible Solution (PBFS) would be to restripe the Salt River Bridge, as shown in **Figure 29**, from six to eight lanes (four 12-foot lanes in each direction) by simply narrowing the inside and outside shoulders from 10 feet to four feet, allowing for the extension of the existing auxiliary lanes to fully connect the interchange ramps at KY 44 and KY 480. This portion of I-65 currently operates at LOS E, but would improve to an acceptable LOS C with the extension of the existing auxiliary lanes. AASHTO's *A Policy on Design Standards – Interstate System (May 2016)* allows four-foot shoulders on bridges having an overall length in excess of 200-feet. Therefore, this improvement could be implemented without a design exception.

Figure 30. Dual Lane Off-Ramp at Exit 117 SB Off Ramp

9.1.2 Additional Spot Improvement: Exit 117 Southbound Off Ramp

During the initial concept development phase, the Exit 117 southbound off ramp was identified as a location with both safety and congestion issues. This portion of I-65 currently operates at an undesirable LOS E during the PM peak due to traffic from the ramp backing up onto the mainline, resulting in conflicts between through traffic and exiting traffic at Exit 117. The first concept is to shift the decelerating traffic away from mainline I-65 by constructing a dual lane off ramp as shown in **Figure 30**.

However, the dual lane off ramp will not completely address the congestion issues at the ramp terminal's intersection with KY 44. Therefore, a ramp split will be constructed to connect the ramp directly to Conestoga Parkway (CS 1170), as shown in **Figure 31**. This concept will remove the heavy flow of traffic attempting to turn right onto KY 44 and right onto Adam Shepherd Parkway (for access to Conestoga Parkway). These improvement concepts improve the existing PM peak from LOS E to D.

Figure 31. Ramp Split at Exit 117 SB Off Ramp

Based on FHWA's *Policy on Access to the Interstate System*, a request must be submitted to FHWA to prove that the proposed changes do not have significant adverse impacts on the safety and operations of mainline I-65 or the ramps. Additionally, based on early discussions with FHWA, a portion of Conestoga Parkway may be required to become a state-maintained facility if this option is constructed.

9.1.3 Eight-Lane Widening

Widening I-65 from six to eight lanes will likely be completed in phased segments. The construction cost estimates of the five construction sections, as shown in **Figure 32**, can be treated as individual projects and can be completed as funding is made available. As shown, most of the total construction cost is the full depth pavement replacement, which has to occur regardless of whether or not I-65 is widened. The only exception is the eight-lane widening in Construction Section 3. If this section were widened to include eight mainline interstate lanes with full inside and outside shoulders for the entire segment length, the necessary widening of the Salt River Bridge would cost more than the pavement replacement. An alternative to widening the Salt River Bridge is the PBFS concept discussed above in **Section 9.1.1**.

