KENTUCKY 90

from the Barren County line to Burkesville

Metcalfe and Cumberland Counties

Item Number: 08-136.00

Final Report

PRE-DESIGN SCOPING STUDY

Prepared for:

KENTUCKY TRANSPORTATION CABINET

DIVISION OF PLANNING

January 2007

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Prepared by:

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EXECUTIVE SUMMARY

The KY 90 Pre-Design Scoping Study was prepared to assist the Kentucky Transportation Cabinet (KYTC) in defining the scope and extent of improvements best suited to meet the current and future needs of this facility between the Metcalfe-Barren County line and Burkesville in Cumberland County, a distance of about 26 miles. A project study team approach was used, consisting of representatives from the KYTC Central Office, District 3, and District 8; Lake Cumberland and Barren River Area Development Districts; and Qk4. Public involvement activities included project team meetings, resource agency coordination, local officials and public information meetings, and website information.

KY 90 typically has two narrow driving lanes, narrow to no shoulders, and winds through a hilly and heavily wooded area with restricted sight distances, providing few opportunities to pass slower vehicles. Several small towns are situated along the roadway, including one National Register of Historic Places District, a potential expansion of that district, five potential historic districts, and numerous potentially eligible individual historic sites. Heavy freight truck and recreational vehicle traffic are common. KY 90 is a major east-west connector in Metcalfe and Cumberland Counties. Glasgow, located west of the study area, is the region's economic activity center, providing employment, health care, and educational opportunities to study area residents. Tourists are attracted to the major recreational areas of Lake Cumberland and Dale Hollow Lake east of the study area, and truck traffic to the major employers/manufacturers. KY 90 is a critical link for study area residents, as well as tourists, and manufacturers receiving and moving goods to markets. Improved connectivity would play an important role in the region's future economic growth and development, commercial truck access, projected traffic demands, and access to public recreational activities, health care services, jobs, higher education, and other opportunities.

Corridor issues and concerns were identified through discussions with KYTC officials, comments from local officials and stakeholders, on-site visits, traffic records, project team meetings, and public information meetings. Safety overshadowed all other issues, prompted mainly by the large volume of commercial truck and recreational vehicle traffic, and substandard roadway geometrics. Other corridor issues included: minimize/avoid impacts to communities and historic properties, promote economic development and tourism, environmental issues, compatibility with scheduled KY 90 improvements in Barren County, and the expectations of elected officials, community leaders, and citizens.

The project study team — following a careful consideration of corridor issues, concerns, and existing conditions — developed the project goals.

- *Improve safety along the KY 90 corridor.*
- *Provide a facility meeting current design standards, capable of serving recent growth, and sustaining current and projected traffic demands.*
- *Improve roadway geometrics to accommodate recreational vehicles and commercial trucks, including possible passing and climbing lanes.*
- *Minimize/avoid impacts to potential historic districts.*
- *Minimize/avoid impacts to communities.*
- *Provide roadway improvements between the Barren County line and Burkesville (KY 61) to compliment the planned Barren County improvements.*
- *Improve accessibility for local people seeking access to the recreational, employment, educational, and health care opportunities in south central Kentucky.*

An analysis of existing conditions confirmed the narrow lanes and shoulders, several reduced speed curves, steep inclines, heavy truck and recreational vehicle traffic volumes, and limited passing opportunities. Two high crash rate locations were identified: the areas around the KY 90/KY 640 intersection in Summer Shade, and the KY 90/KY 163 intersection. (KY 90/KY 163 intersection deficiencies are anticipated to be corrected with implementation of KYTC item no. 3-276.50, KY 163 relocation.) Percent passing sight distances are highly variable, ranging from 20-100 percent. Almost

all the 100-percent is located in Summer Shade, and just over half the project length is rated 71 percent or less passing sight distance. Passing opportunities are frequently prevented by the on-coming traffic. Most crashes occur during daylight hours on dry roads, with a majority involving a fixed object (*i.e.*, single vehicle, driver loses control), followed by rear end (*i.e.*, speed differentials due to congestion or entering/leaving roadway) and right-angle crashes (*i.e.*, common at crossroads and driveways due to right-of-way conflicts, or limited visibility and speed differentials). Traffic volume is projected to increase about 95-percent by the year 2030. Roadway improvements through the small towns are potentially difficult given the positioning of numerous historic resources. Any bypasses might incur adverse impacts to the residents and community businesses.

