I-71 Corridor Study

Final

Between I-64 in Jefferson County and I-75 in Boone County

Jefferson, Oldham, Henry, Trimble, Carroll, Gallatin and Boone Counties, Kentucky

Item No.: 99-394.00

Prepared for:

KENTUCKY TRANSPORTATION CABINET

Kentucky Transportation Cabinet
Division of Planning and Highway
Districts 5 & 6

Prepared by:

QK4

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Groundbreaking by Design.

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EXECUTIVE SUMMARY

The Kentucky Transportation Cabinet (KYTC) has initiated a strategic corridor planning study to address safety and congestion and identify and evaluate improvements along the I-71 Corridor between I-64 in Jefferson County (Spaghetti Junction) and I-75 in Boone County, a distance of 77.7 miles (see Figure ES1: Study Area, p. ES2). Between Louisville and Cincinnati, I-71 is primarily a four-lane, divided highway, except for a six-lane section near the Kentucky Speedway around KY 35 near MP 57. Although the entire mainline corridor is encompassed in this study, only a portion of the interchanges are included in the scope of work as indicated in Table ES1:

Table ES1: Interchanges Located in the I-71 Corridor

ID #	County	Exit #	Crossroad	Note	KYTC Item No. or Referenced Study
1	*Jefferson*	*0*	*I-64*	*1*	*5-21.00 & 5-715.00*
2	*Jefferson*	*2*	*Zorn Ave*	*1*	*5-48.10*
3	*Jefferson*	*5*	*I-264*	*1*	*5-48.2 & 48.3*
4	*Jefferson*	*9*	*I-265*	*1*	*5-68.00 Alternatives Study I-71/I-265 Aug. 2010*
5	***Oldham***	***14***	***KY 329***	***2***	
6	***Oldham***	***17***	***KY 146***	***2***	
7	*Oldham*	*18*	*KY 393*	*1*	*5-234.00*
8	*Oldham*	*22*	*KY 53*	*3*	*Oldham Co. IJS February 2011; 5-8201.01*
9	***Henry***	***28***	***KY 153***	***2***	
10	***Henry***	***34***	***US 421***	***2***	
11	***Carroll***	***43***	***KY 389***	***2***	
12	***Carroll***	***44***	***KY 227***	***2***	
13	***Gallatin***	***55***	***KY 1039***	***2***	
14	*Gallatin*	*57*	*KY 35*	*4*	*Kentucky Motor Speedway*
15	***Gallatin***	***62***	***US 127***	***2***	
16	***Boone***	***72***	***KY 14***	***2***	
17	*Boone*	*77*	*I-75*	*1*	

Notes:
1 – Not addressed or studied in this study. Those in Jefferson County are already under redesign as Item Nos. 5-21.0, 715.0, 48.1, 48.2, 48.3, 68.0, 5-234.00, and 804.00; Exit 18 in Oldham County is relatively new and designed to current standards and the interchange is currently under capacity; and the I-75 interchange is excluded from this study. At KYTC's request, the I-75 interchange is excluded from this study due to recent improvements made to the interchange to extend the southbound I-75 entrance to SB I-71 two-lane on ramp through the interchange area.
***2** – Will be studied and addressed in this study **(in bold)**.*
3 – KY 53 has been studied in Oldham County shall be incorporated by reference into this study, including data and recommendations.
4 – The Kentucky Speedway (Exit 57) has been recently reconstructed and studied for event traffic. During normal operations it operates well under capacity. Event day traffic, however, could possibly be improved at this interchange. Therefore this interchange will be included in the Planning Study, but only to the extent necessary for including Event Day operations.

Purpose and Need of the Study

The purpose of this study is to evaluate the safety and congestion of the I-71 Corridor from I-64 in Jefferson County to I-75 in Boone County and to determine needed improvements and relative priorities. The study examines geometric characteristics, crash history, physical constraints, and existing and projected operational characteristics of the I-71 Corridor. The need for the project is supported by the following facts:

- Age of the Interstate and Changing Design Standards – The first section of I-71 in Louisville opened in 1966 between its terminus with I-64 and Zorn Avenue. Its junction with the Watterson Expressway (I-264) opened in 1968, and the complete Kentucky portion of the interstate was opened to the public in 1969 replacing US 42 as the primary route between Louisville and Cincinnati. Although it met design standards and common practices in the 1960's, those standards and practices have changed over the years in an effort to improve safety.
- Between the project limits, 2,705 crashes occurred on I-71 between January 1, 2009 and December 31, 2011. Approximately 535 of those were injury crashes and 15 were fatal crashes. There were 65 0.1-mile spots with a critical crash rate factor (CCRF) exceeding 1.0 and considered high crash locations. Approximately 1,068 crash reports were reviewed over a three-year period from years 2009 – 2011. A review of 2012 crashes revealed three (3) fatalities were found to occur in a 0.2 mile spot in Carroll County (MP 38.9 to MP 39.1). Within a three year span, there were several recurring crashes (65) recorded at MP 62.8 to MP 64.0 in Gallatin County.
- Current Level of Service (LOS) analysis in the study area indicates that over nine (9) miles of I-71 is currently operating at LOS F and eight (8) miles are operating at LOS E with volume/capacity (v/c) ratios in excess of 1.0.
- Design year 2038 capacity analysis shows, even with the I-265 approach to the Ohio River (east end bridge) in Jefferson County, over 21 miles of I-71 operating at LOS F and 4 miles operating at LOS E with frequent traffic backups anticipated at these locations.
- Existing truck traffic as a percent of the overall traffic ranges from 7% in Jefferson County to 35% in Gallatin County. Actual trucks per day range from approximately 5,000 trucks per day in downtown Louisville between Zorn Avenue and I-264 to approximately 11,000 trucks per day between I-265 and KY 329 in Oldham County and KY 35 and US 127 in Gallatin County. It is anticipated that in the future the range in truck traffic as a percent of the overall traffic will continue to grow from 7% to 11% in Jefferson County and from 35% to 46% in Gallatin County, respectively. The actual trucks per day in 2038 are expected to grow between 9,100 from Zorn Avenue to I-264 to as many as 19,600 trucks per day between I-265 and KY 329. There are locations along I-71 with long, steep grades that result in trucks riding alongside each other, either up or down the grade making it nearly impossible for other vehicles to pass.
- As documented herein, there have been several previous studies conducted throughout the I-71 study corridor, each with their own recommendations and conclusions. It is KYTC's desire to develop an overall improvement plan for the I-71 Corridor that focuses on congestion and safety.
- A key element to this study is public involvement and more specifically the involvement of the I-71 Corridor Group, which has been identified as a key stakeholder for this project. This group's focus is the overall I-71 corridor with an emphasis on the rural counties that are not contained within the metropolitan planning organizations of Kentuckiana Regional Planning and Development Agency (KIPDA) and the Ohio Kentucky Indiana Regional Council of Governments (OKI). Most of the counties are agricultural in nature and because farming is rarely a full-time occupation today, the farmers must seek work in industry to fill the void for the creation of new jobs. This focus group feels that widening I-71 plays a vital role in keeping existing industries and attracting new industry while expanding on the potential for tourism growth. The I-71 Corridor Group is very much supportive of a plan for widening I-71.

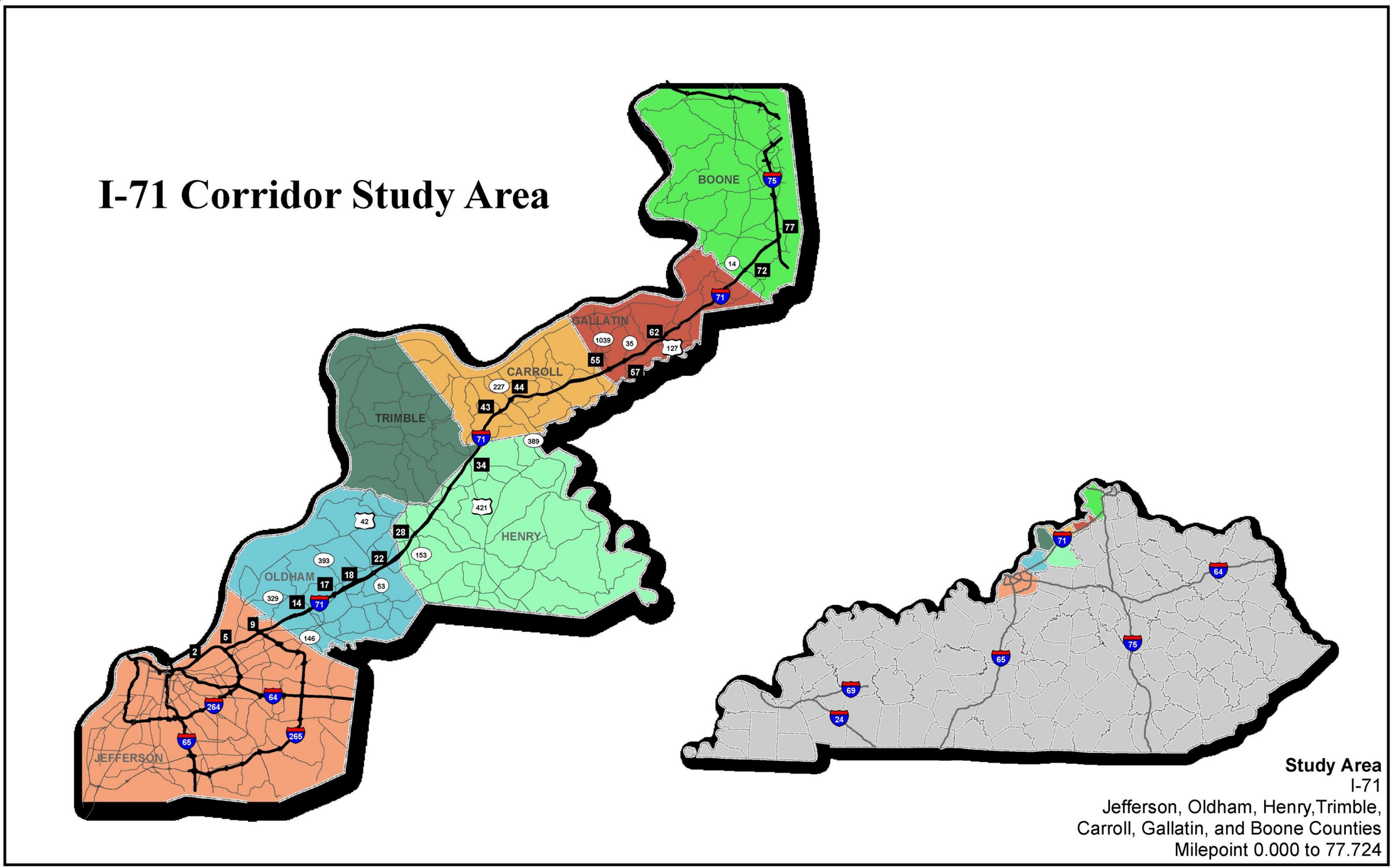


Figure ES1: I-71 Study Area

Recommendations

Using an evaluation of existing roadway conditions including an analysis of grades and horizontal and vertical alignment, field reviews, a review of as-built and current drawings, a review of past I-71 studies, crash data analysis, capacity analysis of existing (2013) and design year (2038) conditions, input from stakeholders and discussions following the 2nd Project Team Meeting, deficiencies for the I-71 Corridor were identified and documented for this report.

Based on the review of crash records and the crash analysis, it was determined that there were seven (7) areas or locations of principal concern in regards to the critical crash rate. These areas were identified as:

1. MP 0 - 0.3 (Approaching Spaghetti Junction) CCRF: > 1.7
2. MP 1.7 - 2.1 (Zorn Avenue Interchange) CCRF: 1.02-1.08
3. MP 4.6 - 5.3 (Watterson Expressway Interchange) CCRF: 1.04-2.98
4. MP 8.4 - 9.1 (Gene Snyder Interchange) CCRF: 1.10-2.13
5. MP 62.8 - 64.0 (1.0 mile north of US 127 interchange in Gallatin County) CCRF: 1.02-2.72
6. MP 71.6 - 72.5 (KY 14 Interchange at Verona) CCRF: 0.96-2.58
7. MP 38.9 - MP 39.1 in Carroll County: three (3) fatalities in 2012

Based on these deficiencies and identified areas of concern, a prioritized list of recommended mainline and crossroad projects were developed. The screening and prioritization of the recommendations for the corridor were based on the purpose and need of the project and input by the Stakeholders groups. The recommendations were divided into 4 main components: Mainline, Mainline Improvements under $10 million, Crossroad Improvements and Intelligent Transportation System (ITS) Improvements. The I-71 Corridor Improvements are listed in Table ES2 (p. ES4-ES5) and shown in Figures ES2 (p.ES6) and ES3 (p. ES7). Quick Wins, low-cost improvements that can be implemented in a short period of time, were identified as a result of the Stakeholder and Project Team input, are also shown in Table ES2.

List of I-71 Improvement Priorities

Based on further evaluations and discussions at the November 13, 2013 Project Team Meeting, the following projects were identified priorities through 2038. Only the mainline widening projects that were through the build year 2038 were detailed and included with few exceptions. Cost estimates that were obtained from previous studies were updated to 2013 using the construction cost index to 2012 and then increasing the costs by 4% to represent 2013 dollars.

1. Improve Safety north of US 127 MP 62.8 to MP 64.0 in Gallatin County—Priority #1.

The purpose of this project is to improve safety by reducing the number of crashes. The Critical Crash Rate Factor (CCRF) for this 1.2-mile stretch of I-71 is 1.86. From the years 2009-2011, there were 41 crashes in wet or snowy weather, 38 single vehicle run-off-the-road crashes; 8 vehicle malfunctions and 2 collisions with deer. Four (4) crashes were located within the spiral horizontal curve near MP 63.0. From January 1, 2013 to July 24, 2013, there have been more crashes in this stretch than all of year 2012. These crashes have occurred following complete pavement rehabilitation in 2011 to repair deficient cross slopes. Motorists must negotiate 4% grades leading to back-to-back spiral curves. According to KYTC District 6 staff, I-71 has closed due to some of these crashes, or narrowed to one lane. Due to the continual crashes at this location and disruption of traffic service and improvement in safety expected, the recommended alternative by the Project Team is a complete reconstruction option which has total cost of $35,200,000.

2. Add Capacity and Improve Safety

The purpose of these projects is to reduce congestion and improve safety on I-71. Today, the following I-71 segments are operating at LOS F with v/c ratios exceeding 0.95 and are recommended for widening to six lanes:

- I-64 to Zorn Avenue in Jefferson County (2.0 Miles) – $23,800,000—Priority #2.
- Zorn Avenue to I-264 in Jefferson County (3.0 Miles) – $27,700,000—Priority #4.
- KY 329 to KY 146 in Oldham County (2.5 miles) – $21,800,000—Priority #11.
- KY 146 to KY 393 in Oldham County (1.0 Mile) – $16,000,000—Priority #38.

Even with the Kennedy Interchange reconstruction and the new east end approach to the bridge over the Ohio River (I-265/Gene Snyder Freeway), these additional I-71 segments will operate at LOS E or F with v/c ratios exceeding 0.90 by the design year 2038.

- KY 393 to KY 53 in Oldham County (4.0 miles) – $25,000,000—Priority #39.
- KY 14 to I-75 in Boone County (5.0 miles) – $32,400,000—Priority #42.

3. Add Truck Climbing Lanes to Reduce Congestion and Improve Safety

Both locations below have heavy trucks with continuous uphill climbs decreasing truck speeds by at least 25 mph.

- **Southbound from MP 38.3 to MP 40.8 in Carroll County – $7,900,000—Priority #8.**

The initial evaluation of crashes in this area did not yield an area with any CCRF greater than 1.0. However, a check of the 2012 crashes revealed three (3) fatalities in a 0.2 mile spot. Looking beyond this 0.2 mile spot, expanding 1.0 mile on either side, this area has multiple maximum 4% grades within back-to-back spiral curves, and two long narrow bridges at the end of a 3% downgrade heading northbound. The reverse is the case travelling southbound, there is a continuous uphill climb for approximately 2.5 miles beginning at approximately MP 38.3 to MP 40.8, with grades ranging from -0.5% to -4.0% and a possible deficient sag curve. The equivalent southbound grade was 3.62% for 2.33 miles. This length, according to the design manual and field observation, slows trucks by nearly 30 mph and increasing the crash involvement rate by nearly five times.

- **Northbound from MP 44.8 to MP 46.1 in Carroll County – $5,500,000—Priority #10.**

In 2012, the vehicle composition included 33.2% trucks. More than 9,700 trucks currently utilize this roadway segment with that number expected to grow. “Trucks passing trucks” affects the free flow speed in the passing lane. A 4,850 foot-long grade northbound begins just east of the KY 227 interchange. This length, according to the *Green Book* and field observation, slows trucks by over 25 mph, increasing the crash involvement rate by nearly five times. Many truck drivers use their flashers to warn other motorists of their slow speeds. Also, the length of the current acceleration ramp from KY 227 to northbound I-71 is short of the desired length under current design standards. The approximate total cost for the northbound truck climbing lane is $5,500,000.

Table ES2: I-71 Corridor Improvements

I-71 CORRIDOR IMPROVEMENTS WITH PHASE COSTS

MAINLINE								COST ESTIMATE DETAIL				
COUNTY	NEW PRIORITY	BEG ROUTE	BEG EXIT OR MP	END ROUTE	END EXIT OR MP	CROSSROAD	PROJECT	PLANNING	DESIGN	R/W	UTILITIES	CONSTRUCTION	TOTAL
Gallatin	1		62.8		64.0		Reconstruct I-71 from US 127 MP 62.8 to MP 64 to improve geometrics		$ 2,200,000	$ 1,500,000	$ 500,000	$ 31,000,000	$ 35,200,000
Jefferson	2	I-64	0	ZORN	2		Widen to 6 lanes		$ 1,500,000	$ -	$ 476,000	$ 21,800,000	$ 23,776,000
Jefferson	4	ZORN	2	I-264	5		Widen to 6 lanes		$ 1,500,000	$ -	$ 514,000	$ 25,700,000	$ 27,714,000
Jefferson	6	I-264	5	I-265	9		Reevaluate needs at I-264/I-71 interchange and I-71 between I-264 and I-265 after I-265 East End bridge has been open at least one year to see if previous recommendations, based on forecasted usage, are still valid.	$ 500,000	$ 9,500,000	$ 30,000,000	$ 3,000,000	$ 150,000,000	$ 193,000,000
Jefferson/Oldham	7	I-265	9	KY 329	14		Widen to 6 lanes and widen clear zones		$ 3,500,000	$ -	$ 700,000	$ 50,000,000	$ 54,200,000
Carroll	9		44.0			Kentucky River	Replace 2 Structurally Deficient Bridges over Kentucky River (021B00042L, 021B00042R)		$ 2,000,000			$ 14,764,800	$ 16,764,800
Oldham	11	KY 329	14	KY 146	17		Widen to 6 lanes		$ 1,500,000	$ -	$ 300,000	$ 20,000,000	$ 21,800,000
Oldham	38	KY 146	17	KY 393	18		Widen to 6 lanes		$ 1,500,000		$ 500,000	$ 14,000,000	$ 16,000,000
Oldham	39	KY 393	18	KY 53	22		Widen to 6 lanes		$ 2,000,000	$ -	$ 500,000	$ 22,500,000	$ 25,000,000
Carroll	40	KY 227	44	KY 1039	55		Construct new interchange near KY 47 and make improvements connecting to US 42		$ 1,500,000	$ 4,000,000	$ 3,000,000	$ 15,000,000	$ 23,500,000
Oldham/Henry	41	KY 53	22	KY 153	28		Widen to 6 lanes		$ 5,600,000		$ 900,000	$ 56,200,000	$ 62,700,000
Boone	42	KY 14	72	I-75	77		Widen to 6 lanes		$ 2,000,000	$ -	$ 400,000	$ 30,000,000	$ 32,400,000
Gallatin	43	US 127	62	KY 14	72		Widen to 6 lanes		$ 6,500,000	$ -	$ 800,000	$ 80,000,000	$ 87,300,000
Henry	44	KY 153	28	US 421	34		Widen to 6 lanes		$ 4,000,000	$ -	$ 480,000	$ 48,000,000	$ 52,480,000
Henry/Trimble/Carroll	45	US 421	34	KY 389	43		Widen to 6 lanes		$ 7,000,000	$ -	$ 720,000	$ 72,000,000	$ 79,720,000
Gallatin	46	KY 35	57	US 127	62		Widen to 6 lanes		$ 3,500,000	$ -	$ 400,000	$ 40,000,000	$ 43,900,000
Carroll	48	KY 227	44	KY 1039	55		Widen to 6 lanes		$ 7,500,000	$ -	$ 1,000,000	$ 88,000,000	$ 96,500,000
													$ 891,954,800

MAINLINE IMPROVEMENTS UNDER $10,000,000								COST ESTIMATE DETAIL				
COUNTY	NEW PRIORITY	BEG ROUTE	BEG EXIT OR MP	END ROUTE	END EXIT OR MP	CROSSROAD	PROJECT		DESIGN	R/W	UTILITIES	CONSTRUCTION	TOTAL
Gallatin/Boone	1A		69.60		77.00		Install cable guardrail					$ 1,200,000	$ 1,200,000
Jefferson	3		9.80			Chamberlain Lane	Address Structurally deficient bridge @ MP 9.8 SB (056B00062L)		$ 500,000			$ 892,800	$ 1,392,800
Jefferson	5	I-264	5	I-265	9		Replace Structurally Deficient Bridge SB over US 42; consider making other geometric improvements to bridges depending, in part, on outcome of study identified in previous priority.		$ 750,000			$ 1,936,800	$ 2,686,800
Carroll	8		38.30		40.80		Add truck climbing lane southbound from MP 38.3 to MP 40.8, including widening bridges		$ 600,000	$ 100,000	$ 200,000	$ 7,000,000	$ 7,900,000
Carroll	10		44.80		46.10		Add truck climbing lane northbound from MP 44.8 to MP 46.1, including extending merge length from KY 227 to I-71 NB		$ 400,000	$ -	$ 100,000	$ 5,000,000	$ 5,500,000
Oldham/Henry	12	I-265	9	US 421	34		Install deer warning signs at 7 locations Priority #12 – IMPLEMENTED AS PART OF THIS STUDY					$ 2,800	$ 2,800
Oldham/Henry	13		22.53		28.32		Install cable guardrail: Oldham/Henry MP 22.53 - MP24.73; Henry MP 25.73 - MP 28.32					$ 718,000	$ 718,000
Henry	14		30.70		31.87		Install cable guardrail					$ 175,500	$ 175,500
Carroll	15		43.90		50.75		Install cable guardrail					$ 1,027,500	$ 1,027,500
Carroll	16		52.54		53.43		Install cable guardrail					$ 133,500	$ 133,500
Henry	17		33.02		38.81		Install cable guardrail					$ 747,750	$ 747,750
Gallatin	18		53.43		56.45		Install cable guardrail					$ 453,000	$ 453,000
Gallatin	19		58.60		59.50		Install guardrail for Steep Slopes NB near KY 465 structure outside lane					$ 17,200	$ 17,200
Carroll	20		50.90		51.20		Install guardrail for Steep Slopes NB inside median side slope steep					$ 30,200	$ 30,200
Carroll	21		53.40		53.50		Install guardrail for Steep Slopes SB outside lane 1.5 miles south of KY 1039 Exit					$ 15,600	$ 15,600
Henry	22		25.9	KY 3320, KY 712			Provide median pier protection @ MP 25.9 (KY 3320) and KY 712					$ 104,000	$ 104,000
Boone	23		76.2	KY 1292			Provide median pier protection @ MP 76.2 (KY 1292)					$ 52,000	$ 52,000
Gallatin	24		59.4	KY 465			Provide median pier protection @ MP 59.4 (KY 465)					$ 52,000	$ 52,000
Gallatin	25		61.8	US 127			Provide median pier protection @ MP 61.8 (US 127)					$ 52,000	$ 52,000
Gallatin	26		66.3	KY 562			Provide median pier protection @ MP 66.3 (KY 562)					$ 52,000	$ 52,000
Gallatin	27		69.8	KY 2850			Provide median pier protection @ MP 69.8 (KY 2850)					$ 52,000	$ 52,000
Carroll	28		46.92			KY 1112	Replace Structurally Deficient Bridge SB over KY 1112 and Whites Run Creek overpass (021B00036L)		$ 750,000			$ 3,190,080	$ 3,940,080
Carroll	29		46.88			KY 1112	Remove curb from KY 1112 and Whites Run Creek (021B00036R)					$ 15,000	$ 15,000
Gallatin	30		53.46			KY 47	Remove curb from KY 47 mainline bridge (039B00023L) or add guardrail protection					$ 11,000	$ 11,000
Gallatin	31		53.46			KY 47	Remove curb from KY 47 mainline bridge (039B00023R) or add guardrail protection					$ 11,000	$ 11,000
Carroll	32		44.33			CSX RR & KY 227	Remove curb from CSX RR & KY 227 mainline bridge (021B00037L) or add guardrail protection					$ 13,000	$ 13,000
Carroll	33		44.33			CSX RR & KY 227	Remove curb from CSX RR & KY 227 mainline bridge (021B00037R) or add guardrail protection					$ 13,000	$ 13,000
Oldham	34		22.0			KY 53	Widen NB off ramp @ KY 53 to 2 lanes		$ 160,000	$ 120,000	$ 120,000	$ 1,100,000	$ 1,500,000
Oldham	35	KY 153	28	KY 153	28		Extend merge length from KY 153 to I-71 NB					$ 160,000	$ 160,000
Henry	36	US 421	34	US 421	34		Extend merge length from US 421 to I-71 SB					$ 150,000	$ 150,000
Carroll	37	KY 227	44	KY 227	44		Extend merge length from KY 227 to I-71 SB					$ 1,000,000	$ 1,000,000
Carroll	47	KY 389	43	KY 227	44		Widen to 6 lanes; includes new structures over KY 227/KY River		$ 600,000	$ -	$ 80,000	$ 8,000,000	$ 8,680,000
													$ 37,854,930

Table ES2: I-71 Corridor Improvements (continued)

I-71 CORRIDOR IMPROVEMENTS WITH PHASE COSTS (CONTINUED)

CROSSROADS				COST ESTIMATE DETAIL					
COUNTY	NEW PRIORITY	ROUTE	PROJECT	PLANNING	DESIGN	R/W	UTILITIES	CONSTRUCTION	TOTAL
Oldham	1	KY 329	Signalize SB ramps, add left turn lane between ramp terminals		$ 100,000			$ 900,000	$ 1,000,000
Oldham	2	KY 146	Signalize SB ramp					$ 200,000	$ 200,000
Jefferson	3	Zorn Avenue	Signalize SB ramps, coordinate with existing signal @ NB ramps					$ 200,000	$ 200,000
Oldham	4	KY 393	Option 4c-3: signalize both intersections, add a second NB left turn lane onto I-71 from KY 393, add a free flow right turn lane from I-71 to KY 393 SB, and widen KY 393 to 4 lanes through the interchange.		$ 600,000	Not Included	Not Included	$ 9,200,000	$ 9,800,000
Oldham	5	KY 53	Option 4c-4: Widen SB exit ramp to separate left & right turns onto KY 53; a second NB left turn lane onto I-71; widen bridge		$ 600,000	Not Included	Not Included	$ 7,500,000	$ 8,100,000
Boone	6	KY 14	Separate left and right turns on SB exit ramp 100'					$ 22,000	$ 22,000
Boone	7	KY 14	Add left turn lanes to entrance ramps		$ 200,000			$ 1,440,000	$ 1,640,000
Carroll	8	KY 227	Separate left and right turns on SB exit ramp 100' and channelize right turns to KY 227 NB					$ 22,000	$ 22,000
Henry	9	KY 153	Separate left and right turns on NB exit ramp 700'					$ 140,000	$ 140,000
Henry	10	KY 153	Add left turn lanes to entrance ramps		$ 200,000			$ 1,480,000	$ 1,680,000
Henry	11	KY 153	Signalize NB ramps					$ 150,000	$ 150,000
Henry	12	US 421	Add left turn lanes to entrance ramps		$ 200,000			$ 1,652,000	$ 1,852,000
Carroll	13	KY 227	Conduct a planning study to improve access management on KY 227 north of I-71 interchange	$ 250,000	$ 1,000,000	$ 1,500,000	$ 1,000,000	$ 2,500,000	$ 6,250,000
Boone	14	KY 14	Correct access control to meet 300' standard					$ 50,000	$ 50,000
Henry	15	US 421	Separate NB left and right turns on NB exit ramp					$ 50,000	$ 50,000
Oldham	16	KY 329	Signalize NB ramp, and add dual left		$ 100,000			$ 400,000	$ 500,000
									$ 31,656,000

INTELLIGENT TRANSPORTATION SYSTEM									
COUNTY**	PRIORITY	BEG* ROUTE SEGMENT	BEG EXIT OR MP	END* ROUTE SEGMENT	END EXIT OR MP	CROSSROAD	PROJECT	ESTIMATED COST	POTENTIAL QUICK WIN
Jefferson	1	FRANKFORT AVE.	0.5	ZORN AVE	0.6		Install one (1) additional camera between Zorn Avenue and Frankfort Avenue on the outside of the curve for monitoring daily traffic, detecting stranded motorists or incidents, and aiding in emergency response.	$ 75,000	X
Jefferson	2	ZORN AVE.	3.4	I-264	5.0		Install two (2) cameras possibly three (3) cameras between Zorn Avenue and I-264 interchange on the outside of the curve to view entire curve for monitoring daily traffic, detecting stranded motorists or incidents, and aiding in emergency response.	$ 255,000	X
Jefferson	3	I-264	6.5	I-265	7.5		Install two (2) cameras on the outside of two double curves for monitoring daily traffic, detecting stranded motorists or incidents, and aiding in emergency response.	$ 170,000	X
Jefferson	4	I-265	10.0	KY 329	10.8		Install one (1) camera on the curve north of I-265 interchange on the outside of curve for monitoring daily traffic, detecting stranded motorists or incidents, and aiding in emergency response.	$ 85,000	X
Jefferson	5	ZORN AVE.	4.0	KY 329	11.0		Install enhanced mile marker signs at 0.2 mile intervals beginning at MP 4.0 to MP 11.0 to provide a reference device for emergency response and for motorist assistance.	$ 14,400	X
Jefferson	6	ZORN AVE.	0.0	KY 329	11.0		Install Wide Beam Radar Stations every 0.5 miles to monitor operational speeds and calculate travel times.	$ 550,000	
Jefferson	7	I-264	22.1	I-264	22.1	I-264 EB	Install one (1) overhead truss-mounted full Dynamic Message Sign just before the US 42 underpass to disseminate roadway condition information to motorists and aid in reducing congestion, delays, and secondary collisions. This will provide information to motorists on I-264 regarding conditions on I-71.	$ 250,000	X
Jefferson	8	US 42	5.6	US 42	5.9	US 42	Install two (2) roadside Dynamic Message Signs on both US 42 approaches to I-264 to disseminate roadway condition information to motorists and aid in reducing congestion, delays, and secondary collisions.. This would provide information regarding conditions on I-71 to motorists on US 42 and also aide in redirecting traffic when incidents or congestion occur on the interstate system.	$ 400,000	X
								$ 1,799,400	

**The county represents the specific county that the improvement is in.

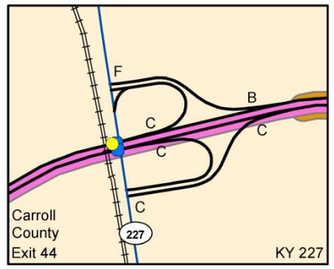
*Beg route and end route are segments intended to assist the reader in locating the improvement the actual improvement is between those two segments.

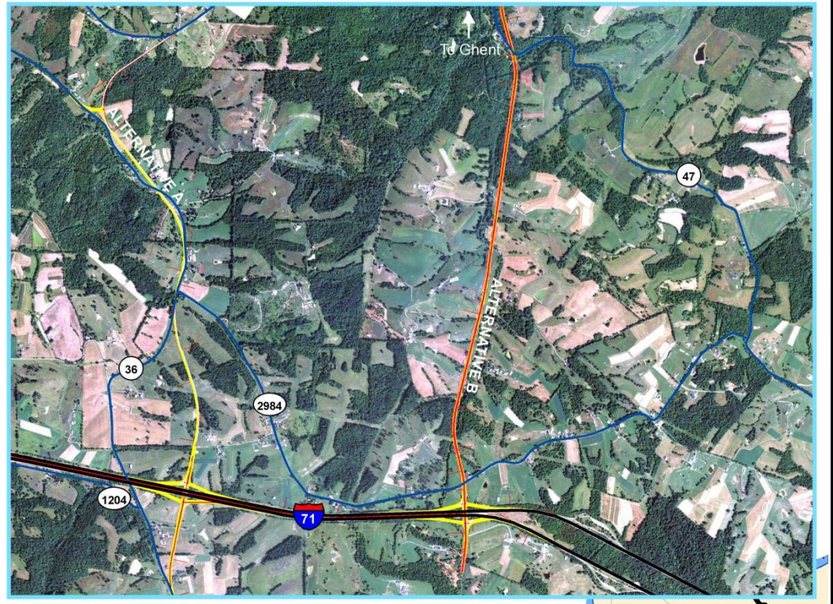
Recommended Improvements

- Structurally Deficient
- Curb on Bridge
- Median Pier Protection Does Not Meet Current Standard Drawing
- Steep Side Slopes
- Inadequate Merge Length
- New Interchange
- Deficient Curve
- Cable Guardrail
- Truck Climbing Lane
- 6 Lanes Warranted through 2038
- 2013 Mainline Improvement Options
- Future Mainline Improvement Options
- 2013 Mainline Improvments Under $10,000,000

IMPLEMENTED DURING STUDY - PRIORITY #12
Eighteen crashes involving animals (deer) were identified between various milepoints in Oldham and Henry Counties early in this study as Priority 12. KYTC District 5 staff installed deer signs at these locations during the course of this study.

Enlarged to show detail





Priority 40 New Interchange Alternatives Near KY 47
Recommended Alternative B

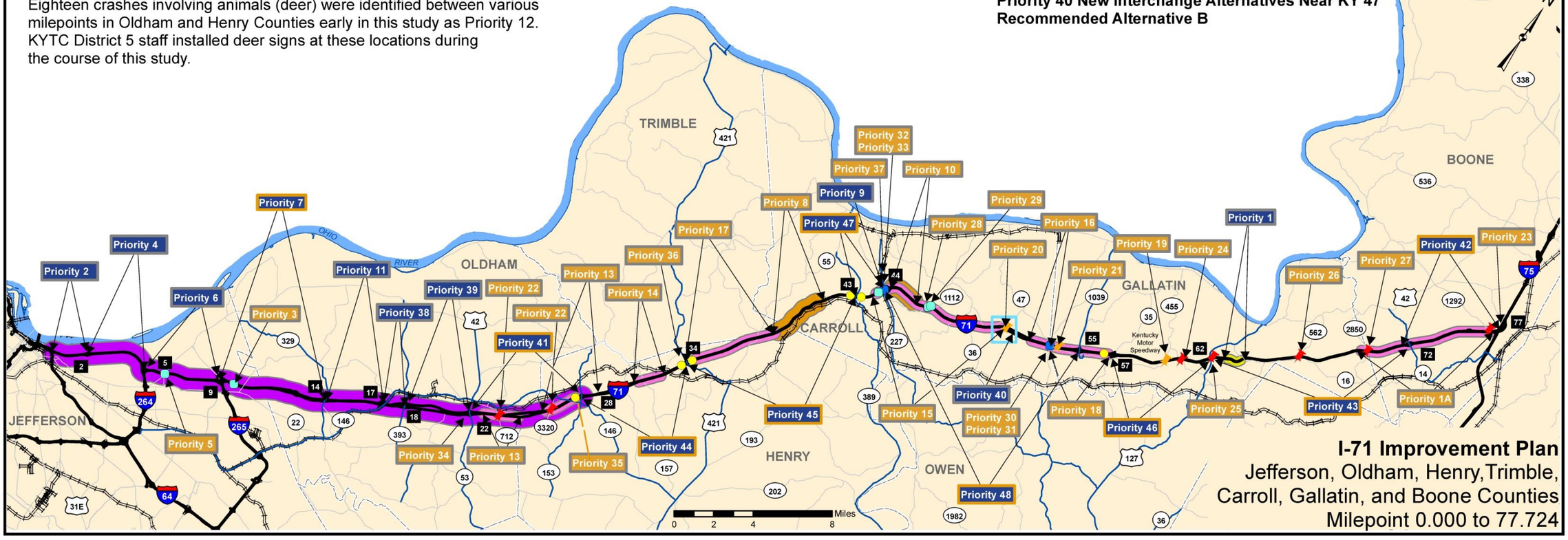


Figure ES2: I-71 Improvement Plan

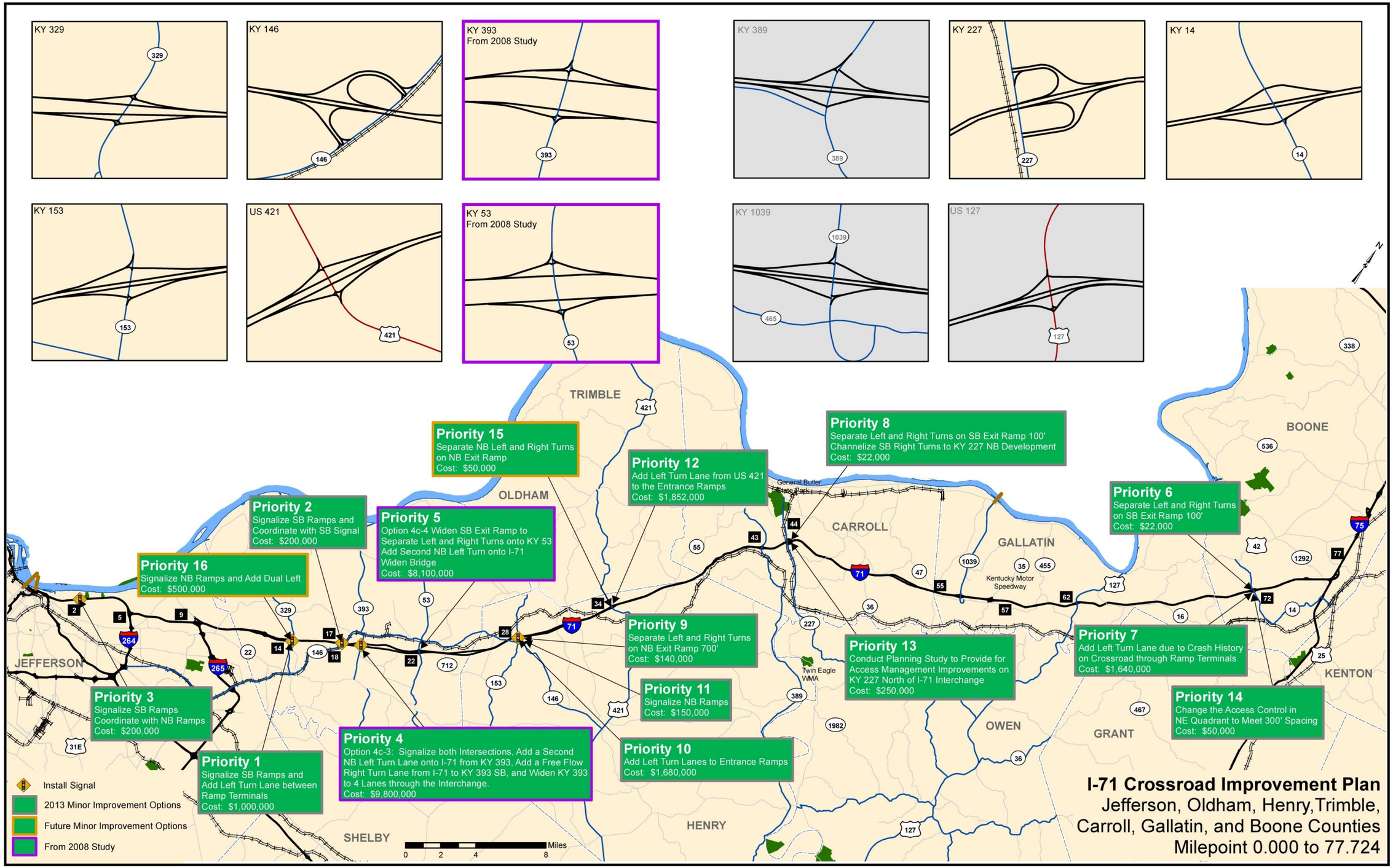


Figure ES3: I-71 Crossroad Improvement Plan

4. Improve System Reliability and Improve Safety by Replacing or Improving Structures.

Each of these structures has a sufficiency rating below 67.0 or is designated as structurally deficient and was recommended for replacement or additional evaluation.

- Replace Southbound Bridge at MP 9.8 over Chamberlain Lane (056B00062L) in Jefferson County – $1,392,000—Priority #3.
- Replace Bridge over US 42 in Jefferson County – $2,687,000—Priority #5.
- Replace Bridges (021B00042L and 021B00042R) over Kentucky River in Carroll County – $16,765,000—Priority # 9.

5. Mainline Structures Recommended for Removal of Curb or Added Crash Protection.

Each of these structures is recommended for curb removal or added crash protection.

- KY 1112 and Whites Run Creek (021B00036R) in Carroll County – $15,000—Priority #29.
- KY 47 (038B00023R) in Gallatin County – $15,000—Priority #30.
- KY 47 (038B00023R) in Gallatin County – $15,000—Priority #31.
- CSX RR & KY 227 (021B00037L) in Carroll County – $13,000—Priority #32.
- CSX RR & KY 227 (021B00037R) in Carroll County – $13,000—Priority # 33.

6. Reevaluate Needs at I-264 to I-265 In Jefferson County (4.0 Miles) – $250,000—Priority #6.

The purpose of this project is to reevaluate recommendations from previous studies after the new I-265 Ohio River Bridge is constructed and open to traffic. The project will include a reevaluation of the I-264/I-71 Interchange and I-71 between I-264 and I-265. Currently I-71 from I-264 to I-265 has a v/c ratio of 0.95 and the 2038 v/c ratio is anticipated to be 1.12 without improvements. The estimated cost for this reevaluation is $500,000. The estimated cost for widening I-71 to six lanes is $57,000,000. The most recent interchange costs that improve I-264 interchange to fully meet design standards and has a desirable LOS operation is approximately $90,300,000 (reconstruction tri-level bridge including a braid to US 42 to accommodate future traffic). The approximate cost for the reconstruction interchange I-265 to accommodate future traffic which includes a flyover ramp from northbound I-265 to southbound I-71 that is compatible with the new east end bridge is approximately $65,500,000. Each interchange cost assumes replacement of all structures.

7. Implemented During Study—Priority #12.

Eighteen crashes involving animals (deer) were identified between various mileposts in Oldham and Henry Counties and were identified early in this study as Priority Improvement #12. KYTC District 5 staff has implemented this improvement by installing deer signs at these locations during the course of this study.

Cable Guardrail

A review of crossover crashes, existing head-on crashes, guardrail locations, and relevant proximity to the seven crash concerns, the following locations as shown are recommended for cable guardrail:

- MP 69.60 - MP 77.00 in Gallatin/Boone Counties – $1,200,000—Priority #1A.
- MP 22.53 - MP 28.32 in Henry County – $718,000—Priority #13.
- MP 30.50 - MP 31.87 in Oldham/Henry Counties – $175,500—Priority #14.
- MP 43.90 - MP 50.75 in Carroll County – $1,027,500—Priority #15.
- MP 52.54 - MP 53.43 in Carroll County – $133,500—Priority #16.
- MP 33.02 – MP 38.81 in Henry County – $747,500—Priority #17.
- MP 53.43 – MP 56.45 in Gallatin County – $453,000—Priority #18.

Guardrail for Steep Slopes

The following locations are recommended for guardrail along steep slope areas:

- MP 58.6 – 59.5 in Gallatin County – $17,200—Priority #19.
- MP 50.9 – 51.2 in Carroll County – $30,200—Priority #20.
- MP 53.4 – 53.5 in Carroll County – $15,600—Priority #21.

Provide Updated Median Pier Protection

The following locations are recommended for median pier protection:

- MP 25.9 in Henry County – $104,000—Priority #22.
- MP 59.4 in Gallatin County – $52,000—Priority #23.
- MP 61.8 in Gallatin County – $52,000—Priority #24.
- MP 66.3 in Gallatin County – $52,000—Priority #25.
- MP 69.8 in Gallatin County – $52,000—Priority #26.
- MP 76.2 in Boone County – $52,000—Priority #27.

Extend Merge Lengths

Several ramp merges are deficient due to inadequate mainline capacity. Those issues will be improved only when the mainline is widened. However, the following ramps do not have the appropriate length required for entering I-71and was therefore recommended for improvement. These priorities are not included as a part of any other priority.

- KY 153 (Exit 28) northbound merge in Oldham County – $160,000—Priority #35.
- US 421 (Exit 34) southbound merge in Henry County – $150,000—Priority #36.
- KY 227 (Exit 44) southbound merge in Carroll County – $1,000,000—Priority #37.

Crossroad Improvement Priorities

Each I-71 crossroad ramp terminal and including the first intersection beyond the ramp terminals, was analyzed for improvements where a crash or capacity issue was identified. These improvements were prioritized based on their immediate/short-term (Quick Win) or future need and whether the crossroad was located in a 0.1 mile crash spot with a pattern. Left turn lane analyses and signal warrants were examined. Each recommendation was a result of less than desirable LOS or was identified as a crash issue.

- Priority #1—Signalize SB Ramps and add left turn lane on KY 329 between the ramp terminals in Oldham County - $1,000,000.

- Priority #2—Signalize SB Ramp at KY 146 Interchange in Oldham County – $200,000.
- Priority #3—Signalize SB Ramps at Zorn Avenue (Exit 2) Interchange and coordinate signal with existing NB Ramps signal in Jefferson County – $1,680,000.
- Priority #4—Signalize both ramp terminal intersections, add a second NB left turn lane from KY 393, add a free-flow right turn lane from I-71 to KY 393 and widen KY 393 to 4 lanes in Oldham County – $9,800,000.
- Priority #5—Widen the southbound exit ramp at KY 53 Interchange to provide separate left and right turn lanes onto KY 53, add a second NB left turn lane onto I-71 and widen the existing bridge on KY 53 in Oldham County – $8,100,000.
- Priority #6—Provide separate left and right turns on the southbound exit ramp approximately 100 feet at the KY 14 Interchange in Boone County – $22,000.
- Priority #7—Add left turn lanes on entrance ramps to I-71 at KY 14 in Boone County – $1,640,000.
- Priority #8—Provide separate left and right turns on the southbound exit ramp approximately 100 feet and channelize right turns to KY 227 in Carroll County – $22,000.
- Priority #9—Provide separate left and right turn lanes on the northbound exit ramp approximately 700 feet at KY 153 Interchange in Henry County – $140,000.
- Priority #10—Add left turn lane to the entrance ramps at KY 153 Interchange in Henry County – $1,680,000.
- Priority #11—Signalize NB ramps at KY 153 Interchange in Henry County – $150,000.
- Priority #12—Add left turn lanes to entrance ramps at US 421 Interchange in Henry County – $1,852,000.
- Priority #13—Conduct Planning Study ($250,000) to improve access management on KY 227 north of I-71 Interchange in Carroll County – a preliminary estimate of a viable improvement option is $6,250,000.
- Priority #14—Correct access control to meet 300-foot standard at KY 14 Interchange in Boone County – $50,000.
- Priority #15—Provide separate left and right turn lanes on the NB exit ramp at US 421 Interchange in Henry County – $50,000.
- Priority #16—Signalize NB ramp and add dual left turn lanes at KY 329 Interchange in Oldham County – $500,000.

Intelligent Transportation System (ITS) Improvements

Intelligent Transportation System (ITS) encompasses a broad range of modern computer and communications technologies. When integrated into the transportation system infrastructure or in vehicles, these technologies help monitor and manage traffic flow, reduce congestion, provide improved mobility, safety, air quality, and productivity. The purpose of TRIMARC is to improve the performance of the existing freeway system in the Metropolitan Louisville and Southern Indiana area. Based on coordination with KYTC District 5 staff, listed below is a list of ITS recommendations for the I-71 Corridor. They were prioritized in order based on results of the capacity analysis results.

- Install six (6) additional cameras in Jefferson County – $585,000 Total—Priorities #1–#4.
- Install Enhanced Mile Marker signs (MUTCD code D10-5, blue background with white legend and border) beginning at MP 4.0 – $255,000—Priority #5.
- Provide Wide Beam Radar stations every 0.5 mile from MP 0.00 to 11.3 – $170,000—Priority #6
- Install Dynamic Message Signs (DMS) – $650,000—Priorities #7 and #8

New Interchanges

Interchanges at five (5) locations were evaluated. Based upon the amount of traffic diverted, interchange spacing, and consideration of analyses in previous studies, it is recommended that the following new interchange be considered for implementation.

- New interchange near KY 47 with improvements connecting to US 42 in Carroll County - $23,500,000—Priority #40.

Beyond 2038

This study was to also prioritize the entire corridor for widening to six lanes. Priorities 41-48 address those segments of I-71 beyond 2038 for widening and are identified as follows:

- KY 14 to I-75 in Boone County (5.0 miles) – $32,400,000—Priority #42.
- US 127 to KY 14 in Gallatin County (10.0 miles) – $87,300,000—Priority #43.
- KY 153 to US 421 in Henry County (6.0 miles) – $52,480,000—Priority #44.
- US 421 to KY 389 in Henry/Trimble/Carroll Counties – $79,720,000—Priority #45.
- KY 35 to US 127 in Gallatin County (5.0 miles) – $43,900,000—Priority #46.
- KY 389 to KY 227 in Carroll County (1.0 mile) – $8,680,000—Priority #47.
- KY 227 to KY 1039 in Carroll County (11 miles) – $96,500,000—Priority #48.

Conclusions

The purpose of the I-71 Corridor Study was to evaluate the existing and projected future conditions of I-71 from I-64 in Jefferson County to I-75 in Boone County and their crossroads within the interchange area and one crossroad beyond, as they relate to safety, and congestion; and develop an overall improvement plan for needed improvements and priorities. This document is based on an evaluation of existing conditions and an analysis of future conditions, a crash analysis, I-71 Corridor Group input and Project Team input recommending a total of 48 mainline improvements, 16 crossroad improvements, and 8 ITS improvements for consideration. Although there may not be a substantial difference between projects that are close in priority, i.e. Priorities 4 and 5; there is however, a difference between projects ranked 1-20 versus projects ranked 40-48.

I-71 CORRIDOR STUDY

1.0 Introduction

The Kentucky Transportation Cabinet (KYTC) has initiated a corridor planning study to address safety and congestion and identify and evaluate improvements along the I-71 Corridor between I-64 in Jefferson County and I-75 in Boone County (approximately milepoint 76.4). The interchange with crossroads identified in Table 1, ramp terminals at crossroads identified in Table 1, and one intersection in each direction beyond the ramp terminals were also included as a part of this study. I-71 carries approximately between 25,700 and 80,500 vehicles per day (vpd), with a large percentage of these vehicles being trucks.

1.1 Project Location

Interstate 71 (I-71) is an interstate that begins at I-64 in Jefferson County and extends north and ends at I-90 in Cleveland, Ohio. The portion of I-71 included in the I-71 Corridor study area is approximately 78 miles in length between I-64 and I-75 in Boone County (see Figure 1, Study Area, p. 2). Table 1 identifies those interchanges that are located in the I-71 Corridor and indicates which interchanges were included for this study:

Table 1: Interchanges Located in the I-71 Corridor

ID #	County	Exit #	Crossroad	Note	KYTC Item No. or Referenced Study
1	*Jefferson*	*0*	*I-64*	*1*	*5-21.00 & 5-715.00*
2	*Jefferson*	*2*	*Zorn Ave*	*1*	*5-48.10*
3	*Jefferson*	*5*	*I-264*	*1*	*5-48.2 & .3*
4	*Jefferson*	*9*	*I-265*	*1*	*5-68.00 Alternatives Study I-71/I-265 Aug. 2010*
5	***Oldham***	***14***	***KY 329***	***2***	
6	***Oldham***	***17***	***KY 146***	***2***	
7	*Oldham*	*18*	*KY 393*	*1*	*5-234.00*
8	*Oldham*	*22*	*KY 53*	*3*	*Oldham Co. IJS February 2011; 5-8201.01*
9	***Henry***	***28***	***KY 153***	***2***	
10	***Henry***	***34***	***US 421***	***2***	
11	***Carroll***	***43***	***KY 389***	***2***	
12	***Carroll***	***44***	***KY 227***	***2***	
13	***Gallatin***	***55***	***KY 1039***	***2***	
14	*Gallatin*	*57*	*KY 35*	*4*	*Kentucky Motor Speedway*
15	***Gallatin***	***62***	***US 127***	***2***	
16	***Boone***	***72***	***KY 14***	***2***	
17	*Boone*	*77*	*I-75*	*1*	

Notes:
1 – Not addressed or studied in this study. Those in Jefferson County are already under redesign as Item Nos. 5-21.0, 715.0, 48.1, 48.2, 48.3, 68.0, 5-234.00, and 804.00; Exit 18 in Oldham County is relatively new and designed to current standards and the interchange is currently under capacity; and the I-75 interchange is excluded from this study. At KYTC's request, the I-75 interchange is excluded from this study due to recent improvements made to the interchange to extend the southbound I-75 entrance to SB I-71 two-lane on ramp through the interchange area.
***2** – Will be studied and addressed in this study **(in bold)**.*
3 – KY 53 has been studied in Oldham County shall be incorporated by reference into this study, including data and recommendations.
4 – The Kentucky Speedway (Exit 57) has been recently reconstructed and studied for event traffic. During normal operations it operates well under capacity. Event day traffic, however, could possibly be improved at this interchange. Therefore this interchange will be included in the Planning Study, but only to the extent necessary for including Event Day operations.