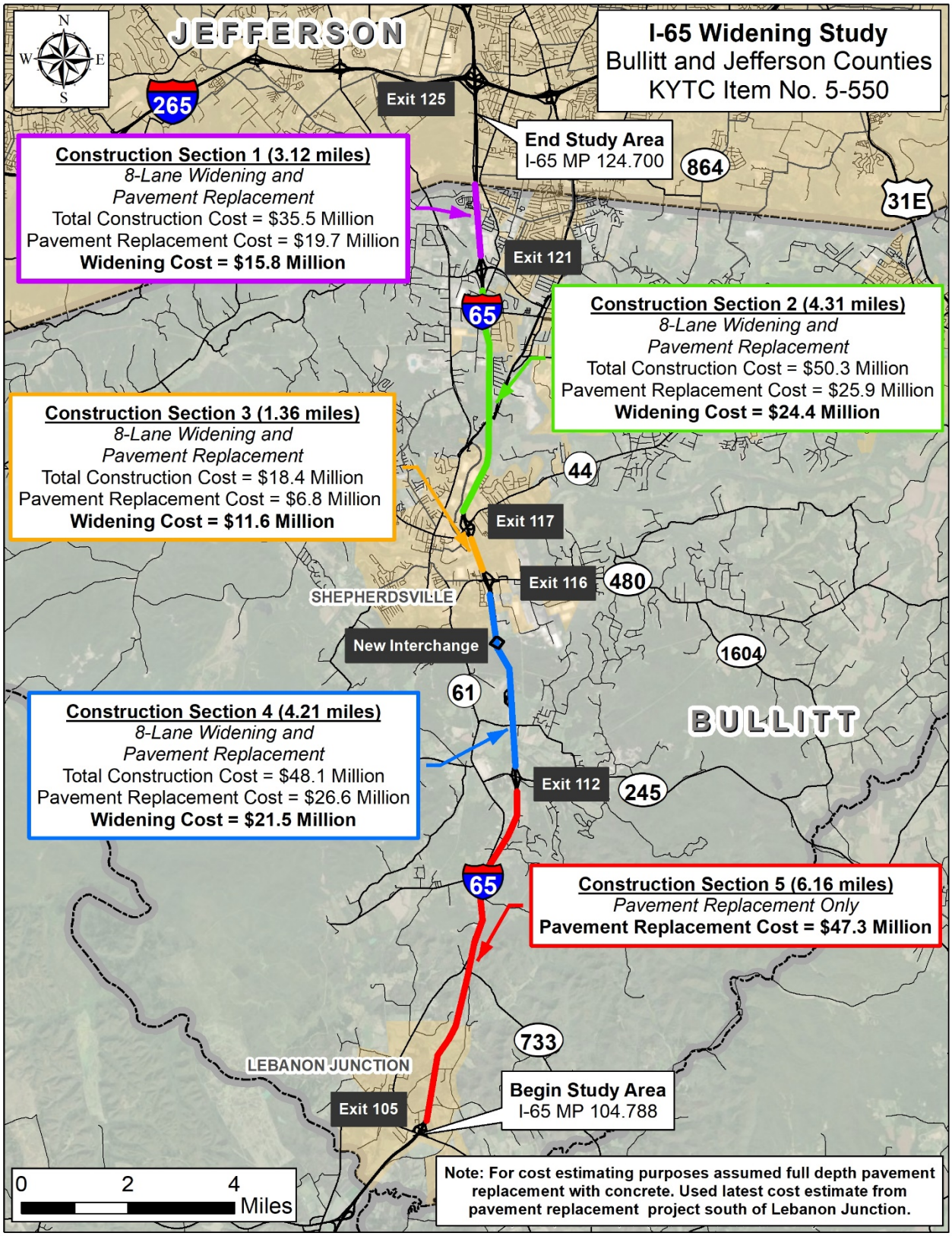


Figure 32. Construction Cost Estimates by Construction Section

9.1.3.1 Maintenance of Traffic

In order to maintain three lanes open to traffic in both directions of travel, widening on I-65 would require several phases of maintenance of traffic (MOT). Where there is a depressed median, Phase 1 could include shifting lanes toward the outside shoulders and reconstruction of the median, as shown in **Figure 33**.

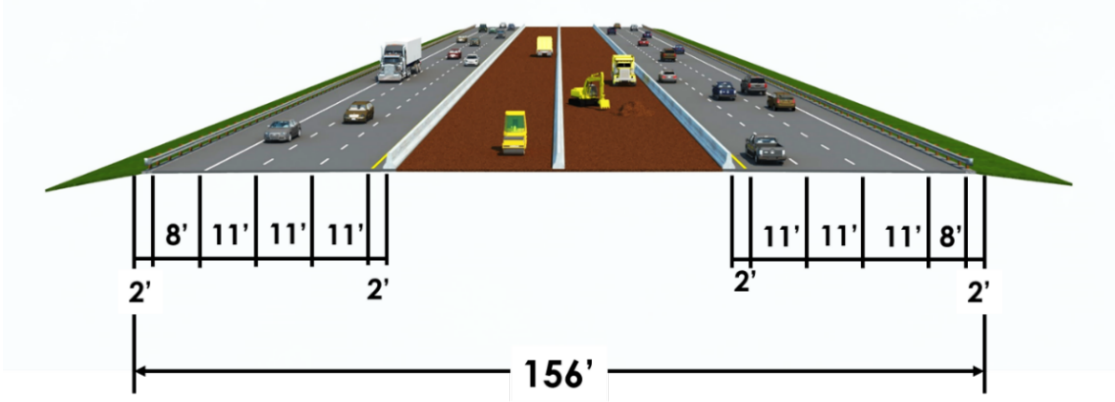


Figure 33. Phase 1 MOT Plan

Phase 2 could include a northbound crossover and reconstruction of the inside lane, shown on **Figure 34**.