Improvement options in the following categories were evaluated:

- Do Nothing – involves only routine roadway maintenance. No action to improve the existing facility. This option was not recommended because it did not address the project goals. However, the Do Nothing option will be referred to as appropriate for baseline comparisons throughout the decision making process.
- Transportation System Management – involves relatively low-cost, but effective, improvements that can be quickly implemented through maintenance type activities (*e.g.*, traffic signing/signals at critical locations, lighting, pavement stripping, trim or remove vegetation and other visual obstacles, improve a street corner radius).
- Operational Improvements – are relatively short distance improvements addressing immediate and short-term needs, generally involving roadway reconstruction to correct horizontal and vertical deficiencies.
- Roadway Reconstruction – generally involves longer-term roadway construction on new alignment, or reconstruction of existing roadway sections of longer lengths. May include bypasses, new road on new alignment, or a new typical section for the existing roadway.

Recommendations

After a careful review and consideration of the existing conditions, cultural and environmental constrains, improvement opportunities were identified covering the full length of the study area. The project team categorized the improvements into one of the three types described below to facilitate implementation strategies.

- Bridge Replacements. Candidate bridges will be selected by the District as warranted by bridge condition and safety considerations. (3 bridge replacements)
- Operational Improvements. Includes improvements addressing immediate and short-term needs. The project team made no attempt to prioritize these improvement opportunities, believing it was best to allow the District to select the improvement(s) to implement based upon available funding and needs. (12 operational improvements)
- Roadway Reconstruction Improvements. Consists of longer-term roadway mainline reconstruction and bypass improvements. The project team prioritized these improvements based upon considerations of safety, traffic volumes, passing opportunities, estimated construction costs, and local knowledge. (16 reconstruction improvements)

The recommended KY 90 improvement opportunities are listed in the table on the following page, *Recommended KY 90 Improvement Opportunities*, by category, along with improvement lengths, estimated construction costs, and priority, if appropriate.

The Enacted Six-Year Highway Plan FY 2007-2012 authorize funding for Design, and a portion was used to fund this Pre-Design Scoping Study. The Enacted Six-Year Highway Plan FY 2007-2012 provided for the following phase costs: $3.25 million for design (2006), $7 million for right-of-way (2008), $2.8 million for utility relocation (2008), and $32 million for construction (2008). Each phase is programmed for funding with State Construction Funds (SP).