1.2 Purpose and Need of the Study

The purpose of this study is to evaluate the safety and congestion of the I-71 Corridor from I-64 in Jefferson County to I-75 in Boone County and to determine needed improvements and relative priorities. The study examines geometric characteristics, crash history, physical constraints and existing and projected operational characteristics of the I-71 Corridor. The need for the project is supported by the following facts:

- Age of the Interstate and Changing Design Standards – The first section of I-71 in Louisville opened in 1966 between its terminus at Spaghetti Junction and Zorn Avenue. Its junction with the Watterson Expressway (I-264) opened in 1968, and the complete Kentucky portion of the interstate was opened to the public in 1969 replacing US 42 as the primary route between Louisville and Cincinnati. Although it met design standards and common practices in the 1960's, those standards and practices have changed over the years in an effort to improve safety.
- Between the project limits, 2,705 crashes occurred on I-71 between January 1, 2009 and December 31, 2011. Approximately 535 of those were injury crashes and 15 were fatal crashes. There were 65 0.1-mile spots with a critical crash rate factor (CCRF) exceeding 1.0 and considered a high crash locations. Approximately 1,068 crash reports were reviewed over a three-year period from years 2009 – 2011. A review of 2012 crashes revealed three (3) fatalities were found to occur in a 0.2 mile spot in Carroll County (MP 38.9 to MP 39.1). Within a three year span, there were several recurring accidents (65) recorded at MP 62.8 to MP 64.0 in Gallatin County.
- Current Level of Service (LOS) in the study area indicates that nine (9) miles of I-71 is currently operating at LOS F and eight (8) miles are operating at LOS E with volume/capacity (v/c) ratios in excess of 1.0.
- Design year 2038 capacity analysis shows, even with the I-265 approach to the Ohio River (east end bridge) in Jefferson County, over 21 miles of I-71 operating at LOS F and 4 miles operating at LOS E with frequent traffic backups anticipated at these locations.
- Existing truck traffic as a percent of the overall traffic ranges from 7% in Jefferson County to 35% in Gallatin County. Actual trucks per day range from approximately 5,000 trucks per day in downtown Louisville between Zorn Avenue and I-264 to approximately 11,000 trucks per day between I-265 and KY 329 in Oldham County and KY 35 and US 127 in Gallatin County. It is anticipated that in the future the range in truck traffic as a percent of the overall traffic will continue to grow from 7% to 11% in Jefferson County and from 35% to 46% in Gallatin County, respectively. The actual trucks per day in 2038 are expected to grow between 9,100 from Zorn Avenue to I-264 to as many as 19,600 trucks per day between I-265 and KY 329. There are locations along I-71 with long, steep grades that result in trucks riding alongside each other, either up or down the grade making it nearly impossible for other vehicles to pass. As documented herein, there have been previous studies conducted throughout the I-71 study corridor, each with their own recommendations and conclusions. It is KYTC's desire to have an overall improvement plan for the I-71 Corridor that focuses on congestion and safety.
- A key element to this study is public involvement and specifically the involvement of the I-71 Corridor Group, which is identified as a key stakeholder for this project. This group's focus is the overall I-71 corridor with an emphasis on the rural counties that are not contained within the

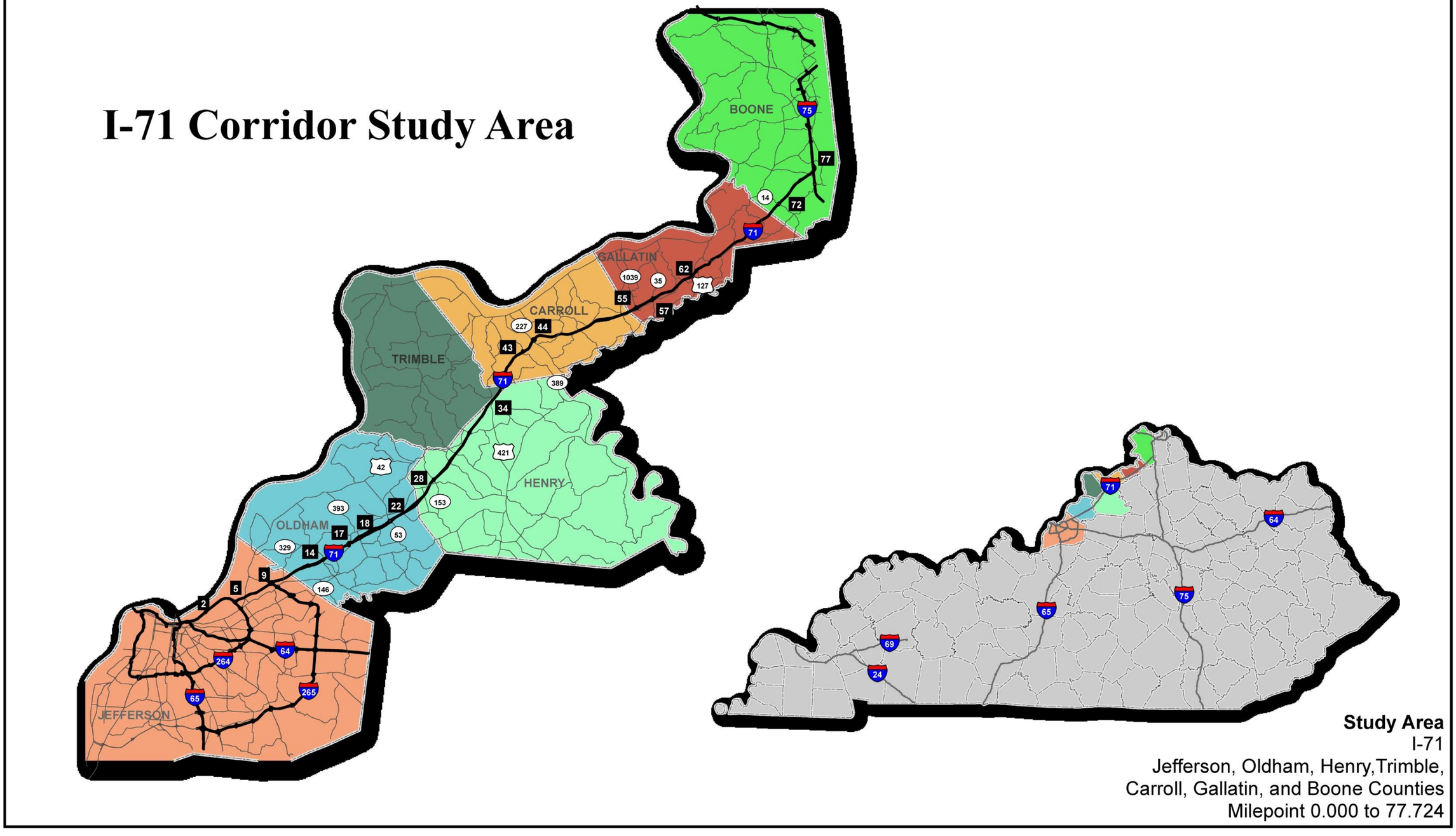


Figure 1: Study Area

metropolitan planning organizations of Kentuckiana Regional Planning and Development Agency (KIPDA) and the Ohio Kentucky Indiana Regional Council of Governments (OKI). Most of the counties are agricultural in nature, and because farming is rarely a full-time occupation today, the farmers must seek work in industry to fill the void for the creation of new jobs. This focus group feels that I-71 plays a vital role in keeping existing industries and attracting new industry while expanding on the potential for tourism growth given the Kentucky Speedway, wineries, and state parks that will generate traffic in the future to warrant future widening of I-71. The I-71 Corridor Group is very much supportive of a plan for widening I-71.

1.3 The Planning Process

The planning process and overall activities for this study includes:

- **Existing Conditions –** inventory of HIS data and existing roadway characteristics for I-71 and crossroads to the first intersection beyond the ramp terminals identified in Table 1 (p. 1), including a crash analysis to assist in determining deficiencies;
- **Data Collection –** obtain current traffic counts including truck percentages to establish traffic patterns;
- **Traffic Forecasts and Modeling –** determine future traffic needs utilizing KYTC's Statewide Traffic Model;
- **Purpose and Need** - develop a well-defined purpose and need;
- **Propose and Analyze Improvements -** include practical solutions and develop cost estimates for options that will satisfy project purpose and goals;
- **Public Involvement/Project Coordination** – conduct a public involvement effort, including the development of a paper and an online survey form regarding the origin and destination of truck trips and the amount of truck travel by major industries in the rural counties to enhance truck travel information contained within KYTC's Statewide Traffic Model. The online survey was distributed to the I-71 Corridor Group for dissemination to respective county industries. The goal of the public involvement effort is to ensure coordination and communication throughout the project between the KYTC and project stakeholders; and
- **Report Documentation –** prepare draft and final technical report(s) to document the study process and recommendations.

1.4 I-71 Corridor Description

I-71 stretches approximately 335 miles from Louisville, Kentucky to Cleveland, Ohio. The I-71 Corridor also includes the cities of Columbus and Cincinnati, Ohio. The diagonal orientation of I-71 provides for the shortest path for the shipment of goods moving between southern portions of the I-65 and I-75 corridors and eastern portions of the I-70, I-76, I-80 and I-90 corridors.

In Kentucky, I-71 begins east of Downtown Louisville at the Kennedy Interchange, where it meets I-64 and I-65. This interchange is often referred to as "Spaghetti Junction." From Louisville, the I-71 Corridor roughly follows the Ohio River northeast toward Northern Kentucky. The I-71 Corridor travels through from south to north, Jefferson, Oldham, Henry, Trimble, Carroll, Gallatin, and Boone counties.

In Jefferson and Oldham Counties, I-71 is an urban interstate to KY 53, while the remaining sections of I-71 are rural in nature. I-71 carries between 25,700 and 80,500 vehicles per day (vpd), with the larger volumes occurring in Jefferson County between I-264 (Watterson Expressway) and I-265 (Gene Snyder Freeway). Between Louisville and I-75, I-71 is primarily a four-lane divided highway, except for a six-lane section that exists near the Kentucky Speedway at KY 35 near MP 57.

1.5 I-71 Corridor Land Use

Existing land use along the I-71 Corridor has been segmented and briefly described according to the following interchange locations.

I-64 (Kennedy Interchange) to I-265 (Gene Snyder Freeway)

Land use along or near the corridor between the I-64 and I-265 interchanges, consists of some industrial uses on the south side of I-71 near Zorn Avenue and a number of parks and recreational areas, including a City of Louisville Soccer Park, Twin Park, Thurman Hutchins Park and Carrie Gaulbert Cox Park on the north side of I-71. On the south side of I-71 where the corridor parallels Mellwood Avenue, the land use is mostly single-family residential. Land use between the I-265 and I-264 interchanges is also primarily single-family residential with a large new hospital complex, the Norton Brownsboro Hospital, occupying the majority of the southeast quadrant of the I-265 interchange. The hospital is accessed from the I-265 (Gene Snyder Freeway)/KY 22 (Brownsboro Road) Interchange located southeast of I-71.

I-265 (Gene Snyder Freeway) to KY 329

Continuing north on I-71 from the I-265 interchange to Heinz Lane, existing land use on the north side of the corridor consists of single-family residential homes located in two large subdivisions. On the south side of I-71 the residential uses are primarily high density multifamily apartment or condominium units. Just west of Heinz Lane along Hitt Lane, there is an existing water treatment plant and a number of commercial/industrial businesses. North of Heinz Lane and continuing to KY 329, the adjoining land use is primarily undeveloped with a few scattered homes located on large farms. There are a few single family subdivisions located to the south of I-71 in this area but are located a significant distance away from the interstate except for the few homes along Meadow Stream Court. There are also rest areas located on either side of I-71 within this section.

KY 329 to KY 146

Located in the northeast quadrant of the I-71 and KY 329 interchange is a large industrial plant, GrillMasters Barbeque Pits. Continuing north from this area, the adjacent land use is undeveloped except for a few scattered single family homes located along Glenarm Road, Echo Valley Drive and Glenarm Frontage Road on the north side of I-71 and homes along Springlake Drive and Millwood Road on the south side. Just west of the KY 146 (Lagrange Road) interchange there is a large established subdivision located along Fox Run on the north side of I-71.

KY 146 to KY 393

Just north of the KY 146 (Lagrange Road) intersection, the northbound and southbound lanes of I-71 split away from each other approximately 1,000 feet to form a diamond interchange with separate ramp intersections at KY 393. Between the KY 146 and the KY 393 interchanges, there is a large industrial park located along Mattingly Drive on the north side of I-71. On the south side of I-71 the land use is comprised of a large single-family subdivision located along Briar Ridge Road and a number of other subdivision streets.

KY 393 to KY 53

Continuing north from the KY 393 interchange, there is a large undeveloped parcel located on the south side of I-71 that has a large utility easement that crosses through it. Just beyond the easement, the land use transitions to single-family residential with several homes located along residential streets that include Borowick Circle, Maple Leaf Drive, Pin Oak Drive, Kinlock Road, Forest Park Drive and Meadowbrook Drive. To the north of I-71, beginning at KY 393, Commerce Parkway parallels the interstate while providing access to several industrial/commercial uses between KY 393 and KY 53. Major traffic generators in this area include Luther Luckett Correctional Complex, Roederer Correctional Complex, Kentucky State Reformatory and Bluegrass Community and Technical College.

KY 53 to US 421

There are several interstate-related commercial land uses located on the north and south sides of I-71 at the KY 53 interchange. These land uses include hotels such as Holiday Inn Express, Days Inn and a Best Western on the south side of I-71 and a Super 8 and Comfort Suites located in the northeast quadrant of the interchange. Other land uses include several restaurants including Domino's Pizza, Taco Bell, Cracker Barrel, and KFC on the north side and Waffle House, Ponderosa Steakhouse, Wendy's and Burger King to the south. Other interstate-related uses include several gas stations and convenience stores. There is also a large Wal-Mart located in the south quadrant of the interchange.

Continuing north from the KY 53 interchange, land uses along I-71 consist of single-family residential homes located along Crystal Drive East on the north side of I-71 and Grange Drive to the south. Adjacent land uses in this area consists of primarily undeveloped parcels and scattered single-family residential homes. At this point the northbound and southbound lanes of I-71 shift back together to cross over KY 712. Just east of the KY 712 overpass, the northbound and southbound lanes separate from each other for a distance of approximately 2.5 miles before coming back together prior to crossing Mt. Olive Road (KY 3320).

After crossing KY 712, the northbound and southbound lanes split again before crossing the Henry County line. The lanes continue north until coming back together to cross Mt. Olive Road. On the north side of I-71 just east of Mt. Olive Road are some single-family homes located along Hickory Hill Road and Manor Drive. At this point, I-71 continues north and crosses over Lagrange Road (KY 146) again before intersecting KY 153 (Lake Jericho Road).

In three of the four quadrants of the I-71/KY 153 interchange, there are interstate-related commercial uses including two major service stations/truck stop/fast food services that generate a substantial amount of vehicle activity. The southeast quadrant of the interchange is occupied by a few scattered residential homes. Continuing north from the KY 153 interchange, the existing land uses becomes less developed with a large portion being occupied by either vacant land or farmland. There are a few single-family homes scattered along Wolfpen Road and Wolfpen Branch Road but these homes are spread apart from each other. There are also some homes that are located along Sulfur Road and Fallen Timber Road that cross underneath of I-71.

US 421 to KY 227

At the US 421 (Campbellsburg Road) interchange, there are a few residences located in the southwest quadrant of the interchange along Paul Nora Drive and Fewell Road. There are also a few interstate-related uses located west of I-71 along US 421. Continuing north from US 421, the adjacent land use is primarily rural residential and agricultural uses. These homes are located mainly along Carmon Creek Road, Old Carmon Road, Mathena Farm Road and Jones Road. After crossing over KY 55 (Carrollton Road), adjacent land use becomes mostly agricultural with large parcels of undeveloped land. After crossing the Carroll County line, KY 2997 parallels the I-71 Corridor until it intersects with KY 389. There are a few homes located along KY 2997 near Woodrow Wilson Road and a number of trailer/modular homes just west of the KY 389 interchange. Within the southeast quadrant of the I-71/KY 389 there is a church and a large cemetery located just east of KY 2997.

Occupying the land use on either side of I-71 north of KY 389 to the Kentucky River are large tracts of rural residential and agriculture use. After crossing the river, I-71 continues north to intersect KY 227. The existing interchange is a partial cloverleaf with both ramp intersections located on the east side of KY 227. Land uses within the interchange area consist of heavy industrial uses. Land use along KY 227 beyond the interchange ramps to the west are mostly interstate-related uses including 4 hotels, service stations and fast food restaurants. In the northwest quadrant of the interchange, there are approximately 13 access points/driveways within 1,500 feet of the southbound ramp terminals. Major traffic generators that currently access I-71 at KY 227 include Kroger, Wal-Mart, General Butler State Park, Carroll County High School and Carroll County Hospital as shown in Figure 2 (p. 5). There is also a substantial amount of truck traffic, 32-35% (2013) and 30-46% in (2038) that originates from US 42, which is located approximately 3.2 miles northwest of the I-71 Corridor. Major freight traffic generators include Arkema Inc., Ghent Rail Yard, Arvin Mentor, Dow Corning Corporation, BPB Manufacturing and North American Steel.

KY 227 to KY 35

Continuing northeast from the KY 227 interchange, the existing land use along I-71 is primarily undeveloped and/or rural residential. There are some widely scattered homes along Marvin Chapel Road, Goose Creek Road, KY 36 and KY 2984. After crossing Ghent Eagle Road, the northbound and southbound lanes split for a short distance, before coming back together just south of a large agricultural farm. From this point, I-71 continues north to cross KY 47 and then intersecting with KY 1039.

Existing land uses between the KY 1039 and KY 35 interchanges include an industrial complex on the north side of I-71 just east of KY 1039, scattered single-family residential along the south side of I-71 and a large RV parking area complex associated with the Kentucky Speedway on the north side of I-71.

A notable land use along the I-71 Corridor includes the Kentucky Speedway, which is located between the interchanges of KY 1039 and KY 35. Recently, there have been many improvements made in this area including the widening of I-71 to six lanes with a barrier wall median and other crossroad improvements. The Kentucky Speedway is a 1.5-mile tri-oval speedway that is located directly north of the KY 35 interchange with the main entrance along KY 35 (Sparta Pike Road). There is another entrance located along Kentucky Speedway Boulevard. The speedway was officially opened in 2000 and has hosted several annual racing events, including ARCA, NASCAR and Indy Racing League racing. The track is currently owned and operated by Speedway Motorsports, Inc. and has a grandstand capacity of 107,000.

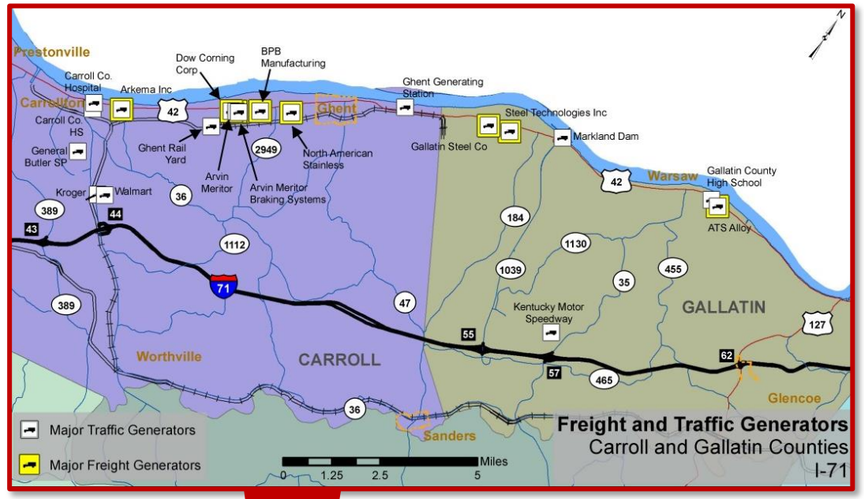
KY 35 to KY 14

Between the interchanges of KY 35 and US 127, development becomes very scattered and scarce, being comprised mainly of single-family residential homes located along area local roads such as Boone Road. There is a large auto salvage yard that lies between east and north of Johnson Hill Road and south of I-71 just west of US 127.

- Major Traffic Generators
- Major Freight Generators

Major Traffic Generators - Facilities that might generate traffic (trips to or from the location.) Examples might include schools, hospitals, manufacturing, retail, government or entertainment venues.

Major Freight Generators - Business will have over 100 employees, a building larger than 100,000 sq. ft. and be involved in transporting materials into, out of or both the facility via truck or rail.



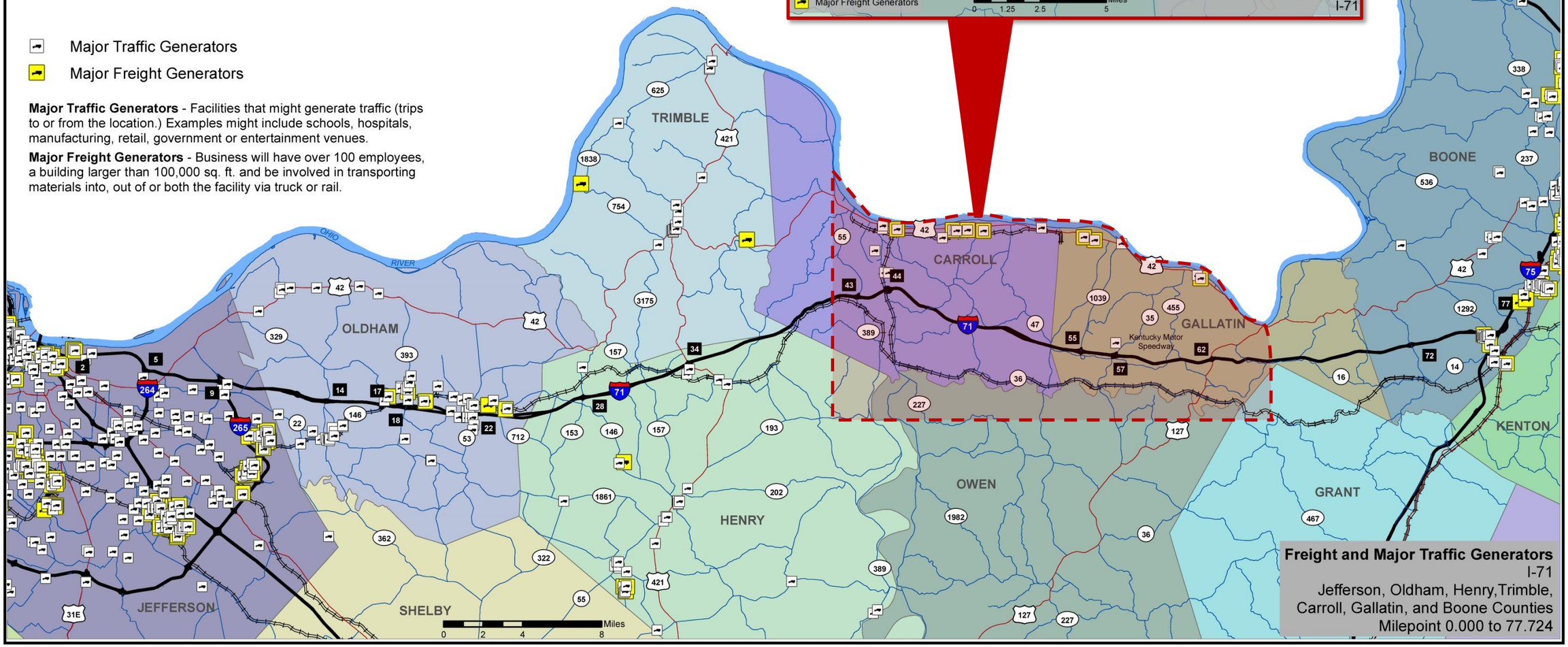


Figure 2: Freight and Major Traffic Generators

Land uses between the interchange of US 127 and KY 14 are comprised mainly of single-family residential homes located along local and crossroads including Tapering Point Drive and KY 16, which both run parallel to I-71 to the south, Walnut Lick Road, Brown Road and Baker Road.

KY 14 to I-75

From the KY 14 interchange and continuing north to the project termini at I-75, existing land uses include a high school located in the southeast quadrant of the KY 14 interchange, single-family residential homes along local roads including Poole Road, Stephenson Mill Road, Katie Road, and Pennington Road. On the north side of I-71 there is a large landfill facility and several single-family homes located along McCoys Fork Road. On the south side of I-71 just west of I-75, there are a group of industries located along Chandler Drive, south of Beaver Road. I-71 in Boone County is currently rural in nature, but is expected to be urban by the design year 2038.

1.6 Safety Overview

The purpose of the I-71 Corridor Study is to study needed improvements to address safety and congestion. The primary focus for major improvements along I-71 have been in Jefferson and Gallatin Counties, with the reconstruction of the Kennedy (I-64/I-65) Interchange, the proposed east end bridge (I-265), recent construction projects on I-71 and I-264 (5-48.20 I-264 improvements at I-71), the planned I-71 projects at Zorn Avenue and I-265 (Item Numbers 5-48.1 and .3) and improvements to I-71 around KY 35 and the Kentucky Motor Speedway. Therefore, the focus of this study will be to develop an overall plan for I-71 in terms of safety and congestion, especially for section of I-71 between I-265 and I-75 in Boone County. It is apparent that KYTC has already made many efforts to improve safety with the installation of reflectors, cable barrier, and some widening including the following:

- Installation of reflectors on some of the guardrail from MP 23.0 to MP 24.5 in Oldham County.
- Installation of reflectors to improve night time driving safety between KY 53 and KY 153 in Henry County.
- Installation of "Slippery When Wet" Road Signs around MP 63.0 to MP 64.0 in Gallatin County.
- Installation of high friction pavement and oversized signs in the area of MP 63.0 in Gallatin County.
- Installation of new guardrail to south of KY 2850 (MP 69.2) to south of KY 14 (MP 70.9) in Boone and Gallatin Counties and MP 43.6 to MP 53.5 in Carroll County and Gallatin Counties.
- Installation of Jersey barrier where there are now six (6) lanes near MP 56.0 to MP 59.6 in Gallatin County.
- Resurfacing of northbound and southbound slow lanes at MP 59.0 to MP 63.0 in Gallatin County, southbound lanes resurfaced south of Carrollton in the same location where fences were installed as a result of a recent rock fall and pavement rehabilitation projects in Carroll, Gallatin and Henry Counties.

2.0 I-71 BACKGROUND

The current reconstruction of the Kennedy (I-64/I-65) interchange, the proposed east end approach to the Ohio River Bridge (I-265), recent projects let to construction at I-71 and I-264 (Item Number 5-48.2 I-264 improvements at I-71) and the planned I-71 projects at Zorn Avenue and I-265 (Item Numbers 5-48.1 and 0.3) will improve chokepoints at various locations along their respective routes, but will not negate the need for additional capacity in Jefferson County.

Through 2030, the Kennedy Interchange Reconstruction and the east end (I-265) bridge have been modeled and are expected to provide a reduction in mainline I-71 traffic for each of the following sections:

- Frankfort Avenue and Zorn Avenue: 4%
- Zorn Avenue to I-264: 14%
- I-264 to I-265/east end bridge: 13%
- East of I-265/east end bridge: 3%

However, this reduction still leaves over 83,000 vehicles per day in year 2030 on I-71 mainline. When projected to 2038, utilizing the growth rates from the *Louisville Southern Indiana Ohio River Bridges Traffic Forecast February 2012*, the above sections still operate at LOS F, with a v/c ratio exceeding 1.0 in year 2013. As expected, although it removes some mainline traffic, the addition of the east end bridge increases the traffic volume for the I-265 southbound to I-71 northbound movement by a factor of 10.

KYTC Item No. 48.00 was the preliminary design for complete widening of I-71. During 2005, this project was replaced with three projects (Item Nos. 5-48.10, .20 and .30) to address the bottlenecks. In 2010, the Louisville Bridges project (Item No. 5-715.00) was substantially reduced in size and footprint. Part of that reduction included removing the I-71 approaches and Item Number 5-48.10 (auxiliary lanes from the Kennedy Interchange to Zorn Avenue) from the Highway Plan.

As mentioned previously, at the request of KYTC, the I-71 Corridor study does not include the I-71/I-75 Interchange since very recent improvements which include the extension of the I-75 southbound two lane ramp to I-71 southbound through the interchange area. The study also does not include the programmed improvements to the Kennedy Interchange (Exit 0), Zorn Avenue interchange (Exit 2), I-264 Interchange (Exit 5) and the I-265 Interchange (Exit 9) in Jefferson County, since those improvements are currently under redesign or have been a part of other studies (see Section 2.1 and for other excluded interchanges are listed in Table 1, p.1.).

2.1 Previous I-71 Studies

To date, there have been a number of previous studies conducted within the I-71 Corridor study area (see Previous Study Recommendations, Figure 3, p. 7). A brief description of each study and their recommendations are identified as follows:

I-71 Widening Study, Jefferson County, Item No. 5-48.0 (October 1999) and subsequent work

In 1993 KYTC contracted with Qk4 (then Presnell Associates Inc.) for a Widening Study on I-71 from the northern limit(s) of the Kennedy Interchange north to I-265. The objectives of the I-71 widening study were to provide an engineering evaluation and an environmental overview so relative costs and impacts associated with the project could be identified. The following three alternatives were considered:

- Six-lane facility, widening with existing roadbed requiring some design exceptions.
- Six-lane facility, meeting current design standards.
- Eight-lane facility meeting current design standards.

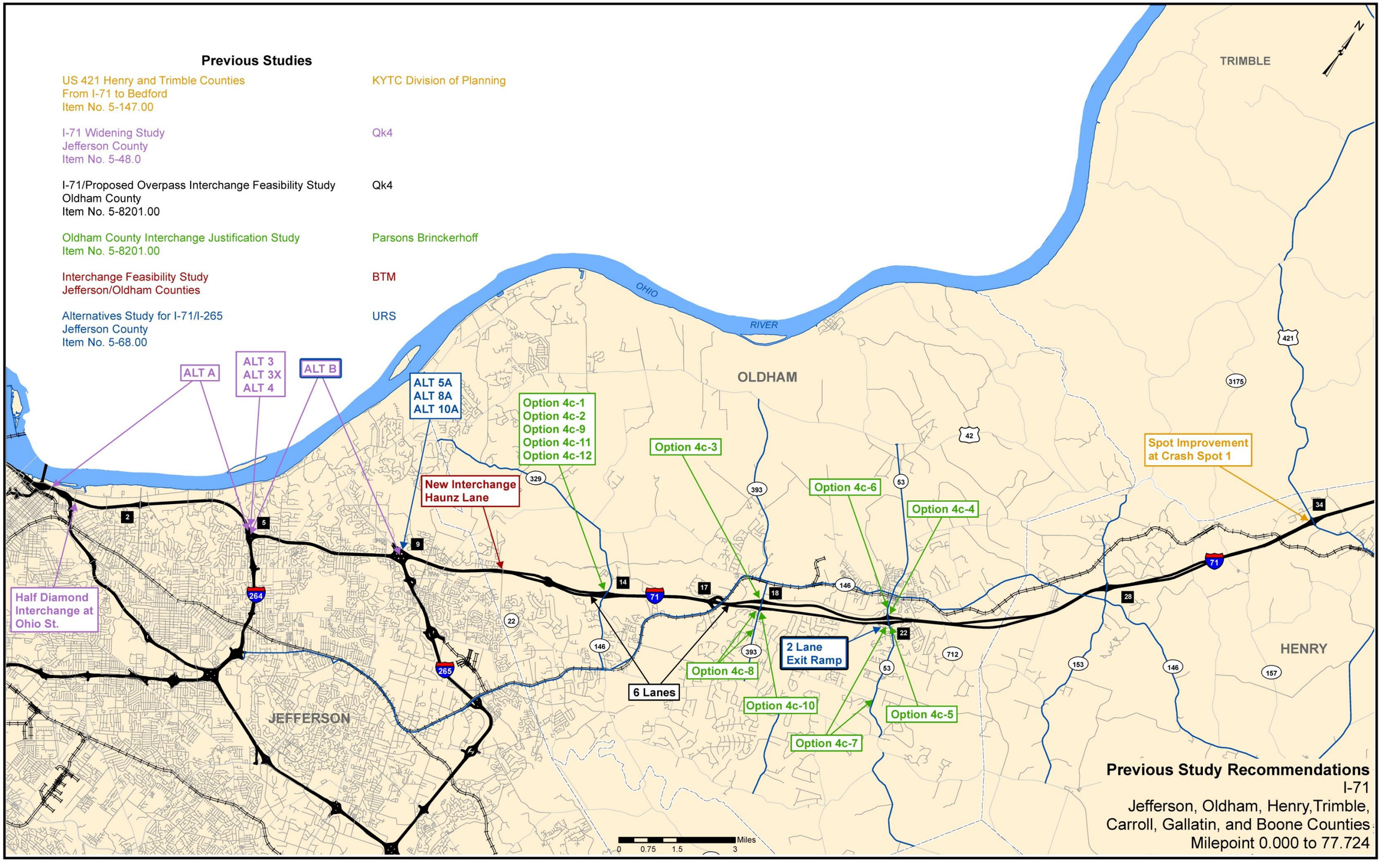


Figure 3: Previous Study Recommendations

With the interface with the potential Ohio River Bridge(s) project, the study was put on hold for completion of an *Ohio River Crossing Major Investment Study (MIS)* in early 1994. The Scoping Study was completed in 1999 and recommended six-lanes which would be compatible with eight-lanes in the future. Based on design year (2025) traffic demands, an eight-lane section was required to achieve an overall acceptable design year level of service (LOS). Construction of an eight-lane facility would require major reconstruction of the Kennedy Interchange. It was documented that an eight-lane section could be constructed in coordination with the Kennedy Interchange Improvements as recommended from the *Ohio River Bridges Study*. Community concerns were expressed from day 1 about the impacts on future mass transit in the Louisville area if the median green space in the corridor was used for highway rather that potential future transit use. Interests also favored additional bicycle facilities to address people movement in lieu of widening I-71.

In 2000, KYTC advertised for Phase 1 Design and Environmental for I-71 and Qk4 was selected. Interest group (transit and bicycle) opposition to widening I-71 to six (6) lanes resulted in an extensive public involvement process. A series of public and follow up meetings were held. In early 2005, a Peer-to-Peer Review (FHWA lead) on potential managed lanes resulted in the redirection of the project to address "Choke Points/Bottlenecks" in lieu of overall widening to six (6) lanes. Based on comments received from FHWA, it was recommended that the focus of the study shift towards the following:

- Fix chokepoints and bottlenecks on I-71 at following locations:
  - between Zorn Avenue and Kennedy Interchange (Item Number 5-48.10);
  - at I-264 interchange to US 42 (Item Number 5-48.20); and
  - at I-265 interchange (Gene Snyder Freeway)(Item Number 5-48.30)
- Install cable barriers in median
- Expand TRIMARC – by adding additional cameras, new sensors, and dynamic message signs
- Identify Potential Park and Ride Lots

In 2007, Qk4's contract was modified for the design of improvements to address the Kennedy Interchange to Zorn Avenue choke point/bottleneck (KYTC Item No. 5-48.10). As the project was merged with the 2003 *Final Environmental Impact Statement (FEIS)* Louisville Bridges Project (LSIORB) recommended reconstruction of the Kennedy Interchange, determinations were made that project Item No. 5-48.10 would be staged with the Kennedy Interchange construction. However, in 2010, the Louisville Bridges project was substantially reduced in size and footprint and the new footprint followed along the existing alignment. In the 2012 Supplemental EIS for the revised LSIORB project and in the current Design Build Project for the Downtown Segment of the LSIORB, work north of Frankfort Avenue (including the new I-71 Interchange ramps in the 2003 FEIS proposal) was eliminated. Qk4 has completed most of the design of that project, but the current Highway Plan has not been modified since the Louisville Bridges footprint was reduced and project Item No. 5-48.10 has not yet been added back. Item Number 5-48.10 widening from the Kennedy Interchange to Zorn Avenue has not progressed to future phases and therefore, will be prioritized with other recommendations as part of this study.

I-71/Proposed Overpass Interchange Feasibility Study, I-71 between KY 393 (Exit 18) and KY 53 (Exit 22), Item No. 05-8201.00 (November 2008)

A Feasibility Study was conducted in 2008 for a proposed interchange in Oldham County between exits 18 (KY 393) and 22 (KY 53). The study included analysis for the existing, Do-Nothing, and four Build Alternatives scenarios. The 900+ acre Oldham Reserve (a mixed use development) between I-71 and KY 53 prompted the study. The build alternatives included 2 interchange options: a standard diamond and a collector/distributor system.

An interchange at a proposed overpass near KY 2857 (MP 20.6), was recommended as the best solution to alleviate future traffic congestion in the area. In addition to the interchange analysis, a spot improvement was identified that could be made to the existing I-71 northbound exit ramp at KY 53 to address immediate safety problems. A dual left turn lane would be added as an independent and separate project.

Alternatives Study, Final Report, US 421, Henry and Trimble Counties from I-71 to Bedford, Item No. 5-147.00 (April 2009)

The purpose of this study was to evaluate alternatives for the possible reconstruction of US 421 from the I-71 interchange to Bedford. Alternate #3a was chosen as the primary recommendation. This alternative included improvements to the large horizontal curve and the widening and upgrading of the existing route to meet current design standards. The estimated cost for this rebuild was $42,000,000 in 2007. A spot improvement at crash spot #1, which widened US 421 to four lanes for safer access near the I-71 interchange, was chosen to meet the needs and project goals.

Alternatives Study for I-71/I-265, Item No. 5-68.00 Final Report (August 2010)

Multiple alternatives were developed to meet the project study purpose and need which was to improve the safety and operation of the interchange. The alternatives included interim (quick-fix) improvements and ultimate build solutions. The alternatives that were recommended are as follows:

Alternative 5A – estimated cost $70 million

- Construct a two-lane flyover from I-265 northbound to I-71 southbound
- Add an auxiliary lane to the outside of I-71 northbound
- Add an auxiliary lane to the inside of I-71 southbound to I-264
- Widen I-71 Ramp 5 to two lanes to KY 22
- Reconstruct Ramp 3 and add auxiliary lane to Chamberlain Lane
- Align new I-265 northbound ramps with I-265 southbound ramp @ KY 22
- Reconstruct Springdale Road Bridge

Alternative 8A - estimated cost $86.5 Million

- I-71 is widened at the flyover merge point to 5 lanes and tapers back down to 2 lanes
- Widen I-265 to 6 lanes
- Construct flyover from I-265 southbound to I-71 northbound and I-265 northbound to I-71 southbound

- Construct Collector Distributor (C/D) system and barrier wall on I-265 northbound and southbound from KY 22 to KY 841

Alternative 10A - estimated cost $65 Million

- Construct a C/D system on I-71 southbound and I-71 northbound to address AM and PM weave
- Reconstruct Springdale Road Bridge over I-71
- Add an auxiliary lane to the outside of I-71 northbound
- Widen I-71 Ramp 5 to 2 Lanes to KY 22
- Add an additional lane in each direction on I-71

The I-265 interchange is now affected by the east end approach to the I-265 bridge approach over the Ohio River and has since been reconfigured to work with that project.

Oldham County Interchange Justification Report, Summary of Findings and Recommendations, Item No. 05-8201.01 (February 2011)

The purpose of this study was to determine the need for and evaluate options to improve safety, traffic operations, connectivity, and regional access in the LaGrange, Oldham County area through the evaluation of a new interchange on I-71 between KY 393 and KY 53 (previously studied in the *I-71 Proposed Overpass Interchange Feasibility Study, November 2008*). The Project Development Team recommended that Scenario 4c and Transportation System Management (TSM) improvements that would allow access to and from the developing areas of the Oldham Reserve be advanced. After the options in the TSM Scenario are committed and attained and a need for additional access arises, the study area is to be revisited in regards to new access to I-71. At this time, given cost considerations, similar traffic operations, and uncertain future development, the TSM alternative is prudent.

The Scenario 4c projects that were listed as high or as a top priority are listed as follows:

- Option 4c-3: I-71 Westbound and Eastbound/KY 393. This option considered signalizing both intersections, adding a second northbound left turn lane onto I-71 westbound from KY 393 and adding a free-flow right turn lane from I-71 eastbound to KY 393 southbound. It included widening the interchange to provide four through lanes (two per direction) through the interchange. The 2013 estimated construction cost for this option is approximately $9.8 million.
- Option 4c-4: I-71 Westbound Ramps/KY 53. This option considered the widening of the westbound off-ramp to separate the left and right turn lanes onto KY 53 and a second northbound left turn lane onto I-71. As a result of the second turn lane, the bridge over I-71 westbound would be widened. The 2013 estimated construction cost for this option is approximately $8.1 million.

Interchange Feasibility Study, Proposed I-71 Interchange, Jefferson/Oldham Counties (July 2011)

This project was a planning study to evaluate the feasibility of an interchange located along I-71 near the Jefferson/Oldham County line. The interchange would be part of a proposed north-south connector between KY 22 and US 42. The primary objective of the feasibility study was to identify a new interchange that would help alleviate congestion in this area and connect to local roads to the north and south. The connector and the new I-71 interchange are not a part of the Kentucky Transportation Cabinet's (KYTC) current Six-Year Highway Plan (for FY 2012 – 2018). The project is a part of KIPDA's Transportation Improvement Plan and Long-Range Transportation Plan, *Horizon 2030*. The conclusion of the study was the interchange would not be a feasible solution to reducing congestion unless capacity is added to I-71.

2.2 2012 Highway Plan

As required by the *Kentucky Revised Statutes, Chapter 176,* the 2012 Highway Plan represents the major highway improvement project phases that are scheduled for the next six years. The plan outlines scheduled project phases for FY 2012 through FY 2018. Identified and shown in Figure 4 (p.10) are the major projects listed for the I-71 Corridor Study at the onset of this study:

- Item No. 5-0048.01: I-71 Study from I-64 to I-265 (study complete).
- Item No. 5-0048.10: I-71 auxiliary lanes between I-64 and Zorn Avenue (designed but were not included in the current Highway Plan at the time of this study).
- Item No. 5-0048.20: Interim Improvements on I-71 including addition of northbound and southbound auxiliary lanes (let to construction).
- Item No. 5-0048.30: Reconstruction of the I-71/I-265 Interchange, MP 7.5 to MP 9.8 auxiliary lane I-71 northbound to I-265 southbound (in the design phase).
- Item No. 5-0068.00: I-71 at I-265 Study for Future Adequacy (completed).
- Item No. 5-0230.00/5-0234.00: KY 393 Reconstruct from northern ramp of I-71 to North of KY 146. MP 4.672-5.868 southbound exit ramp add right and left turn lane (in the design phase).
- Item No. 5-0388.01: Widen KY 53 from KY 22 at Ballardsville to I-71 (Phase 2) Plan. Stops short of access control at New Moody Lane.
- Item No. 5-0444.00: Access Management and Intersection Signal Improvements to provide congestion relief on KY 53 from downtown LaGrange to I-71, MP 6.488-7.137 southbound exit ramp (dual right).
- Item No. 5-0467.00: Pedestrian/Bike Bridge over I-71 along KY 146 allowing for widening of I-71.
- Item No. 5-0468.00: Construction of a Park and Ride facility including a parking lot, shelter, playground, bike lockers, walkways and a 1000' access road located on Apple Patch Way off of KY 329 near I-71 Exit 14 in Crestwood.
- Item No. 5-0594.00: Reconstruct/Widen I-264 from Westport Road to I-71.
- Item No. 5-8201.00: Overpass over I-71.
- Item No. 5-8201.01: Interchange study at I-71 and KY 2857 (complete).
- Item No. 5-8708.00: Provide a new four-lane connector between the new I-71 overpass and US 53 (Ring Road) (12CCN).

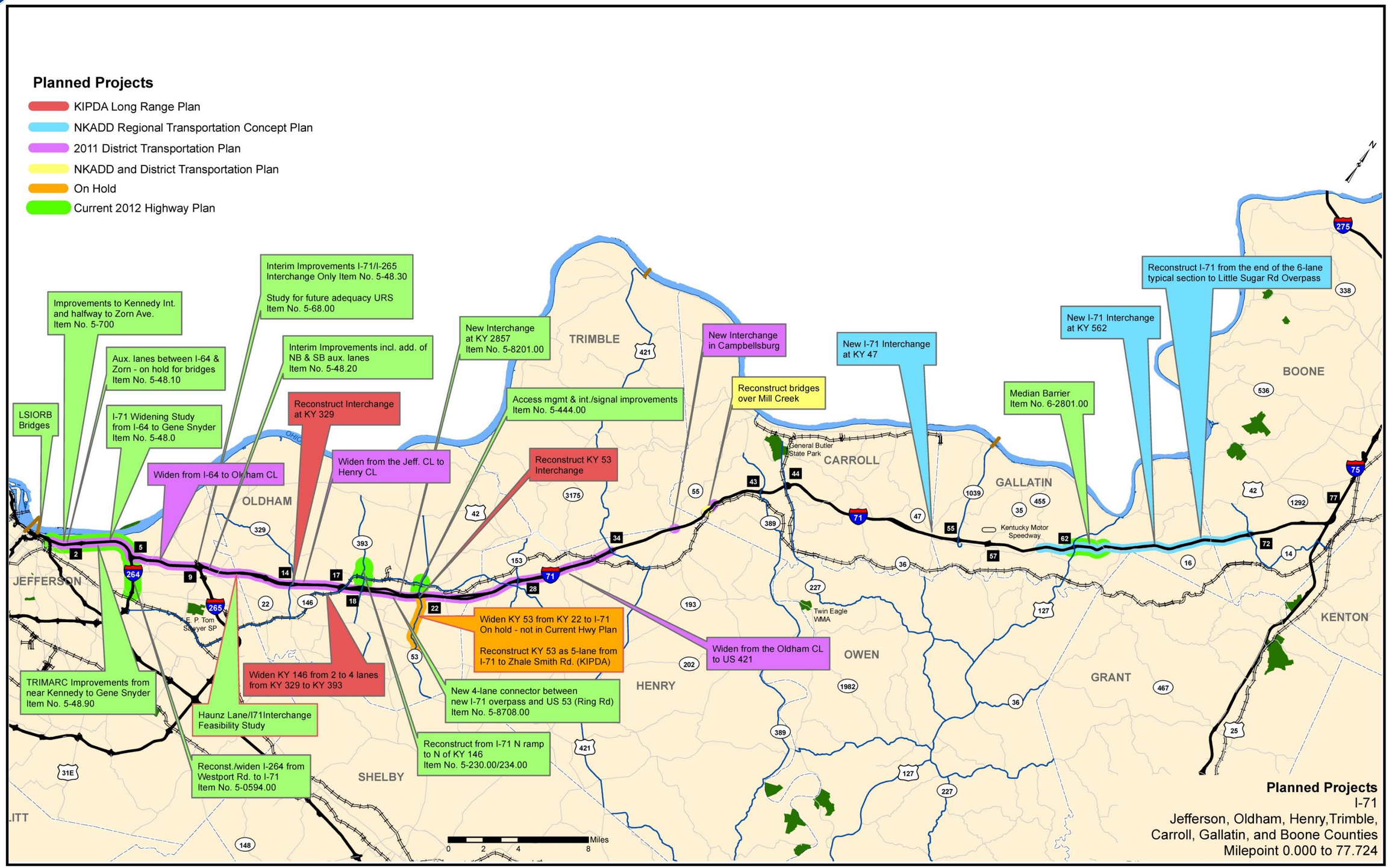


Figure 4: Planned Projects

2.3 PIFS for I-71

The Unscheduled Projects List (UPL) is an internal KYTC maintained database that contains all identified project needs (or phases) that have not yet been programmed through the Six-Year Highway Plan. A Project Identification Form (PIF) is then prepared for every unscheduled project that either would be included on the Unscheduled Projects List (UPL) and/or the KYTC Six-Year Highway Plan. PIF's that have been identified for the I-71 Corridor are summarized in Table 2.

2.4 2011 District Transportation Plan

In the past, the Kentucky Transportation Cabinet (KYTC) has maintained a list known as the Unscheduled Needs List (UNL), which consists of potential projects suggested from the public, Highway Districts, planning and design studies, ADDs, MPOs, local officials, legislators, and various constituents. The Division of Planning has re-evaluated the planning process to analyze and document the engineering component of project identification more thoroughly and to create a Highway District Transportation Plan for each of the Highway Districts. The District Transportation Plan is an internal working document and is not subject to public review or comments. The product of the revised planning process is a ranked list of projects, now titled the Unscheduled Projects List (UPL), recommended for funding in each Highway District.

A process was implemented in 2011 that uses data maintained by KYTC, the District's crash history and traffic data to prioritize the Top 30 projects in each Highway District from the Unscheduled Projects List (UPL). Because of its population size and current transportation needs, a Top 50 UPL was developed for Highway District 5, which includes the Greater Louisville Metropolitan Area. The following projects representing Districts 5 and 6 and their priority rank are shown in Figure 4 (p. 10) and listed from the 2011 District Transportation Plan into the FY 2012 – FY 2018 Highway Plan.

- Rank #3— Widen I-71 from I-64 to the Jefferson/Oldham County line to improve congestion, reduce crashes and improve geometrics.
- Rank #4—Widen I-71 from Jefferson/Oldham County line to Henry County line to reduce congestion.
- Rank #5—Reconstruct I-71/KY 53 Interchange to improve overall level of service.
- Rank #6—Reconstruct I-71 bridges over Mill Creek.
- Rank #26—Widen I-71 from Oldham/Henry County line to Exit 34 (US 421) to improve congestion.
- Rank #45—New interchange in Campbellsburg area to address congestion and safety issues by creating a bypass for truck traffic.

Table 2: Project Identification Forms (PIFS)

COUNTY	DISTRICT	PIF#	DATE	BMP	EMP	LENGTH	COSTS	DESCRIPTION
Jefferson	5	05 056 A0071 32.0	8/27/2008	9.063	9.163	0.100	$117.8M, $101.7M	Reconstruction of the I-71/I-265 interchange including a possible flyover ramp from I-265 N to I-71 southbound
Oldham	5	05 056 A0071 34.00	1/1/2000, 8/28/2008	11.000	11.100	0.100	$20.7M, $24.0M	New interchange and connector road from KY 1447 to US 42 with Interchange near Jefferson/Oldham Co. Line
Oldham	5	94 982 0071 33.21	11/5/2010	14.480	14.580	0.100	$15.3M, $17.8M	Reconstruct interchange at KY 329
Henry	5	05 052 A0071 24.00	11/3/2011	24.727	33.355	8.628	$154.5M	Improve congestion by widening I-71 from Oldham County Line to Exit 34/US 421
Henry	5	05 052 A0071 10.00	3/1/2006, 12/2/2010	37.183	37.283	0.100	$17.9M, $21.0M	New interchange at KY 55
Carroll	6	06 021 A0071 2.00	1/1/0001, 7/12/2011	39.300	40.000	0.700	$5.6M	Improve safety by replacing two bridges that have a high crash rate and are having maintenance issues
Carroll	6	06 021 A0071 1.00	12/3/2010, 9/1/2007	53.300	53.433	0.133	$35.0M	New Interchange near KY 47
Gallatin	6	06 039 A0071 3.00	9/1/2008, 12/7/2010	59.500	65.500	6.000	$60.0M	Reconstruct I-71 from the end of the 6-lane typical section to Little Sugar Road Overpass
Gallatin	6	06 039 A0071 2.00	9/1/2008	65.500	72.000	6.500	$69.0M	Reconstruct I-71 with additional lanes from Little Sugar Road Overpass to north of KY 14
Gallatin	6	06 039 A0071 1.00	12/7/2010	66.273	66.373	0.100	$30.5M	New Interchange near KY 562
Boone	6	06 008 A0071 2.00	8/1/2006, 8/11/2006	72.000	77.724	5.724	$58.5M	Increased capacity for I-71 along with the need for a pavement rehab and expand ITS system south
Boone	6	06 008 A0071 1.00	1/1/2000	76.630	77.724	1.094	No cost estimate provided	Widen ramp from I-71 northbound to I-71/75 northbound

This plan at the onset of this I-71 study has been updated for 2013 and now the #3 and #4 projects are ranked #1 and #2.

2.5 Metropolitan Transportation Plan, Horizon 2030 (KIPDA)

The *Metropolitan Transportation Plan, Horizon 2030*, is the planning document that reflects all surface transportation investments through the year 2030 in the Louisville (KY-IN) Metropolitan Planning Area (MPA). *Horizon 2030* is a cooperative effort between member governments, the Transportation Technical Coordinating Committee (TTCC), the Transportation Policy Committee (TPC), and the general public. *Horizon 2030* is a project specific plan that is intended to serve as a guide for the development of the region's transportation system. The TPC, as the governing body for the Kentuckiana Regional Planning Development Agency (KIPDA), has the responsibility for providing consideration for the transportation needs and impacts to the region. Each transportation project that is regionally significant and/or utilizes federal transportation funds is identified in the Metropolitan Transportation Plan, providing a vision of how the transportation network will function and appear in the future.

The Transportation Improvement Program (TIP) is a four-year, short-range fiscal programming document representing the first four years of the Metropolitan Transportation Plan. The TIP also contains information about various funding sources and Federal funding requirements. KIPDA is the responsible agency for annually updating the TIP. The TIP indicates which specific projects are scheduled and the funding type. It is the responsibility of the TPC to approve the TIP. The FY 2012 – FY 2017 document was approved by the TPC on July 25, 2013, but is currently undergoing Federal and State review. Those projects identified in the FY 2011 – FY 2015 TIP located in the I-71 Corridor are shown in Figure 4 (p.10) and are listed as follows:

ID #396: Reconstruct interchange at I-71 and KY 329. This project will improve access to I-71 and improve safety. Project costs are estimated at $25.5 million and are estimated to be open to the public in 2025.

ID #952: New interchange and connector road from KY 1447 to US 42 with interchange on I-71 near Jefferson/Oldham County border. This project will provide access to I-71 between I-265 and Crestwood to alleviate congestion on KY 22, US 42 and KY 1694. Estimated costs of project are $22 million and the project was estimated at the time to be open to the public in 2013.

ID #1456: Pavement rehabilitation. This project will mill 2' intermediate overlay on I-71 from MP 0.0 to MP 5.55. Estimated project cost is $2 million and was expected to be complete in 2010.

ID #1463: Interstate Traffic Management (TRIMARC) improvements on I-71 from near the Kennedy interchange (MP 0.00) to the Gene Snyder Freeway (MP 9.80). See KIPDA #133. The project is estimated to cost $7.56 million and is estimated to open to the public in 2015.

ID #1478: Addition of north and southbound auxiliary lanes on I-71 near the Kennedy Interchange, including operational improvements to the Zorn Avenue Interchange. Project length is 1.5 miles. This project will improve access to Kennedy and Zorn Avenue interchanges, reduce congestion and improve safety. Project cost is estimated at $24.5 million and is currently under construction.