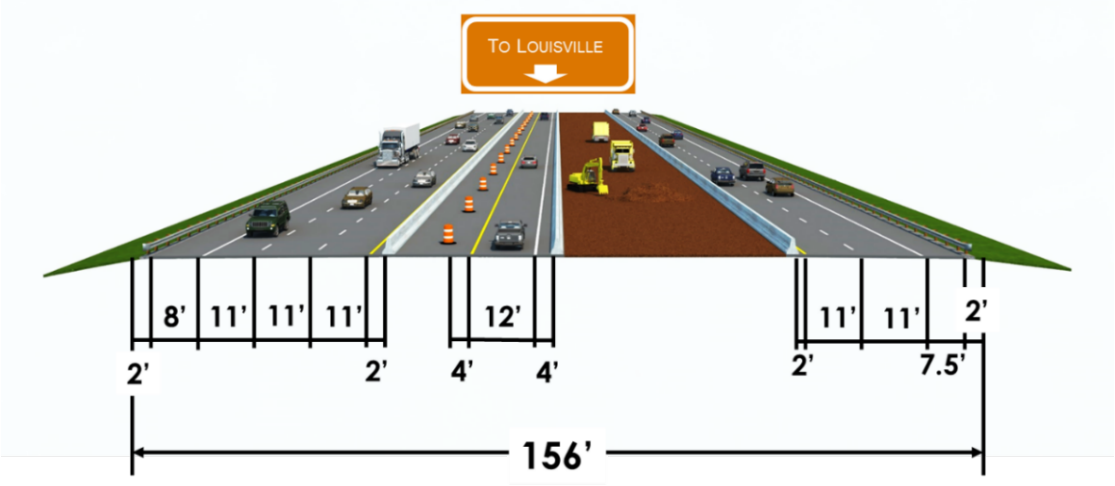


Figure 34. Phase 2 MOT Plan

Phase 3 could include reconstructing the northbound outside lanes and shoulders, shown on **Figure 35**.

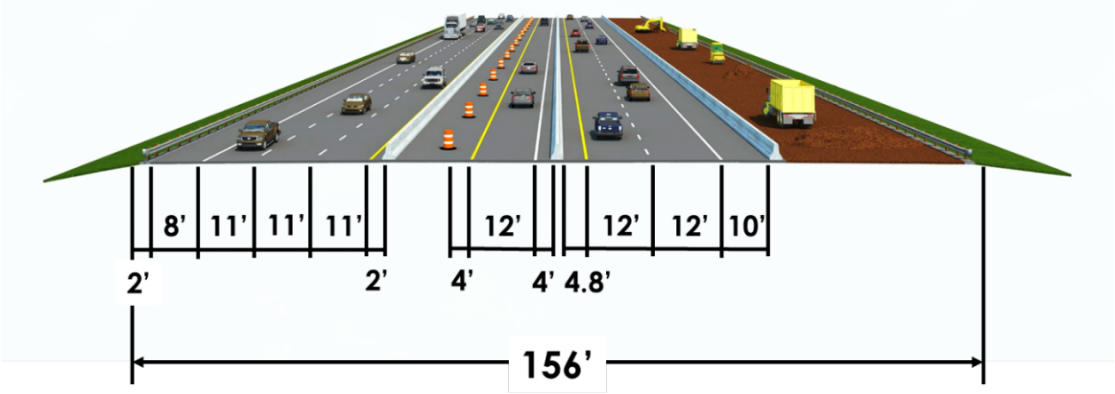


Figure 35. Phase 3 MOT Plan

Phase 4 could include the reverse of Phase 2, a southbound crossover and reconstruction of the inside lane, as seen in **Figure 36**.

Figure 36. Phase 4 MOT Plan

Phase 5 could include the reverse of Phase 3, reconstruction of the southbound outside lanes and shoulders, as seen in **Figure 37.**

Figure 37. Phase 5 MOT Plan

9.2 Final Project Team Meeting

Following the development of the revised improvement concepts, the project team met for the final time on May 28, 2020. The purpose of the meeting was to discuss the survey results from the public, review the refined simulation model results, and discuss project team recommendations. A detailed summary of the final project team meeting is included in **Appendix G**. Key discussion items included the following:

- The project team decided to remove the new interchange at KY 61 as a study priority. KIPDA estimates a new interchange at this location would cost $29.2 million. The proposed improvements at the Exit 117 southbound off-ramp (Study Priority 2) are $7.7 million. Relative to the cost of constructing a new interchange, lower cost improvements can be made at Exit 117 which will allow it to accommodate future traffic demand at a desirable level of service.

- The Salt River Bridge should be able to handle an additional lane of traffic in both directions as proposed in the restriping concept. Conventional bridge design requires that the exterior beams be designed for the same design loads as the interior beams for both new and widening projects. This has been KYTC policy for a number of years. That way when a bridge is widened, the existing exterior beams can be utilized for additional lanes. As part of a future design phase, a Load Rating of the existing beams will be required.