Recommended KY 90 Improvement Opportunities

Priority	Exhibit Item	Improvement Description	Length (miles)	Est. Cost* (million dollars)
Bridge Replacements (no priority)				
	9	Replace existing bridge over Wisdom Creek.	--	0.5
	12	Replace existing bridge at Dutch Creek.	--	0.7
	13	Replace existing bridge west of Allen Creek Road.	--	0.6
Operational Improvements (no priority)				
	2	Reconstruct the KY 90 intersection at Bronston Howard Road (access road to Summer Shade Elementary School) in Summer Shade using the existing right-of-way.	0.14	0.2
	8.1	Reconstruct the KY 90/KY 3115 intersection in Marrowbone.	0.22	0.3
	D + 5	Roadway section from the Metcalfe-Cumberland County line to the curve at Anderson Lane (item 5). Reconstruct curve just east of the Metcalfe-Cumberland County line near Anderson Lane to meet current design standards.	0.291	0.4
	E + 6	Roadway section from the end of the curve at Anderson Lane (item 5) to the beginning of the curve near Pitman Creek (item 6). Reconstruct curve west of Pittman Creek Road to meet current design standards.	0.633	1.0
	F.1	Roadway section F between White Road and Ferris Fork Creek. Improve typical section safety and rock wall slope immediately north of roadway.	0.35	1.7
	11	Reconstruct the KY 90/KY 100 intersection. Existing intersection would be shifted west and KY 100 realigned to provide a more favorable geometry with KY 90. Turning lanes would be added to KY 90.	0.29	0.4
	14	Curve at Allen Creek. Reconstruct curve east of Allen Creek Road and near Grider to meet current design standards.	0.25	0.6
	18.1	Reconstruct the KY 90/KY 61 intersection in Burkesville. Add a right turn lane on KY 61 southbound.	0.17	0.3
	A-P	Passing lane only on this mainline section.	1.25	0.8
	C-P	Passing lane only on this mainline section.	1.36	1.1
	F-P	Passing lane only on this mainline section.	1.00	1.0
	H-P	Passing lane only on this mainline section.	1.22	0.9
Prioritized Mainline Road Reconstruction (priority order as indicated)				
1	Summer Shade Bypass: (1-1-P, 1-1, 1-2)			
	1-1-P	Summer Shade Bypass 1 with an eastbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 0.86 miles long, estimated construction cost is $0.6 million.	2.31	11.7
	1-1	Summer Shade Bypass 1. Begin west of Hill Top VW Road, curve southeast on new alignment to proceed east to bypass Summer Shade to the south, and reconnect with KY 90 east of Ernie Ferrell Road. This improvement is more expensive and longer than 1-2, and crosses more varying terrain features, but positions the roadway further from residential dwellings.	2.31	11.1
	1-2	Summer Shade Bypass 2. Begin east of Big Jack Road, curve southeast on new alignment to proceed east to bypass Summer Shade to the south, and reconnect with KY 90 about Ernie Ferrell Road. This improvement costs less and is shorter than 1-1, but locates the roadway closer to residential dwellings.	1.76	4.9
2	16 + 18	Reconstruct KY 90 from Burkesville Hill Road/Saw Mill Cut to the KY 90/KY 61 intersection. Begin east of the KY 90/KY 2276 intersection, follow the existing alignment east to the first curve, continue northeast on new alignment, curving east to reconnect with KY 90 near the hilltop and end near the county hospital. Continue by widening KY 90 to 3-lanes, and constructing curb, gutter and sidewalks from near the county hospital to the intersection; reconstructing the elementary school entrance and exit roads; and adding a right hand turn lane on KY 61 southbound.	1.29	9.1
3	15	Norris Branch Road to Owens Road. Relocate KY 90 on new alignment to eliminate curve at KY 691. Begin east of Norris Branch Road, proceed east on new alignment to reconnect with KY 90 in the vicinity of Owens Road.	0.92	10.3

Priority	Exhibit Item	Improvement Description	Length (miles)	Est. Cost* (million dollars)
4	Waterview Bypass with a passing lane: (10-1-P, 10-1, 10-2)			
	10-1-P	Waterview Bypass 1 with a westbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 1.15 miles long, estimated construction cost is $2.9 million.	2.15	10.6
	10-1	Waterview Bypass 1. Begin from the curve west of Waterview's limits, proceed northeast, curving east to bypass Waterview to the north on new alignment, then curving southeast to reconnect with KY 90 in the vicinity of Taylor Road.	2.15	7.7
	10-2	Waterview Bypass 2. Begin from the curve west of Waterview's limits, proceed in a more direct eastern alignment to bypass Waterview to the north and reconnect with KY 90 west of Dutch Creek Road. Improvement 10-2 crosses within the potential National Register Historic District boundaries.	1.52	5.1
5	A-P	Roadway section A with a westbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 1.25 miles long, estimated construction cost is $0.8 million.	1.69	3.1
6	8	Reconstruct KY 90 through Marrowbone with curb, gutter, and sidewalks, using the existing right-of-way. Includes reconstructing the KY 3115 intersection to more favorable geometrics.	0.72	0.6
7	J + K	Roadway section from Owens Road (end of item 15) to beginning of the Burkesville Bypass (item 17). Roadway section from the beginning of the Burkesville Bypass (item 17) to the beginning of the Burkesville Hill Road reconstruction (item 16).	0.88	1.5
8	I	Roadway section from the end of the curve at Allen Creek (item 14) to near Norris Branch Road (beginning of item 15).	0.63	1.1
9	H-P	Roadway section H with an eastbound passing lane beginning just east of Waterview (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane is 1.22 miles long, estimated construction cost is $0.9 million.	1.22	2.7
10	B	Roadway section from end of Summer Shade Bypass (item 1) to the scheduled KY 163 improvement.	1.32	2.2
11	G + 9	Roadway section from the end of the Marrowbone Bypass (item 7) to the beginning of the Waterview Bypass (item 10). Replace existing bridge over Wisdom Creek.	1.24	2.5
12	Beaumont Bypass: (4-1, 4-2)			
	4-1	Beaumont Bypass 1. Begin from the scheduled KY 163 improvement, proceed almost due east on new alignment to bypass Beaumont to the south, and rejoin KY 90 east of Beaumont. This improvement is more direct and slightly shorter than 4-2.	0.893	1.6
	4-2	Beaumont Bypass 2. Begin from the scheduled KY 163 improvement, curve southeast on new alignment to bypass Beaumont to the south, and rejoin KY 90 east of Beaumont.	0.916	2.0
13	F-P	Roadway section F with a westbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 1.00 miles long, estimated construction cost is $1.0 million.	2.26	5.7
14	Burkesville Bypass: (17, 17-P)			
	17	Burkesville Bypass. Begin near KY 90/KY 2276 intersection, proceed southeasterly on new alignment to bypass Burkesville on the south, and reconnect with KY 90 at the KY 90/KY 61 intersection west of the Cumberland River Bridge. Includes reconstructing KY 90/KY 2276 intersection.	1.57	21.7
	17-P	Burkesville Bypass with an eastbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 0.73 miles long, estimated construction cost is $8.1 million.	1.57	29.8
15	C-P	Roadway section C with an eastbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 1.36 miles long, estimated construction cost is $1.1 million.	5.67	10.3
16	Marrowbone Bypass: (7-1, 7-2)			
	7-1	Marrowbone Bypass 1. Begin east of Hominy Creek Road, proceed east to bypass Marrowbone to the north on new alignment, and curve southeast to reconnect with KY 90 in the vicinity of KY 496.	2.02	35.2
	7-2	Marrowbone Bypass 2. Begin east of Hominy Creek Road, proceed east to bypass Marrowbone to the north on new alignment, and curve southeast to reconnect with KY 90 in the vicinity of KY 496. 7-2 follows the same alignment as 7-1, except the mid-section curves south of 7-1 on new alignment.	2.03	39.0

