II. EXISTING CONDITIONS

Characteristics of US 431 are identified in the following sections. Information is included about highway systems, geometric characteristics, bridges, traffic conditions, vehicle crashes, adequacy ratings, and planned highway improvements. Roadway information was summarized from the KYTC Highway Information System (HIS) database in July 2007. Photographs taken throughout the study area can be found in **Appendix A**. Additional information on the existing conditions is presented in **Appendix B**, as discussed below. **Exhibit 2.1** shows the location of the study area with breaks at county lines and between phases. A section of the route in Logan County (milepoints 13.896 – 20.590) was recently improved to a four-lane section and has been omitted from further study. Copies of the route logs for Phases I and II are included as **Exhibits B.1** and **B.2** in **Appendix B**.

Exhibit 2.1 – Study Area Mileage

County	Begin MP	End MP
Logan	0.000	13.896
	20.590	31.050
Muhlenberg-Phase 1	0.000	17.484
Muhlenberg-Phase 2	17.484	27.779
McLean	0.000	11.573
Daviess	0.000	11.367

A. Highway Systems

Major highway systems information is shown in **Exhibit B.3** in **Appendix B**, including the State Primary Road System, Functional Classification System, National Highway System (NHS), National Truck Network (NN), Designated Truck Weight Class, and Defense Highway Network. Major highway systems summarized for the study area are as follows:

- State-maintained roads in Kentucky are categorized under the State System, ranging from the highest order classification to the lowest as follows: State Primary roads, State Secondary roads, Rural Secondary roads, and Supplemental roads. State Primary routes are those routes which are considered to be long-distance, high-volume intrastate routes that are of statewide significance. Mobility is the prime function of the routes which can be distinguished by high traffic-carrying capacity. These routes link major urban centers within the state and/or serve as major regional corridors. US 431 is categorized as a state primary route throughout the study area.

- One of 13 functional classification categories is assigned to each state-maintained road in Kentucky, based on the function the road provides and whether the road is in an urban or rural setting. These are classified from highest to lowest and by geographic designation as: Rural Interstate, Urban Interstate, Other Rural Freeways and Expressways (Principal Arterial), Other Urban Freeways and Expressways (Principal Arterial), Other Rural Principal Arterial, Other Urban Principal Arterial, Rural Minor Arterial, Urban Minor Arterial, Rural Major Collector, Urban Collector, Rural Minor Collector, Rural Local, and Urban Local. In the study area, US 431 is an arterial, varying by location between Urban and Rural, Principal and Minor.

- The NHS, first established in 1991 by the Intermodal Surface Transportation Efficiency Act (ISTEA), includes Interstate Highways and other significant Principal Arterials important to the nation's economy, defense, and mobility. US 431 is not a component member of the NHS.

- The NN includes roads designated for use by commercial trucks with increased dimensions (102 inches wide; 13 feet, 6 inches high; semi-trailers up to 53 feet long; and trailers up to 28 feet long – not to exceed two trailers per truck). The 102-inch wide trucks may also travel within 5 miles of a NN highway to pick up or deliver goods or commodities or to access essential services, such as fuel, lodging, or food. Portions of the route in the study area have been state or federally designated to the NN.

- Kentucky Revised Statutes impose weight limits on the state-maintained highway system. There are three weight classification limits: (1) AAA – 80,000 lbs. maximum gross vehicle weight; (2) AA – 62,000 lbs. maximum gross vehicle weight; and (3) A – 44,000 lbs. maximum gross vehicle weight. For special circumstances, occasional exceptions are granted for over-dimensional or overweight vehicles by permits issued by the KYTC, Division of Motor Carriers. In the study area, US 431 has a weight classification limit of AAA.

Portions of the route have also been included on the Bike Route System and the Scenic Byway System, as summarized in **Exhibit B.4**. Three bike trails intersect US 431 while traveling on other routes. One trail, the Midland Kentucky Trail, follows US 431 for approximately 0.3 miles in Muhlenberg County. US 431 is also part of the Blues to Bluegrass Scenic Byway in Muhlenberg County.