- Constructing a ramp split from the southbound Exit 117 off ramp to Conestoga Parkway may require KYTC to add Conestoga Parkway to the state-maintained roadway network.

- Coordination with FHWA, initiated with this study, will be necessary for any proposed changes to mainline I-65 or interstate ramps. It appears all improvement concepts comply with the 1998 FHWA/KYTC Memo[6] which detailed goals for the widening of I-65 and I-71 from four-to-six lanes and the latest *Interstate Design Standards - A Policy on Design Standards – Interstate System (May 2016)*.

[6] Memorandum of Agreement Stage Development of Plans for Interstate Widening Projects in Kentucky; June 22, 1998

10.0 Conclusions

This section provides recommendations for the I-65 Conceptual Improvements Study. Prioritization was accomplished by the project team through examination of technical analyses, stakeholder input, and engineering judgement.

10.1 Prioritization

The purpose of the I-65 Conceptual Improvements Study was to evaluate the existing and projected future conditions of I-65 as they relate to safety and congestion and to develop an overall improvement plan for needed improvements and priorities. Based on this evaluation, the Project Team identified priorities through 2030. With the study portion of I-65 spanning almost 20 miles and the high cost of replacing the existing pavement, widening I-65 from six to eight lanes will likely require phased implementation. Given the high cost, only mainline widening projects that were over capacity by 2030 were listed as a priority.

10.2 Cost Estimates

Planning level cost estimates were prepared for the revised improvement concepts, shown in **Table 6**, based on average KYTC unit costs. KYTC District 5 assisted in this effort by providing approximate right-of-way and utility cost estimates. The only location requiring right-of-way and utility acquisitions is through Shepherdsville (Construction Section 3) where, due to the existing raised median, all widening must occur to the outside. Widening will take place in the depressed median at all other locations. For cost estimating purposes it was assumed the full depth pavement replacement will be concrete. The latest cost estimate from the pavement replacement project south of Lebanon Junction (Item No. 5-2088), which was let in 2020, was used for these construction cost estimates.

Table 6. Cost Estimates (2020 Millions)

Improvement Concept	Design	Right-of-Way	Utility	Construction	CEI	Total
Restripe Salt River Bridge*	$0.6	$0.0	$0.0	$3.2	$0.2	$4.0
Exit 117 Improvements	$0.4	$5.1	$0.6	$1.5	$0.1	$7.7
Construction Segment 1	$3.6	$0.0	$0.0	$35.5	$1.8	$40.9
Construction Segment 2	$5.0	$0.0	$0.0	$50.3	$2.5	$57.8
Construction Segment 3**	$1.3	$0.0	$0.0	$8.4	$0.4	$10.1
Construction Segment 4	$2.7	$0.0	$0.2	$26.6	$1.3	$30.8
Construction Segment 5	$4.7	$0.0	$0.0	$47.3	$2.4	$54.4

* The construction cost includes replacing the existing pavement within the transitions/lane tapers to remove the existing rumble stripes and replace the striping.
** The construction cost assumes no widening of the Salt River Bridge. Includes a full depth pavement replacement and restriping the Salt River Bridge to extend auxiliary lanes on I-65 between the KY 480 (Exit 116) and KY 44 (Exit 117) Ramps.

10.3 Benefit-to-Cost Analysis

To assist in prioritizing improvement concepts, the project team conducted a benefit-to-cost analysis (BCA). This analysis provided a means for determining which improvements have the greatest benefit and are the most economical. The BCA was conducted based on both operational and travel time savings. **Table 7** presents a summary of the results.

Table 7. Benefit-to-Cost Summary

Construction Segment	Benefit			Total Cost	B/C Ratio
	Operational Savings	Travel Time Savings	Maintenance		
Segment 1	$84.4	$37.2	-$23.2	$40.9	2.4
Segment 2	$133.5	$10.4	-$32.9	$57.8	1.9
Segment 3	$35.7	$11.4	-$5.8	$10.1	5.1
Segment 4	$125.4	$1.5	-$15.6	$30.8	3.6
Segment 5	$171.5	$0.0	-$28.8	$54.4	2.6

As shown, each segment has a B/C ratio exceeding 1.0, indicating the benefits of each project outweigh the costs. Travel time savings could not be quantified for the Exit 117 improvements because of a lack of traffic data on Conestoga Parkway. Therefore, a B/C ratio was not calculated for this improvement concept.