* Estimated construction cost based upon 2006 estimated bid costs. Does not include utility and right-of-way costs.

1.0 INTRODUCTION

1.1 Purpose of the Study

The pre-design scoping study purpose is to investigate the need to improve KY 90 from the Metcalfe-Barren County line to KY 61 in Burkesville in Cumberland County, a distance of about 26 miles. The study examines improvement strategies to address both current and future needs for KY 90 from mile point 0.00 to 11.72 in Metcalfe County and mile point 0.00 to 14.11 in Cumberland County. KY 90 is a major east-west route through the two counties.

1.2 Project Background

The Kentucky Transportation Cabinet (KYTC) recognized the need to study potential improvements to KY 90, and included study funds in the Fiscal Year 2005-2010 Six-Year Highway Plan (SYP), approved 2005; and again in the Enacted Six-Year Highway Plan FY 2007-2012, approved May 2006. The study's intent is to identify, collect, and study critical information concerning the project corridor. This, in turn, will help the KYTC make decisions regarding the need for roadway improvements, and define potential roadway improvements that would better serve the Metcalfe and Cumberland County residents. The study will also assist the KYTC in addressing environmental issues as defined in the 1969 National Environmental Policy Act (NEPA) should federal funding become available for any portion of this project. The study of KY 90 improvements initially began in early 2003, with a limited amount of preliminary work done under item number 3-112.00 in the 2002 SYP before the study's suspension. The study resumed in late 2005 under item number 8-136.00 in the 2005 SYP with an assessment of existing conditions, which included a review of existing reports, meeting minutes, plans, an analysis of existing and projected traffic volumes, and a crash history analysis of the roadway. An environmental overview/footprint was developed to identify environmentally and culturally sensitive locations. The KY 90 study area and project termini are indicated by the highlighted area on the attached exhibits (see Exhibit 1, *Project Study Area Location Map*, and Exhibit 3, *Environmental Footprint*, in Appendix A; and Appendix B, existing KY 90 photographs).

If implemented, the project would help improve the east-west connection from Glasgow to Burkesville. Public involvement included project team meetings, local officials meeting, stakeholders meeting, public information meetings, resource agency coordination, and website information.