ID #1479: Reconstruct I-71/I-264 interchange including the addition of north and southbound auxiliary lanes on I-71 and I-264. This project will reduce congestion and improve safety at I-71/I-264 and I-264/US 42 interchanges. Project length is 2.2 miles. Estimated project cost is $26.6 million and the project is estimated to open in 2014.

ID #1480: Reconstruction of the I-71/I-265 (Gene Snyder Freeway) interchange including a possible flyover ramp from I-265 northbound to I-71 southbound. This project will reduce congestion and is estimated to cost $90 million. The project is estimated to open in 2020.

ID #1760: This project consists of spot improvements and pavement rehabilitation on I-71. The purpose of the project is roadway maintenance. The project is estimated to cost $6 million and was estimated to open in 2010.

ID #133: This project consists of Interstate Traffic Management (TRIMARC) incident management for I-64, I-65, I-71, I-264 (Henry Watterson Expressway) and I-265 (Gene Snyder Freeway) in Jefferson County. The purpose of the project is to manage traffic flow on interstates in Louisville using TRIMARC message boards. The estimated project cost is $109.6 million.

ID #1789: Provide digital message signs (DMS)/cameras on I-265 on either side of I-64 and I-65 interchanges, and on I-71 northbound in Oldham County, as part of the TRIMARC system. This will be part of a larger ITS project in Highway Districts 4, 5, and 6. The estimated cost of the project is $850,000 and was estimated to be open in 2011.

ID #418: Reconstruct KY 53 as a 5-lane (5th lane will be a center turn lane) roadway from I-71 to Zhale Smith Road. This project will improve traffic safety by eliminating substandard vertical and horizontal curves. The estimated cost for the project is $20 million and estimated to open in 2015.

ID #1290: Access management and intersection/signal improvements along KY 53 from I-71 north to downtown LaGrange. This project will provide relief to congestion problems along this portion of KY 53. Frequent access points along the route and multiple access points to certain business locations increase the opportunity for vehicle conflicts. The estimated cost for the project is $1.4 million and was estimated to be open in 2011.

ID #432: Reconstruct KY 329 as a two-lane road (no additional lanes) from I-71 to Jefferson County line. The purpose of this project is to improve road geometry to enhance safety. The estimated cost for the project is $48.7 million and estimated to open in 2025.

ID #147: Relocate and widen KY 393 from 2 to 3 lanes (3rd lane will be a center turn lane) from I-71 to north of KY 146 (LaGrange Road). Reconstruct KY 393 from northern ramp of I-71 to north of KY 146 (stations 10+100 to 12+100). The purpose of this project is to improve safety and reduce congestion by improving roadway geometry and adding a grade separated railroad crossing. Project length is 0.9 miles. The estimated cost is $13.8 million and was estimated to open in 2012.

ID #442: Construct LaGrange Road overpass (4 travel lanes and 1 center turn lane) over I-71 from Business Park Road to New Moody Lane. The purpose of the project is to improve traffic flow. Project length is 0.3 mile. The estimated project cost is $25 million and is estimated to open in 2015.

2.6 2040 Ohio-Kentucky-Indiana Regional Council of Governments (OKI) Plan

Every four years, the Ohio-Kentucky-Indiana Regional Council of Governments (OKI) updates the *OKI 2040 Regional Transportation Plan*. The Plan is the long-range, comprehensive transportation-planning document for the three-state, eight-county Greater Cincinnati region. It defines the goals for transportation in the region, establishes existing and future transportation needs and allocates projected revenue to transportation programs and projects that address those needs. The only project near I-71 or involving I-71 was the following:

Camp Ernst Road Reconstruction/Extension - The project involves reconstruction of the existing County-maintained portion of Camp Ernst Road from KY 237 Pleasant Valley Road to KY 536 Hathaway Road. From there, it would be constructed as a new road to the I-71 interchange at Verona. The purpose of the project is to improve north-south mobility through central and southern Boone County. A four-lane median-divided highway is proposed, with partial control of access and at-grade intersections with major crossing routes – Longbranch Road, KY 536 Hathaway Road, Rice Pike, KY 1292 Beaver Road, and US 42.

3.0 EXISTING CONDITIONS INVENTORY

This section addresses existing transportation conditions including previous work that has been completed for I-71 and a description of existing roadway facilities, including traffic volumes, traffic operations, roadway geometry, structures, pavement, and other identified transportation characteristics. This information will be used to help identify existing deficiencies or substandard roadway elements.

3.1 Recent Maintenance Projects on I-71

In an effort to reduce the number and frequency of crashes and improve overall traffic safety throughout the corridor, KYTC Districts 5 and 6 have recently implemented several safety projects along I-71.

3.1.1 Rehabilitation Projects

Recent or planned rehabilitation projects within the I-71 Corridor include:

- MP 38.808 to MP 53.433 - Rehabilitation in Carroll County (2012)
- MP 53.433 to MP 56.763 - Rehabilitation in Gallatin County (2012)
- MP 27.8 to MP 38.8 (southbound only) – Rehabilitation in Henry County

3.1.2 Cable Guardrail

Median cable guardrails or barrier walls currently exist at a few locations on I-71:

- MP 0.68 to MP 11.42 in Jefferson and Oldham Counties
- MP 56.45 to MP 59.85 in Gallatin County (Jersey barrier wall)
- MP 61.6 to MP 63.5 in Gallatin County

The installation of median cable guardrails at additional locations has either been let recently to contract or is expected to be let to contract in 2013:

- MP 15.0 to MP 17.7 in Oldham County
- MP 59.85 to MP 61.6 in Gallatin County
- MP 63.5 to MP 69.6 in Gallatin County

3.1.3 Signing

The installation of "Slippery When Wet" road signs (W8-5) have been installed near MP 63.0 to MP 64.0 in Gallatin County.

3.1.4 Reflective Guardrail

The installation of reflectors on guardrails has occurred from MP 23.0 to MP 24.5 in Oldham County.

Photo 1: Oversized Curve Warning Signs

3.1.5 High Friction Pavement and Oversized Curve Warning Signs (see Photo 1)

The installation of high friction pavement and oversized curve warning signs at MP 63.0 has been completed in Gallatin County. High Friction Pavement has also been installed at the I-71 SB entrance and exit ramps at I-265 and at the I-71 SB exit to I-264 W (2012).

3.2 Roadway Characteristics

In Jefferson and Oldham Counties, I-71 is functionally classified as a State Primary Urban Interstate to KY 53; the remaining sections of I-71 are considered a Rural Interstate. Within the project study area I-71 links the City of Louisville and eastern Jefferson County to Northern Kentucky/Cincinnati. The entire route is on the National Highway System (NHS) and the National Truck Network (NTN). Table 3 (p. 14-16) summarizes the general existing roadway characteristics as detailed in the KYTC Highway Information System (HIS) database.

3.3 Existing Traffic

I-71 carries between 25,700 and 80,500 vehicles per day (vpd), with the highest volumes found to occur in Jefferson County between I-264 and I-265. Existing traffic data along I-71 and along the crossroads were obtained from the KYTC Division of Planning. Existing KYTC counts were available for the sections of I-71 from I-64 (Exit 0) to KY 53 (Exit 22), KY 35 (Exit 57) to US 127 (Exit 62), and from KY 14 (Exit 72) to I-75 (Exit 77). In order to supplement these counts, additional 48-hour traffic volume/classification counts were collected along I-71 for the sections between:

- KY 53 (Exit 22) and KY 153 (Exit 28)
- KY 153 (Exit 28) and US 421 (Exit 34)
- US 421 (Exit 34) and KY 389 (Exit 43)
- KY 389 (Exit 43) and KY 227 (Exit 44)
- KY 227 (Exit 44) and KY 1039 (Exit 55)
- KY 1039 (Exit 55) and KY 35 (Exit 57); and
- US 127 (Exit 62) and KY 14 (Exit 72)

Twelve-hour turning movement counts were collected at the ramp terminals for the following interchanges:

- KY 329
- KY 146
- KY 153
- US 421
- KY 389
- KY 227
- KY 1039
- US 127
- KY 14

Table 3: I-71 Existing Conditions Inventory

County	Beginning MP	Beginning Feature	Ending MP	Ending Feature	Length (Miles)	Number of Lanes	Median Width (in feet and not including inside shoulder)	Shoulder Width (feet)	Terrain Class	Structural Number of Pavement	2011 ADT (vehicles per day)
Jefferson	0.000	I-64	1.724	Zorn Avenue Overpass	1.724	4	34	L:3, R:10	Flat	5.10	68,800
	1.724	Zorn Avenue Overpass	5.096	I-264 Underpass	3.372	4 or 5	34, >99			5.10	68,100
	5.096	I-264 Underpass	9.063	I-265 Underpass	3.967	4, 5, 6	>99, 54		Rolling	4.80-5.10	79,500
	9.063	I-265 Underpass	11.315	Jefferson-Oldham County Line	2.252	4, 6	54		Flat	4.80	63,100
Oldham	11.315	Jefferson-Oldham County Line	12.724	Entrance to NB Rest Area	1.409	4	93		Rolling		
	12.724	Entrance to NB Rest Area	13.224	Entrance to SB Rest Area	0.500						
	13.224	Entrance to SB Rest Area	14.472	KY 329 Overpass	1.248						
	14.472	KY 329 Overpass	17.478	KY 146 Underpass	3.006		54				59,600
	17.478	KY 146 Underpass	18.494	KY 393 Overpass	1.016		93				51,300
	18.494	KY 393 Overpass	21.828	KY 53 Underpass	3.334						48,400
	21.828	KY 53 Underpass	24.727	Oldham-Henry County Line	2.899		54, 93				37,200
Henry	24.727	Oldham-Henry County Line	27.669	KY 153 Underpass	2.942		52, 93	L: 3,4 R: 10			
	27.669	KY 153 Underpass	33.355	US 421 Underpass	5.686		52, 54, 93				29,200
	33.355	US 421 Underpass	38.086	Henry-Trimble County Line	4.731		54	L: 3, R:10			33,500
Trimble	38.086	Henry-Trimble County Line	38.808	Trimble-Carroll County Line	0.722			L: 4; R: 10			29,900
Carroll	38.808	Trimble-Carroll County Line	42.802	KY 389 Underpass	3.994			L: 3; R: 10		5.00	29,200
	42.802	KY 389 Underpass	44.315	KY 227 Overpass	1.513						33,500
	44.315	KY 227 Overpass	53.433	Carroll-Gallatin County Line	9.118						27,200
Gallatin	53.433	Carroll-Gallatin County Line	54.980	KY 1039 Underpass	1.547			L: 3 R:10			
	54.980	KY 1039 Underpass	56.673	KY 35 Underpass	1.693						29,500
	56.673	KY 35 Underpass	61.774	Gallatin-Boone County Line	5.101	4, 5, 6, 7	31-54	L: 3, 14; R: 10			29,400
	61.774	KY 35 Underpass	69.890	Gallatin-Boone County Line	8.116	4	54	L: 3; R: 10			31,700
Boone	69.890	Gallatin-Boone County Line	72.081	KY 14 Underpass	2.191			L: 3; R: 10			31,700
	72.081	KY 14 Underpass	75.648	Southbound Weigh Station Entrance	3.567						36,700
	75.648	Southbound Weigh Station Entrance	76.630	I-75 Overpass	0.982						
	76.630	I-75 Overpass	77.724	I-75	1.094						

Notes: All data is from KYTC's Highway Information System Database and KTC Crash Lookup Program (2009-2011) unless otherwise noted. All sections (a) are Interstate functional class; (b) a State Primary route in the SPRS; (c) on the National Highway System, the National Truck Network, and the Strategic Highway Network; (d) have a AAA truck weight class; and (e) have 12 foot wide travel lanes. Number of lanes shown includes auxiliary lanes at interchanges.

Table 3: I-71 Existing Conditions Inventory (continued)

County	Beginning MP	Beginning Feature	Ending MP	Ending Feature	Horizontal Curves > 2.5 Degrees (From HIS)	Vertical Grades Between 2.5 and 4.0% (From HIS)	CCRF*	Number of Crashes	Number of Injury Crashes	Percent of Injury Crashes	Number of Fatal Crashes	Percent of Fatal Crashes
Jefferson	0.000	I-64	1.724	Zorn Avenue Overpass	None	None	2.791	472	75	15.9%	0	0.0%
	1.724	Zorn Avenue Overpass	5.096	I-264 Underpass	MP4.6-4.8 (2.6), 4.9-5.2 (6.8)		0.728	236	48	20.3%	0	0.0%
	5.096	I-264 Underpass	9.063	I-265 Underpass		MP 4.71-4.90; 5.15-5.42; 5.58-6.05; 6.89-7.37; 8.35-8.67	0.950	406	70	17.2%	0	0.0%
	9.063	I-265 Underpass	11.315	Jefferson-Oldham County Line	None		0.608	126	26	20.6%	1	0.8%
Oldham	11.315	Jefferson-Oldham County Line	12.724	Entrance to NB Rest Area		None	0.658	81	21	25.9%	1	1.2%
	12.724	Entrance to NB Rest Area	13.224	Entrance to SB Rest Area			0.241	12	2	16.7%	0	0.0%
	13.224	Entrance to SB Rest Area	14.472	KY 329 Overpass			0.757	84	23	27.4%	1	1.2%
	14.472	KY 329 Overpass	17.478	KY 146 Underpass			0.413	100	29	29.0%	1	1.0%
	17.478	KY 146 Underpass	18.494	KY 393 Overpass			0.391	36	5	13.9%	0	0.0%
	18.494	KY 393 Overpass	21.828	KY 53 Underpass		MP 21.04-21.28	0.319	86	19	22.1%	0	0.0%
	21.828	KY 53 Underpass	24.727	Oldham-Henry County Line		MP 22.00-22.44; 22.64-22.90; 23.66-24.50	0.817	70	21	30.0%	1	1.4%
Henry	24.727	Oldham-Henry County Line	27.669	KY 153 Underpass		MP 25.08-26.84	1.033	80	14	17.5%	0	0.0%
	27.669	KY 153 Underpass	33.355	US 421 Underpass		MP 27.66-28.57; 28.79-30.51; 31.75-32.24; 32.49-33.06	0.959	133	28	21.1%	0	0.0%
	33.355	US 421 Underpass	38.086	Henry-Trimble County Line		MP 33.90-35.09; 35-34-35.79; 36.67-36.94; 37.24-38.09	0.478	56	9	16.1%	1	1.8%
Trimble	38.086	Henry-Trimble County Line	38.808	Trimble-Carroll County Line		MP 38.15-38.81	0.136	3	0	0.0%	0	0.0%
Carroll	38.808	Trimble-Carroll County Line	42.802	KY 389 Underpass	MP 39.67-39.83 (2.6); 39.97-40.14 (3.3); 40.58-40.74 (3.1); 40.92-40.98 (3.0)	MP 38.81-39.44; 39.65-39.84	0.637	59	15	25.4%	1	1.7%
	42.802	KY 389 Underpass	44.315	KY 227 Overpass	None	None	0.962	39	5	12.8%	0	0.0%
	44.315	KY 227 Overpass	53.433	Carroll-Gallatin County Line		MP 44.77-45.77; 46.33-49.28; 50.05-50.49; 52.29-53.43	0.638	124	27	21.8%	1	0.8%
Gallatin	53.433	Carroll-Gallatin County Line	54.980	KY 1039 Underpass		MP 53.43-53.46; 53.86-54.26	0.331	14	2	14.3%	0	0.0%
	54.980	KY 1039 Underpass	56.673	KY 35 Underpass		MP 55.80-56.27	0.395	18	2	11.1%	0	0.0%
	56.673	KY 35 Underpass	61.774	Gallatin-Boone County Line	MP 57.57-57.90 (2.6)	MP: 56.73-57.74; 58.49-58.91; 59.39-61.77	0.603	70	14	20.0%	1	1.4%
	61.774	KY 35 Underpass	69.890	Gallatin-Boone County Line	MP 61.76-61.87 (2.6); 61.87-62.03 (3.6); 63.69-64.51 (3.2)	MP: 61.77-63.13; 63.40-65.28; 66.23-67.00; 68.74-69.86	1.001	185	38	20.5%	5	2.7%
Boone	69.890	Gallatin-Boone County Line	72.081	KY 14 Underpass	None	MP 70.08-70.44; 71.04-71.62	1.131	71	13	18.3%	0	0.0%
	72.081	KY 14 Underpass	75.648	Southbound Weigh Station Entrance		MP 73.38-73.61; 73.38-75.65	0.877	85	16	18.8%	1	1.2%
	75.648	Southbound Weigh Station Entrance	76.630	I-75 Overpass		MP 75.65-76.25	0.922	30	4	13.3%	0	0.0%
	76.630	I-75 Overpass	77.724	I-75	MP 76.97-77.27 (3.5); 77.36-77.54 (3.9)	None	0.826	29	9	31.0%	0	0.0%

Notes: All data is from KYTC's Highway Information System Database and KTC Crash Lookup Program (2009-2011) unless otherwise noted. All sections (a) are Interstate functional class; (b) a State Primary route in the SPRS; (c) on the National Highway System, the National Truck Network, and the Strategic Highway Network; (d) have a AAA truck weight class; and (e) have 12 foot wide travel lanes. Number of lanes shown includes auxiliary lanes at interchanges.

Source: Average % of Injury and Fatal Crashes on Interstates http://www.ktc.uky.edu/files/2012/09/KY-Traffic-Collision-Facts-2011.pdf

* Critical Crash Rate Factor: A measure that, when close to or > 1.00, indicates a statistically significant number of crashes

CCRF exceeds or is near 1.0

% of Injury Crashes highlighted cells show sections higher than Interstate average of 17.4%

% of Fatal Crashes highlighted cells show sections higher than Interstate average of 0.47%

Table 3: I-71 Existing Conditions Inventory (continued)

County	Beginning MP	Beginning Feature	Ending MP	Ending Feature	Condition Component of Adequacy Rating	Safety Component of Adequacy Rating	Service Component of Adequacy Rating	Composite Adequacy Rating	Composite Adequacy Rating Percentile
Jefferson	0.000	I-64	1.724	Zorn Avenue Overpass	30	30	16	76	26.5
	1.724	Zorn Avenue Overpass	5.096	I-264 Underpass					
	5.096	I-264 Underpass	9.063	I-265 Underpass	30	30	8	68	14.93
	9.063	I-265 Underpass	11.315	Jefferson-Oldham County Line	30	30	16	76	26.5
Oldham	11.315	Jefferson-Oldham County Line	12.724	Entrance to NB Rest Area	30	30	28	88	62.87
	12.724	Entrance to NB Rest Area	13.224	Entrance to SB Rest Area					
	13.224	Entrance to SB Rest Area	14.472	KY 329 Overpass					
	14.472	KY 329 Overpass	17.478	KY 146 Underpass					
	17.478	KY 146 Underpass	18.494	KY 393 Overpass					
	18.494	KY 393 Overpass	21.828	KY 53 Underpass					
	21.828	KY 53 Underpass	24.727	Oldham-Henry County Line	40	25	29.75	94.75	24.67
Henry	24.727	Oldham-Henry County Line	27.669	KY 153 Underpass	40	25	33.25	98.25	54.45
	27.669	KY 153 Underpass	33.355	US 421 Underpass					
	33.355	US 421 Underpass	38.086	Henry-Trimble County Line					
Trimble	38.086	Henry-Trimble County Line	38.808	Trimble-Carroll County Line	40	25	35	100	100
Carroll	38.808	Trimble-Carroll County Line	42.802	KY 389 Underpass					
	42.802	KY 389 Underpass	44.315	KY 227 Overpass					
	44.315	KY 227 Overpass	53.433	Carroll-Gallatin County Line					
Gallatin	53.433	Carroll-Gallatin County Line	54.980	KY 1039 Underpass					
	54.980	KY 1039 Underpass	56.673	KY 35 Underpass					
	56.673	KY 35 Underpass	61.774	Gallatin-Boone County Line	40	25	33.25	98.25	54.45
	61.774	KY 35 Underpass	69.890	Gallatin-Boone County Line	40	21	33.25	94.25	17.53
Boone	69.890	Gallatin-Boone County Line	72.081	KY 14 Underpass	40	21	29.75	90.75	9.59
	72.081	KY 14 Underpass	75.648	Southbound Weigh Station Entrance					
	75.648	Southbound Weigh Station Entrance	76.630	I-75 Overpass					
	76.630	I-75 Overpass	77.724	I-75					

Notes: All data is from KYTC's Highway Information System Database and KTC Crash Lookup Program (2009-2011) unless otherwise noted. All sections (a) are Interstate functional class; (b) a State Primary route in the SPRS; (c) on the National Highway System, the National Truck Network, and the Strategic Highway Network; (d) have a AAA truck weight class; and (e) have 12 foot wide travel lanes. Number of lanes shown includes auxiliary lanes at interchanges.

Seasonal adjustment factors were applied to these counts to determine base year (2013) average daily traffic (ADT) volumes (see Figure 5, p. 18). To determine ramp ADT's, the 12-hour counts were extrapolated to 24-hour volumes using functional class hourly percentages from KYTC's 2008 Traffic Forecast Report.

AM and PM periods varied by roadway section and ramp. The worst case scenario peak traffic on the roadway and peak traffic on the ramps were used. Roadway peak hours were found from tube counts and ramp peak hours were found from our 12-hour turning movements. The peak hour and a peak hour factor were also used in analyzing the worst 15 minutes of the peak hour. Utilizing the Highway Capacity Software, these counts and the base year 2013 ADTs were used to determine levels of service, volume to capacity ratios, and to measure density to determine which segments of I-71 are operating at capacity.

As expected, traffic volumes are generally higher for the southbound direction travelling toward Louisville during the AM peak hour (see Figure 6, p. 19). For the PM peak hour, existing traffic volumes are higher for the northbound direction from I-64 in downtown Louisville to KY 153 (Exit 28) in Henry County (see Figure 7, p. 20). Between KY 153 and US 421 (Exit 34) the directional travel is split at 50 percent. From US 421 to KY 1039 (Exit 55), traffic volumes are once again higher for the southbound direction. Beyond KY 1039 and continuing to the project study terminus at I-75 (Exit 77) with the exception of the section of I-71 between US 127 (Exit 62) and KY 14 (Exit 72), traffic volumes are higher for the northbound direction.

3.4 Level of Service (LOS) and Volume to Capacity (v/c) Ratios (See Figure 5 page 18)

Level of Service (LOS) is a qualitative measure that is used to describe the operational performance of a roadway. The performance measure upon which the LOS is based on varies depending upon the type of facility. For freeway or interstate facilities, LOS is evaluated based on the density of vehicles in the area of analysis usually measured in terms of passenger cars per mile per lane (pc/mi/ln). In the case of ramp merge and diverge movements, LOS is typically based upon the density of vehicles in the area of the movement considering upstream and downstream ramps. LOS for unsignalized and signalized intersections are measured in delay (seconds per vehicle).

LOS as defined in the "2010 *Highway Capacity Manual (HCM)"* as an index of the quality of flow in terms of factors such as speed, travel time and delay. LOS is expressed in letters ranging from "A" to "F", where each LOS represents a range of operating conditions. LOS A represents the best operating conditions and LOS F represents the worst condition (i.e. severe congestion). For the figures and tables developed for this study, a red shading was used to illustrate LOS F. LOS E corresponds to the capacity of the facility, specific movement or intersection operation. A yellow shading was used to indicate areas that were operating at LOS E. In rural areas, LOS C is usually desirable because it ensures a comfortable and an acceptable quality of service to facility users. LOS D is generally considered the minimum acceptable LOS in urban areas (as shown in Table 5, p. 21). The LOS criteria used to evaluate interstate or freeway facilities, merge and diverge movements, and signalized and unsignalized intersections are shown in Table 4.

The volume to capacity (v/c) ratio is another measure that reflects mobility and quality of travel of a facility or a section of a facility. The v/c ratio compares traffic volumes with the available capacity of the roadway. For example, a v/c of 1.00 typically indicates the roadway is operating at its capacity. The KYTC recommends a targeted v/c ratio of 1.0 in urban areas and 0.90 in rural areas based on design hour volumes and has adopted a related design policy memorandum (03-11) dated November 2, 2011 regarding the traffic analysis of multi-lane freeways **(see Appendix C).** This policy states that the targeted v/c ratio for freeway and multi-lane segments is 1.0 in urban areas and 0.90 in rural areas.

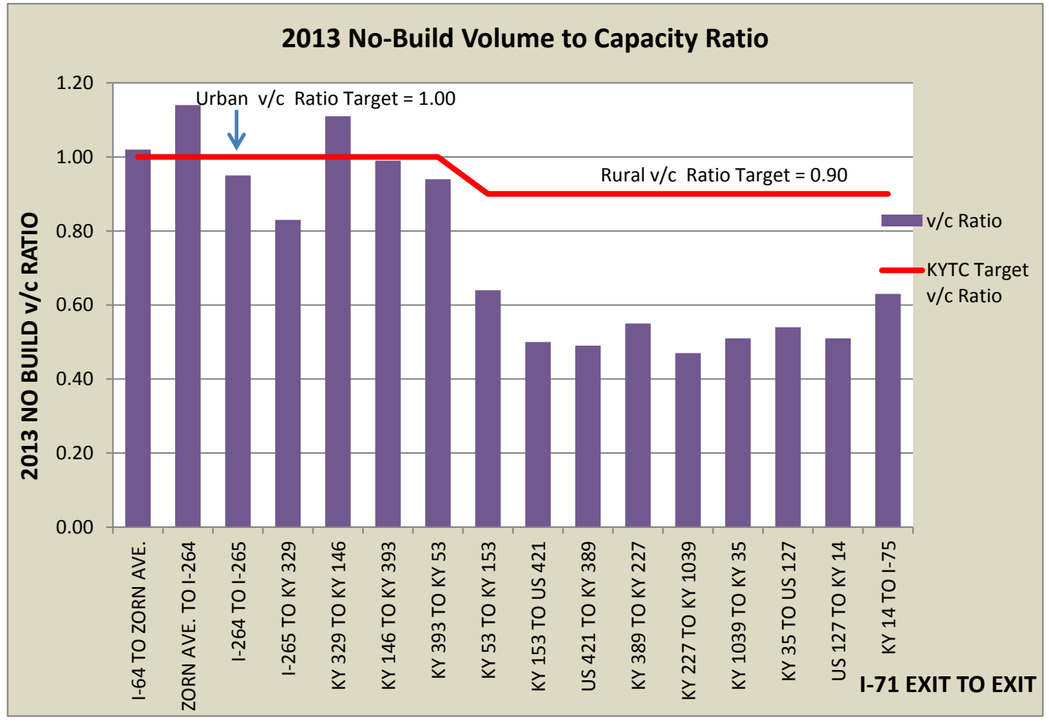
Table 4: LOS Criteria

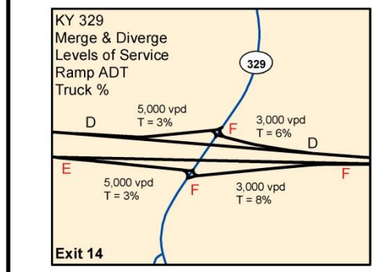
LOS	Freeway	Merge/Diverge	Signalized Intersections	Unsignalized Intersections
	Density (pc/mi/ln)*		Delay (seconds/vehicle)	
A	≤ 11	≤ 10	≤ 10	≤ 10
B	11 to 18	10 to 20	10 to 20	10 to 15
C	18 to 26	20 to 28	20 to 35	15 to 25
D	26 to 35	28 to 35	35 to 55	25 to 35
E	35 to 45	>35	55 to 80	35 to 50
F	Greater than 45	Demand Exceeds Capacity	Greater than 80	Greater than 50

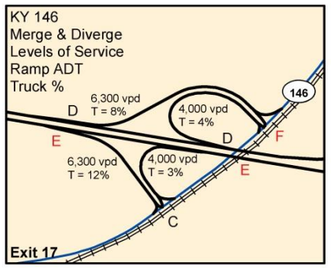
** pc/mi/ln = passenger cars per mile per lane*

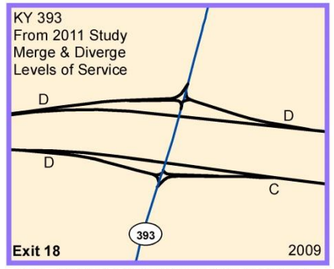
Chart 1 illustrates the 2013 No Build v/c ratio comparison to the targeted KYTC goal. Based on the capacity analysis conducted for 2013 No Build conditions and the KYTC v/c policy targets, the following mainline sections of I-71 (see Figure 5, p. 18) were identified as either currently operating at or near capacity or being severely congested:

Chart 1: 2013 No-Build Volume to Capacity Ratio Comparison

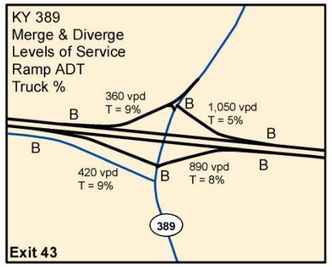


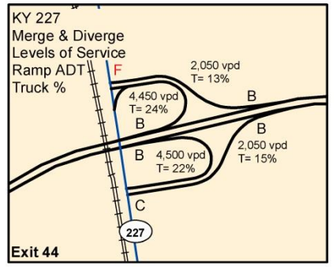


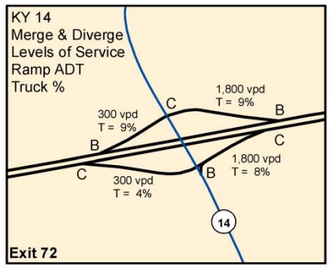


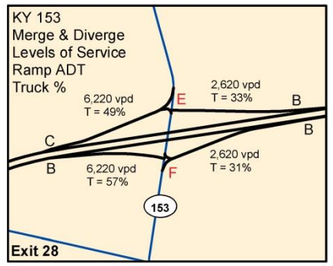


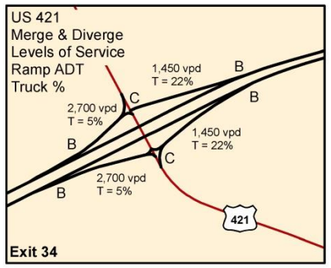
Ramp Terminal LOS were not available in this study.

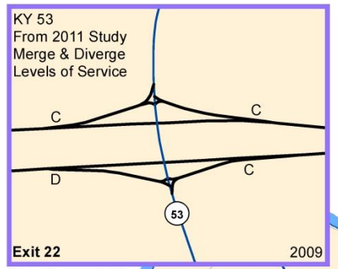




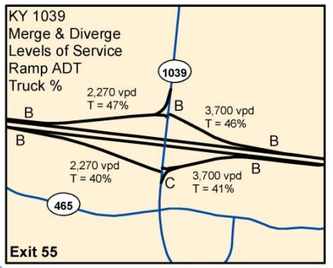








Ramp Terminal LOS were not available in this study.



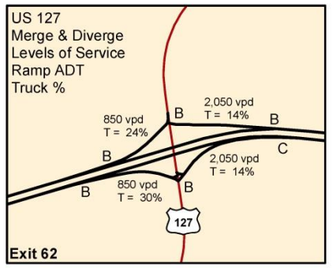


Figure 5: 2013 No-Build ADT Traffic Volumes and Capacity

KY 329
Merge & Diverge
Levels of Service
DDHV
Truck %
Exit 14

KY 146
Merge & Diverge
Levels of Service
DDHV
Truck %
Exit 17

KY 393
From 2011 Study
Merge & Diverge
Levels of Service
DDHV
Exit 18 2009

Ramp Terminal LOS were not available in this study.

KY 389
Merge & Diverge
Levels of Service
DDHV
Truck %
Exit 43

KY 227
Merge & Diverge
Levels of Service
DDHV
Truck %
Exit 44

KY 14
Merge & Diverge
Levels of Service
DDHV
Truck %
Exit 72

KY 153
Merge & Diverge
Levels of Service
DDHV
Truck %
Exit 28

US 421
Merge & Diverge
Levels of Service
DDHV
Truck %
Exit 34

KY 53
From 2011 Study
Merge & Diverge
Levels of Service
DDHV
Exit 22 2009

Ramp Terminal LOS were not available in this study.

KY 1039
Merge & Diverge
Levels of Service
DDHV
Truck %
Exit 55

US 127
Merge & Diverge
Levels of Service
DDHV
Truck %
Exit 62

DDHV 4,060
Truck % 7
LOS F
Density 46.5
v/c 0.95

DDHV 4,550
Truck % 7
LOS F
Density 63.4
v/c 1.07

DDHV 4,010
Truck % 10
LOS E
Density 42.4
v/c 0.95

DDHV 3,340
Truck % 18
LOS D
Density 31.9
v/c 0.83

DDHV 2,440
Truck % 18
LOS C
Density 24.9
v/c 0.70

DDHV 2,170
Truck % 18
LOS C
Density 22.3
v/c 0.62

DDHV 1,980
Truck % 21
LOS C
Density 19.9
v/c 0.59

DDHV 1,790
Truck % 25
LOS C
Density 18.6
v/c 0.56

DDHV 1,320
Truck % 31
LOS B
Density 14.3
v/c 0.44

DDHV 1,200
Truck % 32
LOS B
Density 13.2
v/c 0.40

DDHV 1,240
Truck % 32
LOS B
Density 14.6
v/c 0.42

DDHV 1,100
Truck % 33
LOS B
Density 12.2
v/c 0.37

DDHV 1,170
Truck % 35
LOS B
Density 13.2
v/c 0.40

DDHV 1,310
Truck % 31
LOS B
Density 14.2
v/c 0.44

DDHV 1,250
Truck % 31
LOS B
Density 13.6
v/c 0.42

DDHV 1,510
Truck % 30
LOS B
Density 16.3
v/c 0.50

DDHV 2,680
Truck % 7
LOS C
Density 25.7
v/c 0.63

DDHV 2,620
Truck % 7
LOS C
Density 25.1
v/c 0.61

DDHV 1,860
Truck % 10
LOS B
Density 14.5
v/c 0.44

DDHV 1,520
Truck % 18
LOS B
Density 12.3
v/c 0.38

DDHV 2,320
Truck % 18
LOS C
Density 23.2
v/c 0.67

DDHV 2,060
Truck % 18
LOS C
Density 21.0
v/c 0.59

DDHV 1,890
Truck % 21
LOS C
Density 18.8
v/c 0.56

DDHV 1,380
Truck % 25
LOS B
Density 14.1
v/c 0.43

DDHV 1,160
Truck % 31
LOS B
Density 12.6
v/c 0.39

DDHV 1,070
Truck % 32
LOS B
Density 11.7
v/c 0.22

DDHV 1,220
Truck % 32
LOS B
Density 14.3
v/c 0.41

DDHV 800
Truck % 33
LOS A
Density 8.9
v/c 0.27

DDHV 1,060
Truck % 35
LOS B
Density 12.0
v/c 0.37

DDHV 1,250
Truck % 31
LOS B
Density 13.6
v/c 0.42

DDHV 1,130
Truck % 31
LOS B
Density 12.3
v/c 0.38

DDHV 1,430
Truck % 30
LOS B
Density 15.4
v/c 0.47

OHIO RIVER
OLDHAM
JEFFERSON
HENRY
CARROLL
GALLATIN
OWEN
GRANT
BOONE
KENTON
General Butler State Park
Kentucky Motor Speedway
Twin Eagle WMA

Note: Density is passenger cars/mile/lane
DDHV = Directional Design Hour Volume (vehicles/hour)
vph = Vehicles per Hour
T = Truck %
Miles 0 2 4 8

Mainline Northbound
No Build
LOS F and/or v/c ratio greater than 1.0 in urban/rural areas
LOS E in urban areas and LOS D/E in rural areas

Mainline Southbound
No Build
LOS F and/or v/c ratio greater than 1.0 in urban/rural areas
LOS E in urban areas and LOS D/E in rural areas

Interchange Insets
From Previous Study
LOS Exceeds Acceptable LOS D in Urban Area
Exceeds Acceptable LOS C in Rural Area

AM 2013 No Build
Directional Design Hour Volumes and Capacity
I-71
Jefferson, Oldham, Henry,Trimble,
Carroll, Gallatin, and Boone Counties
Milepoint 0.000 to 77.724

Figure 6: AM 2013 No-Build Directional Design Hour Volumes and Capacity

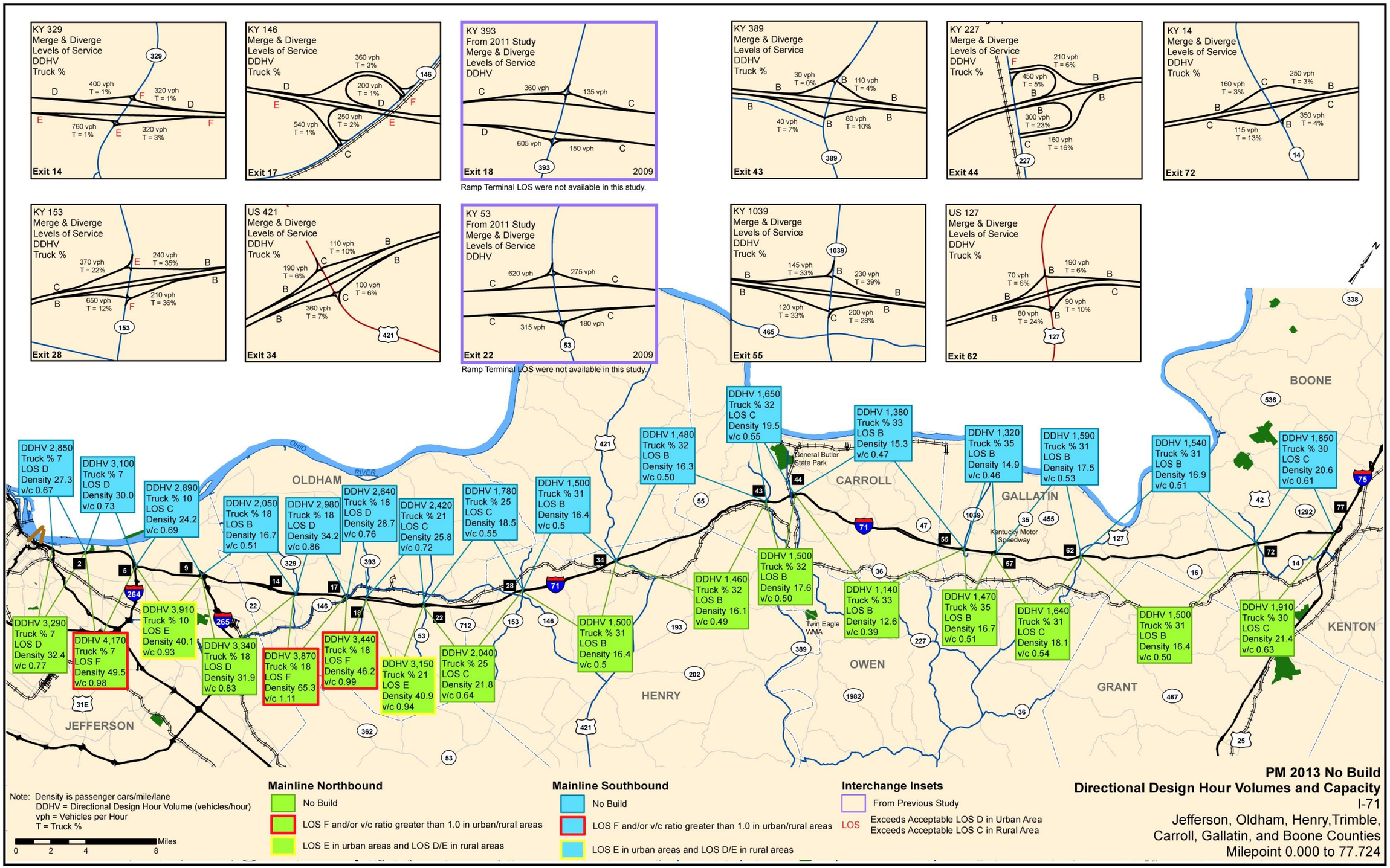


Figure 7: PM 2013 No-Build Directional Design Hour Volumes and Capacity

Table 5: I-71 Mainline 2013 No-Build Capacity Summary

	Exit 0 to 2 I-64 to Zorn Avenue		Exit 2 to Exit 5 Zorn Avenue to I-264		Exit 5 to Exit 9 I-264 to I-265		Exit 9 to Exit 14 I-265 to KY 329		Exit 14 to Exit 17 KY 329 to KY 146		Exit 17 to Exit 18 KY 146 to KY 393		Exit 18 to Exit 22 KY 393 to KY 53		Exit 22 to Exit 28 KY 53 to KY 153	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
AM DDHV	2680	4060	2620	4550	1860	4010	1520	3340	2320	2440	2060	2170	1890	1980	1380	1790
PM DDHV	3290	2850	4170	3100	3910	2890	3340	2050	3870	2980	3440	2640	3150	2420	2040	1780
Truck %	7	7	7	7	10	10	18	18	18	18	18	18	21	21	25	25
LOS AM	C	F	C	F	B	E	B	D	C	C	C	C	C	C	B	C
AM Density	25.7	46.5	25.1	63.4	14.5	42.4	12.3	31.9	23.2	24.9	21.0	22.3	18.8	19.9	14.1	18.6
AM v/c ratio	0.63	0.95	0.61	1.07	0.44	0.95	0.38	0.83	0.67	0.7	0.59	0.62	0.56	0.59	0.43	0.56
Average passenger car speed (mi/hr)	60.0	50.2	60	41.3	74.9	55.2	75	63.4	70.5	69.2	69.3	68.7	73.4	72.8	75.0	73.5
Free Flow Speed (mi/hr)	60.0	60.0	60.0	60.0	73.9	73.9	73.9	73.9	73.0	73.0	69.6	69.6	73.6	73.6	74.2	74.2
LOS PM	D	D	F	D	E	C	D	B	F	D	F	D	E	C	C	C
PM Density	32.4	27.3	49.5	30	40.1	24.2	31.9	16.7	65.3	34.2	46.2	28.7	40.9	25.8	21.8	18.5
PM v/c ratio	0.77	0.67	0.98	0.73	0.93	0.69	0.83	0.51	1.11	0.86	0.99	0.76	0.94	0.72	0.64	0.55
Average passenger car speed (mi/hr)	58.5	60.0	48.4	59.4	56.8	69.8	63.4	74.4	41.8	61.5	52.5	64.9	56.3	68.5	71.6	73.6
Free Flow Speed (mi/hr)	60.0	60.0	60.0	60.0	73.9	73.9	73.9	73.9	73.0	73.0	69.6	69.6	73.6	73.6	74.2	74.2

	Exit 28 to Exit 34 KY 153 to US 421		Exit 34 to Exit 43 US 421 to KY 390		Exit 43 to Exit 44 KY 389 to KY 227		Exit 44 to Exit 55 KY 227 to KY 1039		Exit 55 to Exit 57 KY 1039 to KY 35		Exit 57 to Exit 62 KY 35 to US 127		Exit 62 to Exit 72 US 127 to KY 14		Exit 72 to Exit 77 KY 14 to I-75	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
AM DDHV	1160	1320	1070	1200	1220	1240	800	1100	1060	1170	1250	1310	1130	1250	1430	1510
PM DDHV	1500	1500	1460	1480	1500	1650	1140	1380	1470	1320	1640	1590	1500	1540	1910	1850
Truck %	31	31	32	32	32	32	33	33	35	35	31	31	31	31	30	30
LOS AM	B	B	B	B	B	B	A	B	B	B	B	B	B	B	B	B
AM Density	12.6	14.3	11.7	13.2	14.3	14.6	8.9	12.2	12.0	13.2	13.6	14.2	12.3	13.6	15.4	16.3
AM v/c ratio	0.39	0.44	0.22	0.4	0.41	0.42	0.27	0.37	0.37	0.40	0.42	0.44	0.38	0.42	0.47	0.50
Average passenger car speed (mi/hr)	75.0	74.9	75.0	75.0	70.0	70.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	74.7	74.5
Free Flow Speed (mi/hr)	74.2	74.2	74.3	74.2	69.6	69.6	74.6	74.6	73.6	73.6	73.9	73.9	74.6	74.6	74.6	74.6
LOS PM	B	B	B	B	B	C	B	B	B	B	C	B	B	B	C	C
PM Density	16.4	16.4	16.1	16.3	17.6	19.5	12.6	15.3	16.7	14.9	18.1	17.5	16.4	16.9	21.4	20.6
PM v/c ratio	0.5	0.5	0.49	0.50	0.50	0.55	0.39	0.47	0.51	0.46	0.54	0.53	0.50	0.51	0.63	0.61
Average passenger car speed (mi/hr)	74.5	74.5	74.6	74.5	70.0	69.7	75.0	74.8	74.3	75.0	73.8	74.0	74.5	74.3	71.8	72.3
Free Flow Speed (mi/hr)	74.2	74.2	74.2	74.2	69.6	69.6	74.6	74.6	73.6	73.6	73.9	73.9	74.6	74.6	74.6	74.6

density = pc/mi/lane
Red shading is LOS F and/or v/c ratio > 1.0 in urban areas or LOS F in rural areas.
Yellow shading is LOS E in urban areas or LOS D/E in rural areas.
**I-71 is the East/West street except for US 421 and KY 14 ramp terminals.

3.4.1 Mainline

I-64 to Zorn Avenue: This section of I-71 from I-64 in downtown Louisville to Zorn Avenue has an ADT of 73,500 vehicles per day (vpd) and has a truck traffic percentage of 7% (5,100 trucks). The measured density is 46.5 pc/mi/ln and this section is currently operating at LOS F with a v/c ratio of 1.02.

I-264 (Watterson Expressway) to I-265 (Gene Snyder Freeway): The section of I-71 between I-264 and I-265 has an ADT of 80,500 vpd and has a truck percentage of 10% (8,100 trucks). The measured density is 42.4 pc/mi/ln and this section is operating at LOS E with an overall v/c ratio of 0.95.

KY 329 to KY 146: This section in Oldham County from KY 329 to KY 146 has an ADT of 48,900 vpd and a truck percentage of 18% (8,800 trucks). The measured density is 65.3 pc/mi/ln and this section is currently operating at LOS F with a v/c ratio of 1.11.

KY 146 to KY 393: This section has an ADT of 51,800 vpd and a truck percentage of 18% (9,300 trucks). The measured density is 46.2 pc/mi/ln and this section is currently operating at LOS F with a v/c ratio of 0.99.

3.4.2 Merge/Diverge Areas

The mainline of I-71 was also evaluated to determine the current operation of vehicles exiting and entering I-71 at interchanges included in this study. Using the criteria in Table 4 (p. 17), the following results were identified. Each movement is depicted in Figure 5 (p. 18) and described in Table 6 (p. 23).

KY 329 – The northbound exit and entrance ramps at the KY 329 interchange are currently operating at LOS E and F, respectively.

KY 146 – The northbound exit and entrance ramps at the KY 146 interchange are operating at LOS E.

KY 393 – Based on the previously cited 2008 Study, the northbound and southbound exit and entrance ramps are operating at LOS E.

3.4.3 Crossroad/Ramp Terminal Intersections

Interchange crossroad ramp terminal intersections included in this study were evaluated in terms of capacity. For those interchanges that were not a part of this study (as shown in Table 1 p. 1), information that was related to capacity was extracted from previous studies and illustrated on Figures 5, 6 and 7 (pp. 18-20). Each intersection and corresponding capacity metrics are shown in Table 6 (p. 23).

KY 329 – The north and south intersections of the I-71 ramp terminals and KY 329 are both currently operating at LOS F. The left turn turns off of both exit ramps operate at LOS F. In addition, there is a large volume traveling KY 329 south in the AM peak (830 vph) to I-71 southbound.

KY 153 – The north intersection of the I-71 ramp terminal and KY 153 is operating at LOS E and the south intersection is operating at LOS F. The northbound left turns are between 200 and 400 vph during the peak hours.

KY 146 – The north intersection of the southbound I-71 exit ramp/northbound I-71 entrance ramp at KY 146 is operating at LOS F. The I-71 northbound lefts are between 400 and 500 vph.

KY 227 – The north intersection of the southbound I-71 exit and entrance ramps at KY 227 is operating at LOS F. The left turns exiting southbound operate at LOS F. The I-71 northbound left turns off of the exit ramps range from 300 and 400 vph during the peak hours.

3.5 Mainline Deficiencies (See Exhibits 1-6, pages 24-29)

Existing road geometrics were evaluated and compared to the "*American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highway and Streets, 2011 (6th edition)*," also referred to as the "*Green Book*," and KYTC standards. The review was based on as-built drawings, pavement rehabilitation plans where available, HIS data and field reviews and observations. A field review of the study corridor was conducted to confirm and supplement information previously obtained and to identify additional areas of concern within the I-71 study corridor. Geometric concerns include interchange spacing, sub-standard horizontal and vertical curvature, roadside safety and clear zones. A cursory structure review was also conducted for each structure as well as a review of access control at interchange crossroads, and a review of crossroads between ramp terminals. Existing deficiencies and/or substandard roadway elements are shown in Exhibits 1-6 (p. 24-29). Tables summarizing deficiencies are located in **Appendices D and E** are summarized on Exhibits 1-6.

3.5.1 Interchange Spacing

In accordance with AASHTO's general rule of thumb for minimum interchange spacing, which is one mile in urban areas and two miles in rural areas (measured crossroad to crossroad), there are no locations along the urban sections of I-71 that have interchanges that are located less than one mile apart. Based on a review of the rural interchange spacing requirements, there are two locations along the I-71 Corridor that currently do not meet the recommended minimum spacing rule of thumb of two miles between interchanges:

- Gallatin County between the interchanges of KY 35 (MP 56.673) and KY 1039 (MP 54.980) near Sparta. The distance between these two interchanges is approximately 1.7 miles.
- Between the interchanges of KY 227 (MP 44.315) and KY 1389 (MP 42.802) in Carroll County. The distance between these two interchanges is approximately 1.5 miles.

Although these two locations do not currently meet AASHTO interchange spacing requirements, the *Green Book* recommended minimum spacing for ramp terminals are met: in both instances the distance between the entrance ramp to the adjacent interchange exit ramp at each of these locations is greater than 1,600 feet and the distance from exit ramp to adjacent interchange exit ramp is greater than 1,000 feet. The full table is located in **Appendix D.**

3.5.2 Horizontal Alignment

The horizontal alignment of a roadway has a direct influence on traffic operation and safety within the corridor and is directly related to the design speed of the roadway. The horizontal alignment includes elements such as the superelevation, curvature and sight distance. The complete inventory of the horizontal alignment of I-71 is shown in **Appendix E**.

3.5.2.1 Shoulders

For the majority of I-71, the inside paved shoulder width is 3 feet and the outside paved shoulder width is 10-feet. The inside paved shoulder width for a short section of I-71 near KY 35 is 14 feet and the outside shoulder paved width for a short section of I-71 in the vicinity of I-264 is 4 feet. *A Policy on Design Standards - Interstate System, January 2005*, recommends a paved width of 12 feet should be considered if truck volumes exceed 250 directional design hourly volumes (DDHV). However, recent interstate pavement rehabilitation projects that have been let to construction have used 10-foot paved shoulders for sections with truck volumes that exceed the 250 DDHV value.