10.4 Improvement Concept Prioritization

The improvements between the KY 480 and KY 44 interchanges and at the southbound exit ramp to KY 44 were determined to have top priority because these concepts address existing congestion and safety issues, have a relatively low cost, and would improve the portion of the corridor with the worst existing pavement rating in the study area. The next priority is to widen I-65 from six to eight lanes and/or replace the existing pavement, starting with the sections carrying the most traffic –from north to south. **Table 8** and **Figure 38** present the proposed prioritization of the improvement concepts and the associated evaluation results, including benefit-cost ratios. Once implemented, these improvements will replace all of the existing pavement along the study portion of I-65, provide auxiliary lanes between the ramps at Exit 116 (KY 480) and Exit 117 (KY 44), and provide eight through lanes north of Exit 117 (KY 44) to Exit 125 (Gene Snyder).

Table 8. Improvement Concept Prioritization and Evaluation Matrix

Overall Priority	Improvement Description	Length (mi.)	Year Traffic Demand Will Exceed Available Capacity	Total Cost Estimate (2020 millions)	Benefit Cost Ratio
1	**Exit 116 to Exit 117** Full Depth Pavement Replacement + Restripe Salt River Bridge to Extend Auxiliary Lanes on I-65 between the KY 480 (Exit 116) and KY 44 (Exit 117) Ramps	1.36	2021	$10.1	5.1
2	**Exit 117** Southbound Dual Lane Off-Ramp and Ramp Split to Conestoga Pkwy	0.96	2020	$7.7	--
3	**Exit 121 to Exit 125** 8-Lane Widening + Full Depth Pavement Replacement	3.12	2020	$40.9	2.4
4	**Exit 117 to Exit 121** 8-Lane Widening + Full Depth Pavement Replacement	4.31	2023	$57.8	1.9
5	**Exit 112 to Exit 116** Full Depth Pavement Replacement	4.21	2032	$30.8	3.6
6	**Exit 105 to Exit 112** Full Depth Pavement Replacement	6.16	2046	$54.4	2.6