1.3 Corridor Issues

Discussions with KYTC officials, comments from local officials, stakeholders, and citizens, on-site visits, and project team meetings identified corridor issues, which centered around safety and connectivity. Safety emerged as the overwhelming primary corridor issue, with concerns focused on crashes and near crashes, the high volume of commercial truck and recreational vehicles, speeding vehicles, and sub-standard roadway geometrics (*i.e.*, narrow driving lanes and shoulders, sharp turns/curves, steep grades, restricted sight distances, limited passing opportunities). Local users consistently voiced safety concerns associated with the large volume of wide freight trucks and recreational vehicles on KY 90's narrow lanes. Trucks use KY 90 as a "short-cut" to the manufacturing and fowl processing plants, business establishments, and other destinations generally located outside the project study area. Recreational vehicles (*e.g.*, trailers, campers, and boats of all sizes) are attracted to the major state recreational areas of Lake Cumberland and Dale Hollow Lake. Speed limits are seemingly frequently ignored, especially through the towns. KY 90 has some sharp curves, steep grades, and reduced speed limits that restrict traffic flow. Narrow lanes and restricted sight distances provide few opportunities to pass slower vehicles. Additionally, the high volume of on-coming traffic frequently prevents passing opportunities. Local users also claim meeting a wide-bodied truck or trailer on the narrow lanes with little to no shoulder width is an intimidating experience. Some sections of KY 90 apparently received resurfacing improvements, which left considerable differences in height between the pavement surface and the shoulder surface. This is especially

noticeable between the Metcalfe-Barren County line and Summer Shade. If the vehicle tires should drop off the pavement edge, then a safe recovery becomes very difficult.

It was generally agreed that an improved roadway would improve safety, and also enhance connectivity, tourism, and recreational vehicle and commercial truck access, thereby increasing the potential for future economic growth and development, while sustaining current and projected traffic demands. KY 90 is a major east-west connector in Metcalfe and Cumberland Counties, as well as a primary access route from the west to the major recreational areas. For local residents, KY 90 provides access to economic and employment centers, health care, and educational opportunities, especially those located to the west in Glasgow. KY 90 characteristically has narrow driving lanes and very narrow to no shoulders almost throughout the study area, along with geometric deficiencies that impede traffic flow. The National Register Historic District in Marrowbone, as well as the other numerous historic properties in the small towns potentially eligible for National Register listing as historic properties and districts, could make KY 90 improvements through the towns difficult. Therefore, by-pass options were suggested for consideration to avoid adverse impacts to the towns' cultural resources. The identified corridor issues fall into the following eleven major categories:

- *Geometric and Safety*
- *Truck and Recreational Vehicles*
- *Historical and Environmental*
- *Match KY 90 Improvements West of Beaumont*
- *Community Impacts (Amish)*
- *Expectations of Elected Officials and Community Leaders*
- *Growth and Economic Development*
- *Sidewalks in Marrowbone District*
- *Add Shoulders and Widen Lanes for Truck Traffic*
- *Passing and Truck Climbing Lanes*
- *Flooding at Marrowbone*

2.0 EXISTING CONDITIONS

2.1 Project Location

The project is located in south-central Kentucky in Metcalfe and Cumberland Counties. The project begins at the Metcalfe-Barren County line and extends east through southern Metcalfe County to terminate at the KY 90/KY 61 intersection in Burkesville (about 26 miles). The project corridor is a fairly typical south-central rural Kentucky 2-lane blacktop highway winding through hilly terrain, small towns, and agricultural-residential areas, with scattered small service-oriented commercial businesses.

Three other highway projects listed in the Enacted Six-Year Highway Plan FY 2007-2012 are near the KY 90 study area:

- 3-108.50, KY 90, Barren County, Spot Improvements. Reconstruct KY 90 from east of Glasgow to the Metcalfe County line.
- 3-276.50, KY 163, Monroe County, Relocation. From south of Cyclone Road in Monroe County extending north to KY 90 in Metcalfe County.
- 8-158.04, KY 61, Cumberland County, Relocation. Burkesville-Columbia Road, Burkesville to Jones Chapel.

2.2 Roadway Characteristics

A windshield survey of KY 90 between the Metcalfe-Barren County line and Burkesville reveals KY 90 as generally a narrow, 2-lane, undivided roadway with narrow shoulders closely following "the lay of the land" and the associated curves, hills, and creek valleys. Consequently, sight distances are sometimes limited, and vehicle-passing opportunities restricted. Shoulders are narrow to almost appearing non-existent, frequently falling off sharply near the roadway edge. One section of KY 90 appeared to have a more favorable typical section (*i.e.*, about 5-miles between Beaumont and the Metcalfe-Cumberland county line) with 11-foot wide lanes and 6-foot paved shoulders. Utility line/pole placement varies from adjacent to the roadway, to a significant offset from the roadway. Residences are generally situated some distance away from the roadway; except in the more built-up/urban areas where residences and commercial buildings sometimes almost abut the roadway, and roadside parking is the norm. The more recently constructed residences are positioned further from the roadway. The existing KY 90 roadway generally follows the terrain, which only occasionally required deep fills and rock cuts. Consequently, deviating from the current alignment could require significant fills, rock cuts, and other earthwork.