Table 6: 2013 No-Build Ramp and Ramp Terminal Capacity Summary

	EXIT 9 to Exit 14 I 265 to KY 329				Exit 14 - Exit 17 KY 329 to KY 146				Exit 22 to Exit 28 KY 53 to KY 153				Exit 28 to Exit 34 KY 153 to US 421			
RAMPS	**KY 329 Ramps**				**KY 146 Ramps**				**KY 153 Ramps**				**US 421 Ramps**			
	NB		**SB**		**NB**		**SB**		**NB**		**SB**		**NB**		**SB**	
	LOS	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**
Merge AM	C	26.2	D	32.1	23.8	C	C	26.9	14.5	B	C	22.2	13.3	B	B	16.3
Merge PM	F	43.2	D	34.2	38.7	E	D	33.3	18.5	B	C	21.6	17.5	B	B	18.8
Diverge AM	C	25.0	C	23.8	22.2	C	B	19.8	12.6	B	B	13.6	11.9	B	B	12.9
Diverge PM	E	39.2	D	31.0	39.1	E	D	28.2	16.4	B	B	14.7	13.7	B	B	15.8
RAMP TERMINALS**	**KY 329 Ramp Terminals**				**KY 146 Ramp Terminals**				**KY 153 Ramp Terminals**				**US 421 Ramp Terminals**			
Ramp Terminals	**Queue for KY 329**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for KY 329**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for KY 153**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for KY 421**	**LOS**	**ISSUE**	**Intersection Delay**
NB AM	6	F	EBL	220.1	9	C	EBL	23.2	8	E	EB LR	45.4	0	B	NB L	12.2
NB PM	3	E	EBL	45.0	6	B	EBL	17.8	50	F	EB LR	473.0	1	C	NB L	19.6
SB AM	39	F	WBL	10710.0	38	F	EBL	538.3	1	C	WB L	16.3	1	C	SB L	19.4
SB PM	26	F	WBL	540.3	11	F	EBL	165.5	5	E	WB L	41.3	2	C	SB L	19.3

	Exit 34 to Exit 43 US 421 to KY 389				Exit 43 to Exit 44 KY 389 to KY 227				Exit 44 to Exit 55 KY 227 to KY 1039				Exit 57 to Exit 62 KY 35 to US 127				Exit 62 to Exit 72 US 127 to KY 14			
RAMPS	**KY 389 Ramps**				**KY 227 Ramps**				**KY 1039 Ramps**				**US 127 Ramps**				**KY 14 Ramps**			
	NB		**SB**		**NB**		**SB**		**NB**		**SB**		**NB**		**SB**		**NB**		**SB**	
	LOS	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**
Merge AM	15.1	B	B	14.5	10.5	B	B	14.8	13.2	B	B	14.2	16.6	B	B	14.7	18.2	B	B	15.1
Merge PM	18.3	B	B	17.4	14.2	B	B	18.7	17.2	B	B	17.4	25.5	C	B	17.8	25.9	C	B	18.6
Diverge AM	10.3	B	B	12.6	9.1	A	B	11.0	8.4	A	B	10.4	13.5	B	B	13.9	15.3	B	B	14.4
Diverge PM	15.5	B	B	17.9	13.6	B	B	13.7	12	B	B	12.2	17.8	B	B	16.4	24.6	C	B	18.2
RAMP TERMINALS**	**KY 389 Ramp Terminals**				**KY 227 Ramp Terminals**				**KY 1039 Ramp Terminals**				**US 127 Ramp Terminals**				**KY 14 Ramp Terminals**			
Ramp Terminals	**Queue for KY 389**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for KY 227**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for KY 1039**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for US 127**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for KY 14**	**LOS**	**ISSUE**	**Intersection Delay**
NB AM	0	A	EB LR	9.2	4	C	WB LR	16.9	0,1	A, B	NBT & SBL	9.2, 12.3	0	B	10.4	10.4	0	B	NB LR	11.5
NB PM	0	B	EB LR	10.0	3	C	WB LR	16.0	0,0	B,C	NBT & SBL	11.4, 15.2	0	B	11.2	11.2	0	B	NB LR	12.3
SB AM	0	A	WB LR	9.2	3	D	WB LR	28.0	0	B	WB L	10.9	1	B	10.9	10.9	1	B	SB LR	11.9
SB PM	1	B	WB LR	10.1	12	F	WB LR	154.2	2	B	WB L	10.6	2	B	14.4	14.4	4	C	SB LR	17.9

Density - passenger cars/mile/lane LOS – Level of Service Intersection Delay - seconds/vehicle Queue – number of vehicles in a queue for the cited issue

**I-71 is the East /West Street in the ramp terminal capacity analysis except for US 421 and KY 14 ramp terminals.

Red shading is LOS F in urban/rural areas and Yellow shading is LOS E in urban or LOS D/E in rural areas

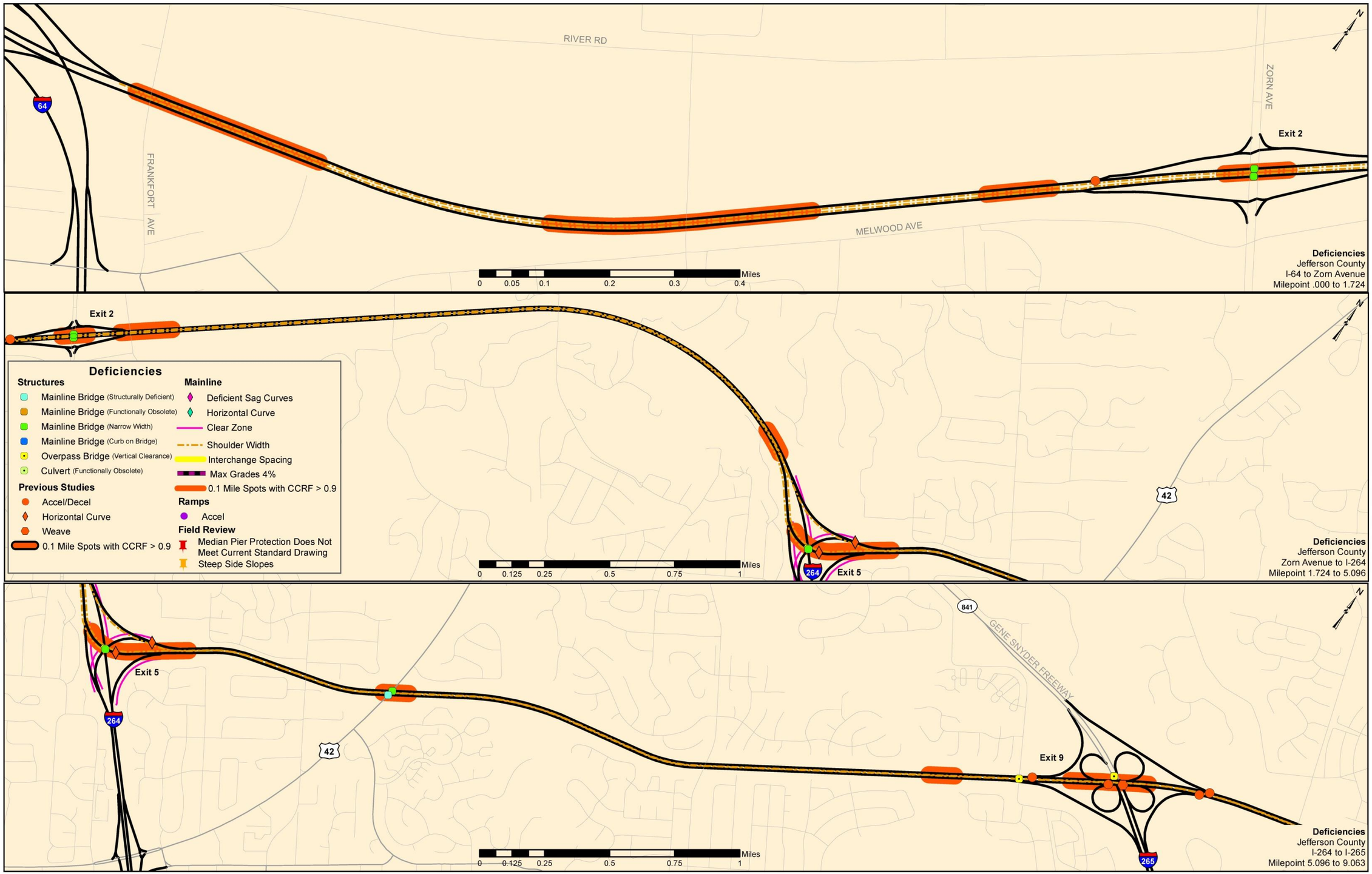


Exhibit 1: Deficiencies I-64 to I-265

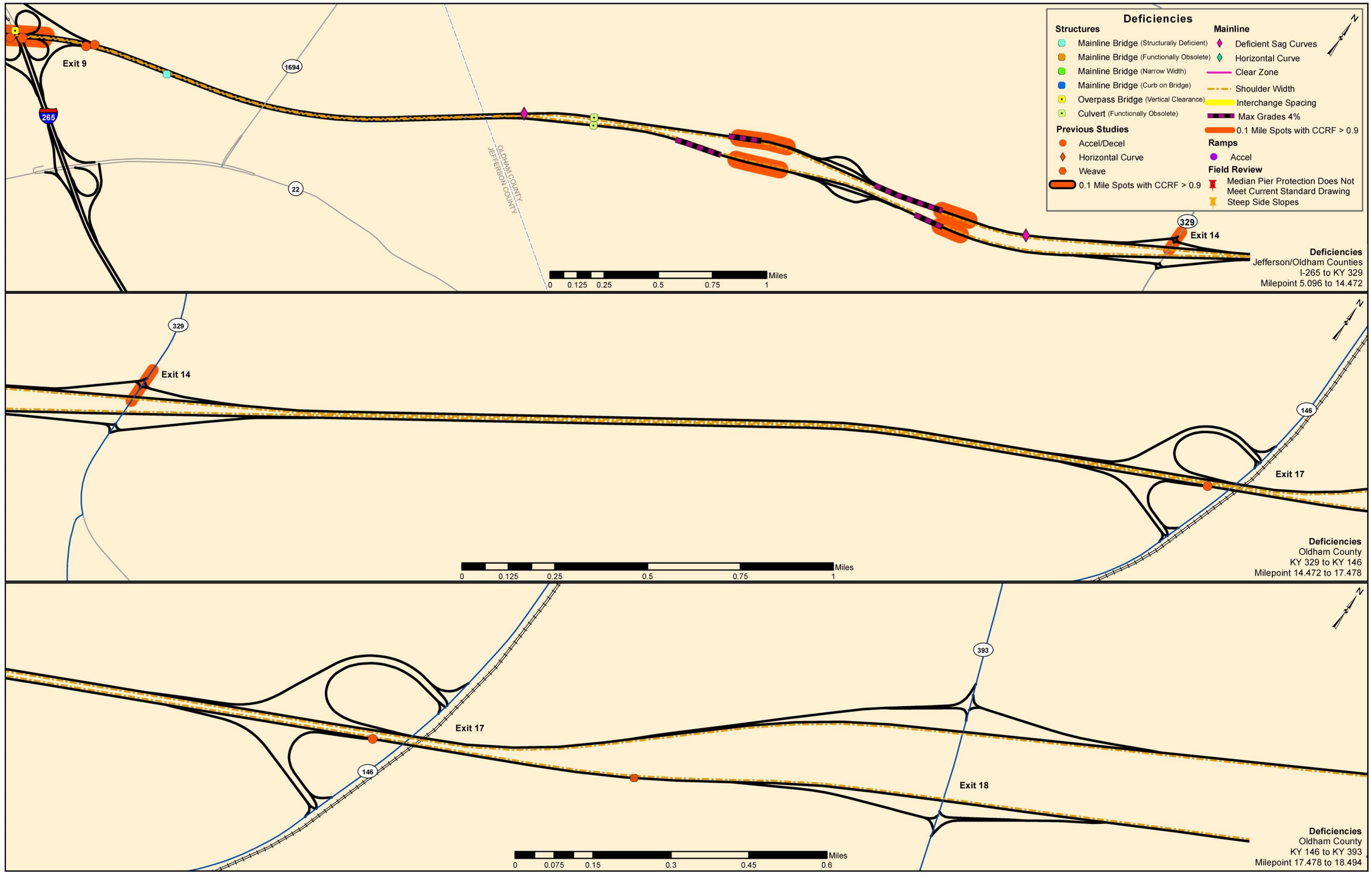


Exhibit 2: Deficiencies I-265 to KY 393

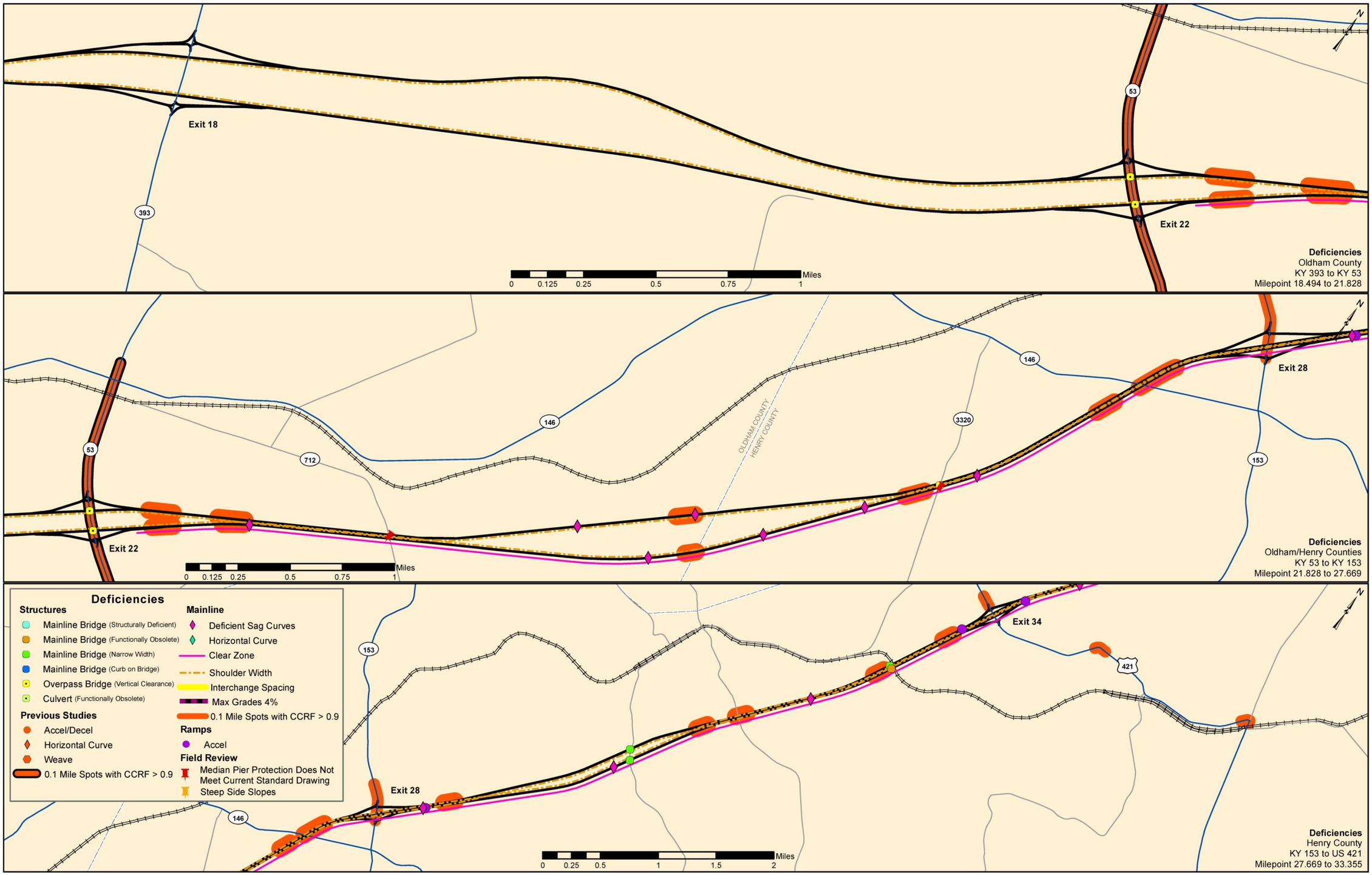


Exhibit 3: Deficiencies KY 393 to US 421

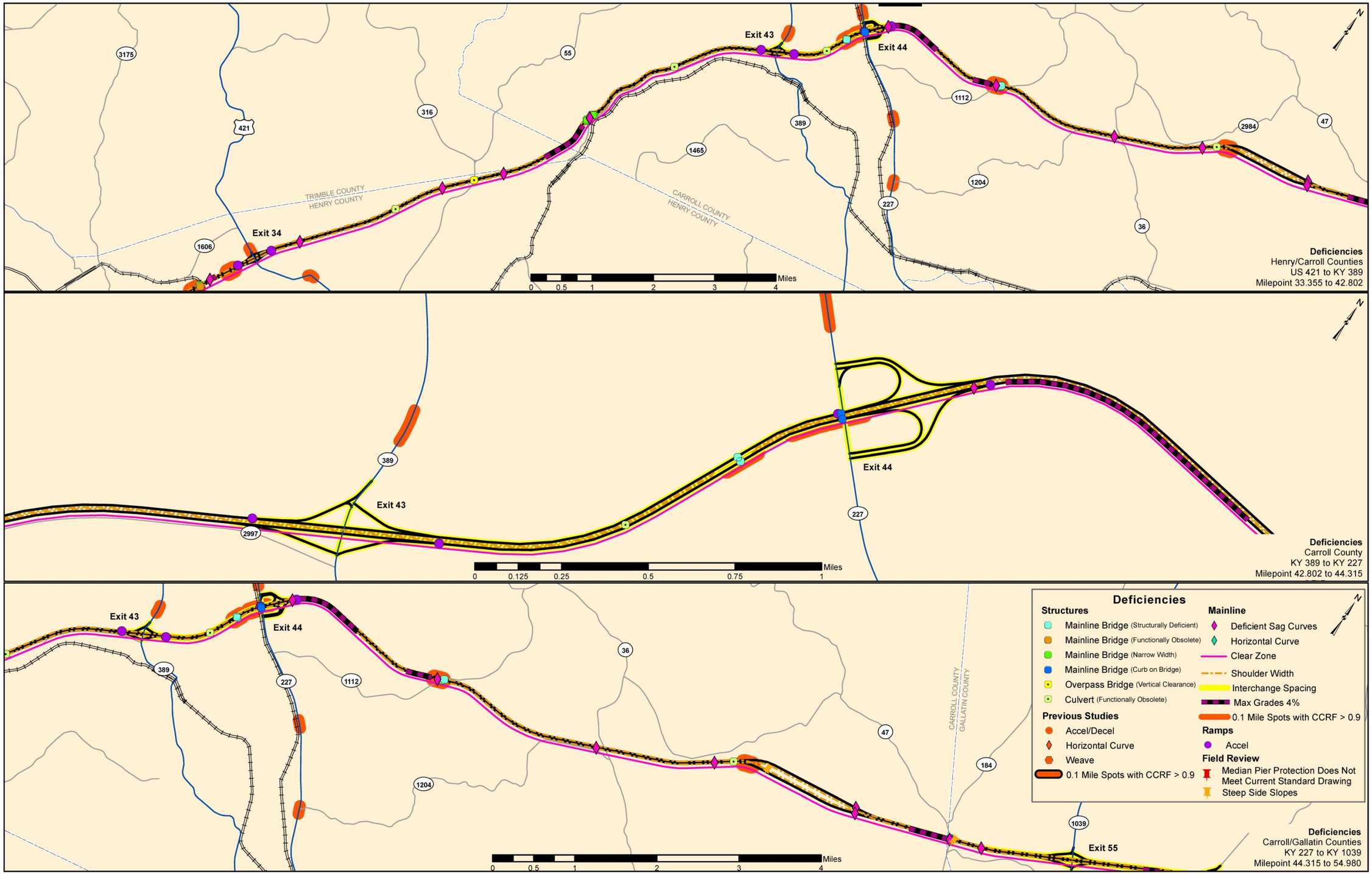


Exhibit 4: Deficiencies US 421 to KY 1039

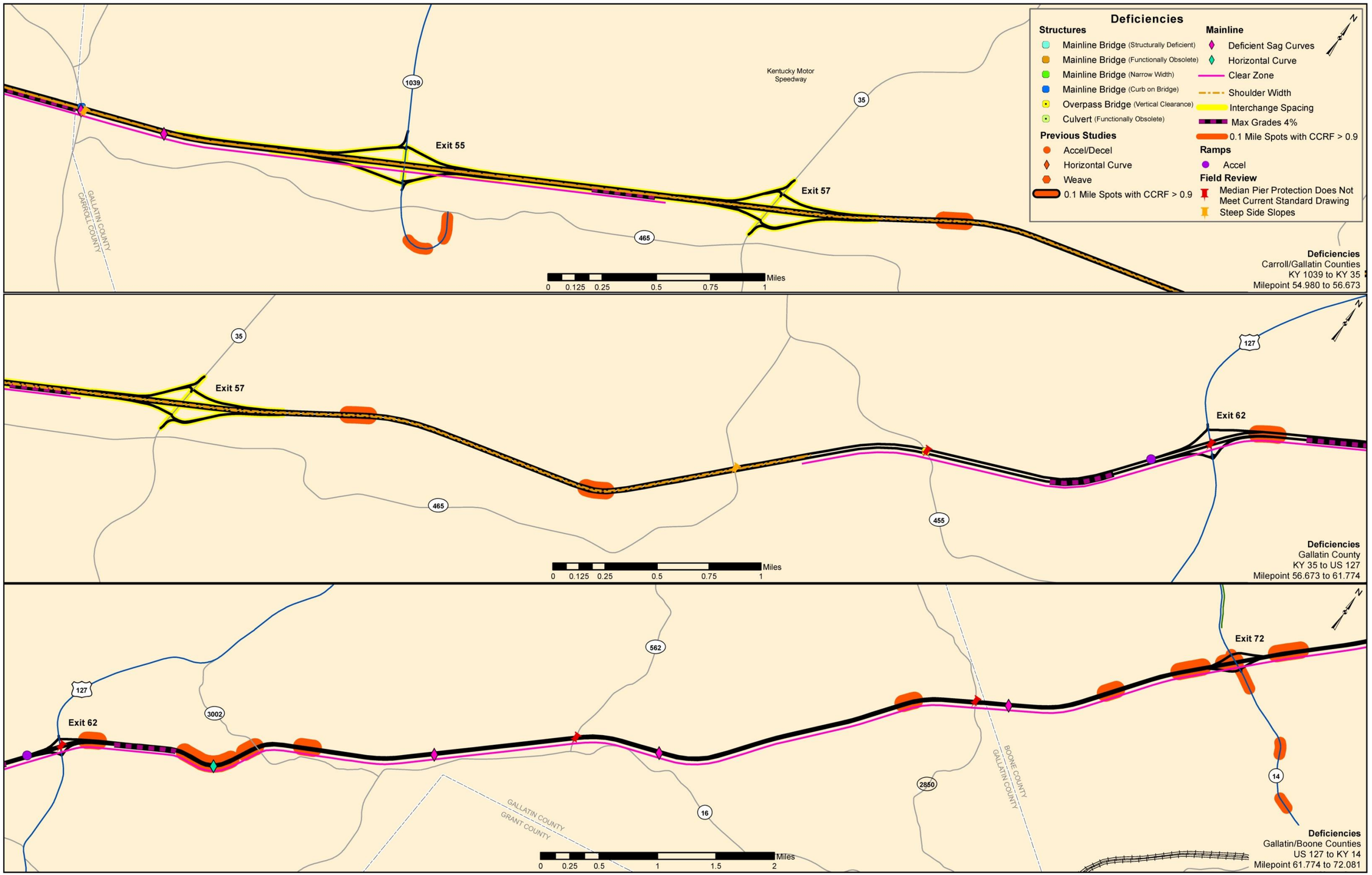


Exhibit 5: Deficiencies KY 1039 to KY 14

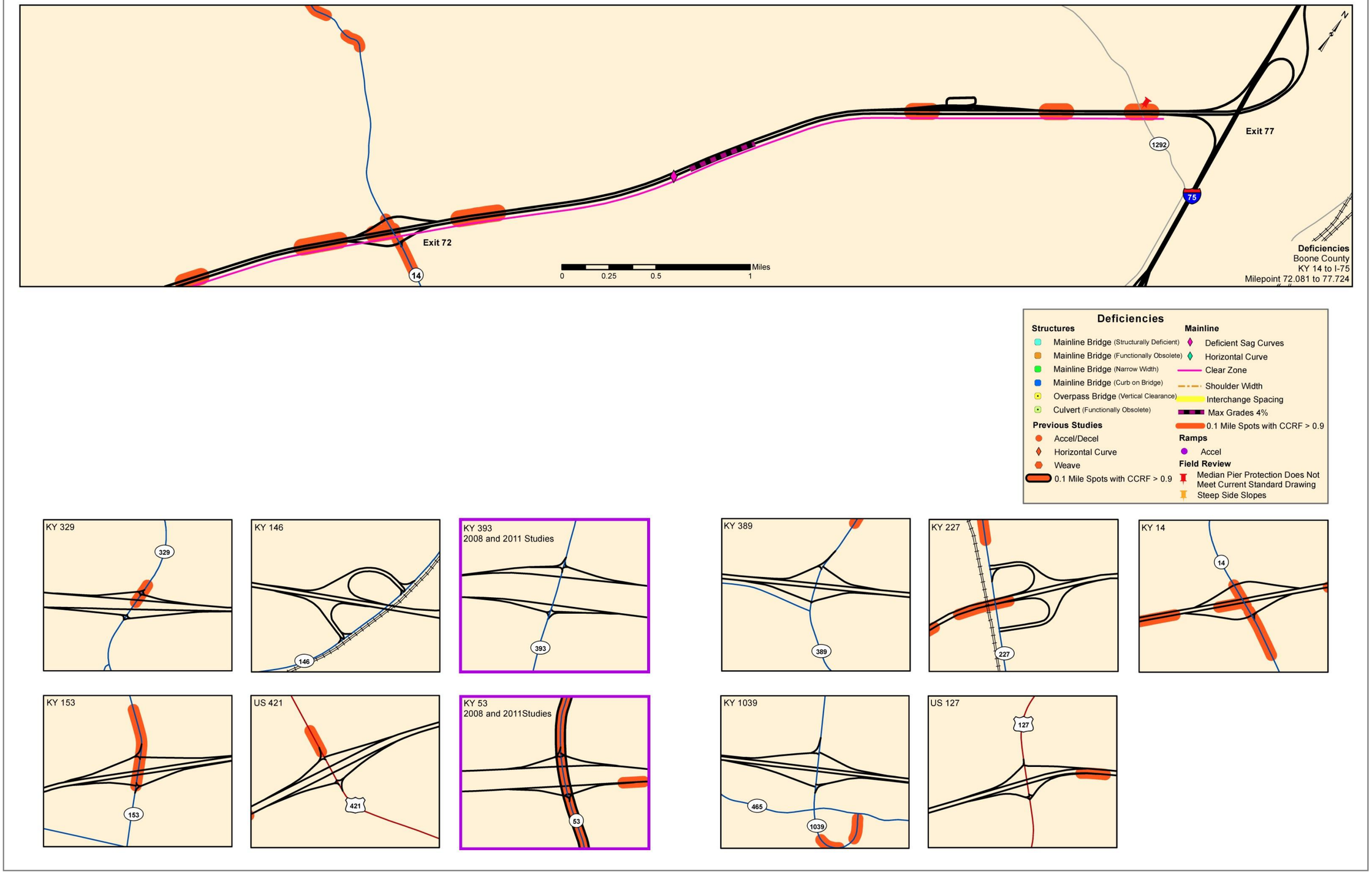


Exhibit 6: Deficiencies KY 14 to I-75

In accordance with the *2011 Roadside Design Guide, 4th Edition,* the recommendation for a clear zone range is 30 to 46 feet for recoverable fill slopes (1V:4H or flatter) on a roadway with a design speed of 70 mph and an average daily traffic (ADT) greater than 6,000 vehicles per day (vpd). For a roadway in a cut section, the clear zone for backslope of 1V:3H or flatter, the width varies from 22 feet to 30 feet. Based on a review of existing plans, the clear zone width from MP 22 near KY 53 in Oldham County to the northern terminus at MP 76.4 in Boone County is less than 30 feet.

3.5.2.2 Curves

Horizontal curves provide a transition between two tangent strips of the roadway, allowing vehicles to negotiate a turn at a gradual rate rather than at a sharp cut. The design of the curve is dependent on the design speed of the roadway, as well as other factors including drainage and friction. Horizontal curves are determined by the radii of the curve. The minimum horizontal radius of the curve is 1,810' for rural areas and 758' for urban areas. One curve along I-71 that does not meet the current criterion is located at approximately MP 63.1. In this case, the radius (1,432 feet) is contained within a spiral curve.

3.5.2.3 Median Width

The median for I-71 is depressed throughout the corridor with the exception near the Kentucky Speedway in Gallatin County. The width varies from 40 feet between I-64 (MP 0.0) and I-264 (MP 4.653) to 60 feet between MP 5.112 to MP 76.893 in Boone County. These widths include the inside paved shoulders. There are locations where the median width varies. One location where the median width varies from 60 feet is located between MP 4.653 and MP 5.112, where the corridor approaches the I-264 (Watterson Expressway) interchange. For the majority of the corridor, the median width for I-71 typically ranges from 40 to 60 feet and therefore meets the recommended minimum median width.

3.5.3 Vertical Alignment

Vertical alignment is the measure of the roadway's change in elevation. The length and steepness of grades can directly affect the operational characteristics. The rate of vertical clearance (K-value) and stopping sight distance are also factors. Recommendations for vertical alignment are based on "*A Policy on Design Standards - Interstate System,* (January 2005) and the *Green Book*, as published by AASHTO.

3.5.3.1 Grades

The interstate policy recommends a maximum grade of 3% for level terrain and 4% for rolling terrain. For I-71, a 4% maximum grade for rolling terrain would apply. Although there are no grades that exceed the maximum grade, there are 18 locations that have 4% grades and are shown on Exhibits 1-6, pages 27-32. Five of those locations have grades that are between 0.5 mile and 1.0 mile in length. There is also one location in Carroll County between milepoints 38.0 and 41.0 where the composite grade is 3.62% for more than two miles in length. When travelling this section of I-71, semi-trucks turn on their flashers to alert motorists to their reduction in speeds.

3.5.3.2 Sags and Crest Curves

There are two types of vertical curves, sag curves and crest curves. Sag curves are used where the change in grade is positive, such as valleys, while crest curves are used when the change in grade is negative, such as hills. The entire I-71 corridor has been rehabilitated at one time or another, with some sections being rehabilitated more recently. Available pavement rehabilitation plans/proposals provided by KYTC were reviewed. Most plans indicated that the rehabilitation projects matched the existing typical sections with little or no major vertical improvements. Therefore, locations where the k value exceeded the minimum coupled with crash data provided indicators of possible issues. Two (2) locations met this criteria. The first is at MP 38.1 to MP 39.2 where three (3) fatalities have occurred in 2012. The second location is between MP 62.8 to MP 64.0, where six 0.1 mile spots have a statistically significant number of crashes.

3.5.4 Steep Side Slopes

A field review revealed that there are three (3) locations where steep side slopes (see photo 2) exist without guardrail protection. These locations include:

- ***MP 59.4 to 59.5 in Gallatin County—***this steep slope is just north of the KY 465 overpass on the northbound side of I-71.
- ***MP 50.9 to 51.1 in Carroll County—***this steep slope is on the northbound side of I-71 near MP 51.0 on the inside median.
- ***MP 53.4 to 53.5 in Carroll County—***this steep slope is on the southbound side of I-71 approximately 1.5 miles south of KY 1039.

Photo 2: Steep Side Slope

3.6 Interchanges

Interchanges represent a critical component of the highway network as they provide a connection to or access to and from intersecting highways and crossroads. The following is a brief description of the interchanges encompassed as a part of this study within the study corridor (see Figure 8 p. 31). Only interchanges that appeared to have a crash issue were evaluated in detail. Those are addressed in Section 4.0 (p. 37).

KY 329 (Exit 14) – This interchange is configured as a conventional diamond interchange with traffic at the ramp terminals being controlled by stop signs.

KY 146 (Exit 17) - This interchange is a partial, two quadrant cloverleaf, commonly referred to a flopped diamond with the northbound and southbound ramp intersections located west of KY 146 and the CSX railroad. The south intersection is controlled by a traffic signal.

KY 153 (Exit 28) – This interchange is located in Henry County and consists of a diamond interchange with traffic on the ramps controlled by stop signs.

US 421 (Exit 34) – The US 421 interchange is located in Henry County and consists of a diamond interchange with traffic at the northbound ramp terminals controlled by a traffic signal. Traffic on the southbound ramp terminals are controlled by a stop sign.

KY 389 (Exit 43) – This interchange is located in Carroll County and consists of a diamond interchange with traffic at the northbound and southbound ramp terminals controlled by stop signs.

KY 329 (Exit 14)
Oldham County

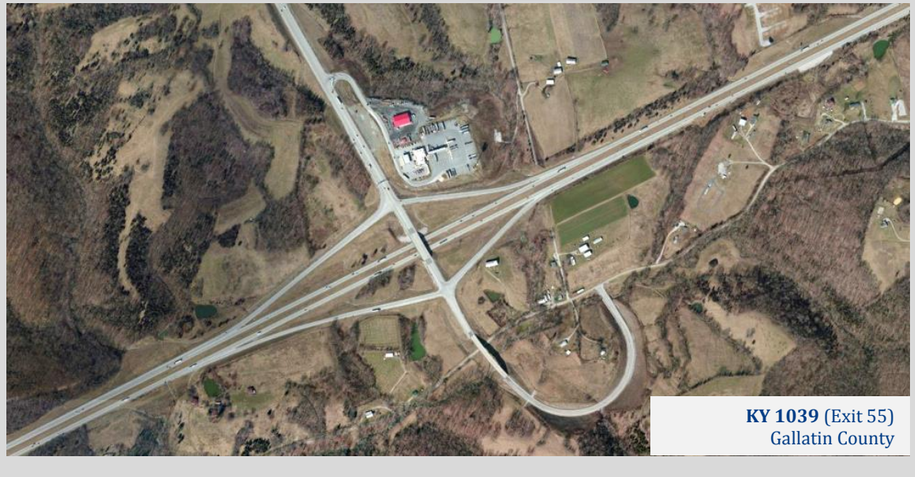
KY 146 (Exit 17)
Oldham County

KY 153 (Exit 28)
Henry County

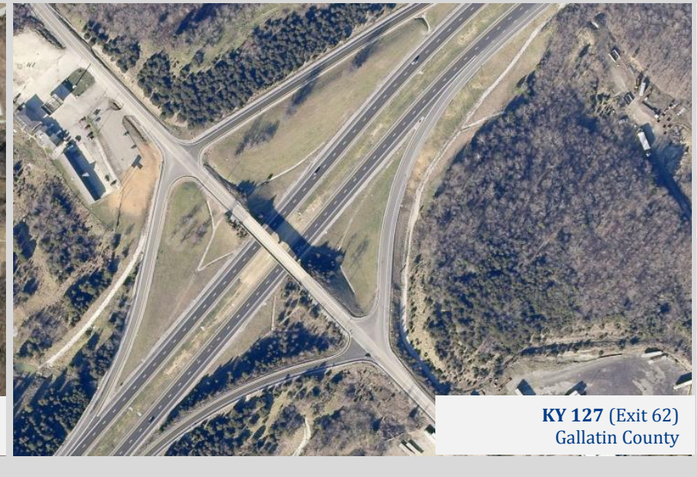
US 421 (Exit 34)
Henry County

KY 389 (Exit 43)
Carroll County

KY 227 (Exit 44)
Carroll County



KY 1039 (Exit 55)
Gallatin County



KY 127 (Exit 62)
Gallatin County

KY 14 (Exit 72)
Boone County

Figure 8: Interchanges in the I-71 Corridor included for this study

KY 227 (Exit 44) - This interchange is a flopped diamond interchange with the northbound and southbound ramp intersections located on the east side of KY 227 and the CSX railroad. Traffic at the ramp terminals is presently controlled by stop signs.

KY 1039 (Exit 55) – This interchange is located in Gallatin County and consists of a diamond interchange with traffic at the ramp terminals controlled by stop signs.

US 127 (Exit 62) – This interchange is located in Gallatin County and consists of a diamond interchange with traffic at the ramp terminals controlled by stop signs.

KY 14 (Exit 72) – This interchange is located in Boone County and consists of a diamond interchange with traffic at the ramp terminals controlled by stop signs.

3.6.1 Acceleration and Deceleration Lengths

Vehicles enter and exit I-71 from the intersecting highways or crossroads using ramps. The point where the mainline and the ramp join together is referred to as a ramp-freeway junction. Vehicles from the ramp enter I-71 and combine with traffic on the mainline to form a merge. Consequently, vehicles from the mainline exit I-71 onto a ramp to diverge. These movements can create delay or safety concerns if adequate distances are not provided for vehicles to perform the movement safely.

The recommended acceleration (merge) and deceleration (diverge) lengths in accordance with minimum *Green Book* standards are 350 feet and 285 feet, respectively for an urban interchange and 580 feet and 340 feet for a rural interchange. The following locations were noted as being deficient and were considered as low cost improvements (Quick Wins):

- KY 153 (Exit 28) in Henry County. The northbound acceleration lane is less than 500 feet.
- US 421 (Exit 34) in Henry County. Both acceleration lanes are less than 435 feet.
- KY 389 (Exit 43) in Carroll County. Both acceleration lanes are less than 455 feet.
- KY 227 (Exit 44) in Carroll County. Both acceleration lanes are less than 460 feet.
- US 127 (Exit 62) in Gallatin County. The southbound acceleration lane is less than 460 feet.

3.6.2 Weaves

In locations where merges are closely followed by a diverge, the traffic to and from the ramps must cross each other and create a movement referred to as a weave. If there is insufficient distance for this movement to occur safely, the weave or weaving segment is considered to be deficient and a cause for concern. There is one area where the weaving area between KY 146 and KY 393 was reported to be deficient according to the *I-71/Proposed Overpass Interchange Feasibility Study, November 2008.*

The *Alternatives Study for I-71/ I-265 Jefferson County, Kentucky KYTC Item Number: 5-68.00 Final Report August 2010* states that the southeastern segment of the Gene Snyder Freeway (I-265) intersects KY 22 very close to the interchange with I-71 (approximately 3,400 feet between centerlines). The interchanges of I-71 and KY 22 with I-265 are so close that they share auxiliary lanes between the ramps and are inadequate for proper weaving. Currently, this system interchange experiences peak hour congestion due to capacity bottlenecks or chokepoints. During the morning peak hour (7 AM –9 AM), the heavy demand from I-265 northbound to I-71 southbound exceeds the capacity of the weaving section between the two loop ramps on I-71. The weaving area between the loop ramps on I-71 is limited to 850 feet.

3.7 Crossroads

The evaluation or analysis of the intersecting crossroads along I-71 is also critical as it is important to assure that these connecting local highways and roads provide adequate capacity to accommodate vehicles entering and exiting the interstate without affecting I-71 or the crossroad in terms of both congestion and safety (see Table 7, p. 33-34). The interchange crossroad geometric conditions were evaluated for deficiencies in detail only when the crossroads exhibited a crash issue between the interchange and the first intersection beyond the ramp terminals. Those locations are discussed in detail in Section 4.0 (p. 37).

3.7.1 Access Control

According to KYTC standards, the measurement for the control of access is typically measured from the end of the ramp termini radius or taper to the centerline of the adjacent commercial or residential access opening. For urban and rural areas, the recommended minimum distance is 100-feet and 300-feet, respectively (see **Appendix F**). As shown in Table 7 (p. 33-34), those areas where the existing distance is less than the recommended value include the following:

- US 421 (Exit 34) in Henry County. For three of the four ramp terminals, northeast, northwest and southwest, the distance from the terminal ramps to the adjacent access opening is less than 300 feet.
- KY 389 (Exit 43) in Carroll County. The distance from the southeast ramp terminal to the adjacent access opening (cemetery) is less than 300 feet.
- KY 227 (Exit 44) in Carroll County. For three of the four ramp terminals, northeast, northwest and southeast, the distance from the terminal ramps to the adjacent access opening is less than 300 feet.
- US 127 (Exit 62) in Gallatin County. For two of the ramp terminals, northeast and southwest, the distance from the terminal ramps to the adjacent access opening is less than 300 feet.
- KY 14 (Exit 72) in Boone County. For two of the ramp terminals, northeast and southeast, the distance from the terminal ramps to the adjacent access opening is less than 300 feet.

3.8 Structures

Structures are a critical element in the consideration of interstate improvement costs. Many of the mainline structures along I-71 greater than 200 feet in length do not carry the full roadway width across the structure. Four (4) mainline structures have plinth curbs with no guardrail protection. In addition many of the overpasses are signed for less than 16 feet of clearance over the shoulder of the road. An inventory of the overpass structures indicate many bridge piers located immediately adjacent to the I-71 outside shoulder in each direction. Therefore, any widening or shoulder improvements planned to eliminate guardrail would require a reconstruction/replacement of the existing overpass structures to carry the desired clear zone.

A preliminary structure evaluation for the I-71 corridor was conducted during the course of this study. Those results along with an inventory of those structures are located in **Appendix G.** If I-71 is widened to six-lanes, there are 11 structures in Jefferson County that will be improved as a part of the Kennedy Interchange reconstruction (LSIORB) project therefore, will most likely not require replacement. One structure will be improved with Item Number 5-48.10 which is nearing final design (Kennedy Interchange to Zorn Avenue Auxiliary lanes). Along I-71 there are at least 25 structures that are Reinforced Concrete Deck Girder bridges (RCDG).

Table 7: I-71 Crossroads Existing Conditions Inventory

I-71 CROSSROADS EXISTING CONDITIONS INVENTORY

GENERAL CROSSROAD INFORMATION																							
County	Route	Beginning MP	Beginning Feature	Ending MP	Ending Feature	Length	Signal (Y/N) Type	Federal System	National Highway Network	State Highway System	Truck Route Network and Truck Weight	Coal Haul System	Extended Weight System	# of Lanes	Lane Width	Shoulder Type	Shoulder Width	Median Type	Median Width	Speed Limit	Traffic Count (ADT)	2038 Traffic	Estimate / Actual (Year)	% Total Trucks	2038 ADT
Oldham	KY 329	5.100	KY 1817	5.100	KY 1817	0.000	Other/No Control	Major Collector	No	State Secondary	No - AAA	No	No	2	10	Combination	2	None	N/A	55	3,796	5,900	Actual (2009)	6.10%	8,800
		5.100	KY 1817	6.100	Old Zaring Road	1.000	Other/No Control													55/35					
		6.100	Old Zaring Road	6.191	Brownsboro Alternate	0.091	Other/No Control													35					
		6.191	Brownsboro Alternate	6.534	Brownsboro Alternate	0.343	Other/No Control										2/8								
		6.534	Brownsboro Alternate	6.894	I-71 Underpass	0.360	No Control (Interchange)								10/11		8/6			55					
		6.894	I-71 Underpass	7.226	KY 329B	0.332	Stop Sign							2/4	11	Paved w/ Bit. Mat.	6				11,370	15,800	Actual (2010)		19,300
Oldham	KY 146	4.363	Glenarm Road	4.363	Glenarm Road	0.000	Other/No Control	Minor Arterial	No	State Secondary	No - AAA	No	No	2	10	Combination/ Curbed	4/ N/A	None	N/A	55	7,857	10,500	Actual (2010)	5.60%	13,500
		4.363	Glenarm Road	4.534	Edds Court	0.171	Other/No Control											None/Raised NM	N/A /16						
		4.534	Edds Court	5.855	I-71 Ramp	1.321	W/ signalization/actuated									Curbed/ Paved w/ Bit. Mat.	N/A /10	Raised Non Mountable	16			17,000			
		5.855	I-71 Ramp	6.047	I-71 Overpass	0.192	No Control (Interchange)																		
		6.047	I-71 Overpass	6.268	Fox Run	0.221	Other/No Control													45	13,842		Actual (2009)		
		6.268	Fox Run	6.414	N. Old Lagrange Road Conn	0.146	Other/No Control									Combination	4	None	N/A					5.40%	22,900
		6.414	N. Old Lagrange Road Conn	6.655	Railroad Crossing	0.241	N/A																		
		6.655	Railroad Crossing	6.829	KY 1817	0.174	Other/No Control																		
		6.829	KY 1817	7.062	Cedar Point Lane	0.233	Other/No Control													45/35					
		7.062	Cedar Point Lane	7.156	Old Lagrange Rd. N	0.094	Other/No Control													35	11,854		Actual (2011)		
		7.156	Old Lagrange Rd. N	7.419	KY 393 North	0.263	W/ signalization/actuated																		
Henry	KY 153	5.521	KY 146	5.521	KY 146	0.000	Stop Sign	Minor Arterial	No	State Secondary	No - AAA	No	No	2	12	Paved w/ Bit. Mat.	8	None	N/A	55	6,887	7,200	Actual (2011)	10.10%	11,800
		5.521	KY 146	5.811	I-71 Overpass	0.290	No Control (Interchange)														6,332	6,600	Actual (2010)		10,800
		5.811	I-71 Overpass	6.108	Wolf Pen West Road	0.297	Other/No Control																		
		6.108	Wolf Pen West Road	6.186	Foxboro Road	0.078	Other/No Control									Stabilized	3								
Henry	US 421	21.542	KY 55	21.542	KY 55	0.000	Other/No Control	Minor Arterial	No	State Primary	No - AAA	No	No	2	10	Combination	4	None	N/A	55	4,894	4,200	Actual (2010)	12.50%	5,400
		21.542	KY 55	22.081	Cardinal Drive	0.539	Other/No Control													55/35					
		22.081	Cardinal Drive	22.161	South Second Street	0.080	Other/No Control													35					
		22.161	South Second Street	22.189	North Second Street	0.028	Other/No Control																		
		22.189	North Second Street	22.294	North/South First Street	0.105	Other/No Control								13										
		22.294	North/South First Street	22.357	Chilton Court	0.063	Other/No Control																		
		22.357	Chilton Court	22.529	KY 997	0.172	Other/No Control																		
		22.529	KY 997	22.604	Bell Ave/Boyer Lane	0.075	Other/No Control																		
		22.604	Bell Ave/Boyer Lane	22.668	Monroe Lane	0.064	Other/No Control																		
		22.668	Monroe Lane	22.883	Randell Drive	0.215	Other/No Control																		
		22.883	Randell Drive	23.050	Lake Road	0.167	Other/No Control																		
		23.050	Lake Road	23.073	Old Carmon Road	0.023	Other/No Control																		
		23.073	Old Carmon Road	23.862	Citation Lane	0.789	Other/No Control													35/55					
		23.862	Citation Lane	24.113	I-71 Overpass	0.251	No Control (Interchange)								12		8								
		24.113	I-71 Overpass	24.486	Carmon Creek Rd/Lea View Ave	0.373	Other/No Control									Paved w/ Bit. Mat.				55	3,777	2,000	2,011	N/A	2,900
		24.486	Carmon Creek Rd/Lea View Ave	24.710	KY 1606	0.224	Other/No Control								10	Combination	3								
Carroll	KY 389	4.280	KY 2997	4.280	KY 2997	0.000	Other/No Control	Major Collector	No	State Secondary	No - AA	No	No	2	9	Combination	2	None	N/A	55	734	1,500	Actual (2010)	3.90%	1,800
		4.280	KY 2997	4.367	I-71 Overpass	0.087	No Control (Interchange)								9/12										
		4.367	I-71 Overpass	4.843	Greens Bottom Road	0.476	Other/No Control														954	1,100			1,300
		4.843	Greens Bottom Road	5.425	Lock No. 1 Road	0.582	Other/No Control								9										
		5.425	Lock No. 1 Road	7.239	KY 55	1.814	Stop Sign																		
Carroll	KY 227	1.686	KY 1204	1.686	KY 1204	0.000	Other/No Control	Minor Arterial	No	State Secondary	Yes (state designated) AAA	No	No	2	12	Combination	12	None	N/A	55	3,741	5,700	Actual (2009)	3.80%	9,400
		1.686	KY 1204	3.652	KY 1112	1.966	Other/No Control											None/Raised NM	18	55/45					
		3.652	KY 1112	4.241	I-71 Underpass	0.589	No Control (Interchange)										10	Raised NM/None							
		4.241	I-71 Underpass	4.670	Old US 227 Road	0.429	Other/No Control									Paved w/ Bit. Mat.									
		4.670	Old US 227 Road	5.060	Floyd Drive	0.390	Other/No Control										6	None	N/A	45	13,239	12,500	Actual (2010)		20,500
		5.060	Floyd Drive	5.180	Mall Road	0.120	W/ signalization/actuated																		
		5.180	Mall Road	5.275	Railroad Crossing	0.095	N/A																		
		5.275	Railroad Crossing	5.380	Old US 227 Road	0.105	Other/No Control								11										
		5.380	Old US 227 Road	5.839	W. Jay Louden Rd/KY 3242	0.459	W/ signalization/actuated									Combination	4/10								
Gallatin	KY 1039	0.000	KY 465	0.000	KY 465	0.000	Stop Sign	Major Collector	No	State Secondary	AAA	No	No	2	12	Paved w/ Bit. Mat.	10	None	N/A	45	292	400	Actual (2011)	6.00%	500
		0.000	KY 465	0.645	I-71 Overpass	0.645	No Control (Interchange)							2/3											
		0.645	I-71 Overpass	1.771	KY 1130/Zalas Run	1.126	Other/No Control							3/4				Flush/None	13 / N/A	45/55	5,985	7,600	Actual (2010)	N/A	11,600
Gallatin	US 127	1.691	KY 455	1.691	KY 455	0.000	Other/No Control	Minor Arterial	No	State Primary	No - AAA	No	No	2	10	Paved w/ Bit. Mat.	2	None	N/A	55	3,643	3,700	Actual (2010)	3.80%	4,700
		1.691	KY 455	2.644	I-71 Overpass	0.953	No Control (Interchange)								10/11	Combination	8								
		2.644	I-71 Overpass	3.207	Old US 127	0.563	Other/No Control	Major Collector	No	State Secondary					11						1,818	2,600		10.60%	3,300
		3.207	Old US 127	3.986	Spencer Road	0.779	Other/No Control								11/10	Paved w/ Bit. Mat.	1								
		3.986	Spencer Road	4.417	KY 3002	0.431	Other/No Control								10										
Boone	KY 14	0.000	US 42	0.000	US 42	0.000	Stop Sign	Rural Major Collector	No	State Secondary	No - A	No	No	2	9	Combination	2	None	N/A	55	2,455	2,600	Actual (2011)	20.80%	3,200
		0.000	US 42	1.186	Carr Road	1.186	Other/No Control																		
		1.186	Carr Road	1.846	Brown Road	0.660	Other/No Control										2/10								
		1.846	Brown Road	2.045	Poole Road	0.199	Other/No Control								12		10								
		2.045	Poole Road	2.180	I-71 Overpass	0.135	No Control (Interchange)																		
		2.180	I-71 Overpass	3.028	Inverness Drive	0.848	Other/No Control								12/9		10/4			55/45					
		3.028	Inverness Drive	3.472	Rosenstiel Road	0.444	Other/No Control													45	3,425	4,200	Actual (2012)		6,600
		3.472	Rosenstiel Road	3.482	Porter Road	0.010	Other/No Control								9		4								
		3.482	Porter Road	3.982	KY 16/KY 491	0.500	Stop Sign													45/35					

General Crossroad Information Data was extracted from KYTC's Highway Information System database unless otherwise noted.

Table 7: I-71 Crossroads Existing Conditions Inventory (continued)

I-71 CROSSROADS EXISTING CONDITIONS INVENTORY (continued)

GENERAL CROSSROAD INFORMATION							ROUTE SEGMENT CRASH DATA												CROSSROAD CRASHES (0.1 mile Spots CCRF>1)			ACCESS CONTROL BETWEEN I-71 RAMP TERMINALS			
County	Route	Beginning MP	Beginning Feature	Ending MP	Ending Feature	Length	Number of Crashes	Number of Darkness Crashes	Number of Run-off-Road Crashes	Number of Fatal Crashes	Number killed	Number of Injury Crashes	Number Injured	ADT	Actual Crash Rate	Critical Crash Rate	Road Type	Crash Query	Segment CCRF	Begin MP	End MP	0.1 mile spot CCRF>1	NE	NW	SE	SW
Oldham	KY 329	5.100	KY 1817	5.100	KY 1817	0.000	38	6	10	0	0	5	7	7,833	208.385	748.764	Urban 4-Lane Undivided	All	0.278	6.312 6.788	6.412 6.888	1.25 1.56	70	550	340	685
		5.100	KY 1817	6.100	Old Zaring Road	1.000																				
		6.100	Old Zaring Road	6.191	Brownsboro Alternate	0.091																				
		6.191	Brownsboro Alternate	6.534	Brownsboro Alternate	0.343																				
		6.534	Brownsboro Alternate	6.894	I-71 Underpass	0.360																				
		6.894	I-71 Underpass	7.226	KY 329B	0.332																				
Oldham	KY 146	4.363	Glenarm Road	4.363	Glenarm Road	0.000	85	15	17	0	0	15	20	11,399	222.840	272.551	Rural 2-Lane	All	0.818	7.091 7.299 7.406	7.191 7.399 7.506	1.30 1.82 1.16			550(off) 400 (on)	130(on) 560(off)
		4.363	Glenarm Road	4.534	Edds Court	0.171																				
		4.534	Edds Court	5.855	I-71 Ramp	1.321																				
		5.855	I-71 Ramp	6.047	I-71 Overpass	0.192																				
		6.047	I-71 Overpass	6.268	Fox Run	0.221																				
		6.268	Fox Run	6.414	N. Old Lagrange Road Conn	0.146																				
		6.414	N. Old Lagrange Road Conn	6.655	Railroad Crossing	0.241																				
		6.655	Railroad Crossing	6.829	KY 1817	0.174																				
		6.829	KY 1817	7.062	Cedar Point Lane	0.233																				
		7.062	Cedar Point Lane	7.156	Old Lagrange Rd. N	0.094																				
		7.156	Old Lagrange Rd. N	7.419	KY 393 North	0.263																				
Henry	KY 153	5.521	KY 146	5.521	KY 146	0.000	37	4	2	0	0	3	3	6,851	741.672	388.129	Rural 2-Lane	All	1.911	5.778 5.890 5.999	5.878 5.990 6.099	1.31 1.31 2.45	300	580	305	400
		5.521	KY 146	5.811	I-71 Overpass	0.290																				
		5.811	I-71 Overpass	6.108	Wolf Pen West Road	0.297																				
		6.108	Wolf Pen West Road	6.186	Foxboro Road	0.078																				
Henry	US 421	21.542	KY 55	21.542	KY 55	0.000	37	3	18	0	0	8	11	4,992	213.672	303.441	Rural 2-Lane	All	0.704	21.515 23.021 24.224	21.615 23.121 24.324	2.43 1.07 1.03	150	260	310	160
		21.542	KY 55	22.081	Cardinal Drive	0.539																				
		22.081	Cardinal Drive	22.161	South Second Street	0.080																				
		22.161	South Second Street	22.189	North Second Street	0.028																				
		22.189	North Second Street	22.294	North/South First Street	0.105																				
		22.294	North/South First Street	22.357	Chilton Court	0.063																				
		22.357	Chilton Court	22.529	KY 997	0.172																				
		22.529	KY 997	22.604	Bell Ave/Boyer Lane	0.075																				
		22.604	Bell Ave/Boyer Lane	22.668	Monroe Lane	0.064																				
		22.668	Monroe Lane	22.883	Randell Drive	0.215																				
		22.883	Randell Drive	23.050	Lake Road	0.167																				
		23.050	Lake Road	23.073	Old Carmon Road	0.023																				
		23.073	Old Carmon Road	23.862	Citation Lane	0.789																				
		23.862	Citation Lane	24.113	I-71 Overpass	0.251																				
		24.113	I-71 Overpass	24.486	Carmon Creek Rd/Lea View Ave	0.373																				
		24.486	Carmon Creek Rd/Lea View Ave	24.710	KY 1606	0.224																				
Carroll	KY 389	4.280	KY 2997	4.280	KY 2997	0.000	15	4	6	1	1	2	3	1,083	427.442	424.549	Rural 2-Lane	All	1.007	4.694 6.991	4.794 7.091	0.98 1.46	540	430	60 (cemetery)	980
		4.280	KY 2997	4.367	I-71 Overpass	0.087																				
		4.367	I-71 Overpass	4.843	Greens Bottom Road	0.476																				
		4.843	Greens Bottom Road	5.425	Lock No. 1 Road	0.582																				
		5.425	Lock No. 1 Road	7.239	KY 55	1.814																				
Carroll	KY 227	1.686	KY 1204	1.686	KY 1204	0.000	65	9	6	0	0	13	18	12,305	116.156	261.576	Rural 2-Lane	All	0.444	1.625 2.680 4.508 5.756	1.725 2.780 4.608 5.856	1.07 1.08 1.36 2.05	105	135	-177	305
		1.686	KY 1204	3.652	KY 1112	1.966																				
		3.652	KY 1112	4.241	I-71 Underpass	0.589																				
		4.241	I-71 Underpass	4.670	Old US 227 Road	0.429																				
		4.670	Old US 227 Road	5.060	Floyd Drive	0.390																				
		5.060	Floyd Drive	5.180	Mall Road	0.120																				
		5.180	Mall Road	5.275	Railroad Crossing	0.095																				
		5.275	Railroad Crossing	5.380	Old US 227 Road	0.105																				
		5.380	Old US 227 Road	5.839	W. Jay Louden Rd/KY 3242	0.459																				
Gallatin	KY 1039	0.000	KY 465	0.000	KY 465	0.000	24	3	5	0	0	4	6	7,862	157.423	357.251	Rural 4-Lane Undivided	All	0.441	0.026 0.217	0.126 0.317	1.76 1.68	1130	1100	1130	2250
		0.000	KY 465	0.645	I-71 Overpass	0.645																				
		0.645	I-71 Overpass	1.771	KY 1130/Zalas Run	1.126																				
Gallatin	US 127	1.691	KY 455	1.691	KY 455	0.000	18	4	7	0	0	5	7	3,737	161.375	327.138	Rural 2-Lane	All	0.493				230	795	365	32
		1.691	KY 455	2.644	I-71 Overpass	0.953																				
		2.644	I-71 Overpass	3.207	Old US 127	0.563																				
		3.207	Old US 127	3.986	Spencer Road	0.779																				
		3.986	Spencer Road	4.417	KY 3002	0.431																				
Boone	KY 14	0.000	US 42	0.000	US 42	0.000	66	9	36	1	1	18	26	2,744	551.580	322.971	Rural 2-Lane	All	1.708	0.022 0.718 0.834 1.087 2.131 2.255 2.360 2.992 3.478	0.122 0.818 0.934 1.187 2.231 2.355 2.460 3.092 3.578	1.66 1.99 2.32 1.33 1.40 1.09 1.12 2.55 1.59	92	432	284	389
		0.000	US 42	1.186	Carr Road	1.186																				
		1.186	Carr Road	1.846	Brown Road	0.660																				
		1.846	Brown Road	2.045	Poole Road	0.199																				
		2.045	Poole Road	2.180	I-71 Overpass	0.135																				
		2.180	I-71 Overpass	3.028	Inverness Drive	0.848																				
		3.028	Inverness Drive	3.472	Rosenstiel Road	0.444																				
		3.472	Rosenstiel Road	3.482	Porter Road	0.010																				
		3.482	Porter Road	3.982	KY 16/KY 491	0.500																				

General Crossroad Information Data was extracted from KYTC's Highway Information System database unless otherwise noted.
Route Segment Crash Data was taken from Kentucky Transporation Center's Buildup Program for January 1, 2009 to December 31, 2011
Access Control between I-71 ramp terminals was scaled from aerial photos

Recently, it has also been KYTC standard practice to replace those structures with many interstate widening projects. However, some appear to have the width and clearance necessary for widening and are so noted. There are a number of structurally deficient bridges or bridges with low sufficiency ratings that are recommended for additional evaluation or replacement (see Section 3.8, p. 32). There are also five (5) wagon box culverts that are recommended for replacement if I-71 is widened to six lanes because of the difficulty in maintaining traffic. According to the National Bridge Inventory forms, the remaining culverts have narrow shoulders and should also be considered for replacement. To be conservative, the I-71 widening cost estimates contained within this study include replacement of all structures.