B. Geometric Characteristics

Geometric characteristics for major routes in the study area are listed in **Exhibits B.5** and **B.6** for Phases I and II, respectively, including the number of lanes, lane widths, shoulder widths, roadway type, local terrain, speed limits, percent passing sight distance, and pavement type.

In the study area, US 431 lies on flat to rolling terrain with a primarily undivided, two lane cross-section and with driving lanes ranging from 9 to 12 feet in width. 80% of the corridor length in Phase I and 23% of the length in Phase II has driving lanes less than 12 feet wide. Sidewalk facilities are provided alongside US 431 in some of the developed areas, including portions of Central City, Russellville, and Livermore.

C. Bridges

Bridge data for the structures along US 431 are presented in **Exhibits B.7** and **B.8** for Phases I and II. A bridge with a sufficiency rating less than fifty (50.0) is considered to be eligible for replacement with federal funds under the Federal-Aid Highway Bridge Replacement and Rehabilitation Program. Bridges can be rated either structurally deficient or functionally obsolete. Within the project area, only the structure at Muhlenberg County milepoint 27.7 (497-foot long Overflow Structure) is structurally deficient and falls below a 50.0 sufficiency rating. It was noted in a previous report that this structure should be replaced if the route is widened in this area. Phase I contains seven bridges listed as functionally obsolete; Phase II also contains seven functionally obsolete structures.

With the designation of the southern portion of US 431 as a part of the NN, narrow bridges south of Russellville will likely serve higher volumes of wide vehicles. There are two narrow structures within this section of roadway:

- Bridge over South Fork of Red River, Logan County MP 0.987, 318 feet long; and
- Bridge over North Fork of Red River, Logan County MP 4.025, 318 feet long.

D. Traffic and Operational Measures

Existing (Year 2007) and estimated future (Year 2030) traffic and operational conditions are discussed in the following subsections for each major route in the study area. **Exhibits B.9** through **B.14** depict key traffic information along the route for both analysis years.

1. Existing Traffic Volumes (Year 2007)

Traffic volumes on US 431 range from 2,580 vehicles per day (vpd) near the Logan/Muhlenberg County line to 29,900 vpd in Owensboro. The roadway, like many in this portion of Kentucky, follows the rolling terrain, resulting in numerous curves and grades and the associated sight distance limitations. The speed limit is 55 mph, dropping as low as 35 mph passing through various communities. **Exhibits B.9** and **B.10** tabulate traffic characteristics for Phases I and II, respectively.

A large number of heavy trucks were observed in Muhlenberg County due to coal mining operations. According to 2005 data from the KYTC Coal Haul Highway System, as much as 3 million tons of coal is hauled by truck along segments of US 431 south of the Ford Parkway in Muhlenberg County. North of the parkway, as much as 2 million tons are hauled annually through segments concentrated in Muhlenberg County, but routes extend as far north as southern Owensboro. Reported haul weights are shown in **Exhibits B.11** and **B.12**. Plans for a new $3.3 billion power plant north of Central City may further increase hauled tonnages and, therefore, increase the number of heavy trucks.

2. Level of Service (Year 2007)

The Level of Service (LOS) is a qualitative measure of highway traffic conditions, as defined in the *2000 Highway Capacity Manual* (HCM), published by the Transportation Research Board (TRB). Individual levels of service characterize these conditions in terms of speed, travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Six levels of service are defined and given letter designations from A to F, with LOS A as the best condition, representing free flow conditions, and ranging to LOS F, representing severe congestion and/or time delays. Typically, a minimum of LOS D is considered acceptable in urban areas and LOS C is considered acceptable in rural areas.

On US 431, LOS throughout rural portions of the corridor is restricted by limited passing opportunities and the frequency of access points. Generally, LOS drops to lower levels within the towns and small developed areas along the roadway. Most undeveloped sections function at a LOS D or better. **Exhibit B.13** displays maps of the 2007 LOS.