Tables 1 and 2 (*Existing Highway Systems*, and *Geometric and Traffic Characteristics of Existing Highways*) present an inventory of selected study area roadways and their characteristics. The shaded boxes in Table 2 indicate those roadway sections with widths less than the current design standards of 12-foot wide driving lanes and 8-foot wide shoulders. Refer to Exhibits 1, 3, and 4, *Typical Sections*, in Appendix A, and the color photographs in Appendix B illustrating typical examples of existing KY 90 roadway sections. According to the KYTC Highway Information System (HIS) database, KY 90, within the study area, is a 2-lane, undivided highway traversing rolling terrain. Lane widths vary from 9 to 11-feet wide, however the majority is 10-foot wide lanes. The posted speed limit is mostly 55 mph, reducing to 35 and 45 mph in the more populated areas or where roadway geometrics restrict travel speed. Shoulder width varies from 1-foot (curbed) to 8-feet wide, with 4-foot shoulders comprising about half the length, and the balance almost equally divided between 2-foot and 6-foot wide shoulders. The percent passing sight distance varies from 20 to 100 percent, with Metcalfe County having the largest variability, and Cumberland County mostly 88 percent. The 100-percent passing sight distance corresponds to mile points located in and around Summer Shade; however, KY 90 through Summer Shade is stripped for no passing. Just over half the project length has a 71 percent or less percent passing sight distance rating, and a windshield survey indicated few opportunities to pass. Only two truck climbing lanes (*i.e.*, 3-lane roadway)

exists in the study area. One is located just east of Summer Shade (about 0.64 mile long) on westbound KY 90; the second is located east of Beaumont (about 1.15 miles long), also on westbound KY 90. In addition, KY 90 has several locations with steep grades, reduced speed curves, and rock cuts. In the study area, KY 90 is a State Primary (Other) system, functionally classified as a *Rural Minor Arterial*, with an AAA truck weight class rating. It is not listed on the National Truck Network or National Highway System.

2.3 Traffic and Level of Service

The following paragraphs provide summaries of traffic information and crash analyses. Tables 1 and 2 provide roadway characteristics and information on the major roads within the study area. Existing traffic volumes (year 2005) and truck percentages were obtained from the KYTC Highway Information System (HIS) database.

The KY 90 roadway under study currently has traffic volumes ranging from 2,460 to 5,380 vehicles per day (vpd), which are projected to increase to 4,790 to 10,500 vpd at the same locations by the year 2030 (see Table 2, *Geometric and Traffic Characteristics of Existing Highways*, and Exhibit 2, *Traffic and Crash Locations*, in Appendix A). This represents a projected traffic volume increase of about 95 percent along KY 90 by the year 2030. Other study area highways have existing traffic volumes ranging from a low of 80 vpd along KY 2276 (located in the east near Burkesville) to 3,560 vpd along KY 163 (located in the west). Projected (year 2030) traffic volumes are expected to range from about 110 to 5,910 vpd at the same locations, representing increases of about 38 to 66 percent. Traffic volumes on other study area roadways are expected to increase about 39 to 44 percent. The predicted traffic volumes represent unconstrained traffic increases based on growth trends.

Truck traffic volumes along KY 90 range from about 16 to 19 percent, which is considered higher than average for this highway functional classification (state wide average truck percent for a rural minor arterial is 14.0 percent). Truck traffic volume on other study area roadways is generally not available.