An important criteria used in the evaluation of a roadway bridge structure is its sufficiency rating. The sufficiency rating is a measure of how long the bridge is expected to remain in service. A score of 100 is an entirely sufficient bridge and a score of 0 indicates an entirely deficient bridge. Typically, a structure with a sufficiency rating between 0 and 49.9 are considered eligible for replacement while structures with a rating between 50 and 80 are considered eligible for replacement.

An inventory of the mainline, overpasses and culverts is located in **Appendix G**. It is noted that reinforced concrete deck girders and "haunched" bridges are normally reconstructed in major widening project. Two bridges in Carroll County also appear to have no redundancy built into the structures.

3.8.1 Structurally Deficient

Bridges are considered "structurally deficient" if their significant load carrying elements are determined to be in poor condition due to deterioration of the bridge opening such that road or traffic operations may be interrupted. Structurally deficient is a status used to describe a bridge that has one or more structural defects that require attention. This status does not indicate the severity of the defect but rather that a defect is present. As shown in Table 8 (p.36), there are five (5) locations where mainline structures were identified as structurally deficient. These locations are as follows:

- MP 6.210 This structure is located on I-71 southbound in Jefferson County and crosses US 42.
- MP 9.800 This structure is located on I-71 southbound in Jefferson County and crosses Chamberlain Lane.
- MP 44.000 and 44.020 - both structures located on I-71 in Carroll County and cross the Kentucky River.
- MP 46.920 – This structure is located on I-71 in Carroll County and crosses KY 1112 and Whites Run Creek.

3.8.2 Functionally Obsolete

A "functionally obsolete" bridge is defined as a structure or bridge that does not meet current standards. Examples of functionally obsolete bridges are those that do not have adequate lane widths, shoulder widths, or vertical clearances to accommodate current traffic demand. Also included are bridges that occasionally flood. However, none of the below structures have a known flooding issue. The following structures were identified as being "functionally obsolete."

- MP 5.096 - The structure is located on I-71 northbound in Jefferson County and crosses I-264.
- MP 8.710 – This structure is located on I-71 in Jefferson County and crosses over Springdale Road.
- MP 11.800 – This structure is located on I-71 northbound in Oldham County and crosses the relocation of Moser Road.
- MP 11.830 – This structure is located on I-71 southbound in Oldham County and crosses the relocation of Moser Road.
- MP 32.360 – This structure is located on I-71 northbound in Henry County and crosses the CSX railroad and White Sulfur.
- MP 35.820 – The structure is located on I-71 in Henry County and crosses Jones Road.
- MP 37.193 – This structure is located on I-71 in Henry County and crosses over KY 55.
- MP 43.640 – The structure is located on I-71 in Carroll County and crosses Green Bottom Road.
- MP 50.650 – This structure is located on I-71 in Carroll County and crosses Ghent-Eagle Station Road.

3.8.3 Pier Protection Does Not Meet Current Standards

To reflect changes to standard practices, safety, research and industry changes and improvements, periodic changes to standard drawings are made. A field review revealed there are six (6) locations that do not meet current standards for pier protection for structures (see Photo 3). The safety issue at these locations is the crash protection at these bridge piers were based on previous standards. Some have "mounded fill material" around the pier that now is thought to potentially act as a vault for a vehicle if it is struck; and others are protected by inside shoulder guardrail that is a roadside hazard.

- MP 25.9 - Henry County,
- MP 59.4 - Gallatin County,
- MP 61.8 - Gallatin County,
- MP 66.3 - Gallatin County,
- MP 69.8 - Gallatin County, and
- MP 76.2 - Boone County

Photo 3: Pier protection that does not meet standards

Table 8: I-71 Structures Summary

MP	COUNTY	BRIDGE NUMBER	FEATURES INTERSECTED	FACILITY CARRIED	YEAR BUILT	LENGTH (feet)	ROADWAY WIDTH INCLUDING SHOULDERS (feet)	BRIDGE ROADWAY WIDTH CURB TO CURB (feet)	VERTICAL CLEARANCE TRAVELWAY (feet)	SUFFICIENCY RATING	INSPECTION DATE	DEFICIENCY	TYPE	COMMENTS
6.210	Jefferson	056B00059L	US 42	I-71 SB	1967	269.0	30.0	30.0	22.08	67.0	1/16/2013	Structurally Deficient	Concrete Continuous Tee Beam	Recent deck and barrier improvements but narrow shoulders remain
9.800	Jefferson	056B00062L	CHAMBERLAIN LANE	I-71 SB	1967	124.0	39.0	39.0		84.0	1/11/2013	Structurally Deficient	Concrete Tee Beam	Recent deck and barrier improvements, with full outside shoulders
44.000	Carroll	021B00042L	KENTUCKY RIVER	I-71	1967	769.0	36.1	29.9		49.7	9/7/2011	Structurally Deficient	Steel Continuous Girder and Floorbeam System	church rail and curb no protection, narrow shoulders, WSP Girders rehabbed in 2010
44.020	Carroll	021B00042R	KENTUCKY RIVER	I-71	1967	769.0	36.1	29.9		49.7	10/3/2011	Structurally Deficient	Steel Continuous Girder and Floorbeam System	church rail and curb no protection, narrow shoulders, WSP Girders rehabbed in 2010
46.920	Carroll	021B00036L	KY 1112 & WHITES RUN CRK	I-71	1967	338.9	37.1	29.9		52.0	11/26/2012	Structurally Deficient	Concrete Continuous Tee Beam	church rail curb and no guardrail protection appears to have wider outside shoulder
46.880	Carroll	021B00036R	KY 1112 & WHITES RUN CRK	I-71	1967	338.9	37.1	29.9		69.0	11/26/2012	Not Deficient	Concrete Continuous Tee Beam	rail but guardrail protection
53.460	Gallatin	039B00023L	KY 47	I-71	1967	154.9	38.1	38.1		95.7	7/12/2011	Not Deficient	Concrete Tee Beam	rail curb and no guardrail protection appears to have wider outside shoulder
53.460	Gallatin	039B00023R	KY47	I-71	1967	154.9	38.1	38.1		86.0	7/12/2011	Not Deficient	Concrete Tee Beam	rail curb and no guardrail protection appears to have wider outside shoulder
44.330	Carroll	021B00037L	CSX RR & KY 227	I-71	1967	233.9	37.1	38.1		95.0	11/26/2012	Not Deficient	Concrete Continuous Tee Beam	rail and curb no guardrail protection but has wider shoulders
44.340	Carroll	021B00037R	CSX RR & KY 227	I-71	1967	233.9	37.1	38.1		95.0	11/26/2012	Not Deficient	Concrete Continuous Tee Beam	rail and curb no guardrail protection but has wider shoulders

NOTE: Information for this spreadsheet taken from the National Bridge Inventory Sheets and Bridge Inspection Reports

Indicates either narrow width, sufficiency rating at or near 50, or curb and no guardrail protection on bridge

Photo 4: Bridge with curbs

3.8.4 Bridges with Curbs

The following locations are considered deficient because the bridge has curbs with no protection and metal railing (see Photo 4).

- MP 44.000 – Kentucky River in Carroll County
- MP 44.020 – Kentucky River in Carroll County
- MP 44.330 – CSX RR & KY 227 in Carroll County
- MP 44.340 – CSX RR & KY 227 in Carroll County
- MP 46.920 - KY 1112 & White Run Creek in Carroll County
- MP 53.460 – KY 47 in Gallatin County (both directions)

3.8.5 Vertical Clearance

According to the National Bridge Inventory forms provided by KYTC, the following overpass bridges have less than the required 16 feet of minimum clearance over I-71.

- MP 9.106 – I-265 northbound in Jefferson County (15.91')
- MP 21.828 – KY 53 southbound in Oldham County (15.83')
- MP 21.836 – KY 53 northbound in Oldham County (15.91')
- MP 25.940 – KY 3320 in Henry County (15.71')

The following overpass structures are posted for less than the minimum vertical clearance; however they were not identified as such in the National Bridge Inventory Forms.

- MP 60.363 – KY 455 in Gallatin County
- MP 66.275 – KY 562 in Gallatin County
- MP 68.568 – Walnut Lick Road in Gallatin County
- MP 69.801 – KY 2850 in Gallatin County

3.8.6 Other

There is one location where both structures on I-71 have haunched girders with railing and curb and wider shoulders. However, there is no guardrail protection.

- MP 44.330 and MP 44.340 – Carroll County

There are several locations where the haunched girders may create a vertical clearance issue for either median widening or a shoulder pier. These locations are identified as follows:

- MP 7.490 - Barbour Lane in Jefferson County
- MP 10.276 - KY 1694 (Brownsboro Road) in Jefferson County
- MP 15.774 - Glenarm Road in Oldham County
- MP 23.257- KY 712 (Jericho Road) in Oldham County
- MP 25.940 - KY 3320 (Mt. Olivet Road) in Oldham County
- MP 27.046 - KY 146 in Henry County
- MP 27.677 - KY 153 (Pendleton Road) in Henry County
- MP 30.961 - KY 157 (White Sulfur Road) in Henry County
- MP 37.193 - KY 55 (Carrolton Road) in Carroll County
- MP 42.802 - KY 389 in Carroll County
- MP 49.085 - KY 36 in Carroll County
- MP 60.363 - KY 455 (Johnson Road) in Gallatin County
- MP 61.770- US 127 in Gallatin County
- MP 66.275 - KY 562 in Gallatin County

4.0 SAFETY

One of the primary goals of the I-71 Corridor Study was to evaluate the overall safety throughout the corridor and to determine needed improvements. Crash data and the Kentucky Transportation Center's Crash Analysis methodology was used to identify I-71 roadway sections and crossroads with unusually high crash rates, thus indicating a possible need for safety improvements. Crashes were examined between the dates January 1, 2009 to December 31, 2011. More recent crash data was evaluated where appropriate.

4.1 Overall I-71 Corridor

Crashes on Interstate Highways in Kentucky represent only 9.5% of the total crashes occurring in Kentucky despite serving nearly 17.6% of the state's vehicle-miles of travel. Comparative statistics from the Kentucky State Police (reference: http://www.kentuckystatepolice.org/pdf/KY_Traffic_Collision_Facts_2011.pdf) for all public highways in Kentucky, as are a few for Kentucky's Interstate system. Several observations are highlighted:

- Crashes involving an injury and /or a fatality on I-71 constitute a slightly higher percentage of total crashes than on the Interstate system.
- Crashes that involved a 2nd moving vehicle constituted a much lower percentage of total crashes for both the rural and urban portions of I-71 than on the state's public highways.
- Crashes involving deer and other animals on the rural portion of I-71 constitute about three times the proportion of total crashes than they do on Kentucky's public highways.
- More than 52% of all crashes occurring on the rural portion of I-71 occurred on a grade or the crest of a hill.
- The percentage of head-on crashes, while not high, nonetheless was not that much lower than the statewide average that included non-divided highways. (see Table 9, p. 38)
- Nearly 40% of all crashes on the rural portion of I-71 occurred in dark conditions.

Table 9: I-71 Mainline Crash Segment Summary

County	District	Prefix	Beginning Milepoint	Ending Milepoint	Number of Crashes	Number of Darkness Crashes	Number of Run-Off-Road Crashes	Number of Fatal Crashes	Number of Injury Crashes	ADT	Actual Crash Rate	Average Crash Rate	Critical Crash Rate	Road Type	CCRF	Fatal Crash Rate	Average Fatal Crash Rate	Critical Fatal Crash Rate	Critical Fatal Crash Rate Factor
Jefferson	5	I-71	0.000	1.724	472	17	171	0	75	61,668	405.441	118.809	145.262	Urban Interstate	**2.791**	0.000	0.000	0.000	0.000
Jefferson	5	I-71	1.725	5.096	236	20	73	0	48	64,014	99.876	118.809	137.286	Urban Interstate	0.728	0.000	0.000	0.000	0.000
Jefferson	5	I-71	5.097	9.063	406	52	114	0	70	73,034	128.006	118.809	134.732	Urban Interstate	**0.950**	0.000	0.000	0.000	0.000
Jefferson	5	I-71	9.064	11.315	126	14	30	1	26	59,076	86.530	118.809	142.421	Urban Interstate	0.608	0.643	1.089	3.565	0.180
Oldham	5	I-71	11.316	12.724	81	24	40	1	21	53,095	98.949	118.809	150.453	Urban Interstate	0.658	1.269	1.089	4.750	0.267
Oldham	5	I-71	12.725	13.224	12	1	3	0	2	52,841	41.562	118.809	172.795	Urban Interstate	0.241	0.000	0.000	0.000	0.000
Oldham	5	I-71	13.225	14.472	84	28	43	1	23	53,331	115.349	118.809	152.399	Urban Interstate	0.757	1.432	1.089	5.022	0.285
Oldham	5	I-71	14.473	17.478	100	23	34	1	29	52,413	57.984	118.809	140.479	Urban Interstate	0.413	0.594	1.089	3.458	0.172
Oldham	5	I-71	17.479	18.494	36	13	18	0	5	52,984	61.133	118.809	156.247	Urban Interstate	0.391	0.000	0.000	0.000	0.000
Oldham	5	I-71	18.495	21.828	86	23	37	0	19	52,981	44.476	118.809	139.260	Urban Interstate	0.319	0.000	0.000	0.000	0.000
Oldham	5	I-71	21.829	24.727	70	24	37	1	21	36,156	61.011	56.188	74.651	Rural Interstate	0.817	0.888	1.094	4.077	0.218
Henry	5	I-71	24.728	27.669	80	31	34	0	14	31,721	78.313	56.188	75.782	Rural Interstate	**1.033**	0.000	0.000	0.000	0.000
Henry	5	I-71	27.670	33.355	133	57	75	0	28	31,728	67.338	56.188	70.181	Rural Interstate	**0.959**	0.000	0.000	0.000	0.000
Henry	5	I-71	33.356	38.086	56	20	19	1	9	31,581	34.237	56.188	71.592	Rural Interstate	0.478	0.622	1.094	3.531	0.176
Trimble	5	I-71	38.087	38.808	3	3	0	0	0	28,000	13.571	56.188	99.519	Rural Interstate	0.136	0.000	0.000	0.000	0.000
Carroll	6	I-71	38.809	42.802	59	25	33	1	15	28,681	47.048	56.188	73.830	Rural Interstate	0.637	0.792	1.094	3.889	0.204
Carroll	6	I-71	42.803	44.315	39	10	21	0	5	28,743	81.953	56.188	85.230	Rural Interstate	**0.962**	0.000	0.000	0.000	0.000
Carroll	6	I-71	44.316	53.433	124	49	55	1	27	28,712	43.260	56.188	67.768	Rural Interstate	0.638	0.347	1.094	2.855	0.122
Gallatin	6	I-71	53.433	54.980	14	6	5	0	2	29,586	27.934	56.188	84.461	Rural Interstate	0.331	0.000	0.000	0.000	0.000
Gallatin	6	I-71	54.981	56.673	18	6	5	0	2	29,532	32.898	56.188	83.206	Rural Interstate	0.395	0.000	0.000	0.000	0.000
Gallatin	6	I-71	56.674	61.774	70	20	19	1	14	28,977	43.250	56.188	71.675	Rural Interstate	0.603	0.626	1.094	3.539	0.177
Gallatin	6	I-71	61.775	69.890	185	55	77	5	38	30,552	68.145	56.188	68.091	Rural Interstate	**1.001**	1.860	0.662	2.126	0.875
Boone	6	I-71	69.891	72.081	71	16	34	0	13	33,394	88.662	56.188	78.390	Rural Interstate	**1.131**	0.000	0.000	0.000	0.000
Boone	6	I-71	72.082	75.648	85	34	37	1	16	33,843	64.321	56.188	73.363	Rural Interstate	0.877	0.783	1.094	3.869	0.202
Boone	6	I-71	75.649	76.630	30	3	7	0	4	33,809	82.605	56.188	89.606	Rural Interstate	**0.922**	0.000	0.000	0.000	0.000
Boone	6	I-71	76.631	77.724	29	0	15	0	9	33,328	72.703	56.188	88.015	Rural Interstate	0.826	0.000	0.000	0.000	0.000
Totals					2705	574	1036	15	535										

Data from Kentucky Transportation Center Buildup Program for January 1, 2009 to December 31, 2011
ADT- Average Daily Traffic
CCRF - Critical Crash Rate Factor greater than **0.9**
Crash rates are
Crash Rates are in crashes per 100 million vehicle miles

4.2 Overall Methodology

Crash analysis procedures involve assigning reported crashes to roadway locations by their milepoint and latitude and longitude. The crashes are classified by severity into one of three categories: fatal, injury, or property damage only (PDO). Then, the average crash rate for roadway sections of various lengths is determined. The analysis includes analyzing the entire roadway length under study, followed by analyzing successively smaller roadway sections, especially those containing higher concentrations of crashes. Roadway sections are classified as either "spots" (sections less than 0.3-mile) or "segments" (sections over 0.3 mile). Critical crash rates were calculated for 0.1-mile spots.

The "critical crash rate" is the maximum crash rate expected to occur on a roadway section, given the statewide average crash rate for that functional road class, the ADT volume, and the roadway section length. The ratio of these two rates (*i.e.*, the actual annual crash rate to the critical crash rate) produces a critical crash rate factor (CCRF), or a measure of crash frequency for each segment or spot location. If the roadway section's actual crash rate exceeds the critical rate (*i.e.*, the CCRF is greater than 1.0), then that section is classified as a high crash location. In other words, that roadway section has more crashes than is statistically probable in the absence of an unsafe condition(s).

4.3 I-71 Crashes (see Exhibits 7-12, pages 40-45)

As shown in Table 3 (p. 14), there are multiple segments of I-71 that the % injury and % fatal crashes exceed statewide averages for interstates in Kentucky according to the 2011 Kentucky State Police Collision Facts Report. Using the Kentucky Transportation Center's Crash Buildup Program, as shown in Table 9 (p. 38), there were a total of 2,705 crashes on I-71 within the project limits between January 1, 2009 and December 31, 2011 including 574 in darkness conditions and 1036 that left the roadway. Fifteen involved fatalities and 535 involved injuries.

1,068 crashes were initially flagged in locations (0.1 mile spots) with a critical crash rate factor (CCRF) greater than 0.9 (see Table 9, p. 38) over a three-year period (2009 - 2011). A review of the 1,068 reports indicated that there were approximately 62 considered as high crash locations (see **Appendix H**). When appropriate, crash reports from 2012 and 2013 were also reviewed for the purpose of validating the results and recommendations. Exhibits 7-12 (p. 40-45) illustrate the location of crashes reported for the I-71 Corridor.

After a review of 1,068 crash records and reports for the I-71 Corridor, it was determined there are seven (7) locations of principal concern relating to crashes (see Figure 9, p. 46). These locations were identified as follows and are not in any particular order:

1. MP 0 - 0.3 (Approaching Spaghetti Junction) CCRF: > 1.7

	All Crashes	Rear End	Single Vehicle	Sideswipe	Debris in Road	All Other
NB	39%	79%	10%	4%	4%	3%
SB	61%	59%	28%	11%	1%	1%

Significant congestion related crashes were reported; particularly at the merge/diverge areas with I-64 and entering Spaghetti Junction. However, the actual number of crash records (147) is less than half (342) of what showed in the Buildup Program (most of these were actually in Spaghetti Junction). A statistically significant crash problem still remains from MP 0 to 0.3 (CCRF at least 1.7), however, from MP 0.3 to MP 1.0, significance is doubtful (CCRF<1).

2. MP 1.7 - 2.1 (Zorn Avenue Interchange) CCRF: 1.02-1.08

69% are rear-end type crashes, mostly occurring at the end of the exit ramps.

3. MP 4.6 - 5.3 (Watterson Expressway Interchange) CCRF: 1.04-2.98

	All Crashes	Rear End	Single Vehicle	Sideswipe	All Other	Wet Weather
NB	71%	15%	72%	10%	3%	78%
SB	29%	57%	26%	17%	0%	63%

Several stark patterns were found to occur here: Northbound crashes outnumber southbound crashes 7 to 3; nearly ¾ of northbound crashes are single vehicle run-off-the-road crashes with relatively few rear-end crashes, while the southbound pattern is reversed. Notably, a high percentage of crashes occur in wet or snowy weather, especially for the northbound direction.

4. MP 8.4 - 9.1 (Gene Snyder Interchange) CCRF: 1.10-2.13

	All Crashes	Rear End	Single Vehicle	Sideswipe	Wet Weather
NB	22%	55%	25%	20%	10%
SB	78%	29%	40%	24%	53%

Southbound crashes are 3.5 times more frequent and 5 times more likely to occur in wet weather. The weave area from Gene Snyder northbound to I-71 southbound is a particular area of concern.

5. MP 62.8 - 64.0 (1.0 mile north of US 127 interchange in Gallatin County) CCRF: 1.02-2.72

For six 0.1-mile spots, the CCRF for the 1.2 mile section is 1.86; 65 (57 actual without duplicates) crashes were found to occur in 3 years: 41 crashes occurred in wet or snowy weather; 38 crashes were single vehicle run-off-the-road crashes; 8 were vehicle malfunction and 2 were deer-related. The direction of the crashes varies, but most appear to occur while going downgrade.

6. MP 71.6 - 72.6 (KY 14 Interchange at Verona) CCRF: 0.96-2.58

A safety analysis based on crash data for the years 2009-2011 indicated a potential concern in the vicinity of the KY 14 interchange between MP 71.6 and MP 72.6. Five separate 0.1 mile spots within this one mile section had CCRFs ranging from 0.96 to 2.58. There is a 4:1 ratio of northbound crashes (37) to southbound crashes (9); 10 crashes (all northbound) were found to occur as a result of pooled water/hydroplaning; 12 crashes occurred in a construction zone (11 northbound); 4 crashes were deer-related and 2 crashes occurred due to vehicle malfunction. A review of crash reports were dominated by crashes that reflected conditions before or during roadway reconstruction. Kentucky State Police data was then searched with the following results:

Year	2009	2010	2011	2012	2013*
Number of Crashes: MP 71.6 to 72.6	12	15	17	9	10

The number of crashes occurring after construction appears to have declined relative to those that occurred prior to or during construction. Discussions with Gallatin County police stated that pavement rutting is an issue and that water comes down the lanes both NB and SB in waves and cars take off like skates. A review of the recent pavement condition (dated April 18, 2012) provided by KYTC shows from MP 69.890 to MP 77.724 that pavement rutting was 0.1" both northbound and southbound. Therefore, this section became much less of a concern.

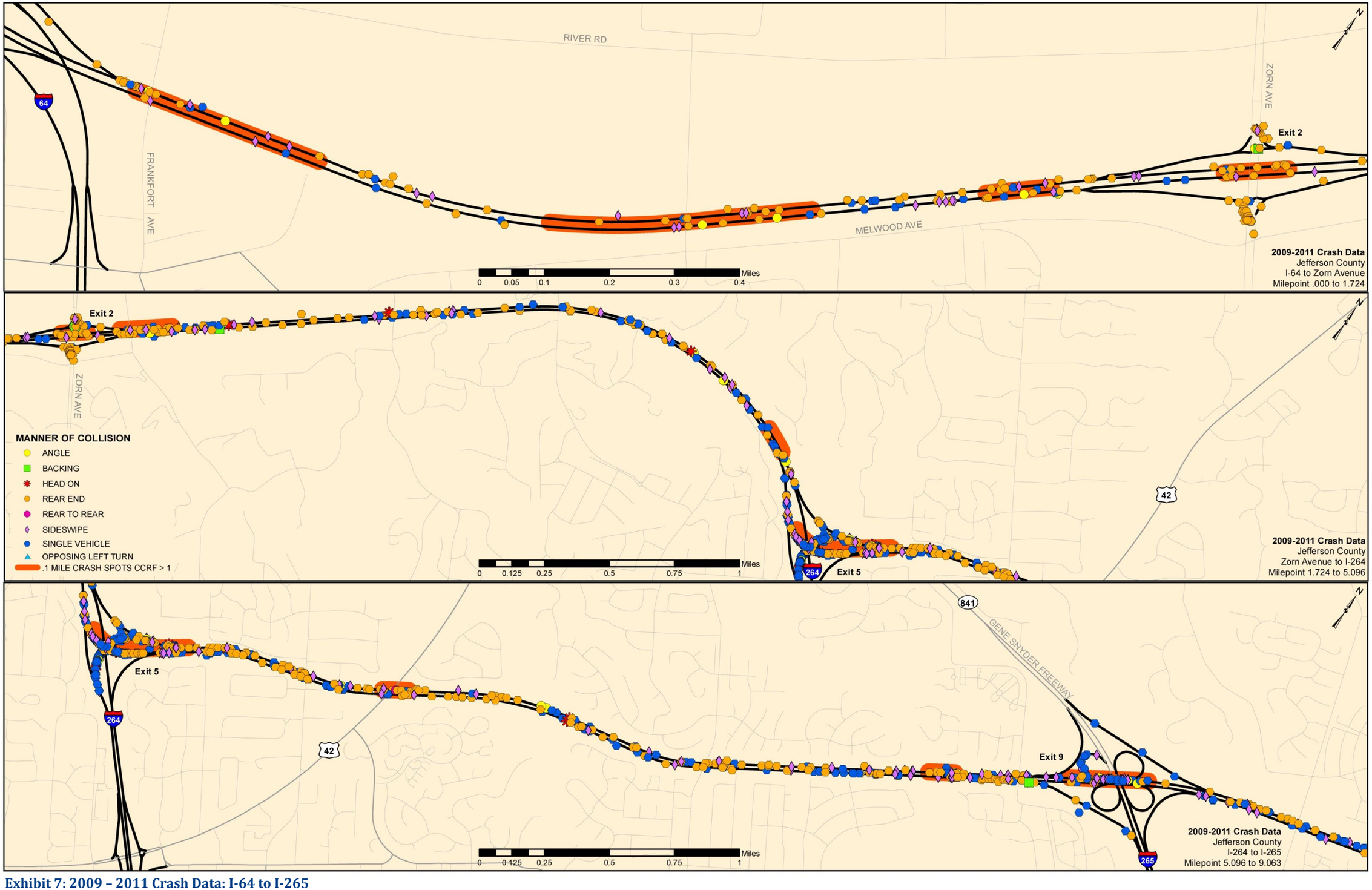


Exhibit 7: 2009 – 2011 Crash Data: I-64 to I-265

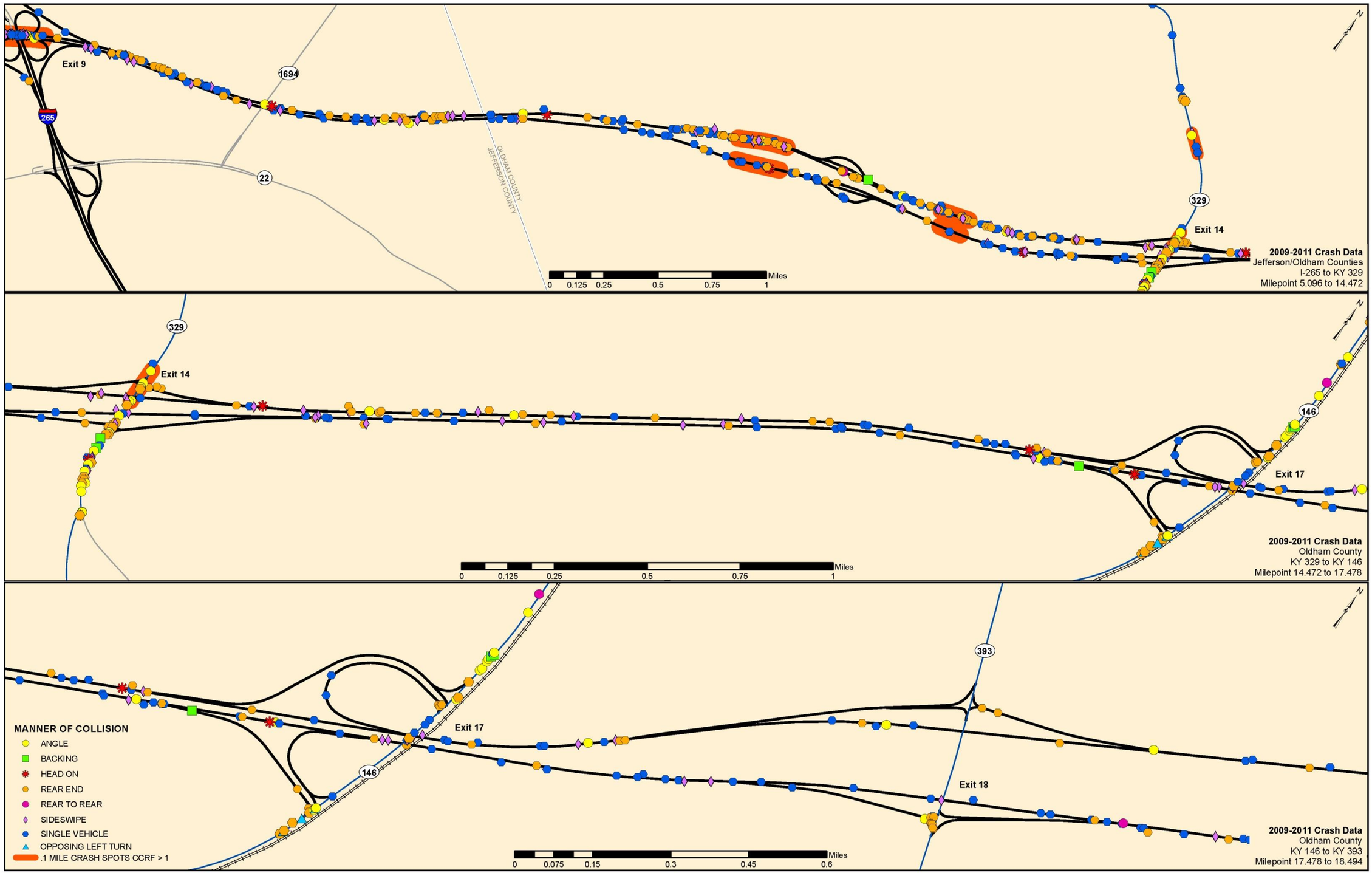


Exhibit 8: 2009 – 2011 Crash Data KY 145 to KY 393

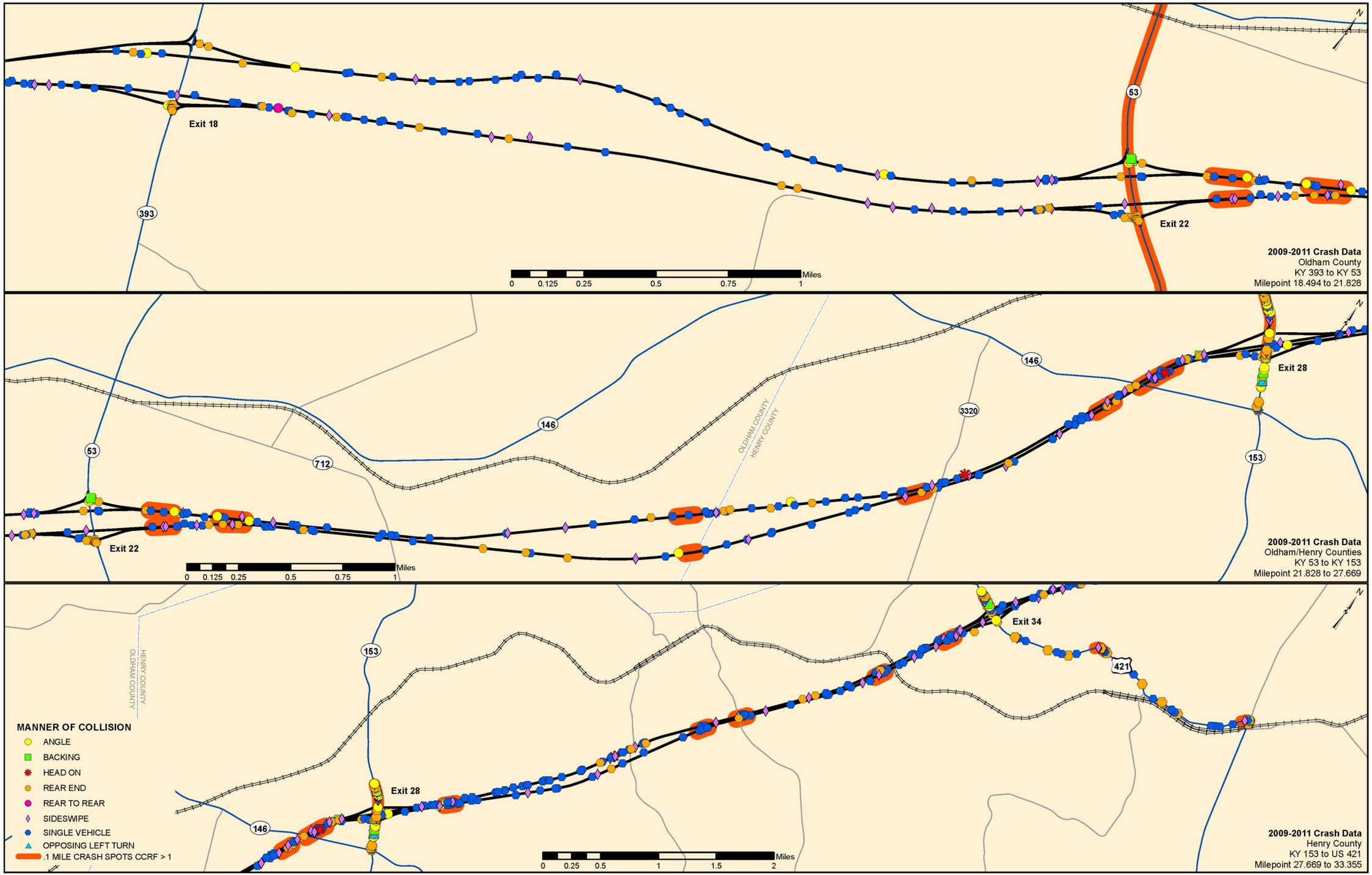


Exhibit 9: 2009 – 2011 Crash Data: KY 393 to US 421

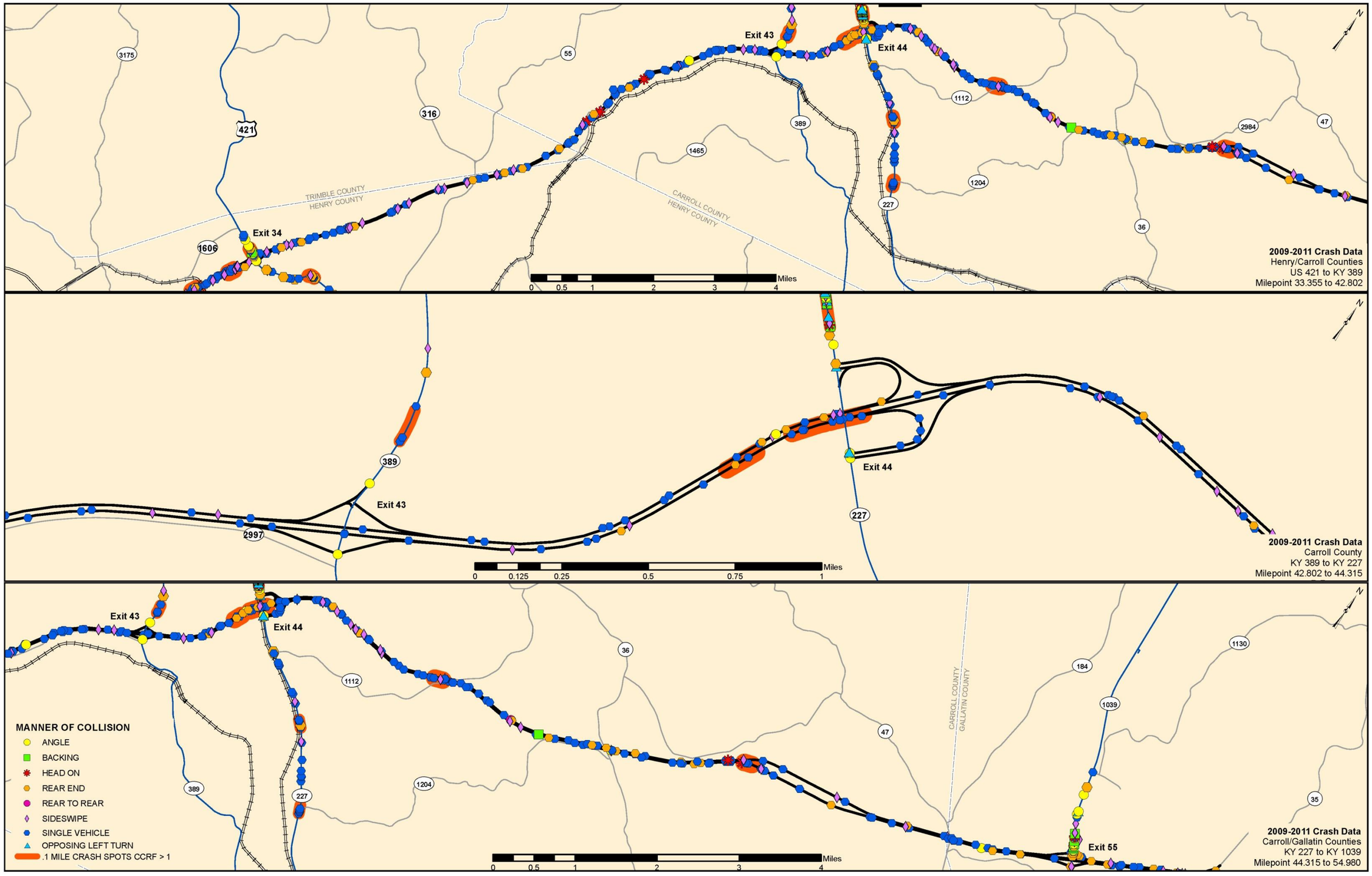


Exhibit 10: 2009 – 2011 Crash Data: US 421 to KY 1039

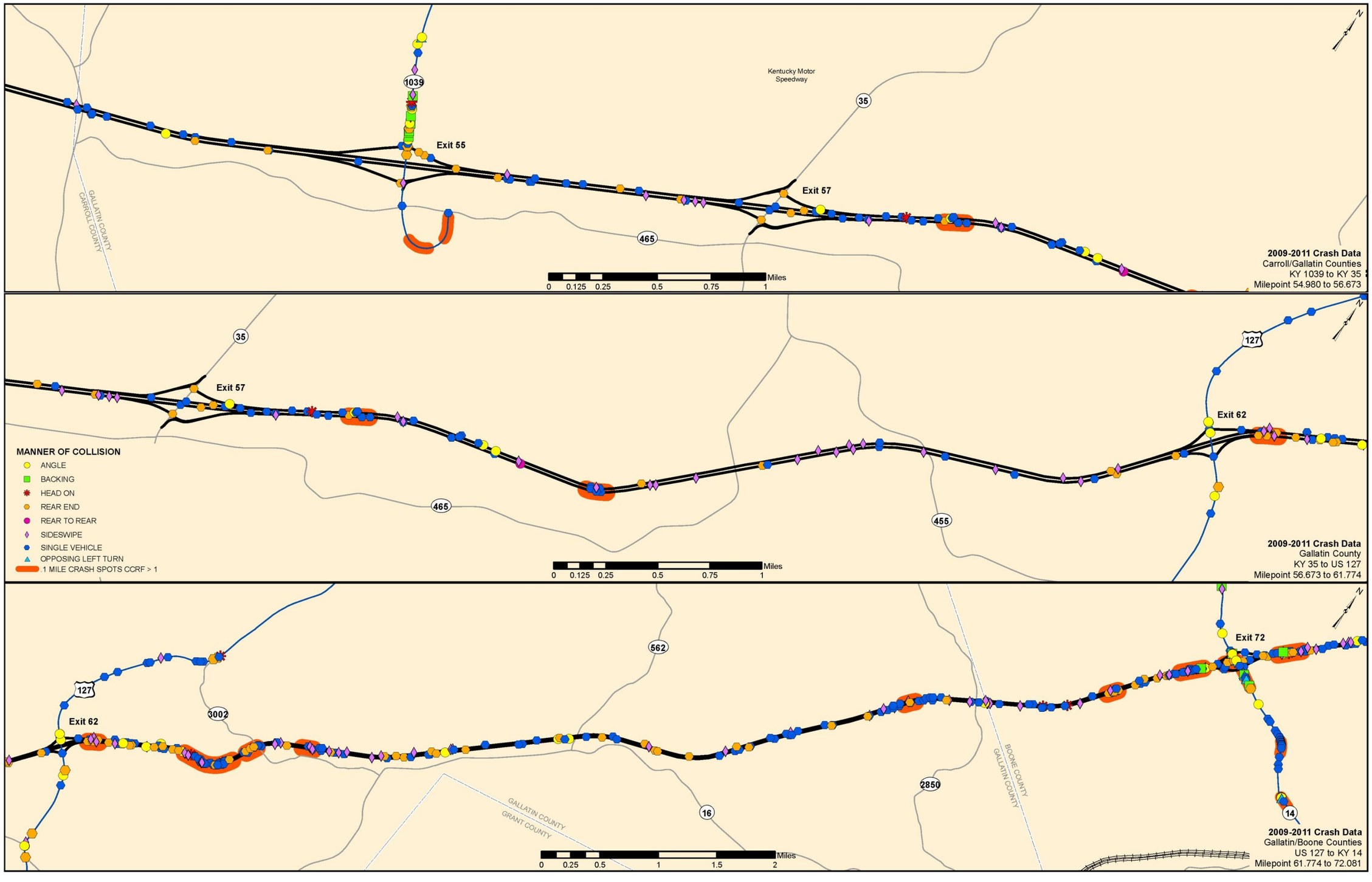


Exhibit 11: 2009 – 2011 Crash Data: KY 1039 to KY 14

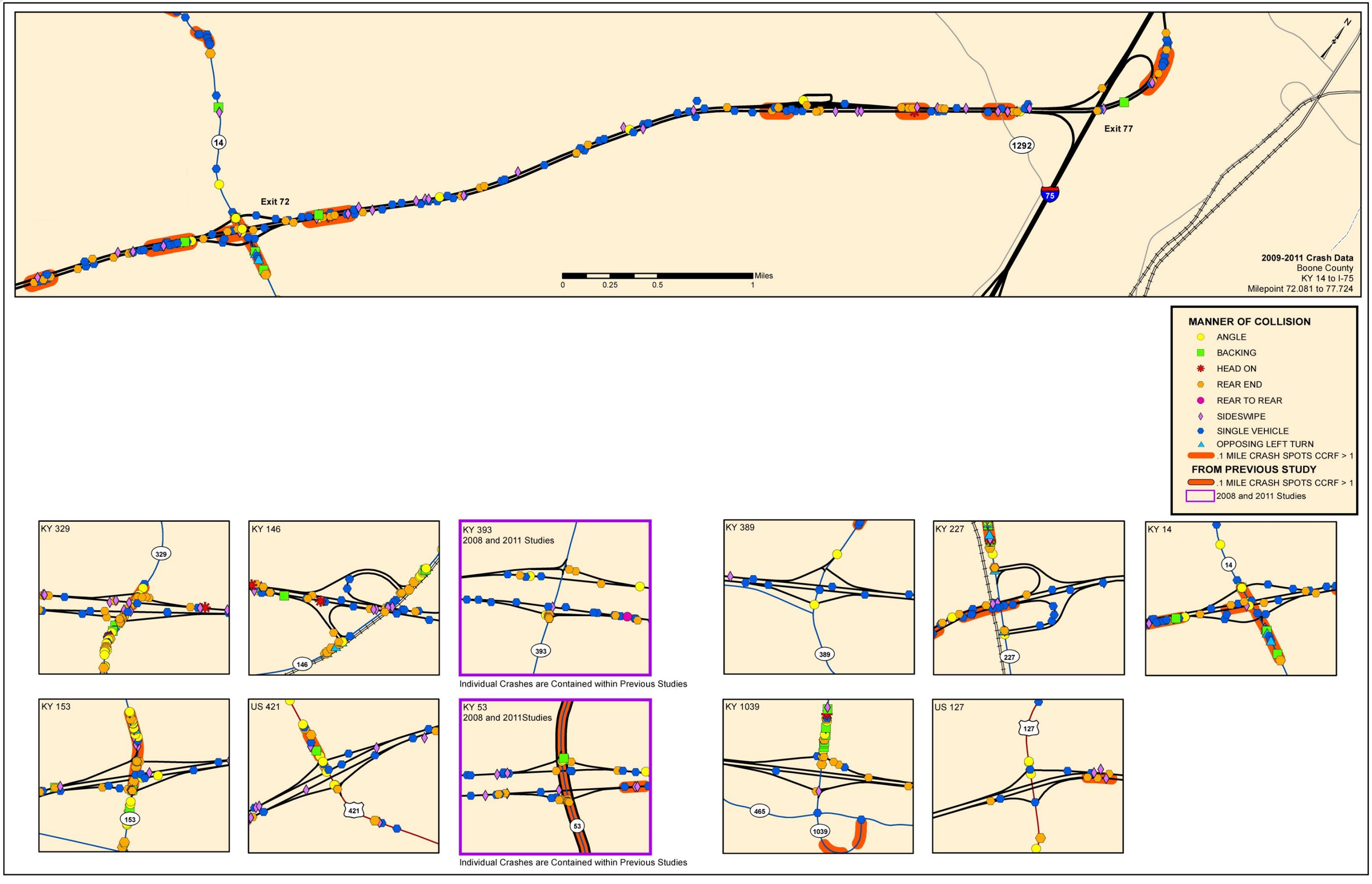


Exhibit 12: 2009 – 2011 Crash Data: KY 14 to I-75

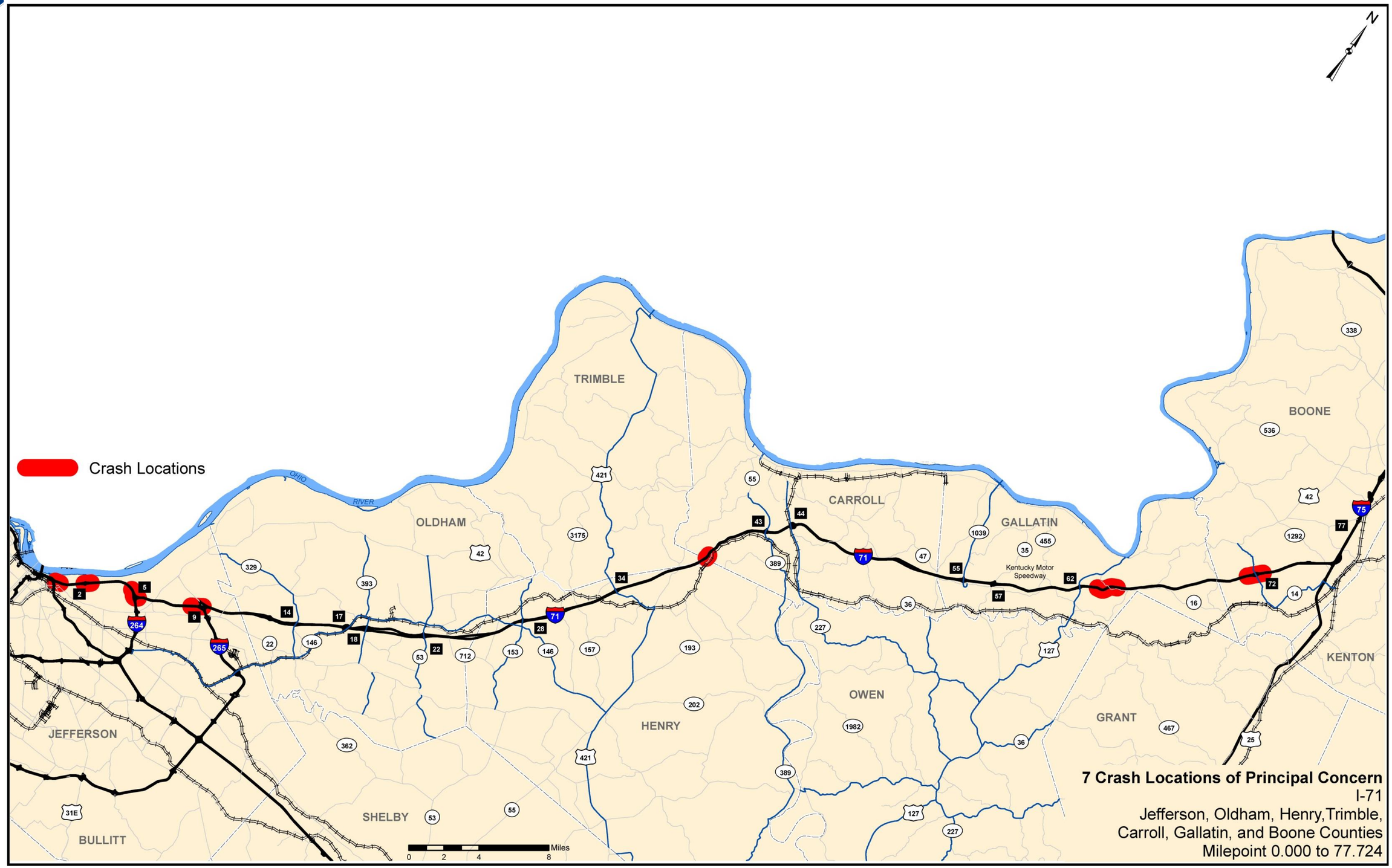


Figure 9: 7 Crash Locations of Principal Concern

7. MP 38.9 - MP 39.1 in Carroll County: three (3) fatalities in 2012

The initial evaluation of crashes in this area did not yield an area with a CCRF> 1.0. However, a check of the 2012 crashes revealed three fatalities in a 0.2 mile spot. Looking beyond this 0.2 mile spot, expanding 1.0 mile on either side, this area has multiple maximum 4% grades within back-to-back spiral curves, and two long narrow bridges at the end of a 3% downgrade heading northbound. The reverse is the case travelling southbound, there is a continuous uphill climb for approximately 2.5 miles beginning at approximately MP 38.3 to MP 40.8, with grades ranging from -0.5% to -4.0% and a possible deficient sag curve. The equivalent southbound grade was 3.62% for 2.33 miles. This length, according to the *Green Book* and field observation, slows trucks by nearly 30 mph increasing the crash involvement rate by nearly five times. Many truck drivers use their flashers to warn other motorists of their slow speeds. This segment has a current year (2013) volume of 29,800 vpd and is estimated to carry 50,240 in 2038. When crashes are analyzed one mile on either side of this spot, the numbers of crashes seem to be on the rise beginning in 2012.

4.4 Ramp Crashes

There are four (4) interchange locations where potential crash issues have been found to occur on interchange ramps (see Exhibit 13, p. 48). These four locations are identified below and the ramp crash patterns at each location are summarized:

Zorn Avenue (Exit 2): More crashes (17) occurred at the northbound exit ramp than on the southbound exit ramp (11). Except for one single-vehicle crash on each exit ramp, all of the ramp crashes were rear-end type crashes. Rear-end crashes were also an issue at both the northbound and southbound entrance ramps. Most of the crashes on the ramps at Zorn Avenue appear to be congestion related.

KY 393 (Exit 18): Crashes on the southbound exit ramp occurred much less frequently (2) than on the northbound exit ramp (9) and rear-end crashes were the dominant crash type. Merge-related crashes occurred at both the northbound and southbound entrance ramps.

KY 53 (Exit 22): Crashes occurred more frequently on both the northbound exit and entrance ramps than on the southbound ramps. Rear-end and single vehicle crashes were the dominant crash type on the exit ramps while single vehicle and sideswipe crashes were the most prominent crash types on the entrance ramps.