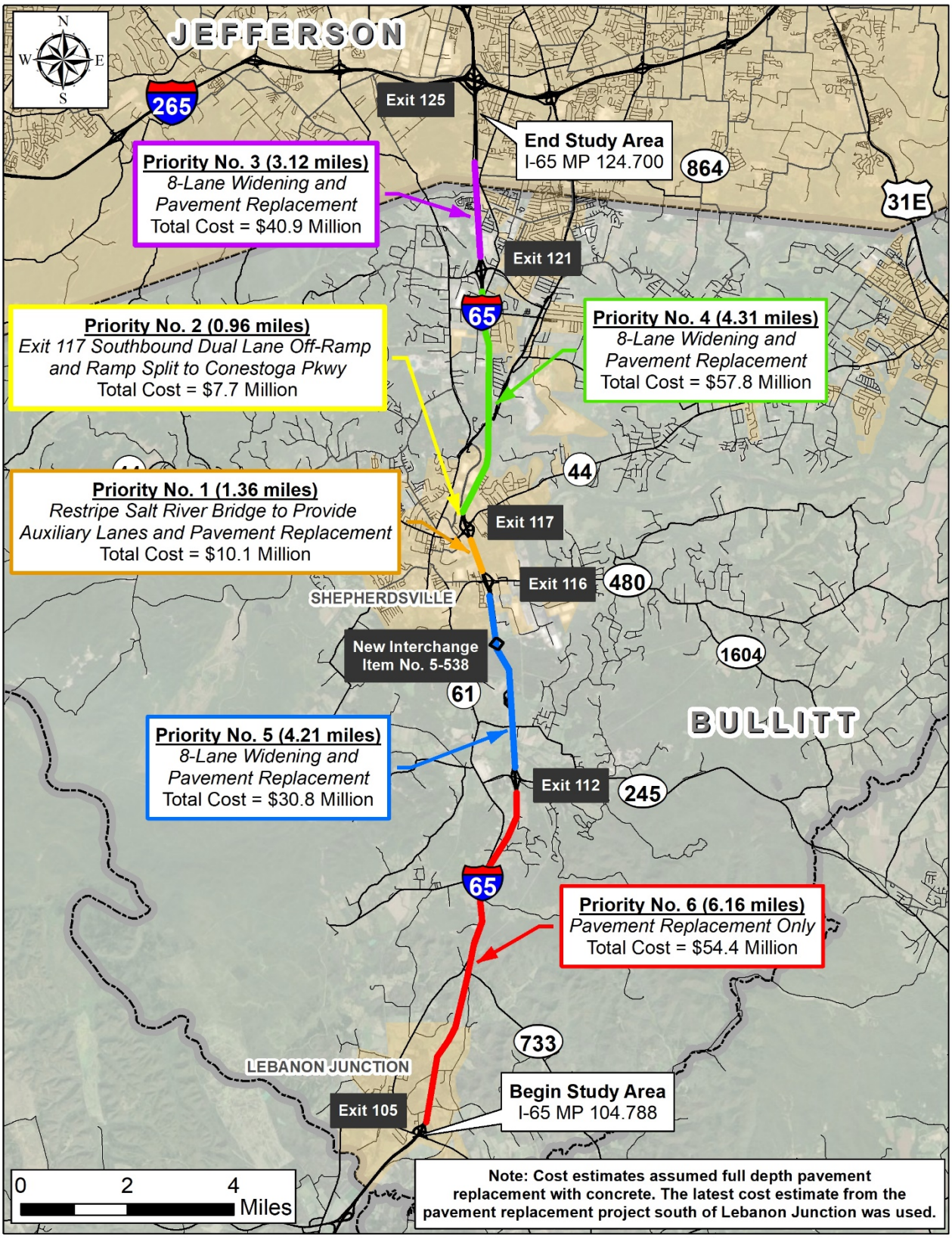


Figure 38. Improvement Concept Prioritization

10.5 Potential Funding Sources

Additional funding sources outside of the Six-Year Highway Plan should be considered for widening I-65. Applying for alternative funding through Federal grants has become more prevalent in Kentucky over the past several years. Possible funding sources include:

- Infrastructure for Rebuilding America (INFRA) Grant: The maximum grant amount for INFRA is $150 million. A grant of this size could allow KYTC to bundle all the construction sections (Total Cost = $214 million). In 2018 NCDOT won a $147 million INFRA Grant to widen and improve 25 miles of I-95.

- Better Utilizing Investments to Leverage Development (BUILD) Grant: The maximum grant amount for BUILD is $25 million. A grant of this size would be ideal for bundling the I-65/KY 480 interchange reconstruction (KYTC Item No. 5-391.30) with restriping the Salt River Bridge to provide auxiliary lanes between KY 480 (Exit 116) and KY 44 (Exit 117) and full depth pavement replacement in Construction Section 3 (Study Priority No. 1). The total cost for these improvements would be $25.6 million and KYTC could request a BUILD Grant in the amount of $20.48 million or 80 percent of the cost.

10.6 Additional Considerations During Design

During the design phase the following options should be considered as part of the development of the widening and/or pavement replacement concepts discussed above in Table 6 and Figure 32:

- For I-65 widening projects: construct wide, full depth pavement shoulders to facilitate future maintenance and to allow for peak hour shoulder lanes in the future.
- Exit 105 Southbound Exit Ramp: construct a parallel deceleration ramp to improve operations and remove decelerating traffic off mainline I-65.
- Southbound Rest Area Entrance Ramp: extend the existing parallel on ramp to improve operations and provide a more adequate distance for vehicles to accelerate before merging onto I-65.
- Southbound Rest Area Exit Ramp: construct an auxiliary lane between the new interchange south of KY 480 (KYTC Item No. 5-538) and the existing southbound Rest Area exit ramp.
- Intelligent transportation systems (ITS) expansion of the Traffic Response and Incident Management Assisting the River City (TRIMARC) system
    - Incident management cameras in Bullitt County
    - Dynamic message signs in Bullitt County
- Emergency turnarounds where median barrier wall is constructed. KYTC's general guidance recommends providing emergency turnarounds every five miles in more densely populated areas such as this. Interchanges are considered an emergency turnaround location.
- Sound barriers where warranted
- Active transportation demand management (ATDM)
    - Express lanes/HOT lanes

    - No access to local interchanges
  - Peak hour shoulder lanes north of John Harper Highway (Exit 121)
    - The 2045 southbound PM peak hour LOS is an E even with the eight-lane widening.

10.7 Next Steps

The next step following this study for any potential improvements would be Phase 1 Design (Preliminary Engineering and Environmental Analysis). Further funding will be necessary to advance an improvement to the design phase as additional phases any projects are not funded in *Kentucky's FY 2020 – FY 2026 Highway Plan*. Coordination with FHWA, initiated with this study, must be continued for any proposed changes to mainline I-65 or interstate ramps.

Contacts/Additional Information

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