3. Estimated No-Build Future Traffic (Year 2030)

No-Build future traffic was estimated using historic growth rates and assuming no significant changes to the roadway. The growth rates were based on KYTC's historic traffic counts for each study area route. The annual growth rate used for projecting future traffic was 1.45%, resulting in 2030 traffic volumes ranging from 3,600 vpd in undeveloped rural areas to 41,600 vpd in Owensboro.

4. Estimated No-Build Future Level of Service (Year 2030)

Significant increases in traffic volumes further deteriorate level of service. For future year 2030 traffic projections, most of the route is anticipated to function at a LOS D or E. Details are presented graphically in **Exhibit B.14**.

E. Crash Analysis

The safety analysis was based on a methodology developed by the Kentucky Transportation Center (KTC) to locate roadway "segments" based upon traffic volumes and geometric characteristics which correspond to high crash concentrations. The procedure was also used to identify the location of 0.10-mile "spots" which demonstrate high crash frequencies. Each segment or spot is assigned a critical rate factor (CRF) based on formulas published by the KTC. The CRF is one measure of the safety of a road, expressed as a ratio of the crash rate at the study location to the average crash rate for roadways of the same functional classification throughout the state.

If the Critical Rate Factor is 1.00 or greater, it is assumed that crashes are happening due to circumstances that cannot be attributed to random occurance. Therefore, it should be studied in more detail to ascertain if there are remedial actions that could be taken to improve the overall safety of the facility.

A crash analysis was completed based on 2003-2006 data available from the KYTC's CRASH database. Calculations for the segments and spots along US 431 are summarized by county and phase in **Exhibits B.15** and **B.16**. Segments and spots with a CRF greater than 1.00 are shaded to add emphasis. A total of 40 high CRF spots were identified during this crash analysis, with CRF as high as 4.85.

F. Adequacy Ratings

The KYTC HIS database provides an adequacy rating percentile for state-maintained arterials and most major collectors. The composite rating is based on the condition, safety, and service component scores of the route, as described below:

- The Condition Index considers only the condition of the road's pavement.
- The Safety Index is evaluated based on lane width, shoulder width, median widths, alignment, and critical crash rate factors.
- The Service Index rates the route's volume-to-capacity ratio and access control.

Exhibit B.17 depicts the adequacy ratings assigned to the entire length of US 431.

Almost one-third of the segments fall into the lowest quartile of the composite adequacy rating scheme. A concentration of poorly rated segments lie in southern Muhlenberg County, primarily because of low Safety Index values.

G. Programmed Highway Improvements

Since this programming study began in 2003, a number of highway improvement projects have been programmed for US 431. A synopsis of these is shown in **Exhibit 2.2**. The "Final Phase" column represents the last phase scheduled as of the 2006-2012 Highway Plan.

Exhibit 2.2 – Programmed Highway Improvements

Item No.	County	BMP	EMP	Project Description	Final Phase	Year
02-5006.00	Mlbg	13.200	13.300	Rockfall Correction	C	2003
02-9.00	McLean	5.988	6.088	Reconstruct KY 136 Intersection	C	2003
02-972.00	McLean	8.265	8.365	Realignment at KY 1080	C	2004
02-900.00	Mlbg	6.200	6.400	Improving Dead Man's Curve	C	2006
02-977.00	Mlbg	23.900	24.100	Realignment north of S Carrollton	C	2006
03-994.00	Logan	4.145	4.245	Realignment at KY 663	C	2007
03-8309.00	Logan/Mlbg	25.718	17.250	Reconstruct to 4-lane	D	2008
03-273.01	Logan	21.311	25.718	Reconstruct to 4-lane	U	2008
02-160.00	Mlbg	15.524	15.824	Improving RR Crossing	C	2009
02-976.00	Mlbg	22.400	22.700	South Carrollton Realignment	C	2009
03-311.10	Logan	---	---	Russellville Southern Bypass	U	2010

Additional projects completed along the study corridor include adding turning lanes in Beechmont (Muhlenberg County) for a new school and widening in Owensboro (Daviess County) from Home Depot to Martin Luther King loop.