4.5 Crossroad Crashes

The KTC Crash Buildup Program was also used to locate crossroad segments. A longer segment was used to ensure that there were not significant patterns along a segment of the crossroad. 0.1 mile spots with statistically significant crash histories in the vicinity of I-71 and the interchange crossroads were calculated. A compilation of crash data analysis is shown in Table 7 on pages 33-34. Each location with a crash issues was analyze for roadway geometry and the issues are identified in Exhibits 13 and 14, pages 48 and 50, a summary of all crossroad crashes are shown in Table 11 (p. 49) and Exhibits 7-12 (pp. 40-45).

There are four (4) interchange locations where the crossroads appeared to have crash issues. The roadway geometrics in the vicinity of the I-71 ramps terminals were analyzed and the crash patterns are shown in Exhibit 14 (p. 50).

- KY 329 (Exit 14) in Oldham County
- KY 153 (Exit 28) in Oldham County
- KY 227 (Exit 44) in Carroll County
- KY 14 (Exit 72) in Boone County

4.6 Truck Climbing Lanes

As shown in Table 11 (p. 51) and in the Mainline Capacity Analysis contained on the Supporting Documentation CD, utilizing the Highway Capacity software, long grades and composite grades on I-71 do not appear to meet warrants for truck climbing lanes under the *KYTC Highway Design Manual, HD-705*. The Highway Capacity Software does not appear to make any discernible difference in LOS over general grades until a grade exceeds 4.0%. I-71 does not have vertical grades that exceeds 4.0%. One of *KYTC's Highway Design Manual* criteria states that the LOS must be improved by two letter grades. However the manual does state that "*safety considerations alone may justify the addition of a climbing lane regardless of grade or traffic volumes" (see Photo 5).* Therefore, maximum grades should not be used as a single design control.

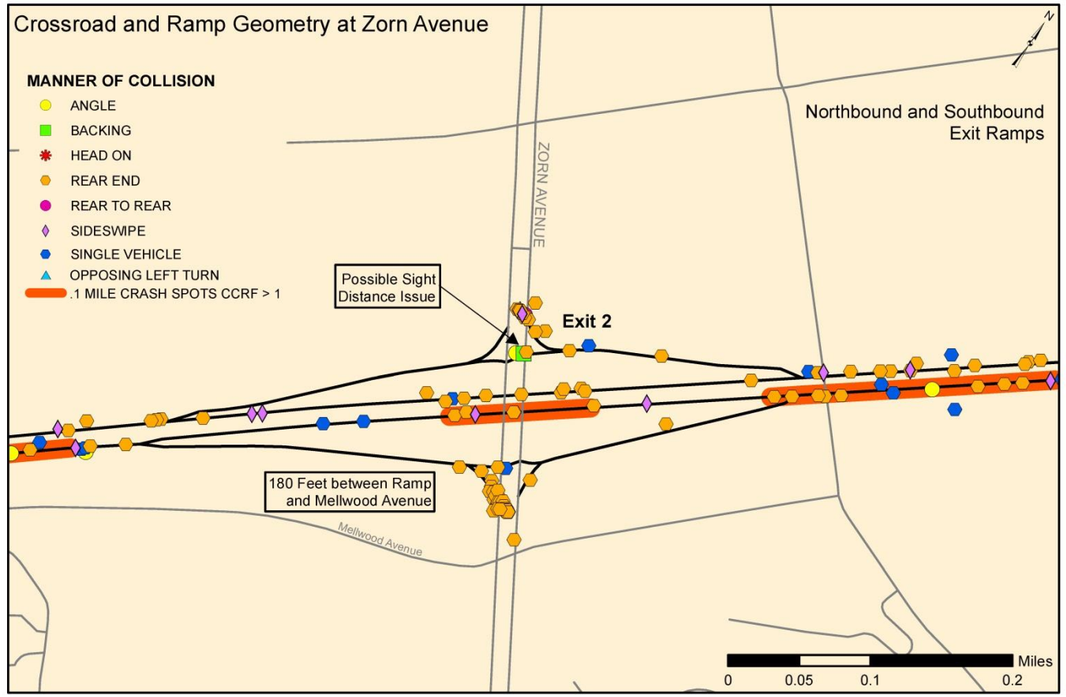
Photo 5: Location for potential truck climbing lane

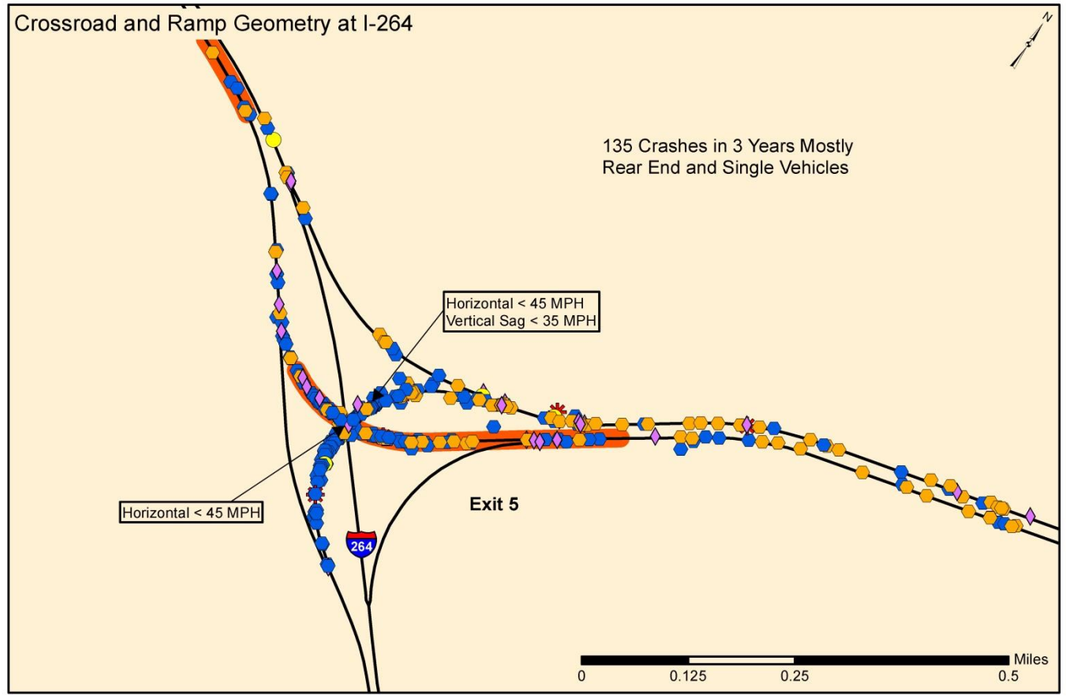
In accordance with "*A Policy on Geometric Design of Highways and Streets, 2011,* it is appropriate to consider the length of the grade in relation to the operation of the vehicle, more specifically to consider the "critical length of grade," which is used to indicate the maximum length of a designated upgrade on which a loaded truck can operate without a substantial reduction in speed. Studies have been documented where in those situations when vehicles deviate from the average speed of the roadway, the greater the potential exists for the vehicle to be involved in a crash.

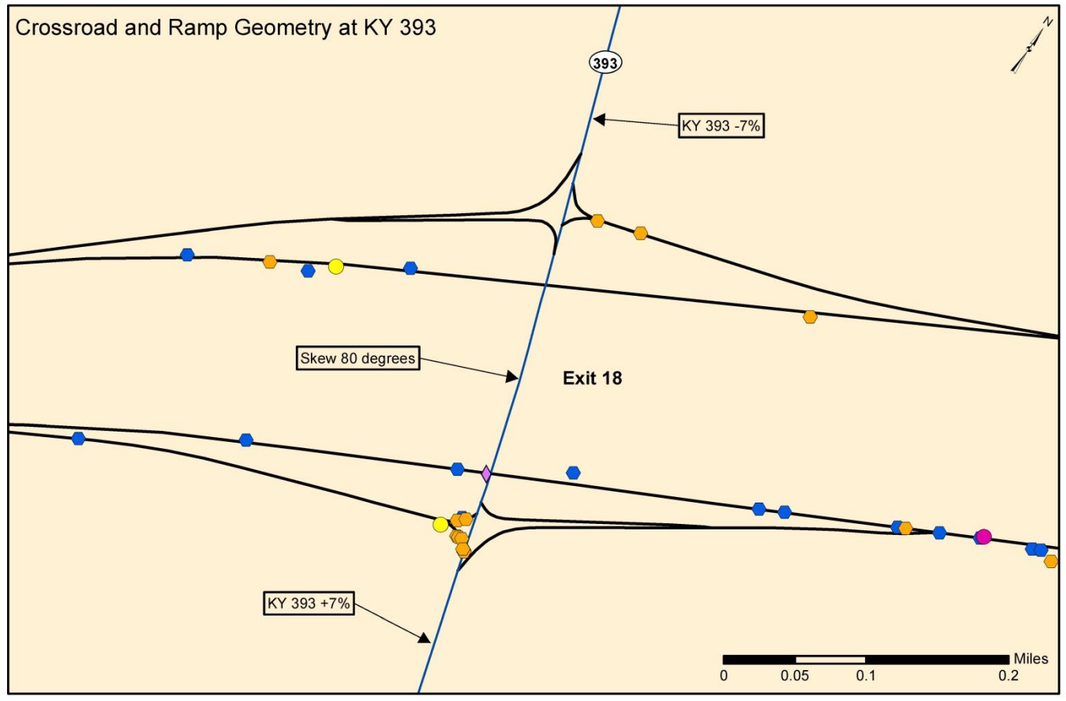
The crash involvement rate increases significantly when the speed reduction from the average travel speed for a truck or other slow moving vehicle exceeds 10 miles per hour. The crash involvement rate at a 10 mph speed differential (approximately 900 crashes per 100 million miles of travel) is roughly doubled (450 crashes per 100 MVM) at a 5 mph speed differential and quadrupled (200 crashes per 100 MVM) where there is no speed differential. Greater speed differentials (15 mph and 20 mph) produce an even greater disproportionality of crash involvement rates (2,200 crashes per 100 MVM and 3,800 crashes per 100 MVM respectively).

Figure 3-28 in the *AASHTO Green Book* depicts the anticipated speed reduction for various combinations of percent upgrade and length of upgrade. For example, a 5% upgrade 1,000 feet in length would result in a 10 mph speed reduction for a typical heavy truck. Other combinations of lower percent but longer grades (1.75% for 2,000 feet; 1.3% for 3,000 feet) also result in a 10 mph speed reduction.

Locations on I-71 were identified where the combination of percent and length of upgrade were likely to produce a 10 mph speed differential for heavy trucks. Locations meeting those criteria are shown in Table 11 (p. 51) as well as current and future year AM and PM peak hour levels of service (LOS).







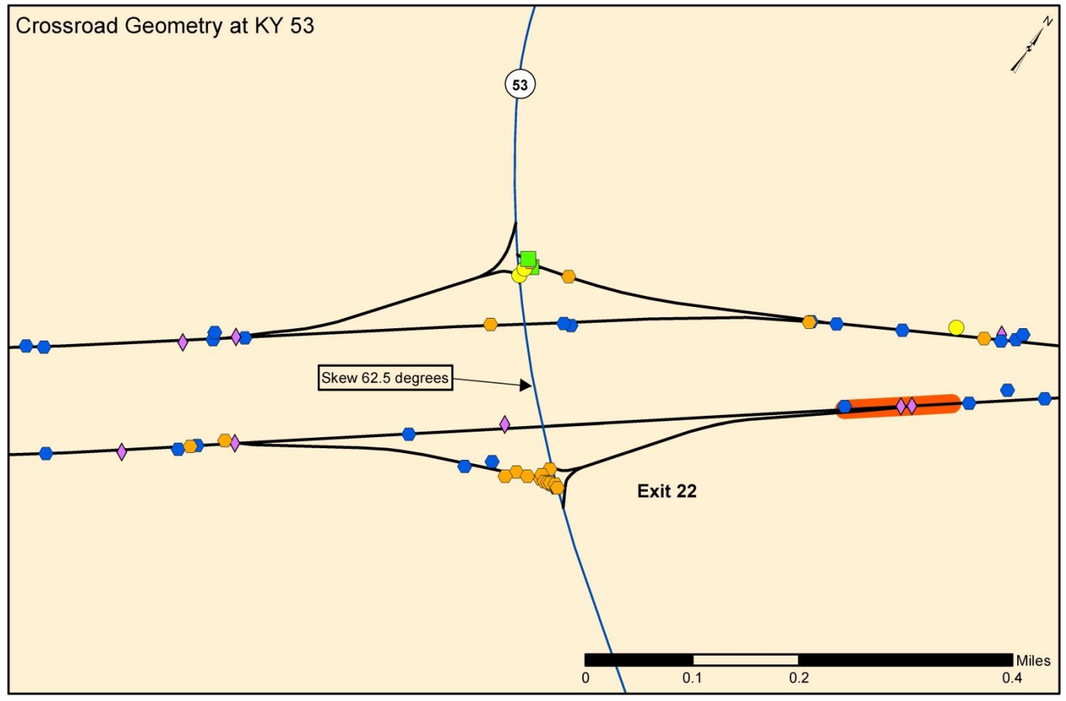
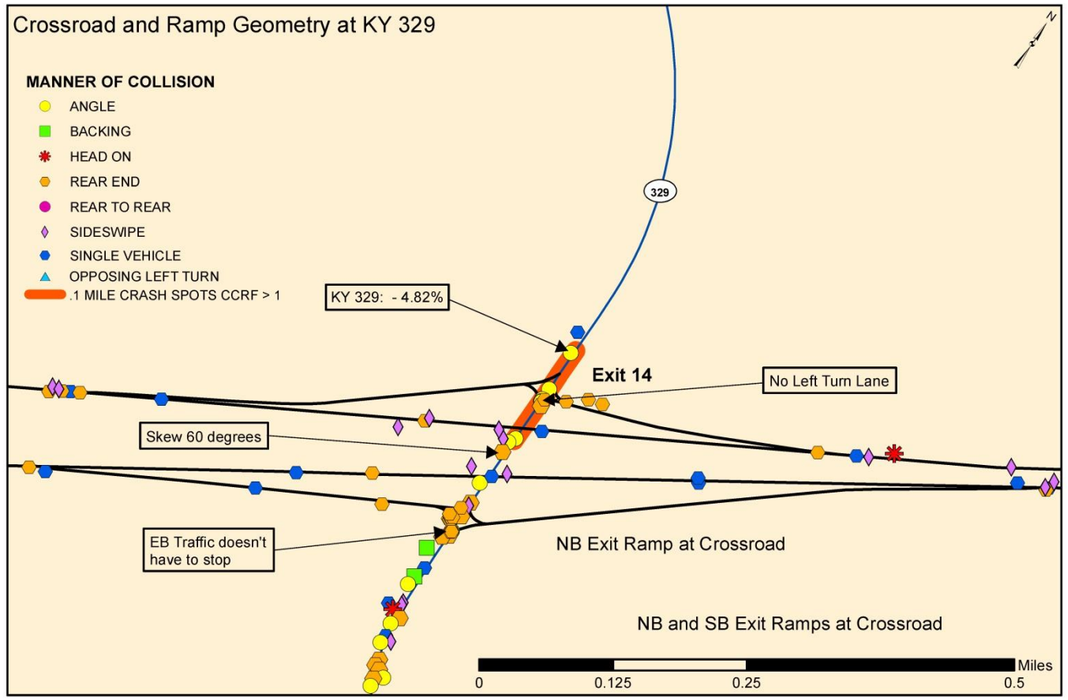
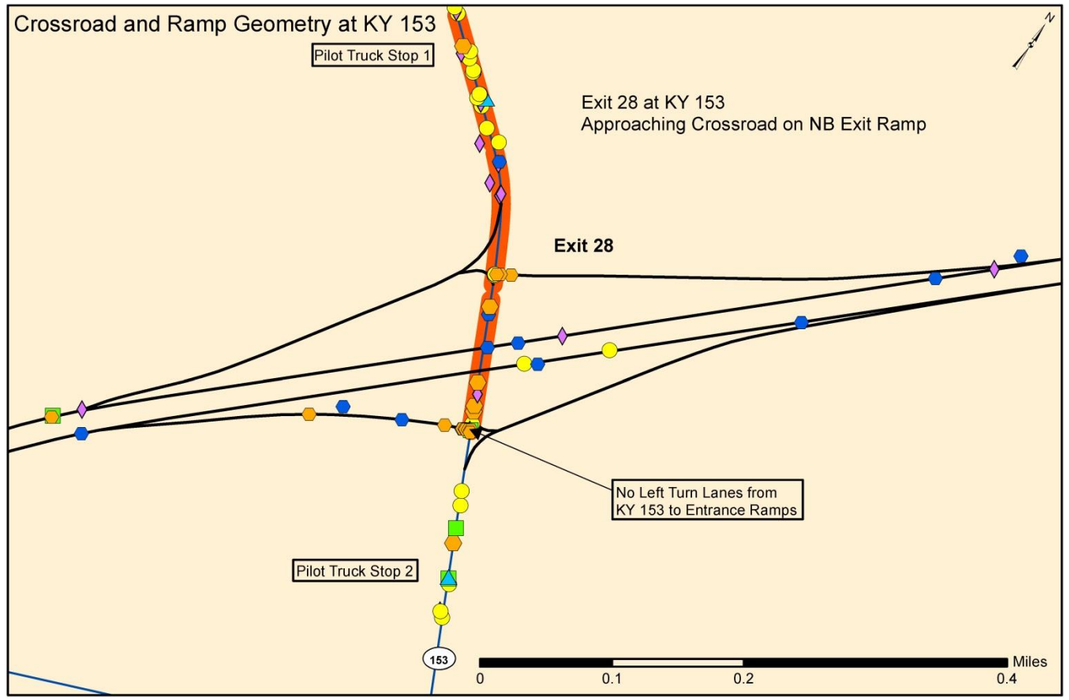


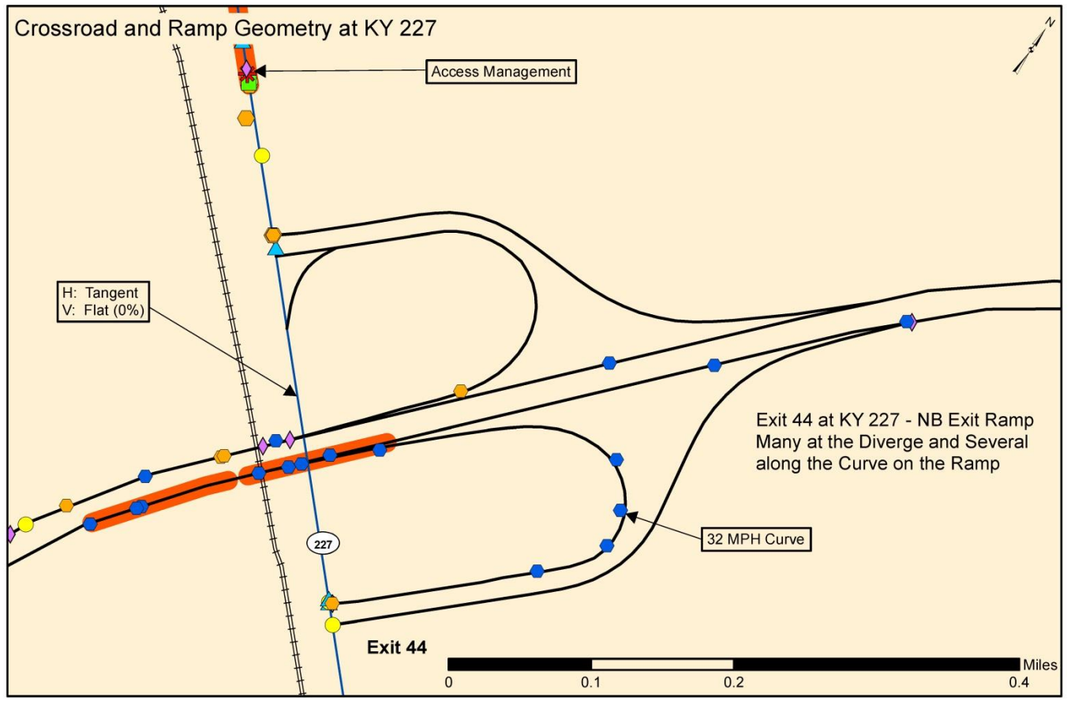
Exhibit 13: Interchange Ramp Crashes

Table 10: Crossroad Crash Locations

Exit No.	County	Intersecting Route	Milepoint @ I-71	0.1-Mile Spots Near I-71 with CCRF > 0.9						MP Range of Crash Records Reviewed	Commentary on Crash or Noted Cause
				Spot	CCRF	Spot	CCRF	Spot	CCRF		
14	Oldham	KY 329	6.89	6.788-6.888	1.565					6.31-6.89	Several at KY 329 end of I-71 exit ramps
28	Henry	KY 153	5.81	5.778-5.878	1.312	5.890-5.990	1.308	5.999-6.099	2.445	5.78-6.10	Angle crashes involving turning vehicles @ I-71 or nearby truck stops
34	Henry	US 421	24.11	24.224-24.324	1.034					21.52-24.32	Most somewhere else, i.e. parking lot
43	Carroll	KY 389	4.37	4.694-4.794	0.980					4.69-4.79	Deer related
44	Carroll	KY 227	4.24	4.508-4.608	1.363					4.51-4.61	Appears to be a function of access management north of I-71
72	Boone	KY 14	2.18	2.131-2.231	1.400	2.255-2.355	1.095	2.360-2.460	1.115	2.13-2.46	Potential site distance problem @ I-71 SB exit







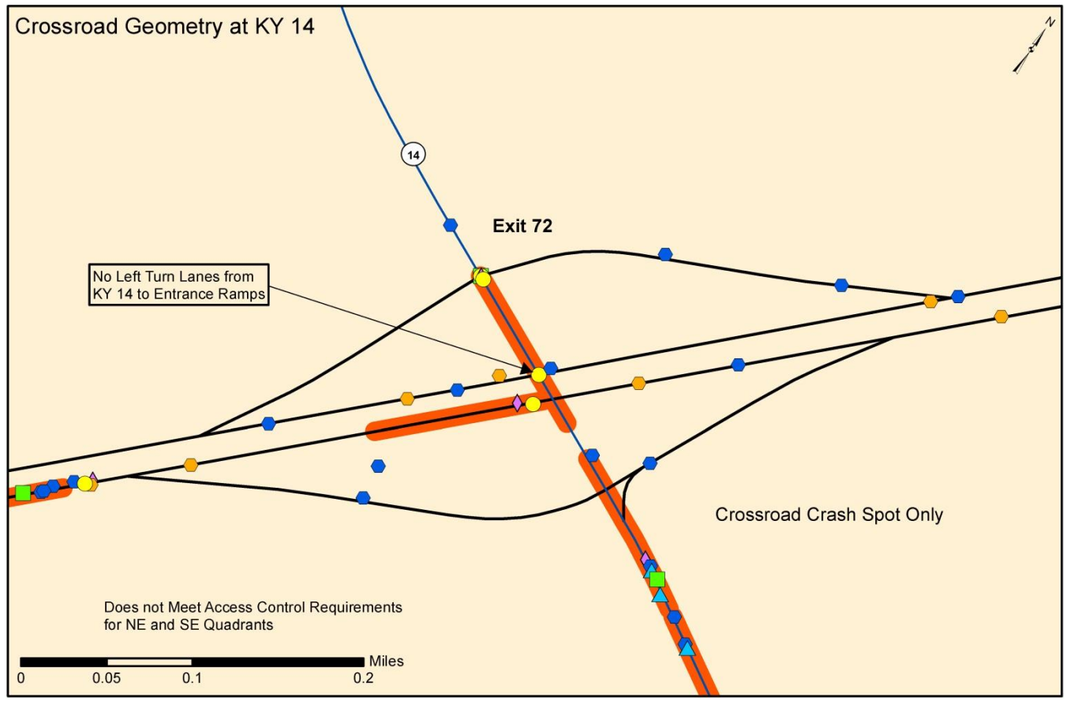


Exhibit 14: Crossroad and Ramp Crashes

Table 11: Locations with Likely 10 mph Speed Differential

County	Grade Percentage					Length of Vertical Curve (ft)	Direction of Travel	LOS			
								AM Peak		PM Peak	
	Approximate Station of PVI or PI from Original Plans	MP	In	Out	Difference			2013	2038	2013	2038
Oldham	474+70	13.135	3.000	-4.000	7.000	1900	NB	B	B	D	F
Henry	1122+25	25.303	3.000	-3.900	6.900	1800	NB	B	C	C	E
Henry	1466+00	31.910	3.000	-3.920	6.920	1800	NB	B	C	B	D
Carroll	2208+00	45.731	4.000	-0.500	4.500	1200	NB	A	A	B	B
Gallatin	2744+00	56.281	4.000	-1.040	5.040	1400	NB	A	B	B	B
Gallatin	2908+00	59.655	- 4.000	2.600	6.600	1300	SB	B	C	B	C
Gallatin	2982+00	61.047	3.000	-4.000	7.000	1900	NB	A	B	B	C
Gallatin	3016+00	61.691	-4.000	4.000	8.000	1600	NB	A	B	B	C
Gallatin	3016+00	61.691	-4.000	4.000	8.000	1600	SB	B	B	B	D
Gallatin	3047+50	62.288	4.000	-4.000	8.000	2200	NB	A	B	B	C
Gallatin	3170+25	64.613	3.960	-3.400	7.360	2050	NB	B	C	B	D
Gallatin	3446+00	69.855	3.940	-1.780	5.720	1500	NB	A	B	B	C

4.7 Corridor Lighting

An important element in regards to overall safety is the presence of adequate lighting throughout the corridor. Currently, every interchange on I-71 between I-64 in Jefferson County and I-75 in Boone County is lighted.

4.8 Cable Guardrail

Crossover median crashes are typically severe on divided highways such as interstate facilities as a result of opposing directions of traffic and speeds. Cable guardrail (see Photo 6) provides a cost-effective solution. Because these guardrails are relatively inexpensive to install and are very effective at reducing the frequency of median crossover collisions, their use is becoming more common and prevalent. The barriers are made cables strung on posts. When a car hits the barrier, the cables flex, absorbing much of a crash's kinetic energy or it redirects the vehicle along the median, preventing a cross-median crash. When a vehicle hits a section of cable barrier, maintenance crews can repair the damaged section quickly. Table 12 identifies the locations of crossover crashes in the I-71 corridor.

In addition to the ability to lessen crash severity, the cable barriers cost less than permanent concrete barriers. Recent installations in Kentucky have averaged $150,000 per mile.

Consideration should be given to the volume of semi-tractor trailers along I-71 when choosing the barrier Test Level required.

Photo 6: Cable Guardrail

As referenced by Brifen, USA Inc. and the FHWA, "In the time it takes for the driver to yawn, a vehicle traveling at highway speeds can cross a highway median and strike opposing traffic head-on. Head-on crashes at highway speed are generally more severe than other types of highway crashes. In 2006, on the National Highway System alone, there were 821 median crossover crashes that resulted in fatalities. Median barriers are longitudinal barriers most commonly used to separate opposing directions of traffic on a divided highway. While these systems may not reduce the frequency of crashes due to roadway departure, they can definitely help prevent a median crash from becoming a median crossover head-on collision."

5.0 FUTURE CONDITIONS

Initially, future year (2038) growth rates were to be developed by the consultant through the use of the KYTC's Statewide Traffic Model. However, following calibration of the model for speeds and the truck information solicited from the industry survey through the stakeholder meetings, KYTC determined that the model was not accurately simulating automobiles for the I-71 mainline and more work would be necessary on the model for which the timeframe was beyond this study's timeframe for completion. Therefore, the model was not used to forecast future automobile traffic volumes on the mainline.

Table 12: Crossover Median Crashes

County	MP	KYTC Plans or Conditions	NB	SB	Crash type
Oldham	11.905	bifurcated		x	Collision with fixed object
Oldham	12.605	bifurcated	x		Head on; dark not lighted
Oldham	13.384	bifurcated	x		Head on; wet
Oldham	14.924	bifurcated		x	Collision with fixed object
Oldham	16.991	2013 letting		x	Vehicle going wrong direction
Oldham	17.209	2013 letting		x	Head on
Henry	25.963	None		x	Occupant fell from moving vehicle
Henry	27.15	None	x		Head on
Henry	29.797	None		x	Occupant fell from moving vehicle
Carroll	39.603	None	x		Occupant fell from moving vehicle
Carroll	40.497	None	x		Occupant fell from moving vehicle curve and grade
Carroll	50.375	None		x	Occupant fell from moving vehicle
Carroll	50.54	None		x	Vehicle going wrong direction
Gallatin	57.348	None		x	Collision with non-fixed object
Gallatin	62.92	Existing cable		x	Vehicle leaving or entering parked position
Gallatin	63.197	Existing cable		x	Collision with fixed object; Raining
Boone	69.899	On list to do whole county not funded	x		Head on; raining
Boone	70.381	On list to do whole county not funded		x	Dark, head on, dry and clear
Boone	70.584	On list to do whole county not funded	x		Dark, not lighted, clear and dry
Boone	72.538	On list to do whole county not funded	x		Head on; raining
Boone	75.669	On list to do whole county not funded	x		Straight and level; dry and clear

The best available tool for the rural sections for I-71 was the KYTC Statewide Traffic Model. However, both KIPDA and OKI had more in-depth models that included the sections on each end of the study, and therefore, those models were used for those sections. This approach was approved by KYTC's Division of Planning. Although utilizing three different models is not ideal, the resultant projections appear to be reasonable, but should be periodically reviewed as conditions change, especially after the east end Louisville Bridge is open to traffic and fully operational.

Future year (2038) growth rates (Table 13) were determined by applying a linear equation to the historical count data, projecting future year volumes using the linear equation and then determining the exponential growth rate based on the projections. Traffic volumes were forecasted using three sources. From I-64 to KY 329 growth rates from the Louisville Bridges study were used to project traffic to future years (shaded green). From US 127 to I-75 on the northern end of the corridor, growth rates from the OKI travel demand model were used (burgundy). From KY 329 to US 127 growth rates determined from historical KYTC traffic counts using linear equations (blue) were used. An exponential growth rate was calculated to match this linear growth.

Table 13: Future Year Traffic Growth Rates

From	To	Overall Growth Rate	Truck % Growth Rate
0.000	1.724	0.80%	2.8%
1.724	4.966	0.60%	1.7%
4.966	9.063	0.40%	3.0%
9.063	14.479	1.70%	1.2%
14.479	17.478	1.00%	1.1%
17.478	18.507	1.00%	1.0%
18.507	21.869	1.00%	1.3%
21.869	27.710	1.00%	1.4%
27.710	33.505	1.00%	1.2%
33.505	42.802	1.50%	0.0%
42.802	44.312	1.00%	0.0%
44.312	54.980	0.50%	1.4%
54.980	56.674	0.50%	0.5%
56.674	61.774	0.80%	0.7%
61.774	72.195	1.85%	0.4%
72.195	77.724	1.85%	0.0%

These growth rates were then used to factor base year (2013) traffic volumes to future year (2038) volumes. Based on these linear growth rates, future traffic volumes along I-71 were projected to range from 29,000 between KY 1039 and KY 35 to 80,500 between I-264 and I-265 in Jefferson County (see Figure 10, p. 54).

However, the Statewide Traffic Model was used for future truck traffic volumes. An industry survey was developed to garner better information regarding industry in the rural areas. The I-71 Corridor Group was provided these surveys to give to their major employers. The survey was also web-based. It yielded a few improvements to the model to provide enhanced truck growth factors. That survey and its accompanying responses can be found in **Appendix I**. These future volumes represent a "no-build" scenario or baseline to evaluate the ability of the I-71 Corridor to meet future travel demand.

Likewise, the Statewide Traffic Model was also used to project future volumes at proposed new interchange locations that have not been a part of an official study. These new interchange volumes were based on projections that the model showed as volumes that would be diverted to these proposed new interchanges.

5.1 2038 No-Build Level of Service (LOS) and V/C Ratio Analysis (See Figure 10 page 54)

Future transportation conditions were analyzed using the growth rates in Section 5.0 to determine how traffic volumes and characteristics of the I-71 corridor might change from existing conditions. This analysis of the future conditions is based on the design year 2038. A base free-flow speed between 60 miles per hour (mph) to 73 mph was used and was adjusted based on roadway geometry.

The traffic policy regarding target v/c ratios for freeways was used as a performance measure to determine recommendations for widening. Chart 2 illustrates where No-Build traffic volumes produce v/c ratios over the targeted 1.0 in urban areas, and 0.9 in rural areas. In 2038, Boone County is expected to be urban therefore, that target v/c ratio is 1.0.

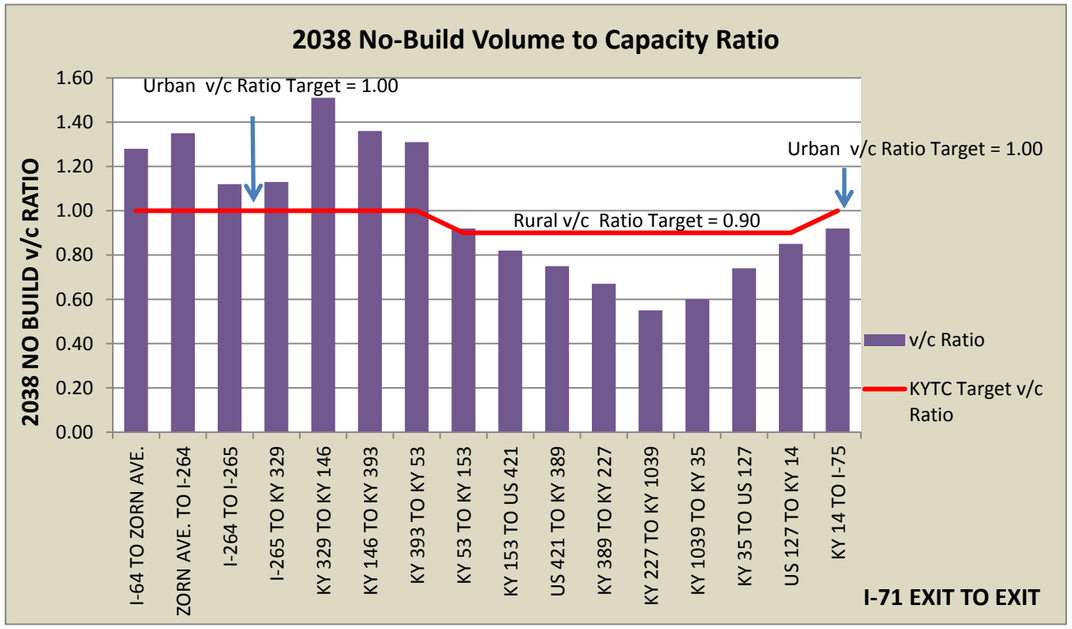


Chart 2: 2038 No-Build Volume to Capacity Ratio Comparison

As stated earlier, the current reconstruction of the Kennedy (I-64/I-65) interchange, the proposed east end approach to the Ohio River Bridge(I-265), recent projects let to construction at I-71 and I-264 (Item Number 5-48.2 I-264 improvements at I-71), and the planned I-71 projects at Zorn Avenue and I-265 (Item Numbers 5-48.1 and 0.3) will improve chokepoints at various locations along their respective routes, but will not negate the need for additional capacity in Jefferson County.

However, this reduction still leaves over 83,000 vehicles per day in year 2030 on I-71 mainline. When projected to 2038, utilizing the growth rates from the *Louisville Southern Indiana Ohio River Bridges Traffic Forecast February 2012*, there are sections from the end of the Kennedy Interchange Reconstruction to I-265 will still operate at LOS F, with a v/c ratio exceeding 1.0 in year 2038.

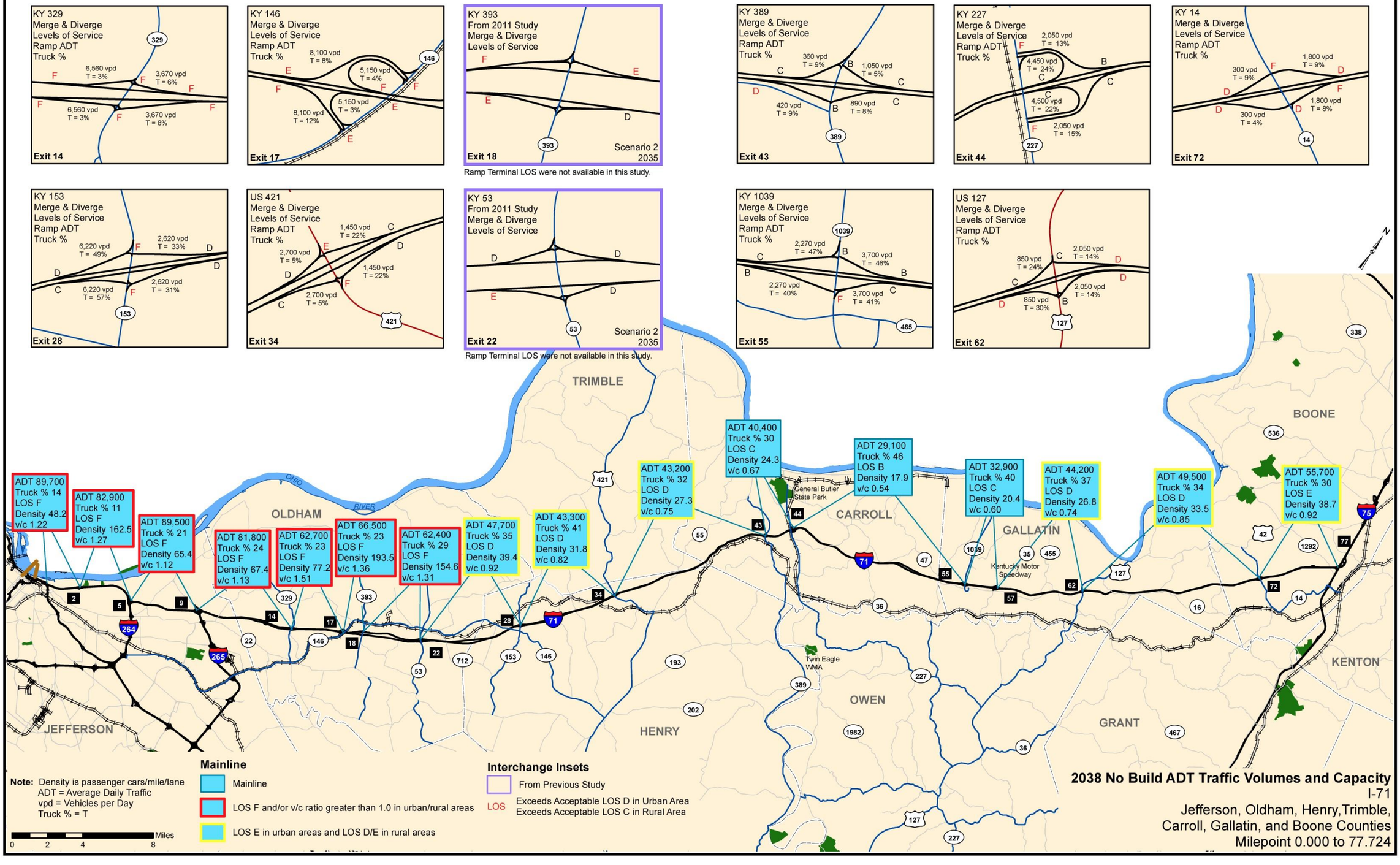


Figure 10: 2038 No-Build Traffic Volumes

Based on capacity analyses conducted for the design year (2038) there are multiple sections of I-71 that will be severely congested or will operate at over capacity without improvements (see Table 14, p. 56). A review of the mainline analysis for I-71 indicates the following:

5.1.1 I-71 Mainline

I-64 to Zorn Avenue (end of reconstructed Kennedy Interchange): This section has a projected design year (2038) ADT of 89,700 vpd and a truck percentage of 14% (12,600 trucks). The measured density for this section is 48.2 pc/mi/ln. Capacity analyses indicate that this section will operate at LOS F with a v/c ratio of 1.22.

Zorn Avenue to I-264: This section has a projected design year ADT of 82,900 vpd and a truck percentage of 11% (9,100 trucks). The measured density for this section is 162.5 pc/mi/ln. Capacity analyses indicate that this section will operate well over capacity at LOS F and a v/c ratio of 1.27.

I-264 to I-265: This section of I-71 between the two major interstates has a design year ADT of 89,500 and a truck percentage of 21% (19,000 trucks). The measured density for this section is 65.4 pc/mi/ln. Capacity analyses indicate that this section will also operate over capacity at LOS F and a v/c ratio of 1.12.

I-265 to KY 329: This section has a design year ADT of 81,800 and a truck percentage of 24% (19,600 trucks). The measured density for this section is 67.4 pc/mi/ln. Capacity analyses indicate that this section will operate over capacity at LOS F and a v/c ratio of 1.13.

KY 329 to KY 146: Future traffic volumes for this section are projected to be 62,700 vpd with a truck percentage of 23% (14,400 trucks). The measured density for this section is 77.2 pc/mi/ln. Design year capacity analyses indicate that this section will operate at LOS F with a v/c ratio of 1.51.

KY 146 to KY 393: This section has a design year ADT of 66,500 vpd with a truck percentage of 23% (15,300 trucks). The measured density for this section is 193.5 pc/mi/ln. Based on design year (2038) capacity analyses, this section will operate at LOS F with a v/c ratio of 1.36.

KY 393 to KY 53: This section has a design year ADT of 62,400 vpd with a truck percentage of 29% (18,000 trucks). The measured density for this section is 154.6 pc/mi/ln. Based on design year (2038) capacity analyses, this section will operate at LOS E with a v/c ratio of 1.31.

KY 53 to KY 153: This section has a design year ADT of 47,700 vpd with a truck percentage of 29% (13,800 trucks). The measured density for this section is 39.4 pc/mi/ln. Based on design year (2038) capacity analyses, this section will operate at LOS D. Although this section will operate at LOS D, it has a v/c ratio of 0.92, which indicates that it may need consideration for improvements.

KY 14 to I-75: This section has a design year ADT of 55,700 vpd with a truck percentage of 30% (21,000 trucks). The measured density for this section is 38.7 pc/mi/ln. Based on design year (2038) capacity analyses, this section will operate at LOS E in the design hour volume. This section of I-71 is expected to transition from rural to urban in the design year 2038, and therefore, would have a v/c ratio target of 1.0.

5.1.2 Merge/Diverge Areas

As shown in Table 15 (p. 57), the following merge/diverge locations along I-71 were identified as being deficient or in need of consideration for improvement:

KY 329 – The northbound exit and entrance ramps at the KY 329 interchange will operate at LOS F for the design year.

KY 146 – The northbound and southbound exit ramps at the KY 146 interchange will operate at LOS F while the northbound and southbound entrance ramps will operate at LOS E.

KY 393 – Based on the 2008 Feasibility Study for a proposed interchange in Oldham County between exits 18 (KY 393) and 22 (KY 53), the northbound and southbound exit and entrance ramps will continue to operate at LOS E for the design year.

KY 14 – The northbound entrance ramp to I-71 will operate at LOS F. This low LOS is due to this segment of I-71 nearing capacity.

5.1.3 Crossroad/Ramp Terminal Intersections

Also as shown in Table 15 (p. 57), the following crossroad ramp terminal intersections were identified as a capacity issue. These locations were considered for improvement.

KY 329 – The north and south intersections of the I-71 ramp terminals and KY 329 will continue to operate at LOS F for the design year.

KY 146 – The intersection for the northbound ramps on the south side of the KY 146/I-71 interchange will operate at LOS E for the design year and the intersection for the southbound ramps on the north side of the interchange will operate at LOS F for the design year.

KY 153 – The north and south intersections of the I-71 ramp terminals and KY 153 will operate at LOS F for the design year.

US 421 – The northbound exit and entrance ramp intersection of the I-71 and US 421 interchange will operate at LOS F for the design year. The southbound entrance and exit ramp intersection will operate at LOS E.

KY 227 – The intersection of the northbound I-71 ramps on the south side of the KY 227/I-71 interchange and the intersection of the southbound I-71 ramps on the north side will both operate at LOS F for the design year.

KY 1039 – The northbound exit and entrance ramp intersection of the I-71 and KY 1039 interchange will operate at LOS F for the design year.

KY 14 – The southbound exit and entrance ramp intersection of the I-71 and KY 14 interchange will operate at LOS F for the design year.

5.2 2038 Level of Service (LOS) and V/C Ratio Analysis (see Figure 11 page 58)

Based on the capacity analysis, improvements were considered to address those locations either projected or determined to operate at or over capacity for the design year (2038). The following types of improvements were considered:

- Both short (or Quick Wins) - and long-term improvements that address capacity and safety problems.
- Improvements designed to address crossroad deficiencies, capacity, or inadequate stacking at interchange locations.
- Recommended improvements including the potential re-alignment of I-71 around MP 63.0 and other locations.
- Potential new interchange locations.
- Additional improvements for the Kentucky Speedway at I-71 and the crossroads for event days.

Table 14: 2038 No-Build Mainline Capacity Summary

	EXIT 0 to 2 I-64 to Zorn Avenue		EXIT 2 to EXIT 5 Zorn Ave. to I-264		EXIT 5 to Exit 9 I-264 to I-265		EXIT 9 to Exit 14 I 265 to KY 329		Exit 14 to Exit 17 KY 329 to KY 146		Exit 17 to Exit 18 KY 146 to KY 393		Exit 18 to Exit 22 KY 393 to KY 53		Exit 22 to Exit 28 KY 393 to KY 53	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
AM DDHV	3270	4960	3040	5290	2070	4450	2010	4430	2980	3140	2660	2830	2430	2530	1810	2310
PM DDHV	4010	3480	4840	3600	4350	3210	4430	2720	4950	3820	4460	3420	4030	3090	2670	2290
Truck %	14	14	11	11	21	21	24	24	23	23	23	23	29	29	35	35
LOS AM	D	E	D	F	B	F	B	F	E	E	D	E	D	D	C	D
AM Density	33.6	109.2	30.0	162.5	17.1	65.4	16.8	67.4	38.2	42.7	31.7	35.1	29.7	31.7	21.3	30.2
AM v/c ratio	0.85	1.28	0.77	1.35	0.52	1.12	0.51	1.13	0.91	0.96	0.81	0.86	0.79	0.82	0.63	0.8
Average passenger car speed (mi/hr)	57.9	27.0	59.4	19.1	74.2	41.8	74.3	40.9	58.3	54.9	62.8	60.3	65.3	63.6	71.9	64.9
Free Flow Speed (mi/hr)	60.0	60.0	60.0	60.0	73.9	73.9	73.9	73.9	73.0	73.0	69.6	69.6	73.6	73.6	74.2	74.2
LOS PM	F	E	F	E	F	D	F	C	F	F	F	F	F	F	E	D
PM Density	48.8	36.9	88.1	38.2	60.5	30.5	67.4	24.3	N/A	77.2	193.5	52.5	154.6	48.0	39.4	29.7
PM v/c ratio	1.04	0.90	1.23	0.92	1.09	0.80	1.13	0.69	1.51	1.17	1.36	1.04	1.31	1.01	0.92	0.79
Average passenger car speed (mi/hr)	48.8	56.0	32.2	55.3	44.1	64.6	40.9	69.7	N/A	36.9	17.2	48.7	20.8	51.3	57.4	65.2
Free Flow Speed (mi/hr)	60.0	60.0	60.0	60.0	73.9	73.9	73.9	73.9	73.0	73.0	69.6	69.6	73.6	73.6	74.2	74.2

	Exit 28 to Exit 34 KY 153 to US 421		Exit 34 to Exit 43 US 421 to KY 389		Exit 43 to Exit 44 KY 389 to KY 227		Exit 44 to Exit 55 KY 227 to KY 1039		Exit 55 to Exit 57 KY 1039 to KY 35		Exit 57 to Exit 62 KY 35 to US 127		Exit 62 to Exit 72 US 127 to KY 14		Exit 72 to Exit 77 KY 14 to I-75	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
AM DDHV	1730	1840	1640	1660	1660	1540	1000	1120	1200	1660	1590	1680	1860	1960	2089	2200
PM DDHV	2250	2080	2230	2030	2040	2040	1440	1410	1660	1550	2100	2030	2480	2400	2785	2700
Truck %	41	41	32	32	30	30	46	46	40	40	37	37	34	34	30	30
LOS AM	C	C	C	C	C	B	B	B	B	C	C	C	C	C	C	C
AM Density	21.7	23.5	18.3	18.6	19.2	17.7	12.5	17.9	14.2	20.4	18.7	19.9	21.8	23.3	24.1	25.9
AM v/c ratio	0.63	0.67	0.55	0.56	0.55	0.51	0.38	0.43	0.44	0.6	0.56	0.59	0.64	0.67	0.69	0.72
Average passenger car speed (mi/hr)	71.6	70.3	73.7	73.5	69.8	70.0	75.0	73.8	75	72.5	73.5	72.7	71.5	70.4	69.8	68.4
Free Flow Speed (mi/hr)	74.2	74.2	74.2	74.2	69.6	69.6	74.6	74.6	73.6	73.6	73.9	73.9	74.6	74.6	74.6	74.6
LOS PM	D	D	D	C	C	C	C	B	C	C	D	C	D	D	E	E
PM Density	31.8	C	27.3	23.8	24.3	24.3	18.4	13.7	20.4	18.8	26.8	25.5	33.5	31.6	38.7	36.5
PM v/c ratio	0.82	0.76	0.75	0.68	0.67	0.67	0.45	0.54	0.6	0.56	0.74	0.72	0.85	0.82	0.92	0.89
Average passenger car speed (mi/hr)	63.5	66.7	67.3	70.0	67.7	67.7	73.6	75	72.5	73.4	67.7	68.7	62.1	63.6	57.9	69.7
Free Flow Speed (mi/hr)	74.2	74.2	74.2	74.2	69.6	69.6	74.6	74.6	73.6	73.6	73.9	73.9	74.6	74.6	74.6	74.6

DDHV – Directional Design Hour Volume v/c – volume to capacity ratio LOS – Level of Service Red shading is LOS F and/or v/c ratio > 1.0 for urban areas and LOS F for rural areas; Yellow shading is LOS E in urban or D/E rural areas.

Table 15: 2038 No-Build Ramp and Ramp Terminal Capacity Summary

	EXIT 9 to Exit 14 I 265 to KY 329				Exit 14 - Exit 17 KY 329 to KY 146				Exit 22 to Exit 28 KY 53 to KY 153				Exit 28 to Exit 34 KY 153 to US 421			
RAMPS	**KY 329 Ramps**				**KY 146 Ramps**				**KY 153 Ramps**				**US 421 Ramps**			
	NB		**SB**		**NB**		**SB**		**NB**		**SB**		**NB**		**SB**	
	LOS	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**
Merge AM	D	35.0	F	49.7	D	31.6	E	35.6	C	24.2	D	31.0	C	22.3	C	25.2
Merge PM	F	58.0	D	31.7	F	51.9	D	34.9	D	31.4	D	29.8	D	29.8	D	29.4
Diverge AM	B	19.7	D	32.9	D	30.7	C	27.2	B	19.3	D	26.5	C	22.4	C	21.5
Diverge PM	F	43.5	F	42.9	F	53.4	F	41.8	C	24.9	C	25.6	C	21.4	C	25.8
RAMP TERMINALS**	**KY 329 Ramp Terminals**				**KY 146 Ramp Terminals**				**KY 153 Ramp Terminals**				**US 421 Ramp Terminals**			
Ramp Terminals**	**Queue for KY 329**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for KY 146**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for KY 153**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for US 421**	**LOS**	**ISSUE**	**Intersection Delay**
NB AM	20	F	EBL	3529.0	15, 2.5	C	EBL, NBL	31.7	24	F	EB LR	264.4	0	C	NB L	16.2
NB PM	19	F	EBL	934.2	30	E	EBL	63.0	87	F	EB LR	1215.0	12	F	NB L	67.0
SB AM	44, N/A	F	NBLT, WBL	145.2, N/A	61	F	EBL	1869.0	2	C	WB L	35.2	3	E	SB L	39.7
SB PM	41	F	WBL	3386.0	23	F	EBL	1016.0	14	F	WB L	333.8	3	C	SB L	24.0

	Exit 34 to Exit 43 US 421 to KY 389				Exit 43 to Exit 44 KY 389 to KY 227				Exit 44 to Exit 55 KY 227 to KY 1039				Exit 57 to Exit 62 KY 35 to US 127				Exit 62 to Exit 72 US 127 to KY 14			
RAMPS	**KY 389 Ramps**				**KY 227 Ramps**				**KY 1039 Ramps**				**US 127 Ramps**				**KY 14 Ramps**			
	NB		**SB**		**NB**		**SB**		**NB**		**SB**		**NB**		**SB**		**NB**		**SB**	
	LOS	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**	**LOS**	**Density**
Merge AM	C	22.1	C	22.6	B	15.4	B	19.6	B	17.1	B	16.9	C	24.6	C	22.4	D	29.9	C	25.7
Merge PM	C	26.8	C	26.8	C	21.3	C	13.9	C	23.2	C	21.1	D	33.3	C	27.2	F	42.8	D	31.4
Diverge AM	B	19.9	B	18.7	B	14.2	B	24.5	B	13.4	B	14.4	D	28.2	C	24.9	C	24.5	C	25.0
Diverge PM	D	28.7	C	25.9	C	21.3	B	17.4	B	19.2	B	17.2	C	21.8	D	29.0	D	33.1	D	31.1
RAMP TERMINALS**	**KY 389 Ramp Terminals**				**KY 227**				**KY 1039 Ramp Terminals**				**US 127 Ramp Terminals**				**KY 14 Ramp Terminals**			
Ramp Terminals**	**Queue for KY 389**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for KY 227**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for KY 1039**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for KY 127**	**LOS**	**ISSUE**	**Intersection Delay**	**Queue for KY 14**	**LOS**	**ISSUE**	**Intersection Delay**
NB AM	0	A	EB LR	9.2	25	F	WB LR	148.7	3	C	SBL	18.7	0	B	EBL	11.1	1	C	NB LR	22.0
NB PM	0	B	EB LR	10.5	9.0	E	WB LR	41.9	10	F	SBL	50.4	0	B	EBL	12.7	2	D	NB LR	26.5
SB AM	0	A	WB LR	9.3	23	F	WB LR	1843.0	0	B	WBL	13.7	1	B	WBLR	12.3	4	C	SB LR	21.2
SB PM	1	B	WB LR	10.8	3,11	F	WB LR, SBL	6462	0	B	WB L	12.6	5	C	WBLR	22.2	30	F	SB LR	182.2

Density - passenger cars per mile per lane LOS – Level of Service Intersection Delay - seconds/vehicle Queue – number of vehicles in a queue for the cited issue

**I-71 is the East /West Street in the capacity analysis except for US 421 and KY 14 ramp terminals. Red shading is LOS F in urban/rural areas and Yellow shading is LOS E in urban; D/E in rural areas.

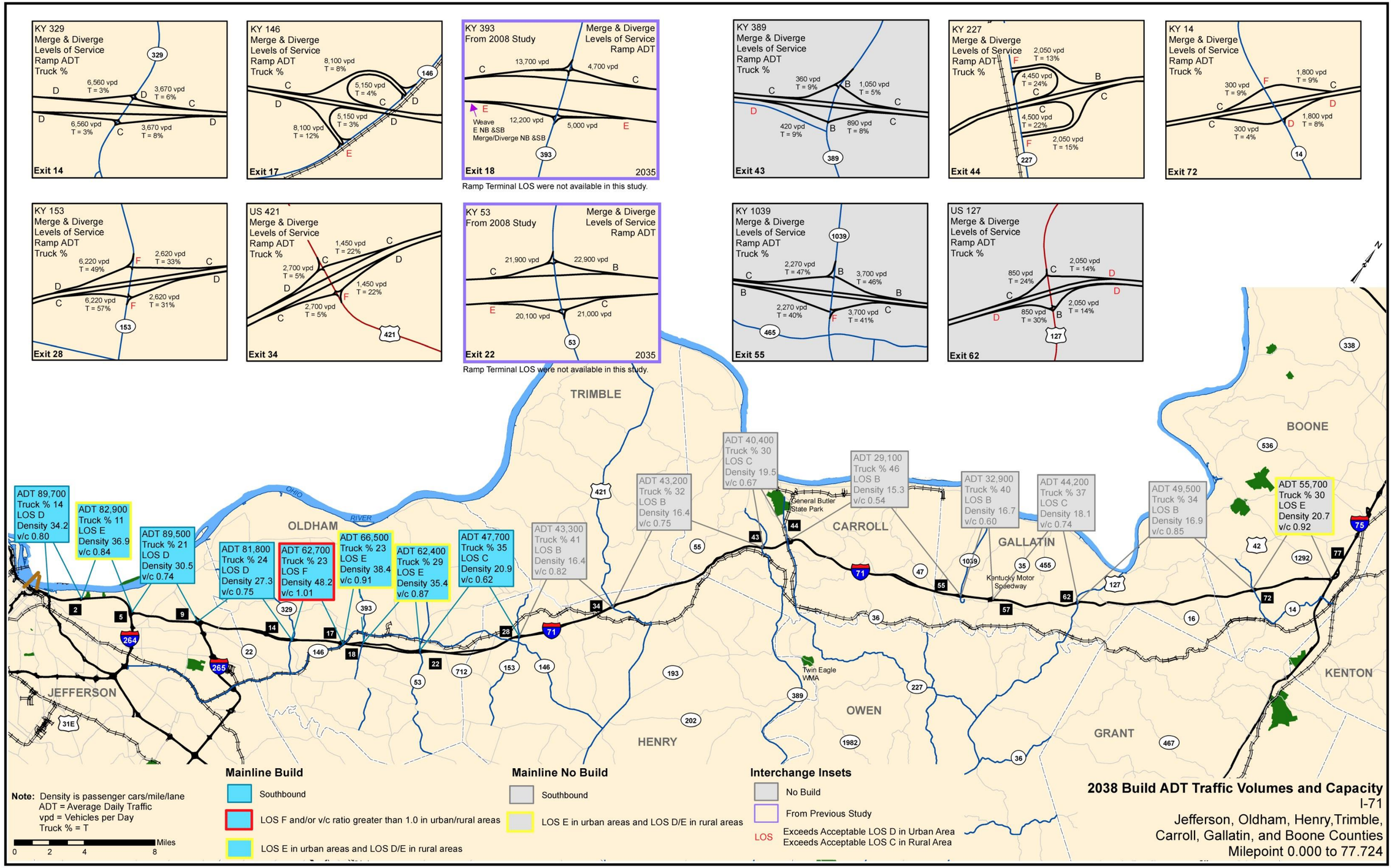


Figure 11: 2038 Build Traffic Volumes and Capacity

Future LOS and v/c ratios with these improvements are shown in Figure 11 (p. 58). AM and PM directional volumes and capacity results are shown in Figures 12 (p. 60) and 13 (p. 61), respectively. The results of the capacity analysis for 2038 are contained in **Appendix J**.

5.2.1 I-71 Mainline

In the below descriptions v/c ratios are denoted only when they exceed 1.0 in an urban area, and 0.90 in a rural area.

I-64 to Zorn Avenue: I-71 would be widened from four to six lanes. This section would operate at LOS D with an overall v/c ratio of 0.80. The density for this section would be 34.2 pc/mi/ln. With six lanes, the northbound lanes are expected to operate at LOS C during the AM peak and LOS D during the PM peak. The southbound lanes are expected to operate at LOS D during the AM peak and LOS C during the PM peak.

Zorn Avenue to I-264: This section would operate at LOS E with an overall v/c ratio of 0.84. The density for this section would be 36.9 pc/mi/ln. The northbound lanes on this section of I-71 with six lanes are expected to operate at LOS C during the AM peak and LOS D during the PM peak. The southbound lanes are expected to operate at LOS E during the AM peak and LOS C during the PM peak.

I-264 to I-265: This section would operate at LOS D with an overall v/c ratio of 0.74. The density for this section would be 30.5 pc/mi/ln. As a six-lane section, the northbound lanes are expected to operate at LOS B during the AM peak and LOS D during the PM peak for this section of I-71 between the two major interstates. The southbound lanes are expected to operate at LOS D for both the AM and PM peak periods.

I-265 to KY 329: This section would operate at LOS D with an overall v/c ratio of 0.75. The density for this section would be 27.3 pc/mi/ln. Assuming six lanes on I-71, the northbound lanes are expected to operate at LOS B during the AM peak and LOS D during the PM peak. The southbound lanes are expected to operate at LOS D during the AM peak and LOS B during the PM peak. Although this section has a lower traffic volume than I-71 from I-64 (Kennedy Interchange reconstruction) to I-265, this section has a higher LOS and v/c ratio due to the higher truck percentages, increase in speeds (from 60 mph to 70 mph speed limit). With the high truck percentages the higher truck factor makes a significant difference in flow rate. As discussed in Section 5.0, the growth rate also changes at the KY 329 interchange from the previous southern sections of I-71 (I-64 (Kennedy Interchange reconstruction) to I-265).

KY 329 to KY 146: This section would operate at LOS F with an overall v/c ratio of 1.01. The density for this section would be 48.2 pc/mi/ln. With six lanes on I-71, the northbound and southbound lanes will operate at LOS C during the AM peak. However, the northbound lanes will operate at LOS F with a v/c ratio of 1.01 during the PM peak. Although this section will continue to operate at LOS F, the v/c ratio improved from 1.51 to 1.01 with six lanes. The southbound lanes will operate at LOS D during the PM peak. This section has a lower traffic volume than from I-64 (Kennedy Interchange reconstruction) to KY 329, this section has a higher LOS and v/c ratio due to the change in terrain, and the higher truck percentages. The terrain transitions from flat to rolling at the KY 329 interchange. With the high truck percentages the higher truck factor makes quite a difference in the flow rate. However, this segment should be watched closely for growth and adjusted in priority if necessary.

KY 146 to KY 393: This section would operate at LOS E with an overall v/c ratio of 0.91. The density for this section would be 38.4 pc/mi/ln. The northbound and southbound lanes on I-71 for this section with six lanes will operate at LOS C during the AM peak hour. The northbound lanes will operate at LOS E and the southbound lanes will operate at LOS C during the PM peak.

KY 393 to KY 53: This section would operate at LOS E with an overall v/c ratio of 0.87. The density for this section would be 35.4 pc/mi/ln. This section with six lanes on I-71 will operate at LOS B for the northbound lanes and LOS C for the southbound lanes during the AM peak hour. During the PM peak, the northbound lanes will operate at LOS E and the southbound lanes will operate at LOS C.

KY 53 to KY 153: This section would operate at LOS C with an overall v/c ratio of 0.62. The density for this section would be 20.9 pc/mi/ln. This section with six lanes on I-71 will operate at LOS B for both northbound and southbound lanes in the AM Peak. In the PM Peak, the northbound lanes will operate at LOS C and the southbound lanes will operate at LOS B.

5.2.2 Merge/Diverge Areas

The following merge/diverge location along I-71 were identified as being deficient or in need of consideration for improvement:

KY 329 – The northbound entrance ramp at the KY 329 interchange will continue to operate at LOS F for the design year.

KY 53 – Recommended two lanes for northbound off ramp from 2008 study and also a low-cost improvement in 2011 study.

5.2.3 Crossroad/Ramp Terminal Intersections

As part of the Scope of Work of this study, each crossroad identified in Table 1 (p. 1), was evaluated to the first intersection beyond the ramp terminals. If there was a safety or capacity issue, the roadway was considered for improvement. Left turn lanes and signals were evaluated where appropriate and recommendations were made. Utilizing 12-hour traffic counts, the installation of traffic signals were evaluated. It appears that the recommended signals meet MUTCD warrants; however, will still have to go through KYTC's approval process for traffic signals before being implemented. Only crossroads that warranted left turn lanes were recommended. In instances of crash issues, the roadway geometrics were also evaluated and presented. In a few instances, a particular movement at a ramp terminal may have had a low LOS yet no improvements were recommended. This decision was due to either a very low traffic volume for that movement, turn lanes and signal warrants were not met, or separating the turning movements did not improve the LOS or delay. The following are the recommended ramp terminal improvements. The charts in this section of the report demonstrate the 2038 capacity analysis using the 2010 Highway Capacity software before and after improvements are made. They also illustrate which movements are the dominant issues, for example, NBT in the issue column means that the northbound through movement is predominantly the reason for a low LOS The green highlights illustrate what the improvement consisted of, the yellow shading indicates a LOS E and the red shading indicates a LOS F condition. The "queue length" refers to the number of vehicles "stacked" on a given ramp for the movement that was the issue.

As identified in Section 3.4 (p. 17), the issues are the same with each identified intersection and only grow in magnitude. Several crossroad ramp terminal improvements are recommended for improvement due to crash issues and are identified as such.

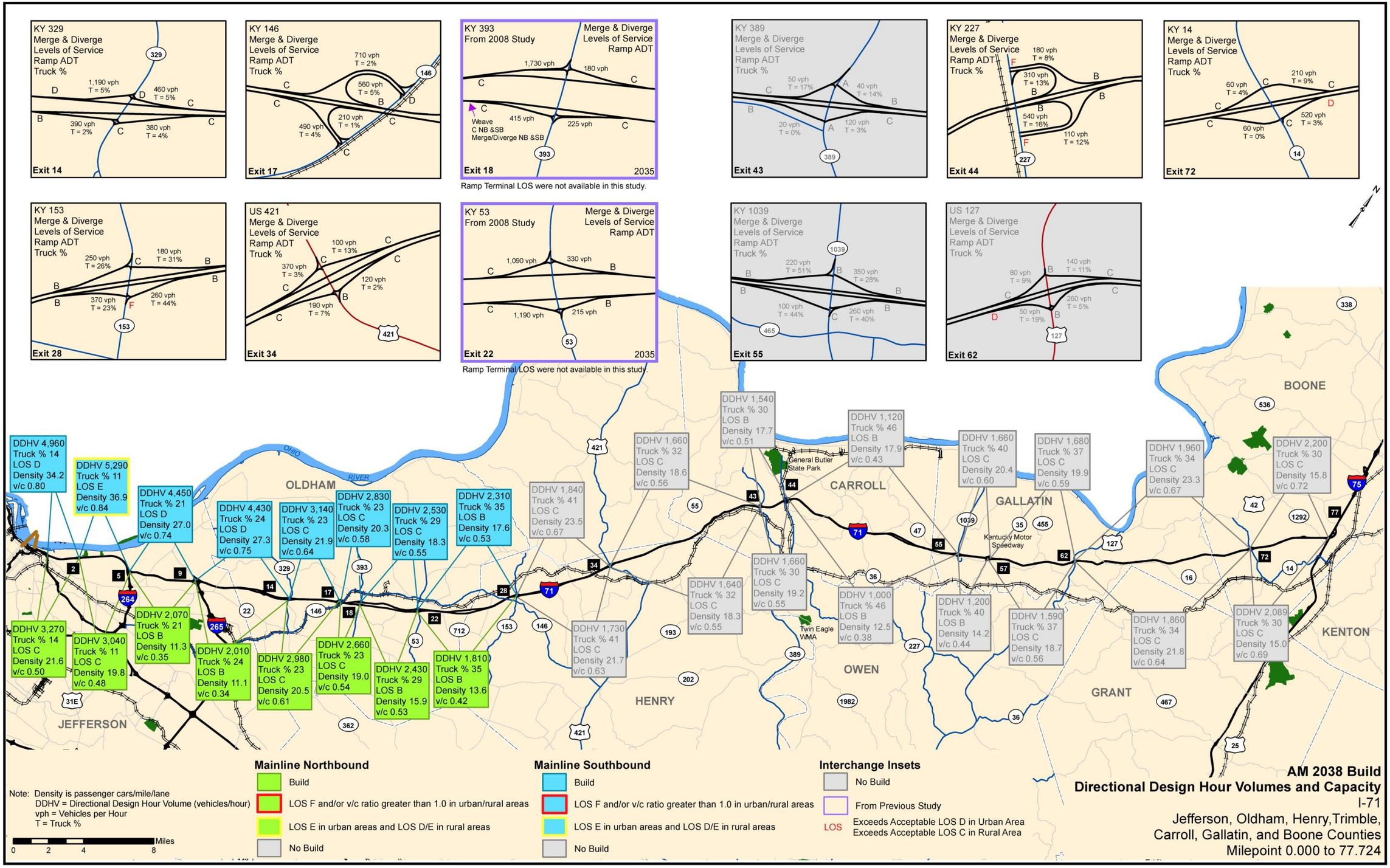


Figure 12: 2038 AM Build Directional Volumes and Capacity

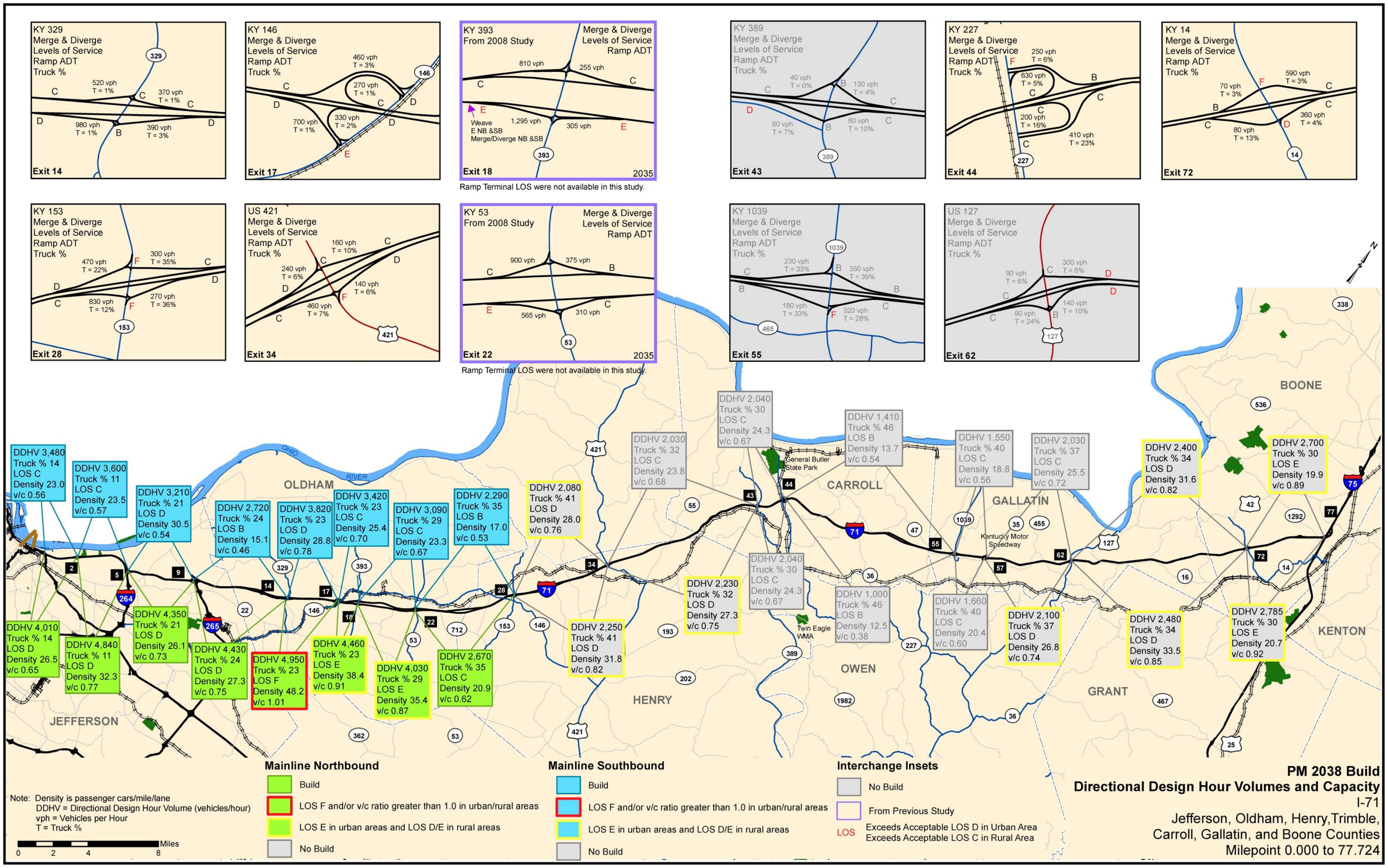


Figure 13: 2038 PM Build Directional Volumes and Capacity

KY 329 – The north intersection of the I-71 ramp terminal and KY 329 will operate at LOS D during the AM peak hour for the design year. Improvements include signalization of the southbound ramp terminals in 2013 and a left turn lane through the interchange area. It is recommended that the northbound ramp terminals be evaluated for signalization in 2038 and possibly the addition of dual left turns should be provided for the southbound terminal intersection.

Before Improvement (2038)

	KY 329 Ramp Terminals			
	Queue Length for issue+	LOS	ISSUE	HCS Intersection Delay*
NB AM	20	F	EBL	3529.0
NB PM	19	F	EBL	934.2
SB AM	44, N/A	F	NBLT, WBL	145.2, N/A
SB PM	41	F	WBL	3386.0

After Improvement (2038)

KY 329 Ramp Terminals			
Queue Length for issue+	LOS	ISSUE	HCS Intersection Delay*
41	C	NBT	24.2
13.1	B	SBT	12.3
11.2,21	D	WBL, SBT	42.3
12	C	SBT	32.6
NB signalized and dual lefts + original SB signalization and left turn lane			

+Measured in vehicles, LOS – Level of Service, Intersection Delay – measured in sec/vehicle

Before Improvement (2013)

	KY 329 Ramp Terminals			
	Queue Length for Issue+	LOS	ISSUE	HCS Intersection Delay
NB AM	6	F	EBL	220.1
NB PM	3	E	EBL	45.0
SB AM	39	F	WBL	10710.0
SB PM	26	F	WBL	540.3

After Improvement (2013)

KY 329 Ramp Terminals			
Queue Length for Issue+	LOS	ISSUE	HCS Intersection Delay
6	F	EBL	220.1
3	E	EBL	45.0
7	D	WBL	41.1
3	B	WBL	15.8
Signalized SB ramps & Left Turn Lane between ramp terminals			

+Measured in vehicles, LOS – Level of Service *Intersection Delay – measured in sec/vehicle

KY 146 – The intersection for the southbound ramps on the north side of the interchange will operate at LOS D for both the AM and PM peak hours. The intersection for the northbound ramp on the south side of the interchange will operate at LOS E during the PM peak.

Before Improvement (2013)

	KY 146 Ramp Terminals			
	Queue Length for Issue+	LOS	ISSUE	HCS Intersection Delay*
NB AM	9	C	EBL	23.2
NB PM	6	B	EBL	17.8
SB AM	38	F	EBL	538.3
SB PM	11	F	EBL	165.5

After Improvement (2013)

KY 146 Ramp Terminals			
Queue Length for Issue+	LOS	ISSUE	HCS Intersection Delay*
9	C	EBL	23.2
6	B	EBL	17.8
1	A	EBL	6.7
3	B	EBL	11.5
Signalized SB ramps it should also be coordinated with NB signal			

+Measured in vehicles, LOS – Level of Service *Intersection Delay – measured in sec/vehicle

KY 53 – The northbound exit ramp of the KY 53 Interchange was determined from the I-71/Proposed Overpass Interchange Feasibility Study (November 2008) to operate at LOS E. Based on the capacity analysis an additional lane was recommended for the northbound exit ramp.

KY 153 – The south intersection of the I-71 ramp terminals and KY 153 will operate at LOS F for both the AM and PM peak hours for the design year. The north intersection will also operate at LOS F during the PM peak hour. Left turn lanes from KY 153 onto the entrance ramps should be provided.

Before Improvement (2038)

	KY 153 Ramp Terminals			
	Queue Length for issue+	LOS	ISSUE	HCS Intersection Delay*
NB AM	24	F	EB LR	264.4
NB PM	87	F	EB LR	1215.0
SB AM	2	C	WB L	35.2
SB PM	14	F	WB L	333.8

After Improvement (2038)

KY 153 Ramp Terminals			
Queue for issue+	LOS	ISSUE	HCS Intersection Delay*
12	F	EB L	186.0
34	F	EB L	427.0
2	C	WB L	35.2
14	F	WB L	333.8
Separate left and right turns on the NB off ramp 700'. 700' should allow the right turns to bypass left turn queue. Development is directly adjacent to the ramp. Add left turn lane from KY 153 to entrance ramps.			

+Measured in vehicles, LOS – Level of Service *Intersection Delay – measured in sec/vehicle

US 421 – The northbound exit and entrance ramp intersection of the I-71 and US 421 interchange will operate at LOS F during the PM peak hour for the design year. The southbound entrance and exit ramp intersection will operate at LOS E during the AM peak hour. Separate left and right turns on the northbound exit ramp to US 421 should be provided in addition to providing a left turn lane from US 421 to the entrance ramps.

Before Improvement (2038)

	US 421 Ramp Terminals			
	Queue Length for issue+	LOS	ISSUE	HCS Intersection Delay*
NB AM	2	C	NB L	16.2
NB PM	12	F	NB L	67.0
SB AM	3	E	SB L	39.7
SB PM	3	C	SB L	24.0

After Improvement (2038)

US 421 Ramp Terminals			
Queue for issue+	LOS	ISSUE	HCS Intersection Delay*
2	C	NB LR	22
2	D	NB LR	26.5
3	E	SB L	39.7
3	C	SB L	24.0
Add Left Turn lane from US 421 to the entrance ramps and separating NB left and right turns.			

+Measured in vehicles, LOS – Level of Service *Intersection Delay – measured in sec/vehicle

KY 227 – The intersection of the northbound I-71 ramps on the south side of the KY 227/I-71 interchange will operate at LOS F during the AM peak hour and LOS C during the PM peak hour. The intersection of the southbound I-71 ramps on the north side will operate at LOS F for both the AM and PM peak hours for the design year. Separate left and right turn lanes should be provided on the exit ramps to KY 227.

Before Improvement (2038)

	KY 227 Ramp Terminals			
	Queue Length for issue+	LOS	ISSUE	HCS Intersection Delay*
NB AM	25	F	WB LR	148.7
NB PM	9.0	E	WB LR	41.9
SB AM	23	F	WB LR	1843.0
SB PM	3,11	F	WB LR, SBL	6462

After Improvement (2038)

KY 227 Ramp Terminals			
Queue for issue+	LOS	ISSUE	HCS Intersection Delay*
21	F	WBR	119.5
1	C	WBL	22.6
5	F	WBL	376.4
11	F	WBL	591.6
Separated Westbound Lefts and Rights at SB ramps PM 100'			

+Measured in vehicles, LOS – Level of Service *Intersection Delay – measured in sec/vehicle

KY 1039 – The northbound exit and entrance ramp intersection of the I-71 and KY 1039 interchange will operate at LOS F for the design year. It did not warrant a left turn lane or have a crash issue, therefore no improvements were recommended.

KY 14 – The southbound exit and entrance ramp intersection of the I-71 and KY 14 interchange will operate at LOS F during the PM peak hour for the design year. Separate left and right turn lanes should be provided at the southbound ramp and provide for left turn lanes on KY 14 between the northbound and southbound entrance ramps.

Before Improvement (2038)

	KY 14 Ramp Terminals			
	Queue Length for issue+	LOS	ISSUE	Intersection Delay*
NB AM	1	C	NB LR	22.0
NB PM	2	D	NB LR	26.5
SB AM	4	C	SB LR	21.2
SB PM	30	F	SB LR	182.2

After Improvement (2038)

KY 14 Ramp Terminals			
Queue for issue+	LOS	ISSUE	Intersection Delay*
1	C	NB LR	22.0
2	D	NB LR	26.5
3	C	SB L	17.3
19	F	SB L	90.6
Separated Westbound Lefts and Rights at SB ramps PM 100'			

+Measured in vehicles, LOS – Level of Service *Intersection Delay – measured in sec/vehicle

Zorn Avenue – Even though Zorn Avenue was not part of the analysis of this study, visual observations show, considering KYTC's Item Number 5-48.10 project, a signal is recommended at the I-71 southbound ramp terminals. Most of the crashes in the seven principle areas of concern at location were associated with the ramp terminals. Frequent backups onto I-71 can be seen during peak times. Motorists also seemed to be confused about who to yield to at the southbound ramps. Signal warrants were not performed as a part of this study for this location. This signal should be coordinated with the northbound ramps.

5.3 2038 BUILD MAINLINE ANALYSIS

Exhibits illustrating the build recommendations are located in **Appendix K**.

5.3.1 New Interchange Considerations

New interchanges along I-71 have been considered in previous studies identified in Section 2.1 (p. 6) of this report. Two locations in Oldham County have previously been analyzed in more detail for new interchanges. Both of these prior studies recognized the need to add capacity to I-71 before constructing a new interchange. These projects are currently listed in *Horizon 2030: The Metropolitan Transportation Plan for the Louisville (KY-IN) Metropolitan Planning Area* and will be considered for implementation by KIPDA as part of their periodic development of a regional Transportation Improvement Program. Their potential utilization is shown in Table 16 (p. 64).

Table 16: Estimated Daily Traffic Volumes at Previously Studied New Interchange Sites

Location	Year of Projected Traffic	NB Off Ramp	NB On Ramp	SB Off Ramp	SB On Ramp
Haunz Lane near Oldham-Jefferson County Line (includes new connector from US 42 to KY 22)	2030	6,000	2,900	3,600	5,700
Diamond Interchange near KY 2857	2015	5,400	1,100	1,100	5,200

As part of the current study, a preliminary analysis utilizing KYTC's Statewide Traffic Model was conducted at several locations to determine whether a new I-71 interchange would be a benefit and to determine the traffic that would be potentially served by the interchange. The model was calibrated with data collected in this study's industry survey to supplement the existing truck data, and speeds were collected along parallel routes. Efforts were made to improve the calibration of the I71 corridor and links were added to the model to give planning level estimates of what daily traffic volumes (ADT) these new interchanges would attract. During calibration efforts, network connectivity was adjusted adjacent to some of these interchanges. Truck matrices were also adjusted for a more even distribution of truck volumes into and out of several traffic analysis zones.

These locations were taken from interchanges identified in the KYTC planning process through a Project Identification Form (PIF). The interchanges that were considered as a part of this study that had not had previous traffic volumes assigned to them were the following:

- KY 55 in Henry County
- Near KY 47 in Carroll County
- Near KY 36 in Carroll County
- KY 562 in Gallatin County

As shown in Table 17, although an Interchange Justification Study (IJR) or Feasibility Study was beyond the scope of the current I-71 study, the potential need for an interchange at KY 55 and/or KY 562 does not appear to be warranted for further consideration at this time.

Table 17: Estimated Daily Traffic Volumes at Potential New Interchange Sites

Proposed Interchange Location	Estimated ADT in 2010 from KYTC Statewide Traffic Model			
	NB Off Ramp	NB On Ramp	SB Off Ramp	SB On Ramp
KY 55 in Henry County	250	830	840	240
Near KY 47 in Carroll County	510	2,620	570	760
Near KY 36 in Carroll County	190	2,275	351	293
KY 562 in Gallatin County	1,140	1,280	<200	<200

Existing Interchanges on I-71 are near MP 44 (KY 227 – Carrollton) and MP 55 (KY 1039 – Vevay/Kentucky Speedway). Therefore, to maximize interchange spacing, a new interchange would be at, or near MP 49.5.

Existing KY 47, which serves the City of Ghent to the north, crosses I-71 at MP 50.62. Existing KY 36, which serves Carrollton to the west, crosses I-71 at MP 49.05. A new, widened or reconstructed roadway would be required between I-71 and US 42 to connect with a new interchange. Tie-ins to the existing roads to the south at the interchange are all that is required (i.e. road improvements to Sanders are not necessary at this time).

A review of the entrance ramps to I-71 for a potential new interchange located near KY 47 in Carroll County indicates that the overall traffic volumes would include approximately 2,000 trucks daily (see Table 17). The majority of this truck traffic appears to originate from the industrial complex near Ghent in eastern Carroll County (see Figure 14). Currently, traffic from this area must access I-71 at either KY 227 in Carrollton or KY 1039 in Gallatin County. Many of the estimated 760 vehicles that would use the southbound on-ramp at a new KY 47 interchange are currently using US 42 to access KY 227, while traveling through the eastern side of Carrollton.

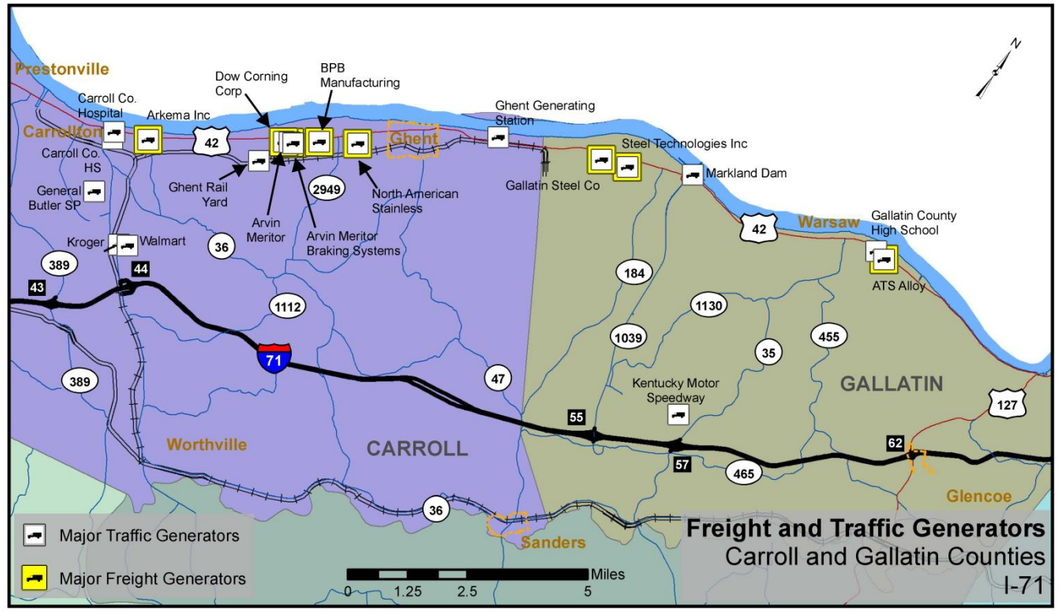


Figure 14: Freight and Traffic Generators in Carroll and Gallatin Counties

Alternate A – construct a new bridge over I-71 approximately 1300 ft. north of the existing crossing with KY 36 and new ramps for the interchange. Construct a new road to the north between the interchange and KY 36 just south of White Run Church. Improve KY 36 between White Run Church and KY 1112. Improve KY 1112 between KY 36 and KY 47 (approximately 2.7 miles). Improve KY 47 between KY 1112 and US 42 in Ghent. Tie to existing KY 36 to the south (see **Appendix K**).

Alternate B – construct widening of existing KY 47 at I-71 and construct new ramps from I-71. Widen and reconstruct KY 47 to US 42 (approximately 5.1 miles). Tie to existing KY 47 to the south of I-71 (see **Appendix K**).

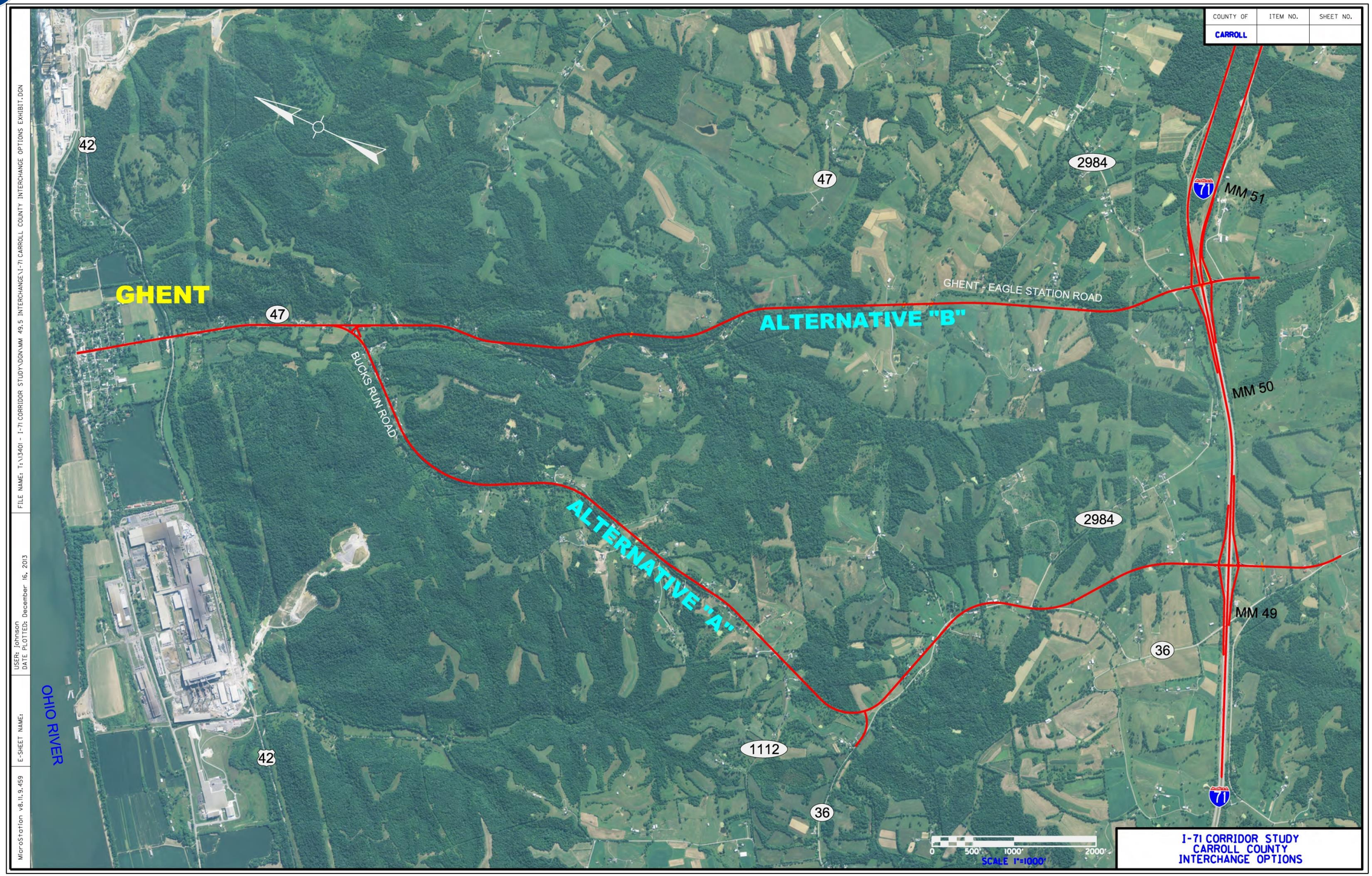


Figure 15: Potential Interchange Locations Near KY 47 and KY 36

PRELIMINARY COST ESTIMATES:

Interchange Alternate A: just north of existing KY 36 Crossing

Phase	Amount
Design	$2,000,000
Right of Way	$5,000,000
Utilities	$3,000,000
Construction	$10,000,000
Total	$20,000,000

Interchange Alternate B: at KY 47 crossing

Phase	Amount
Design	$1,500,000
Right of Way	$4,000,000
Utilities	$3,000,000
Construction	$15,000,000
Total	$23,500,000

An Interchange Justification Study and the appropriate environmental document would be required for this improvement option.

5.3.2 Potential Re-Alignment of I-71 Near MP 63.0

The stretch of I-71 from MP 62.8 to MP 64.4 has six 0.1 mile spots where the Critical Crash Rate Factor (CCRF) exceeds 1.0. From years 2009-2011 there were 41 crashes in wet or snowy weather, 38 single vehicle run-off-the-road; 8 vehicle malfunction and 2 collisions with deer. Four spots were located within the spiral horizontal curve near MP 63.0. From January 1, 2013 to July 24, 2013 there have been more crashes in this stretch than all of year 2012. This is also following complete pavement rehabilitation in 2011 to repair deficient cross slopes (normal crown 1.56% corrected to 2%). Motorists must negotiate 4% grades leading to back-to-back spiral curves. This curve is also located at the base of the 4,400-foot long 4% downgrade (see Figure 16, p. 67). Several fatalities have also occurred here in the past. Additionally, this area is prone to challenges for winter time with snow and ice issues. District 6 staff has had to be close the road during snow events due to slick roadways. Several options were examined to address the issue including curve revisions. However, during the study, District 6 staff stated that now, they are seeing more crashes occurring in the adjacent curves also. Therefore a total reconstruction alternative was also provided as an option, and actually preferred by the Project Team.

In this area I-71 currently operates at Level of Service B; however, there are 25% trucks. These trucks speed up going downhill to climb the next 4% grade up hill. Many pass side-by-side causing vehicles to queue behind them. Discussions with the Gallatin County Sheriff's Office indicated another issue is semis stop at US 127/Glencoe exit to get fuel, then head northbound, sometimes spilling/dripping excess fuel onto I-71 to create a slick road. Between June 4, 2013 and August 15, 2013 there were 6 crashes in or near this location.

IMPROVEMENT OPTIONS:

Three curve revisions were studied together with total reconstruction at MP 63.0. The alternatives considered are described as follows and shown in Appendix K:

- Reconstruct to west – flatten curve by using a special superelevation transition on south end.
- Reconstruct to west with retaining wall – same as Alternate A with wall to avoid channel change.
- Reconstruct to east – flatten curve by increasing previous curve radius on south end.
- Relocate I-71 between MP 63.40 and MP 64.5 (new length is 1.0 mile).

PRELIMINARY COST ESTIMATES:

ALTERNATE A: RECONSTRUCT TO WEST	
Phase	**Amount**
Design	$300,000
Right of Way	$400,000
Utilities	$200,000
Construction	$3,000,000
Total	**$3,900,000**
ALTERNATE B: RECONSTRUCT TO WEST WITH RETAINING WALL	
Design	$500,000
Right of Way	$300,000
Utilities	$200,000
Construction	$4,700,000
Total	**$5,700,000**
ALTERNATE C: RECONSTRUCT TO EAST	
Phase	**Amount**
Design	$400,000
Right of Way	$0
Utilities	$100,000
Construction	$3,600,000
Total	**$4,100,000**
ALTERNATE D: RELOCATE I-71 BETWEEN MP 63.4 AND MP 66.05	
Phase	**Amount**
Design	$2,200,000
Right of Way	$1,500,000
Utilities	$500,000
Construction	$31,000,000
Total	**$35,200,000**

Note: A 1 mile extension of Alternates A – C to improve the Clear Zone results in an additional cost of $500,000.

5.3.3 Analysis For Truck Climbing Lanes

Following the analysis in Section 4.5 (p. 47), there were two areas in Carroll County that were studied for Truck Climbing Lanes:

- MP 38.3 to MP 40.8 in Carroll County
- MP 44.8 to MP 46.1 in Carroll County

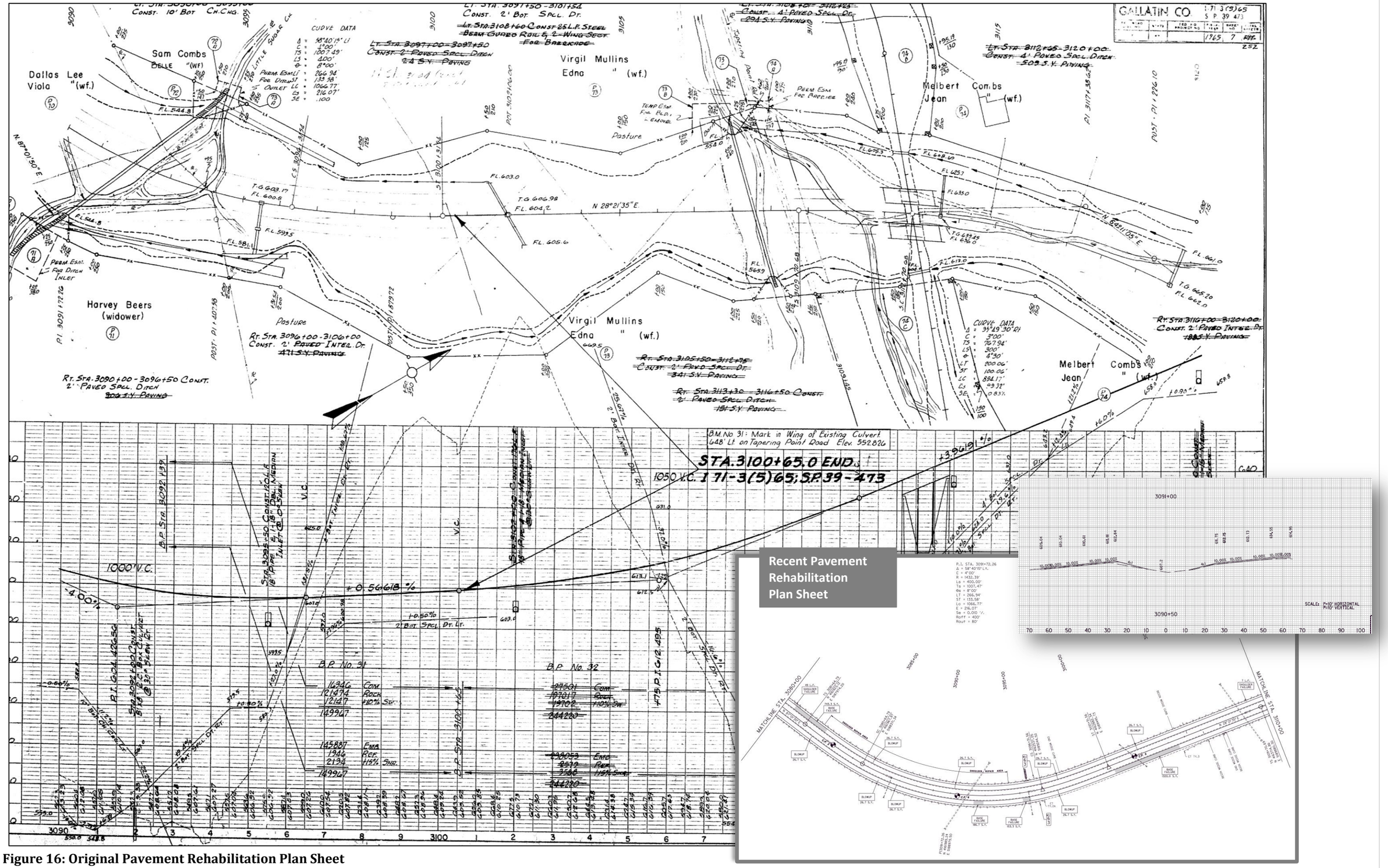


Figure 16: Original Pavement Rehabilitation Plan Sheet

5.3.3.1 MP 38.3 to MP 40.8 in Carroll County

The initial evaluation of crashes in this area did not yield any CCRF > 1.0. However, a check of the 2012 crashes revealed three fatalities in a 0.2 mile spot. The fatal crashes although all northbound were seemingly unrelated to the roadway.

Looking beyond this 0.2 mile spot, expanding 1.0 mile on either side, this area has multiple maximum 4% grades within back-to-back spiral curves, and two long narrow bridges at the end of a 3% downgrade heading northbound. The reverse is the case travelling southbound, there is a continuous uphill climb for approximately 2.5 miles beginning at approximately MP 38.3 to MP 40.8, with grades ranging from -0.5% to -4.0% and a possible deficient sag curve. The equivalent southbound grade was 3.62% for 2.33 miles (see Figure 17, p. 69). This length, according to the design manual and field observation, slows trucks by nearly 30 mph increasing the crash involvement rate by nearly five. Many truck drivers use their flashers to warn other motorists of their slow speeds. This segment has a current year (2013) volume of 29,800 vpd and is estimated to carry 50,240 in 2038. When crashes are analyzed one mile on either side of this spot, the numbers of crashes seem to be on the rise beginning in 2012.

Due to the long grade (see Figure 17, p. 69) a truck climbing lane was studied southbound. In the interim, oversized curve and grade signs and an advisory speed could be installed (see **Appendix K**)

Total Crashes		
Year	MP 38.9 to 39.1	MP 37.9 to 40.1
2009	1	13
2010	2	12
2011	0	5
2012	3(see below)	19
2013 (first 7 months)	2	9

	NB to SB Crash on 1/28/2012	NB Crash on 7/15/2012	NB Crash on 11/5/2012
Time of Day	2:20 a.m.	6:35 p.m.	7:35 p.m.
Sun Issue	No	No	No
Bridge Involved	No	No	No
Basic summary	Driver lost control changing lanes on downgrade.	Driver swerved to avoid debris in road; lost control.	Failed to negotiate horizontal curve
Other	Not wearing belt, but may have still been fatality if had been.	Drive under influence of prescription drugs.	Perhaps not fatal if wearing seatbelt.
	Wet weather	Dry weather	Dry weather

IMPROVEMENT:
Add truck climbing lane in the southbound direction.

PRELIMINARY COST ESTIMATE:

Phase	Amount
Design	$600,000
Right of Way	$100,000
Utilities	$200,000
Construction	$7,000,000
Total	**$7,900,000**

5.3.3.2 MP 44.8 to MP 46.1 in Carroll County

This area showed 0.1 mile crash spots prior to the grade. From travelling experience this northbound grade is considered one of the more difficult grades to maneuver for large vehicles. This interchange is frequented by large trucks. A 4,850 foot-long grade northbound begins just east of the KY 227 interchange (see Figure 18, p. 70). A 2° horizontal curve characterizes the segment nearest the KY 227 interchange. In 2012 there were 33.2% trucks. More than 9,700 trucks currently utilize this roadway segment with that number expected to grow based on the growth rate analysis with KYTC's Statewide Model. "Trucks passing trucks" construct the free flow speed in the fast lane. This length, according to the *Green Book* and field observation, slows trucks by over 25 mph increasing the crash involvement rate by nearly five. Many truck drivers use their flashers to warn other motorists of their slow speeds. Also, the length of the current acceleration ramp from KY 227 to northbound I-71 is 124' short of the desired length under current design standards.

IMPROVEMENT OPTION:
It is recommended that a truck climbing lane begin at the merge point for the northbound entrance ramp (approximately MP 44.8) and continue until tapering back in near MP 46.1 (see **Appendix K**).

PRELIMINARY COST ESTIMATE:

Phase	Amount
Design	$400,000
Right of Way	$0
Utilities	$100,000
Construction	$5,000,000
Total	**$5,500,000**

6.0 I-71 CORRIDOR GROUP AND PROJECT TEAM MEETINGS

Public involvement for the I-71 Corridor Study consists of three (3) stakeholder meetings. The intent of the stakeholder meetings were to be held in conjunction with the scheduled I-71 Corridor Group meetings.

There were also two Project Team Meetings, one to present existing conditions, and one to present analysis and recommendations. Meeting minutes for each of the project team meetings and the I-71 Corridor Group meetings are included in **Appendix A**.

COUNTY OF	ITEM NO.	SHEET NO.
HENRY/ TRIMBLE/ CARROLL	99-394.00	

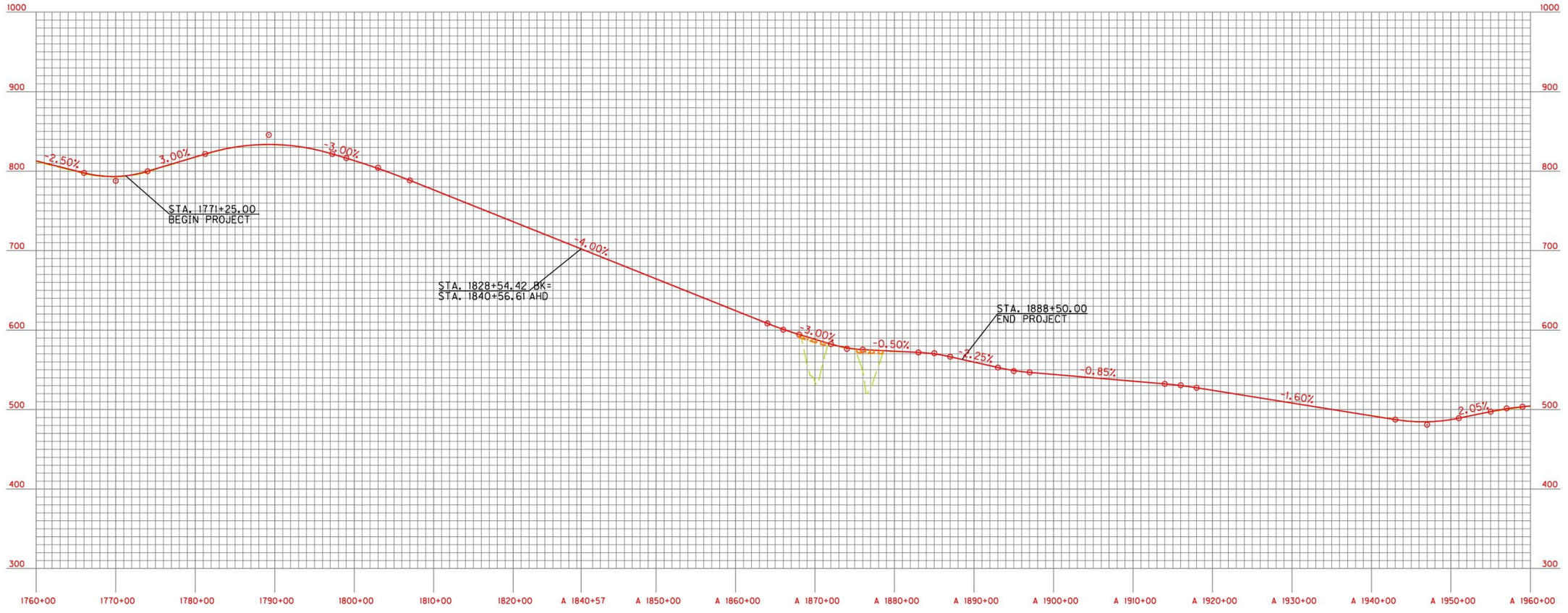


Figure 17: MM 39 Southbound Truck Climbing Lane

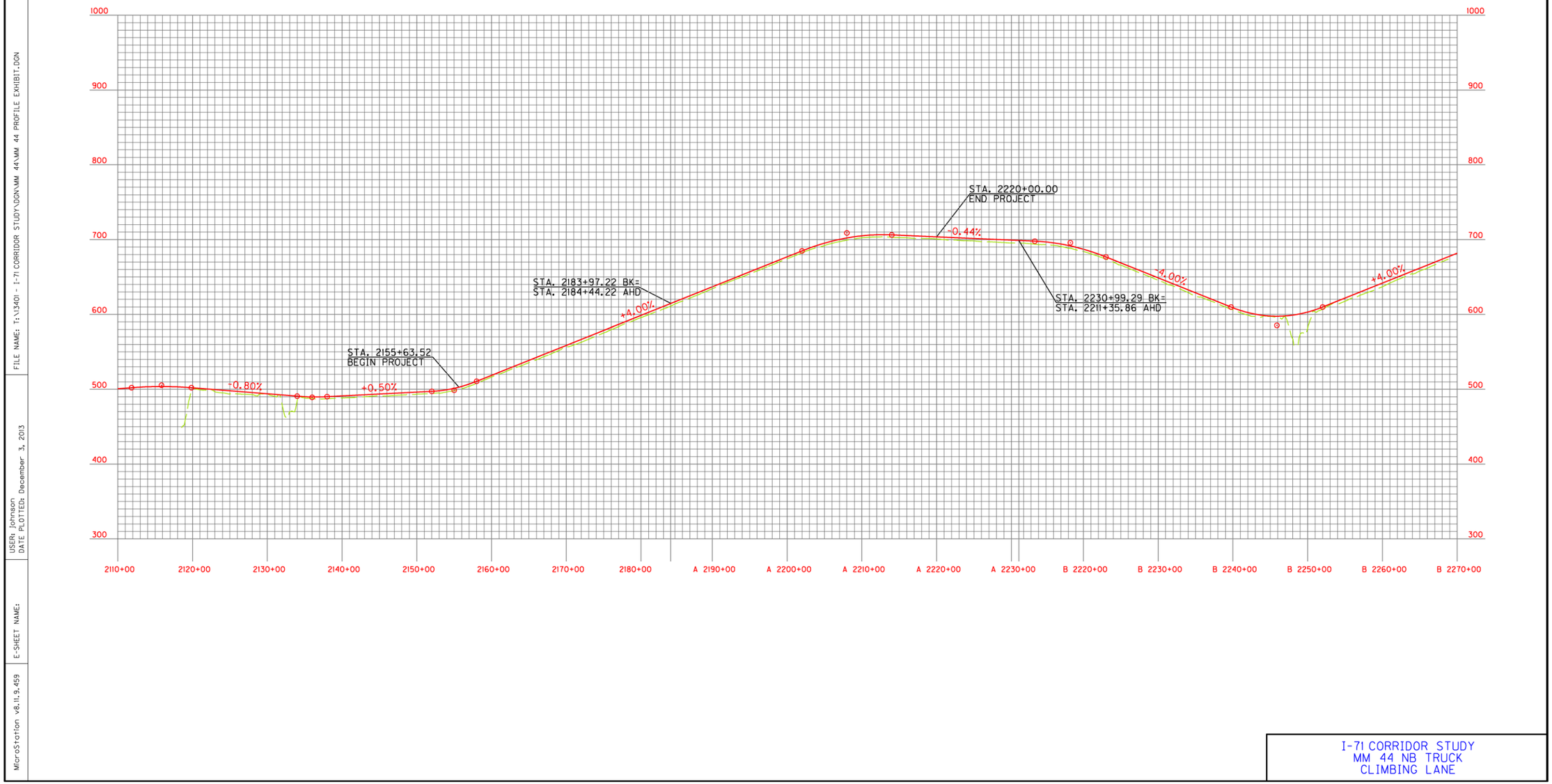


Figure 18: MM 44 Northbound Truck Climbing Lane

I-71 Corridor Group

The I-71 Corridor Group has been identified as a key stakeholder for this project. Most of the rural counties within the study corridor have farms which is rarely a full-time occupation today. The I-71 Corridor Group felt the farmers have to seek other work opportunities to fill the void for the creation of new jobs. The I-71 Corridor focus group believes that I-71 plays a vital role in keeping existing industries in the area. The group also believes that I-71 is important as far as attracting new industry while expanding on the tourism growth potential given the presence of the Kentucky Speedway and numerous wineries and state parks that will generate traffic in the future. The I-71 Corridor Group is very much supportive of a plan for widening I-71 and would like to be involved in the study.

6.1 Local Officials/Stakeholders

Local Officials with the I-71 Corridor Group were asked to identify major freight generators in their area, future industrial park development or expansion, and other job or residential projects that would affect traffic on I-71. Judge/Executives were encouraged to include their planners and economic development staff. An on-line and paper survey was developed to obtain the freight generator information from the rural industries. This information was to be utilized to improve KYTC's Statewide Traffic Model as it related to existing and future freight traffic in mainly the rural counties. The survey resulted in few responses.

Listed as follows is a brief summary of the stakeholder meetings. This information would be used to consider existing and future industry in the Statewide Traffic Model.

Stakeholder meeting #1 - March 29, 2013

An overview of the I-71 Corridor Study was presented by the Kentucky Transportation Cabinet's (KYTC) District 6 Office staff. The I-71 Corridor is unique in that it covers two KYTC districts, two Area Development Districts and a five-county corridor group. A brief summary of the purpose and scope of the I-71 Corridor Study including the following:

- The purpose is to evaluate safety and needs for this 77-mile corridor.
- The goal is to have recommendations from this study by the end of this year, so they are available for consideration into the next highway plan.
- The Scope of Work will focus on the segments of I-71 that have not been studied.
- The Scope includes stakeholder involvement, current conditions, and conditions of the corridor in 25 years. Information on existing conditions (bridges, traffic, crash data, ramps, merge and diverge movements, safety conditions, etc.) will be collected and analyzed, traffic data collected, improvement options identified, and improvements and priorities recommended and then documented.
- Quick Wins will also be identified as a part of this study.
- A draft report is expected in October and a final report in December.

Stakeholder Meeting #2 – April 29, 2013

An overview of the I-71 Corridor Study was again presented by the Kentucky Transportation Cabinet's (KYTC) District 6 Office staff. The purpose is to evaluate safety and needs for this 77-mile corridor from I-64 in Jefferson County to I-75 in Boone County. At the time of the meeting information on existing conditions was being collected and evaluated for the corridor. These conditions range from adequate bridge clearances to crash frequency. The goal is to have recommendations from this study by the end of this year, so they are available for consideration into the next highway plan.

A brief presentation of the purpose and scope of this I-71 study was given and was the exact presentation given at Stakeholder Meeting #1. The key points were:

- Stressed the importance of completing the industry survey for major truck generators.
- The attendees were provided additional questionnaires and asked to meet with their industry representatives to assist in providing truck data to help the consultant better represent the current and future traffic in their counties.

Stakeholder Meeting #3 – December 12, 2013

Following a brief overview by KYTC staff, Qk4 summarized activities since the April meeting including an inventory of existing roadway conditions, a review of previous studies along a portion of I-71, analysis of traffic and crash data, and a comparison of roadway features with current design standards.

Future traffic volumes were projected for the design year 2038. Locations with existing or projected congested conditions were overlaid with high crash spots and geometric design features to pinpoint problem locations.

A list of recommended priority project improvements and corresponding maps were distributed for discussion that included major improvements to mainline I-71 (such as truck climbing lanes, widening from four to six lanes, reconstructing vertical and horizontal curves, and adding new interchanges), minor improvements to mainline I-71 (such as median cable barriers, signage, safety barriers and guardrail), and improvements to interchanging crossroads in the vicinity of I-71. A separate list of recommended priorities for ITS projects was also presented. Four possible locations were considered for a new interchange, with only a location in Carroll County being recommended at this time. Comments received were:

- The interchange near KY 2857 is very important to Oldham County and the development of the Oldham County Reserve, and
- Stakeholders were concerned that some segments needed a more rapid expansion to six lanes in order to attract businesses and industry.

6.2 KYTC Project Team Meetings

Project Team Meeting #1 - June 4, 2013

The purpose of the meeting was to present a brief description of the project and describe the existing conditions on I-71 from I-64 to I-75, along with crossroads. Those have been presented in the existing conditions portion of this report and minutes of the meeting including handouts and the presentation are included in **Appendix B**.

Project Team Meeting #2 - November 13, 2013

The purpose of this meeting was to provide an overview of the options and information that were presented in the August 15, 2013 submittal (see **Appendix L**) of initial priorities submittal requested in the Project Team Meeting, and an evaluation of crash data and initial recommendations for implementation that was requested at the June 4, 2013 project meeting. This submittal included a list of high priority improvement projects. In addition, the analysis of improvements and a draft improvement plan was

presented. At the time of the submittal, traffic forecasts and capacity analyses had not yet been completed. Upon completion of these tasks, the list of projects and their priorities have been revised. Highlights from the meeting included the following:

- The section between KY 14 and I-75 should be considered as an urban section by the design year 2038 based on recent and expected population growth.
- The priority for the section from KY 14 to I-75 has been lowered in priority since the number of crashes has been reduced following completion of the reconstruction project and the lower-than-expected traffic growth does not portend a problem v/c ratio until 2038. A review of existing and information from KYTC also revealed that this section did not have unique or poor performance.
- Based on a review of crash data, a seventh location near MP 39 had been identified for further review because of three (3) recent fatal crashes, but the crash reports revealed no pattern and no problematic roadway issue. However, a truck climbing lane was recommended for the southbound direction near MP 39.
- Coordination with Speedway consultants was conducted to see if any projects were needed due to race events, but none were requested for I-71. There is one crossover location that has not been constructed that may be considered in the future to facilitate race day events.
- The analysis included grades, crash data, traffic data, Levels-of-Service (LOS), horizontal and vertical deficiencies, merge and diverge areas, proximity to existing interchanges, ramp lanes, ramp volumes (including AM and PM peaks), ramp terminals, cable barriers, slopes, medians, pier protection within medians, I-71 structures and bridges over I-71, and deer crossing signs and deer strikes. Each ramp terminal was investigated, and options were reviewed.
- Five (5) possible new interchanges were investigated, but only one is recommended:
  - Two (2) in Oldham County, neither of which are recommended until I-71 is widened.
  - One (1) near KY 55 in Henry County (which was a PIF project) but would not draw much traffic. It is not recommended.
  - One (1) near KY 47 in Carroll County. Two alternatives were investigated; the cost estimates range from $20 million to $23 million, and would serve a large volume of trucks. The connector routes to US 42 may also warrant truck climbing lanes (not included in the cost estimates). This new interchange is recommended.
  - One (1) near KY 562 in Gallatin County, the traffic analysis for which was not encouraging. It is not recommended.
- An overall improvement plan was provided for the ultimate widening of I-71 to six lanes and projected timeframe when various sections of I-71 would be warranted.
- A list of recommended Mainline and Crossroads projects in priority order was presented.
- It was recommended the major capital improvements be differentiated from the operation and maintenance type projects. A $10 million dollar project cost estimate should be the separation point for categorizing projects.
- At MP 63.6 to 64.5 the recommendation was to reconstruct the curves rather than flattening just one curve at MP 63.
  - KYTC District 6 staff stated that now crashes appear to be occurring more in the preceding curves and their preferred alternative is to rebuild the entire section (Alternative 4). This section of I-71 requires frequent shut downs during sever crashes.
- After discussion, the project team recommended changing the order of the top priorities to the following:
  - Gallatin County, reconstruction of curves near MP 63. (no change)
  - Jefferson/Oldham Counties, widening from I-265 to KY 329, a note will be added to indicate that the bridge replacement cost estimate (Priority 3) is included in this cost estimate.
  - Jefferson County, bridge replacement - note that this cost estimate is for providing a new bridge if Priority 2 is not implemented. (was Priority 4)
  - Oldham County, widen I-71 from KY 329 to KY 146 (was Priority 6)
  - Carroll County, add a southbound truck climbing lane from MP 38.3 to MP 40.8. (was Priority 2)
  - Carroll County, add a northbound truck climbing lane from MP 44.8 to MP 46.1. (was Priority 5)

Post Project Team Meeting #2

Discussions regarding priorities in District 5 ensued following the second Project Team Meeting. Priorities in Jefferson County were changed to include the project from I-64 (end of the Kennedy Interchange reconstruction) to Zorn Avenue. Table 18 represents the final priorities following all discussions.

7.0 RECOMMENDED IMPROVEMENTS AND PRIORITIZATION

Using an evaluation of existing roadway conditions including an analysis of grades and horizontal and vertical alignment, field reviews, a review of as-built and current drawings, a review of past I-71 studies, crash data analysis, capacity analysis of existing (2013) and design year (2038) conditions, input from stakeholders and discussions following the 2nd Project Team Meeting, deficiencies for the I-71 Corridor were identified and documented for this report.

Based on these deficiencies and identified areas of concern and the projected traffic and accompanying v/c ratio policy, a list of recommended mainline, crossroad and safety projects in priority order were developed (see Table 18, p. 73-74). The screening and prioritization of the recommendations for the corridor were based on safety and congestion. Quick Wins, which were identified as a result of the Stakeholder Project Team meetings, have also been included. The I-71 Improvement Plan is shown in Figure 19 (p. 75) and the I-71 Crossroad Improvement Plan is shown in Figure 20 (p. 76).

7.1 List of I-71 Improvement Priorities

Based on further evaluations and discussions at the November 13, 2013 Project Team Meeting, the following projects were identified as top priorities. Each mainline build alternative from a previous study is located in **Appendix M**. Only the mainline widening projects through the build year 2038 were detailed and included with few exceptions. Additional build exhibits for projects beyond 2038 are contained in Appendix N. Cost estimates obtained from previous studies were updated to 2013 using the construction cost index to 2012 and then increasing the costs by 4% to represent 2013.

Table 18: I-71 Corridor Improvements

I-71 CORRIDOR IMPROVEMENTS WITH PHASE COSTS

MAINLINE								COST ESTIMATE DETAIL				
COUNTY	NEW PRIORITY	BEG ROUTE	BEG EXIT OR MP	END ROUTE	END EXIT OR MP	CROSSROAD	PROJECT	PLANNING	DESIGN	R/W	UTILITIES	CONSTRUCTION	TOTAL
Gallatin	1		62.8		64.0		Reconstruct I-71 from US 127 MP 62.8 to MP 64 to improve geometrics		$ 2,200,000	$ 1,500,000	$ 500,000	$ 31,000,000	$ 35,200,000
Jefferson	2	I-64	0	ZORN	2		Widen to 6 lanes		$ 1,500,000	$ -	$ 476,000	$ 21,800,000	$ 23,776,000
Jefferson	4	ZORN	2	I-264	5		Widen to 6 lanes		$ 1,500,000	$ -	$ 514,000	$ 25,700,000	$ 27,714,000
Jefferson	6	I-264	5	I-265	9		Reevaluate needs at I-264/I-71 interchange and I-71 between I-264 and I-265 after I-265 East End bridge has been open at least one year to see if previous recommendations, based on forecasted usage, are still valid.	$ 500,000	$ 9,500,000	$ 30,000,000	$ 3,000,000	$ 150,000,000	$ 193,000,000
Jefferson/Oldham	7	I-265	9	KY 329	14		Widen to 6 lanes and widen clear zones		$ 3,500,000	$ -	$ 700,000	$ 50,000,000	$ 54,200,000
Carroll	9		44.0			Kentucky River	Replace 2 Structurally Deficient Bridges over Kentucky River (021B00042L, 021B00042R)		$ 2,000,000			$ 14,764,800	$ 16,764,800
Oldham	11	KY 329	14	KY 146	17		Widen to 6 lanes		$ 1,500,000	$ -	$ 300,000	$ 20,000,000	$ 21,800,000
Oldham	38	KY 146	17	KY 393	18		Widen to 6 lanes		$ 1,500,000		$ 500,000	$ 14,000,000	$ 16,000,000
Oldham	39	KY 393	18	KY 53	22		Widen to 6 lanes		$ 2,000,000	$ -	$ 500,000	$ 22,500,000	$ 25,000,000
Carroll	40	KY 227	44	KY 1039	55		Construct new interchange near KY 47 and make improvements connecting to US 42		$ 1,500,000	$ 4,000,000	$ 3,000,000	$ 15,000,000	$ 23,500,000
Oldham/Henry	41	KY 53	22	KY 153	28		Widen to 6 lanes		$ 5,600,000		$ 900,000	$ 56,200,000	$ 62,700,000
Boone	42	KY 14	72	I-75	77		Widen to 6 lanes		$ 2,000,000	$ -	$ 400,000	$ 30,000,000	$ 32,400,000
Gallatin	43	US 127	62	KY 14	72		Widen to 6 lanes		$ 6,500,000	$ -	$ 800,000	$ 80,000,000	$ 87,300,000
Henry	44	KY 153	28	US 421	34		Widen to 6 lanes		$ 4,000,000	$ -	$ 480,000	$ 48,000,000	$ 52,480,000
Henry/Trimble/Carroll	45	US 421	34	KY 389	43		Widen to 6 lanes		$ 7,000,000	$ -	$ 720,000	$ 72,000,000	$ 79,720,000
Gallatin	46	KY 35	57	US 127	62		Widen to 6 lanes		$ 3,500,000	$ -	$ 400,000	$ 40,000,000	$ 43,900,000
Carroll	48	KY 227	44	KY 1039	55		Widen to 6 lanes		$ 7,500,000	$ -	$ 1,000,000	$ 88,000,000	$ 96,500,000
													$ 891,954,800

MAINLINE IMPROVEMENTS UNDER $10,000,000								COST ESTIMATE DETAIL				
COUNTY	NEW PRIORITY	BEG ROUTE	BEG EXIT OR MP	END ROUTE	END EXIT OR MP	CROSSROAD	PROJECT		DESIGN	R/W	UTILITIES	CONSTRUCTION	TOTAL
Gallatin/Boone	1A		69.60		77.00		Install cable guardrail					$ 1,200,000	$ 1,200,000
Jefferson	3		9.80			Chamberlain Lane	Address Structurally deficient bridge @ MP 9.8 SB (056B00062L)		$ 500,000			$ 892,800	$ 1,392,800
Jefferson	5	I-264	5	I-265	9		Replace Structurally Deficient Bridge SB over US 42; consider making other geometric improvements to bridges depending, in part, on outcome of study identified in previous priority.		$ 750,000			$ 1,936,800	$ 2,686,800
Carroll	8		38.30		40.80		Add truck climbing lane southbound from MP 38.3 to MP 40.8, including widening bridges		$ 600,000	$ 100,000	$ 200,000	$ 7,000,000	$ 7,900,000
Carroll	10		44.80		46.10		Add truck climbing lane northbound from MP 44.8 to MP 46.1, including extending merge length from KY 227 to I-71 NB		$ 400,000	$ -	$ 100,000	$ 5,000,000	$ 5,500,000
Oldham/Henry	12	I-265	9	US 421	34		Install deer warning signs at 7 locations Priority #12 – IMPLEMENTED AS PART OF THIS STUDY					$ 2,800	$ 2,800
Oldham/Henry	13		22.53		28.32		Install cable guardrail: Oldham/Henry MP 22.53 - MP24.73; Henry MP 25.73 - MP 28.32					$ 718,000	$ 718,000
Henry	14		30.70		31.87		Install cable guardrail					$ 175,500	$ 175,500
Carroll	15		43.90		50.75		Install cable guardrail					$ 1,027,500	$ 1,027,500
Carroll	16		52.54		53.43		Install cable guardrail					$ 133,500	$ 133,500
Henry	17		33.02		38.81		Install cable guardrail					$ 747,750	$ 747,750
Gallatin	18		53.43		56.45		Install cable guardrail					$ 453,000	$ 453,000
Gallatin	19		58.60		59.50		Install guardrail for Steep Slopes NB near KY 465 structure outside lane					$ 17,200	$ 17,200
Carroll	20		50.90		51.20		Install guardrail for Steep Slopes NB inside median side slope steep					$ 30,200	$ 30,200
Carroll	21		53.40		53.50		Install guardrail for Steep Slopes SB outside lane 1.5 miles south of KY 1039 Exit					$ 15,600	$ 15,600
Henry	22		25.9	KY 3320, KY 712			Provide median pier protection @ MP 25.9 (KY 3320) and KY 712					$ 104,000	$ 104,000
Boone	23		76.2	KY 1292			Provide median pier protection @ MP 76.2 (KY 1292)					$ 52,000	$ 52,000
Gallatin	24		59.4	KY 465			Provide median pier protection @ MP 59.4 (KY 465)					$ 52,000	$ 52,000
Gallatin	25		61.8	US 127			Provide median pier protection @ MP 61.8 (US 127)					$ 52,000	$ 52,000
Gallatin	26		66.3	KY 562			Provide median pier protection @ MP 66.3 (KY 562)					$ 52,000	$ 52,000
Gallatin	27		69.8	KY 2850			Provide median pier protection @ MP 69.8 (KY 2850)					$ 52,000	$ 52,000
Carroll	28		46.92			KY 1112	Replace Structurally Deficient Bridge SB over KY 1112 and Whites Run Creek overpass (021B00036L)		$ 750,000			$ 3,190,080	$ 3,940,080
Carroll	29		46.88			KY 1112	Remove curb from KY 1112 and Whites Run Creek (021B00036R)					$ 15,000	$ 15,000
Gallatin	30		53.46			KY 47	Remove curb from KY 47 mainline bridge (039B00023L) or add guardrail protection					$ 11,000	$ 11,000
Gallatin	31		53.46			KY 47	Remove curb from KY 47 mainline bridge (039B00023R) or add guardrail protection					$ 11,000	$ 11,000
Carroll	32		44.33			CSX RR & KY 227	Remove curb from CSX RR & KY 227 mainline bridge (021B00037L) or add guardrail protection					$ 13,000	$ 13,000
Carroll	33		44.33			CSX RR & KY 227	Remove curb from CSX RR & KY 227 mainline bridge (021B00037R) or add guardrail protection					$ 13,000	$ 13,000
Oldham	34		22.0			KY 53	Widen NB off ramp @ KY 53 to 2 lanes		$ 160,000	$ 120,000	$ 120,000	$ 1,100,000	$ 1,500,000
Oldham	35	KY 153	28	KY 153	28		Extend merge length from KY 153 to I-71 NB					$ 160,000	$ 160,000
Henry	36	US 421	34	US 421	34		Extend merge length from US 421 to I-71 SB					$ 150,000	$ 150,000
Carroll	37	KY 227	44	KY 227	44		Extend merge length from KY 227 to I-71 SB					$ 1,000,000	$ 1,000,000
Carroll	47	KY 389	43	KY 227	44		Widen to 6 lanes; includes new structures over KY 227/KY River		$ 600,000	$ -	$ 80,000	$ 8,000,000	$ 8,680,000
													$ 37,854,930

Table 18: I-71 Corridor Improvements (continued)

I-71 CORRIDOR IMPROVEMENTS WITH PHASE COSTS (CONTINUED)

CROSSROADS					COST ESTIMATE DETAIL					
COUNTY	NEW PRIORITY	ROUTE		PROJECT	PLANNING	DESIGN	R/W	UTILITIES	CONSTRUCTION	TOTAL
Oldham	1	KY 329		Signalize SB ramps, add left turn lane between ramp terminals		$ 100,000			$ 900,000	$ 1,000,000
Oldham	2	KY 146		Signalize SB ramp					$ 200,000	$ 200,000
Jefferson	3	Zorn Avenue		Signalize SB ramps, coordinate with existing signal @ NB ramps					$ 200,000	$ 200,000
Oldham	4	KY 393		Option 4c-3: signalize both intersections, add a second NB left turn lane onto I-71 from KY 393, add a free flow right turn lane from I-71 to KY 393 SB, and widen KY 393 to 4 lanes through the interchange.		$ 600,000	Not Included	Not Included	$ 9,200,000	$ 9,800,000
Oldham	5	KY 53		Option 4c-4: Widen SB exit ramp to separate left & right turns onto KY 53; a second NB left turn lane onto I-71; widen bridge		$ 600,000	Not Included	Not Included	$ 7,500,000	$ 8,100,000
Boone	6	KY 14		Separate left and right turns on SB exit ramp 100'					$ 22,000	$ 22,000
Boone	7	KY 14		Add left turn lanes to entrance ramps		$ 200,000			$ 1,440,000	$ 1,640,000
Carroll	8	KY 227		Separate left and right turns on SB exit ramp 100' and channelize right turns to KY 227 NB					$ 22,000	$ 22,000
Henry	9	KY 153		Separate left and right turns on NB exit ramp 700'					$ 140,000	$ 140,000
Henry	10	KY 153		Add left turn lanes to entrance ramps		$ 200,000			$ 1,480,000	$ 1,680,000
Henry	11	KY 153		Signalize NB ramps					$ 150,000	$ 150,000
Henry	12	US 421		Add left turn lanes to entrance ramps		$ 200,000			$ 1,652,000	$ 1,852,000
Carroll	13	KY 227		Conduct a planning study to improve access management on KY 227 north of I-71 interchange	$ 250,000	$ 1,000,000	$ 1,500,000	$ 1,000,000	$ 2,500,000	$ 6,250,000
Boone	14	KY 14		Correct access control to meet 300' standard					$ 50,000	$ 50,000
Henry	15	US 421		Separate NB left and right turns on NB exit ramp					$ 50,000	$ 50,000
Oldham	16	KY 329		Signalize NB ramp, and add dual left		$ 100,000			$ 400,000	$ 500,000
										$ 31,656,000

INTELLIGENT TRANSPORTATION SYSTEM									
COUNTY**	PRIORITY	BEG* ROUTE SEGMENT	BEG EXIT OR MP	END* ROUTE SEGMENT	END EXIT OR MP	CROSSROAD	PROJECT	ESTIMATED COST	POTENTIAL QUICK WIN
Jefferson	1	FRANKFORT AVE.	0.5	ZORN AVE	0.6		Install one (1) additional camera between Zorn Avenue and Frankfort Avenue on the outside of the curve for monitoring daily traffic, detecting stranded motorists or incidents, and aiding in emergency response.	$ 75,000	X
Jefferson	2	ZORN AVE.	3.4	I-264	5.0		Install two (2) cameras possibly three (3) cameras between Zorn Avenue and I-264 interchange on the outside of the curve to view entire curve for monitoring daily traffic, detecting stranded motorists or incidents, and aiding in emergency response.	$ 255,000	X
Jefferson	3	I-264	6.5	I-265	7.5		Install two (2) cameras on the outside of two double curves for monitoring daily traffic, detecting stranded motorists or incidents, and aiding in emergency response.	$ 170,000	X
Jefferson	4	I-265	10.0	KY 329	10.8		Install one (1) camera on the curve north of I-265 interchange on the outside of curve for monitoring daily traffic, detecting stranded motorists or incidents, and aiding in emergency response.	$ 85,000	X
Jefferson	5	ZORN AVE.	4.0	KY 329	11.0		Install enhanced mile marker signs at 0.2 mile intervals beginning at MP 4.0 to MP 11.0 to provide a reference device for emergency response and for motorist assistance.	$ 14,400	X
Jefferson	6	ZORN AVE.	0.0	KY 329	11.0		Install Wide Beam Radar Stations every 0.5 miles to monitor operational speeds and calculate travel times.	$ 550,000	
Jefferson	7	I-264	22.1	I-264	22.1	I-264 EB	Install one (1) overhead truss-mounted full Dynamic Message Sign just before the US 42 underpass to disseminate roadway condition information to motorists and aid in reducing congestion, delays, and secondary collisions. This will provide information to motorists on I-264 regarding conditions on I-71.	$ 250,000	X
Jefferson	8	US 42	5.6	US 42	5.9	US 42	Install two (2) roadside Dynamic Message Signs on both US 42 approaches to I-264 to disseminate roadway condition information to motorists and aid in reducing congestion, delays, and secondary collisions.. This would provide information regarding conditions on I-71 to motorists on US 42 and also aide in redirecting traffic when incidents or congestion occur on the interstate system.	$ 400,000	X
								$ 1,799,400	

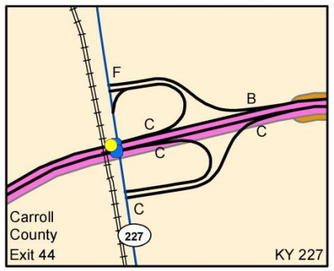
**The county represents the specific county that the improvement is in.
*Beg route and end route are segments intended to assist the reader in locating the improvement the actual improvement is between those two segments.

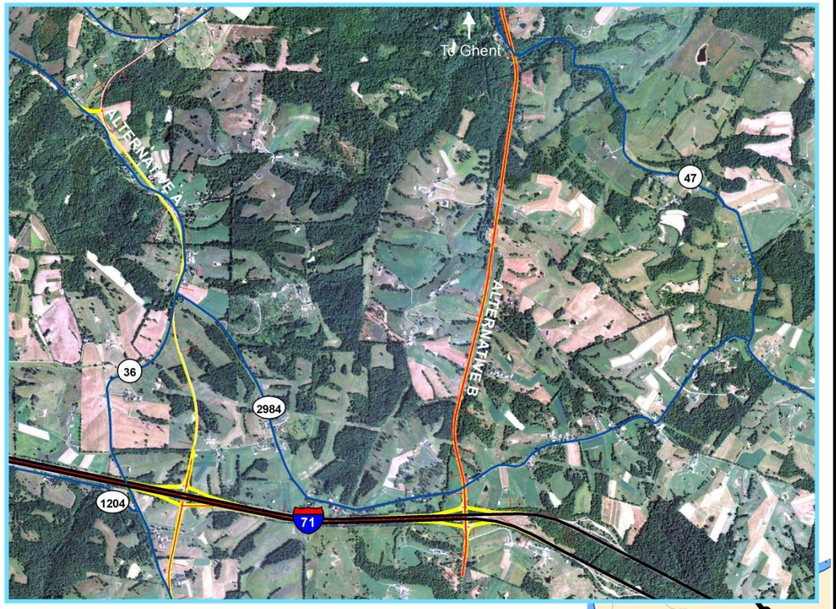
Recommended Improvements

- Structurally Deficient
- Curb on Bridge
- Median Pier Protection Does Not Meet Current Standard Drawing
- Steep Side Slopes
- Inadequate Merge Length
- New Interchange
- Deficient Curve
- Cable Guardrail
- Truck Climbing Lane
- 6 Lanes Warranted through 2038
- 2013 Mainline Improvement Options
- Future Mainline Improvement Options
- 2013 Mainline Improvments Under $10,000,000

IMPLEMENTED DURING STUDY - PRIORITY #12
Eighteen crashes involving animals (deer) were identified between various milepoints in Oldham and Henry Counties early in this study as Priority 12. KYTC District 5 staff installed deer signs at these locations during the course of this study.

Enlarged to show detail





Priority 40 New Interchange Alternatives Near KY 47
Recommended Alternative B

Figure 19: I-71 Improvement Plan

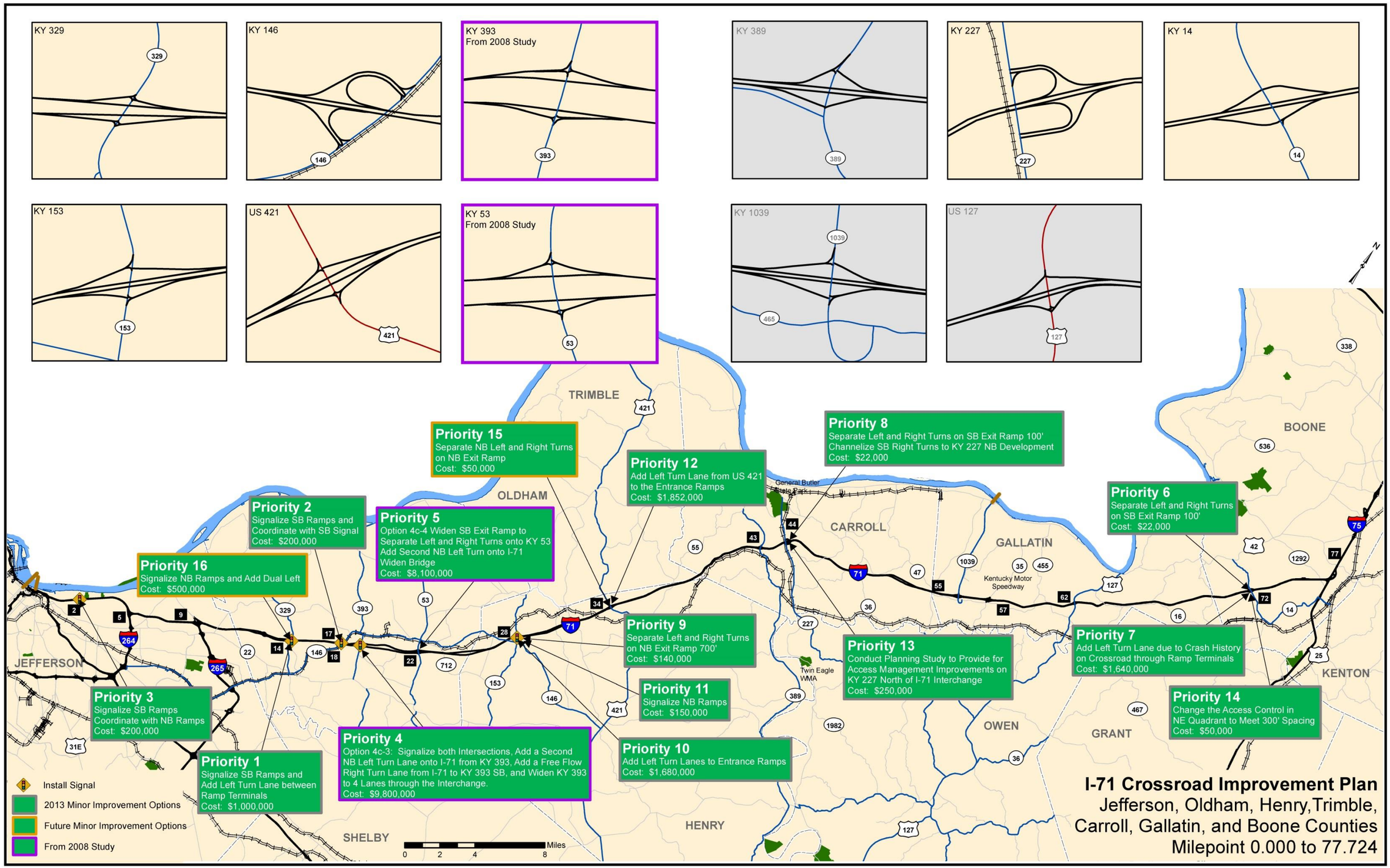


Figure 20: I-71 Crossroad Improvement Plan

1. Improve Safety north of US 127 MP 62.8 to MP 64.0 in Gallatin County

The purpose of this project is to improve safety by reducing the number of crashes. The Critical Crash Rate Factor (CCRF) for this 1.2-mile stretch of I-71 is 1.86. From the years 2009-2011, there were 41 crashes in wet or snowy weather, 38 single vehicle run-off-the-road crashes; 8 vehicle malfunctions and 2 collisions with deer. Four (4) crashes were located within the spiral horizontal curve near MP 63.0. From January 1, 2013 to July 24, 2013, there have been more crashes in this stretch than all of year 2012. These accidents have occurred following complete pavement rehabilitation in 2011 to repair deficient cross slopes. Motorists must negotiate 4% grades leading to back-to-back spiral curves. In this area, I-71 currently operates at Level of Service B; however, the vehicle composition includes 25% trucks. These trucks tend to accelerate going downhill in order to climb the next 4% grade uphill. Many pass each other side by side causing vehicles to queue behind them. The recommended alternative by the Project Team is the complete reconstruction option Alternative D from Section 5.3.2 Potential Re-Alignment of I-71 Near MP 63.0 (p. 66) which has total cost of $35,200,000.

2. Add Capacity from I-64 to Zorn Avenue in Jefferson County (2.0 Miles)

The purpose of this project is to reduce congestion and improve safety on I-71 (Item No.: 5-48.1). This section is currently congested from I-64 in downtown Louisville to Zorn Avenue and has a v/c ratio of 1.02. The 2038 v/c ratio is anticipated to be 1.28 without improvements. This was also one of the 7 crash locations of principal concern. The estimated cost for this widening project is $23,800,000. Beargrass Creek to the north end of the bridge over the abandoned railroad (900 feet south of Edith Road) will be widened to the median and both sides of the existing roadway. From that point north to Zorn Avenue will be widened to 6 lanes on the outside of the existing roadway. Construction of I-71 north of the gore areas of these ramps will be pavement overlay with upgrading of the acceleration and deceleration lanes for the entrance and exit ramps north of Zorn Avenue.

3. Replace Southbound Bridge at MP 9.8 over Chamberlain Lane in Jefferson County

The purpose of this project is to improve system reliability. The bridge (056B00062L) over Chamberlain Lane has been identified as structurally deficient and has a sufficiency rating of 84. This bridge would be widened or not widened with KYTC Item No. 48.20 and would be replaced with Priority Number 7. The estimated cost to replace the bridge is approximately $1,392,000.

4. Add Capacity from Zorn Avenue to I-264 in Jefferson County (3.0 Miles)

The purpose of this project is to reduce congestion and improve safety on I-71. Currently I-71 from Zorn Avenue to I-264 has a v/c ratio of 1.14 and a 2038 v/c ratio of 1.35 without improvements as shown in Figure 9 (p. 46). This segment includes two (2) of the seven (7) crash locations of principal concern. The estimated cost for this widening project is $27,700,000.

5. Replace Bridge over US 42 in Jefferson County

The purpose of this project is to improve system reliability. The bridge over US 42 has been identified as structurally deficient with a sufficiency rating of 67.0. This improvement is needed before overall widening to six lanes. The estimated cost to replace the bridge is approximately $2,687,000.

6. Reevaluate Needs at I-264 To I-265 In Jefferson County (4.0 Miles)

The purpose of this project is to reevaluate recommendations from previous studies after the new I-265 Ohio River Bridge is constructed and open to traffic. The project will include a reevaluation of the I-264/I-71 Interchange and I-71 between I-264 and I-265. Currently I-71 from I-264 to I-265 has a v/c ratio of 0.95 and the 2038 v/c ratio is anticipated to be 1.12 without improvements. The estimated cost for this project is $500,000. The estimated cost for widening I-71 to six lanes is $57 million which includes replacing the US 42, Lime Kiln Lane and Barbour Lane bridges. The most recent interchange costs that improve I-264 interchange to fully meet design standards and has a desirable LOS operation is approximately $90,300,000 (reconstruction tri-level bridge including a braid to US 42 to accommodate future traffic). The approximate cost for the reconstruction interchange I-265 to accommodate future traffic which includes a flyover ramp from northbound I-265 to southbound I-71 that is compatible with the new east end bridge is approximately $65,500,000. Each interchange cost assumes replacement of all structures.

KYTC could stage Priority 6 by building 6b first, 6c second (might also include an I-265 NB flyover to I-71 SB as the 1st phase), and Priority 6a last.

A. I-264 Interchange
B. Widen to 6 lanes from I-264 to I-265
C. I-265 interchange

7. Add Capacity from I-265 to KY 329 in Jefferson/Oldham County (5.8 Miles)

The purpose of this project is to reduce congestion and improve safety on I-71. Currently I-71 from I-64 in downtown Louisville to KY 329 is operating at LOS F with v/c ratios exceeding 1.0 in the PM peak hour and truck percentages varying from 7% to 18%. There are also multiple areas where the Critical Crash Rate Factor exceeds 1.0 indicating that crashes at these locations exceed the crash rate for similar roadways in Kentucky. The estimated total cost is $54,200,000.

8. Add Truck Climbing Lane MP 38.3 to MP 40.8 in Carroll County

The purpose of this project is to reduce congestion and improve safety. The initial evaluation of crashes in this area did not yield an area with any CCRF greater than 1.0. However, a check of the 2012 crashes revealed three (3) fatalities in a 0.2 mile spot. Looking beyond this 0.2 mile spot, expanding 1.0 mile on either side, this area has multiple maximum 4% grades within back-to-back spiral curves, and two long narrow bridges at the end of a 3% downgrade heading northbound. The reverse is the case travelling southbound, there is a continuous uphill climb for approximately 2.5 miles beginning at approximately MP 38.3 to MP 40.8, with grades ranging from -0.5% to -4.0% and a possible deficient sag curve. The equivalent southbound grade was 3.62% for 2.33 miles. This length, according to the design manual and field observation, slows trucks by nearly 30 mph increasing the crash involvement rate by nearly five. Many truck drivers use their flashers to warn other motorists of their slow speeds. This segment has a current year (2013) volume of 29,800 vpd and is estimated to carry 50,240 in 2038. When crashes are analyzed one mile on either side of this spot, the numbers of crashes seem to increase beginning in 2012. The estimated cost for a southbound truck climbing lane at this location is approximately $7,900,000.

9. Replace Bridges (021b00042L and 021B00042R) over Kentucky River in Carroll County

The purpose of this project is to improve system reliability. The bridges over the Kentucky River have been identified as structurally deficient with sufficiency ratings of 49.7. Replacement of each structure would eliminate the possible need for load restrictions. The estimated cost to replace the bridges is approximately $16,765,000.

10. Add Truck Climbing Lane northbound from MP 44.8 to MP 46.1 in Carroll County

The purpose of this project is to reduce congestion and improve safety. A 2° horizontal curve characterizes the segment nearest the KY 227 interchange. In 2012, the vehicle composition included 33.2% trucks. More than 9,700 trucks currently utilize this roadway segment with growth expected. "Trucks passing trucks" affects the free flow speed in the passing lane. A 4,850 foot-long grade northbound begins just east of the KY 227 interchange. This length, according to the *Green Book* and field observation, slows trucks by over 25 mph, increasing the crash involvement rate by nearly five. Many truck drivers use their flashers to warn other motorists of their slow speeds. Also, the length of the current acceleration ramp from KY 227 to northbound I-71 is 124' which is short of the desired length under current design standards. The approximate total cost for the northbound truck climbing lane is $5,500,000.

11. Add Capacity from KY 329 to KY 146 in Oldham County (2.5 miles)

The purpose of this project is to reduce congestion and improve system continuity. Crashes do not appear to be a problem in the section; the CCRF is only 0.43. No 0.1-mile spot in this section has a CCRF exceeding, or even approaching, 1.0. However this section is currently congested, especially in the afternoon peak period traveling northbound.

Capacity analyses indicate that 2038 volumes will result in lower Levels of Service (LOS) except northbound in the afternoon peak period (which is already operating at LOS F and would continue to do so), and higher v/c ratios. To improve congestion, it is recommended that this section of I-71 be widened from four to six lanes. If the next section from KY 146 to KY 393 falls behind Priority #11, it is recommended that a continuous additional lane be considered southbound between exits 17 and 18. The total cost for this improvement is approximately $21,800,000.

12. IMPLEMENTED DURING STUDY - Install deer warning signs between I-265 in Jefferson County and US 421 in Henry County

Eighteen crashes involving animals (deer) were identified between various milepoints in Oldham and Henry Counties were identified early in this study as Priority 12. KYTC District 5 staff installed deer signs at these locations during the course of this study.

7.2 Cable Guardrail

A review of crossover crashes, existing head-on crashes, guardrail locations, relevant location to the above crash concerns and consultation with KYTC, the following locations as shown are recommended for cable guardrail see Table 19.

7.3 Guardrail for Steep Slopes

The following locations are recommended for guardrail along steep slope areas:

- MP 58.6 – 59.5 in Gallatin County (identified as Priority 19);
- MP 50.9 – 51.2 in Carroll County (identified as Priority 20);
- MP 53.4 – 53.5 in Carroll County (identified as Priority 21).

Table 19: Recommendations for Cable Guardrail

County	From MP	To MP	Discussion	Estimated Cost	Study Priority
Gallatin / Boone	69.60	77.00	4 head-on crashes 3 NB, 1 SB, 2 dark, 1 raining, 1 dry/clear	$1,200,000	1A
Henry	22.54	28.32	Designated as KYTC priority; 2.9 median crossover crashes per mile in 5 years; ADT=33,400	$718,000	13
Oldham /Henry	30.50	31.87	Designated as KYTC priority; 2.1 median crossover crashes per mile in 5 years, ADT=33,400	$175,500	14
Carroll	43.90	50.75	Designated as KYTC priority; 1.62 median crossover crashes per mile in 5 years; ADT=29,300	$1,027,500	15
Carroll	52.54	53.43	Designated as KYTC priority; 1.08 median crossover crashes per mile in 5 years; ADT=29,200	$133,500	16
Henry	33.02	38.81	Designated as KYTC priority; 0.7 median crossover crashes per mile in 5 years; ADT = 31,400	$747,500	17
Gallatin	53.43	56.45	No median crossover crashes in 5 years; ADT=29,200. Note this recommendation is included to complete median carrier barrier installation on I-71. It is recommended as the last priority.	$453,000	18

7.4 Crossroad Improvement Priorities

As discussed in Sections 3.7 (p.32) and 4.4 (p.47), each crossroad was analyzed for improvements if a crash or capacity issue was identified. These improvements were prioritized based on their immediate/short-term or future need and whether the crossroad was located in a 0.1 mile crash spot with a pattern.

1. Signalize SB ramps and Add Left Turn Lane on KY 329 between Ramp Terminals on KY 329 in Oldham County

Currently, the I-71/KY 329 ramp terminals for turns from I-71 to KY 329 operate at LOS E and F in the peak hours. There are no left turn lanes under the bridge, and there are steep downgrades in both directions toward the ramp terminals. The hourly volumes for the left turns from I-71 at the northbound ramp terminal are only 70/80 vehicles per day in the AM/PM peak hours. Although both ramp terminals meet signal warrants today, it is recommended that one signal be installed at the southbound ramps. In addition, in order to operate at an acceptable LOS, due to the volume of KY 329 lefts onto northbound I-71, a left turn lane is needed at that location. Due to the nature of the crashes, a review of sight distance was performed. In the interchange area 800 feet of KY 329 is on tangent. The *Green Book* requires 607 feet for autos, 769 feet for a Single Unit Truck and 930 feet for a combination truck. Sight distance is met for two cases (unless vehicles are going over 55 MPH). Tree trimming could be accomplished to extend the sight distance for a cost of approximately $10,000. The cost estimate for this improvement is $1,000,000.

2. Signalize SB Ramp at KY 146 Interchange in Oldham County

The purpose of this project is to improve congestion at the KY 146/I-71 Interchange ramp terminals. The northbound ramps on the south side of the KY 146/I-71 interchange are controlled by a traffic signal. The southbound ramps on the north side of the KY146/I-71 interchange are controlled by a stop sign, but

warrants for a signal are met at that location. Crashes do not appear to be a problem. As shown in Section 5.2 (p. 55) signalizing this location and coordinating the signal with the one currently on the south side of the interchange will improve congestion levels. The estimated cost of installing this signal and interconnecting it with the one currently on the south side of the KY 146/I-71 interchange is $200,000.

3. Signalize Southbound Ramps at Zorn Avenue (Exit 2) Interchange and Coordinate Signal with existing NB Ramps Signal in Jefferson County

The purpose of this project is to signalize the Zorn Avenue/I-71 Interchange southbound ramp terminal and coordinate the signal with the northbound ramps, which is already signalized. The project is estimated to cost approximately $200,000.

4. Signalize Both Ramp Terminal Intersections at the KY 393 Interchange, add second NB Left Turn Lane onto I-71, add free flow Right Turn Lane to KY 393 and Widen KY 393 to four (4) Lanes in Oldham County

This project represents the Scenario 4c-3 Recommended Project Option from the *I-71 Proposed Overpass Interchange Feasibility Study, November 2008.* The project includes adding a second northbound left turn lane onto I-71 to KY 393 southbound and a free-flow right turn lane from I-71 to KY 393 southbound. The project also includes widening KY 393 to four lanes through the interchange area. The cost for this improvement is estimated at $9,800,000. There is an ongoing KYTC project (Item Number 05-234.00) that will widen KY 393 from the I-71 interchange north to KY 146 and will also affect the SB I-71 ramps. The project is well along in the design phase. This recommendation should be coordinated with the 05-234.00 improvement projects.

5. Widen the Southbound Exit Ramp to Provide Separate Left and Right Turn Lanes at KY 53 Interchange, add second NB Left Turn Lane onto I-71 and Widen Existing Bridge in Oldham County

This project represents the Scenario 4c-4 Recommended Project Option from the *I-71 Proposed Overpass Interchange Feasibility Study, November 2008.* The project includes widening the southbound exit ramp to provide separate left and right turn lanes onto KY 53 and adding a second northbound left turn onto I-71. The estimated cost for this improvement is $8,100,000. There is an ongoing KYTC project (Item Number 05-234.00) that will widen KY 393 from the I-71 interchange north to KY 146 and will also affect the SB I-71 ramps. This project is currently in the design phase. As recommended for the previous recommendation, this project should be coordinated with the 05-234.00 improvements.

6. Separate Left and Right Turns on the Southbound Exit Ramp approximately 100 feet at KY 14 Interchange in Boone County

This project includes separating left and right turns on the southbound exit ramp at the KY 14 Interchange. The estimated cost for this improvement is $22,000.

7. Add Left Turn Lanes to Entrance Ramps to I-71 on KY 14 in Boone County

This project includes providing a left turn lane on KY 14 through the interchange area. The estimated cost for this improvement is $1,640,000.

8. Separate Left and Right Turns on the Southbound Exit Ramp approximately 100 feet and Channelize Right Turns to KY 227 NB in Carroll County

This project includes providing separate left and right turn lanes on the southbound exit ramp to KY 227. The estimated cost for this improvement is $22,000.

9. Separate Left and Right Turn Lanes on the Northbound Exit Ramp approximately 700 feet at KY 153 Interchange in Henry County

This project includes providing separate left and right turn lanes on the northbound exit ramp to US 421. The estimated cost for this improvement is $140,000.

10. Add Left Turn Lanes to Entrance Ramps at KY 153 Interchange in Henry County

This project includes providing separate left turn lanes within the interchange area to I-71 at the KY 153 Interchange. The estimated cost for this improvement is $1,680,000.

11. Signalize NB Ramps at KY 153 Interchange in Henry County

This project includes signalizing the northbound ramps at the KY 153 Interchange. The cost for this improvement is estimated at $150,000.

12. Add Left Turn Lanes to Entrance Ramps at US 421 Interchange in Henry County

This project involves adding a left turn lane from US 421 to the entrance ramps for I-71. The cost for this improvement is estimated at $1,852,000.

13. Conduct Planning Study to Improve Access Management on KY 227 north of I-71 Interchange in Carroll County

This project involves conducting a planning study to provide access management improvements on KY 227 north of the interchange. Alternatives to improve access management could range from:

1. closing access points and providing some entrances as right in/right out with u-turns to return to I-71;
2. barrier median along KY 227 in the developed area with right in/right out entrances and a roundabout to return to I-71; or
3. closing all but the three main entrances.

A planning study would present alternatives for consideration and provide a public involvement component to obtain local input. A preliminary cost estimate for a potential solution is estimated to be $6,250,000.

14. Correct Access Control to meet 300-foot Standard at KY 14 Interchange in Boone County

This project includes changing the access control in the northeast quadrant to meet the 300-foot minimum spacing requirement. The cost for this improvement is estimated at $50,000.

15. Provide Separate Turn Lanes on NB Exit Ramp at US 421 Interchange in Henry County

This project includes providing left and right turn lanes on the northbound Exit Ramp to US 421. The cost for this improvement is estimated at $50,000.

16. Signalize NB Ramp and Add Dual Left Turn Lanes at KY 329 Interchange in Oldham County

This project includes signalizing the northbound ramps and adding dual left turn lanes at the KY 329 Interchange. The cost for this improvement is estimated at $500,000.

7.5 Intelligent Transportation System (ITS) Improvements

ITS encompasses a broad range of modern computer and communications technologies. When integrated into the transportation system infrastructure or in vehicles, these technologies help monitor and manage traffic flow, reduce congestion, provide improved mobility, safety, air quality, and productivity. TRIMARC is an example of ITS.

TRIMARC is funded through a cooperative effort between the Kentucky Transportation Cabinet (KYTC) and the Federal Highway Administration. The purpose of TRIMARC is to improve the performance of the existing Freeway system in the Metropolitan Louisville and Southern Indiana area. Through the use of roadway sensors, video monitoring, variable message signs, and highway advisory radio, drivers are quickly alerted with these advanced warning systems. These warning systems help travelers avoid delays, plan alternate routes and enhance their travel experience. By increasing the availability of information on the real-time status of traffic, TRIMARC is realizing improvements in the response time to incidents, preventing the occurrence of secondary incidents and improving air quality through the reduction of traffic congestion.

Based on coordination with TRIMARC and KYTC District 5 staff, listed below is a list of ITS recommendations for the I-71 Corridor. They were prioritized in order of the magnitude of traffic projections in Jefferson County.

1. **Install six (6) additional cameras**

Cameras are useful for monitoring daily traffic, detecting stranded motorists or incidents, aiding in emergency response, etc. The following recommended locations would fill in current "blind spots" where TRIMARC currently has zero capability to monitor:

a. MP 0.5-0.6, curve located between Zorn Avenue and Frankfort Avenue, install 1 camera on outside of curve.

b. MP 3.4-5.0, long curve between Zorn Avenue and I-264 interchange, install three (3) cameras as needed on outside of curve to view entire curve.

c. MP 6.5-7.5, double curves, install 2 cameras on the outside of the curves.

d. MP 10.0-10.8, curve north of I-265 interchange, install 1 camera on the outside of the curve.

The total cost for additional cameras is $75,000.

2. **Enhanced Mile Marker signs (MUTCD code D10-5, blue background with white legend and border) beginning at MP 4.0.**

These are an excellent reference device used in emergency response and for motorist assistance. The total cost for addition enhanced mile marker signs is $255,000.

3. **Provide Wide Beam Radar stations every 0.5 mile from MP 0.00 to 11.3.**

These are necessary in order to monitor operational speeds and calculate travel times, as well as other uses. There is currently a Federal requirement to provide travel time information to motorists. TRIMARC is currently unable to fulfill this requirement due to lack of funds. The total cost for wide beam radar stations is $170,000.

4. **Dynamic Message Signs (DMS).**

These would provide a means to disseminate roadway condition information to motorists and aide in reducing congestion, delays, secondary collisions, etc. Additional signs are requested at the following locations:

a. I-264 EB at MP 22.1 – just before the US 42 underpass. Install overhead truss-mounted full DMS sign. This would be useful in providing information to I-264 traffic regarding conditions on I-71.

b. US 42, both approaches to I-264 – Install the smaller roadside DMS signs (as currently on I-265). These would be useful in providing information regarding conditions on I-71 to motorists on US 42. They would also aide in redirecting traffic when incidents or congestion occurs on the interstate system.

The total cost for Dynamic message Signs is $400,000.

Beyond 2038

This study was to also prioritize the entire corridor for widening to six lanes. Priorities 41-48 address those segments of I-71 beyond 2038 for widening and are identified as follows:

- KY 14 to I-75 in Boone County (5.0 miles) - $32,400,000—Priority #42.

Based on additional crash data analysis a review of crash reports were dominated by crashes that reflected conditions before or during roadway reconstruction. As shown in Section 4.2, the number of crashes occurring after construction appears to have declined relative to those that occurred prior to or during construction, and pavement rutting did not appear to be an issue. Due to the decline of crashes, and that this section of I-71 is expected to be urban in 2038, and the new threshold for KYTC's v/c ratio policy would be 1.0. This section is not expected to approach capacity as an urban section until just beyond 2038. Therefore, it is lower in priority.

After an evaluation of safety concerns, and capacity issues through design year 2038, the remaining sections are prioritized in order of associated traffic volumes:

- US 127 to KY 14 in Gallatin County (10.0 miles) - $87,300,000—Priority #43.
- KY 153 to US 421 in Henry County (6.0 miles) - $52,480,000—Priority #44.
- US 421 to KY 389 in Henry/Trimble/Carroll Counties - $79,720,000—Priority #45.
- KY 35 to US 127 in Gallatin County (5.0 miles) - $43,900,000—Priority #46.
- KY 389 to KY 227 in Carroll County (1.0 mile) - $8,680,000—Priority #47.
- KY 227 to KY 1039 in Carroll County (11 miles) - $96,500,000—Priority #48.

8.0 CONCLUSIONS

The purpose of the I-71 Corridor Study was to evaluate the existing and projected future conditions of I-71 from I-64 in Jefferson County to I-75 in Boone County and their crossroads, as they relate to safety, and congestion; and develop an overall improvement plan for needed improvements and priorities. This document is based on an evaluation of existing conditions and an analysis of future conditions, a crash analysis, I-71 Corridor Group input and Project Team input recommending a total of 48 mainline improvements, 16 crossroad improvements, and 8 ITS improvements for consideration. Although there may not be a substantial difference between projects that are close in priority, i.e. Priorities 4 and 5; there is however, a difference between projects ranked 1-20 versus projects ranked 40-48.

The final 2038 Build Volume to Capacity Ratio Chart (Chart 3) for 2038 shows a balanced I-71 mainline.

Chart 3: 2038 Mainline Build Volume to Capacity Ratio Comparison