Traffic conditions were examined to determine existing and projected Levels of Service. Level of service (LOS) is a method listed in the *2000 Highway Capacity Manual*, published by the Transportation Research Board, and is commonly used to evaluate and describe roadway functions. “Level of service” is defined as a qualitative measure of operational conditions, and the motorists’ perception of those conditions. The conditions are usually defined in terms such as speed, travel time, maneuverability, delay, and comfort and convenience. The letters “A” through “F” designate the six levels of service. LOS A represents the best operating conditions (*i.e.*, free flow conditions), while LOS F defines the worst (*i.e.*, severe congestion). According to the national standards, the lower levels of service (*i.e.*, D, E, and F) are unacceptable for safe and efficient operation. The lower levels generally involve unstable traffic flows, and drivers have little freedom to maneuver. Typically, LOS D is considered the minimum acceptable in urban areas, and LOS C the minimum acceptable in rural areas. Both the *Kentucky Transportation Cabinet Design Manual*, and the American Association of State Highway and Transportation Official’s (AASHTO) *A Policy on Geometric Design of Highways and Streets* state the desired LOS for the design of a rural highway is “C.”

The LOS analysis performed on study area highways indicates the existing LOS’s range from B to C (see Table 2, and Exhibit 2 in Appendix A). For KY 90, the existing 2005 LOS is either B or C, with the project length almost equally divided between the two LOS ratings (*i.e.*, LOS B is about 50.8 percent of the length, and LOS C about 49.2). Most of the LOS B rated roadway is located in the KY 90 section between Beaumont and the Metcalfe-Cumberland County line that has the more favorable typical section. In Cumberland County, the LOS B rated roadway is in the mid-section, which basically follows the valley bottom. The western half of KY 90 in Metcalfe County, which includes Summer Shade, is rated LOS C, whereas in Cumberland County, LOS C occurs in the more rugged areas in the west and east.

TABLE 1 Existing Highway Systems

Begin MP	Begin Route	End MP	End Route	State System	National Truck Network	National Highway System	Functional Classification	Truck Weight Class
KY 90, Metcalfe County								
0.000	Barren C/L	0.899	Pitcock Road	State Primary (Other)	No	No	Rural Minor Arterial	AAA
0.899	Pitcock Road	1.800	n/a	State Primary (Other)	No	No	Rural Minor Arterial	AAA
1.800	n/a	1.926	Whitlow Road	State Primary (Other)	No	No	Rural Minor Arterial	AAA
1.926	Whitlow Road	2.012	Bowman Estate	State Primary (Other)	No	No	Rural Minor Arterial	AAA
2.012	Bowman Estate	2.710	Trinity Lane	State Primary (Other)	No	No	Rural Minor Arterial	AAA
2.710	Trinity Lane	2.912	n/a	State Primary (Other)	No	No	Rural Minor Arterial	AAA
2.912	n/a	3.010	Cemetery Road	State Primary (Other)	No	No	Rural Minor Arterial	AAA
3.010	Cemetery Road	3.350	n/a	State Primary (Other)	No	No	Rural Minor Arterial	AAA
3.350	n/a	4.450	Branstetter Park Old Trace Rd	State Primary (Other)	No	No	Rural Minor Arterial	AAA
4.450	Branstetter Park Old Trace Rd	4.721	KY 163	State Primary (Other)	No	No	Rural Minor Arterial	AAA
4.721	KY 163	4.850	n/a	State Primary (Other)	No	No	Rural Minor Arterial	AAA
4.850	n/a	5.600	Lone Star Ridge Rd	State Primary (Other)	No	No	Rural Minor Arterial	AAA
5.600	Lone Star Ridge Rd	6.450	Martin Cemetery Rd	State Primary (Other)	No	No	Rural Minor Arterial	AAA
6.450	Martin Cemetery Rd	7.600	Stillhouse Branch	State Primary (Other)	No	No	Rural Minor Arterial	AAA
7.600	Stillhouse Branch	8.711	Harvey White Cemetery Rd	State Primary (Other)	No	No	Rural Minor Arterial	AAA
8.711	Harvey White Cemetery Rd	11.719	Cumberland C/L	State Primary (Other)	No	No	Rural Minor Arterial	AAA
KY 90, Cumberland County								
0.000	Metcalfe C/L	1.994	Ferris Fork Rd	State Primary (Other)	No	No	Rural Minor Arterial	AAA
1.994	Ferris Fork Rd	3.919	n/a	State Primary (Other)	No	No	Rural Minor Arterial	AAA
3.919	n/a	4.415	Grey Branch Rd	State Primary (Other)	No	No	Rural Minor Arterial	AAA
4.415	Grey Branch Rd	5.150	n/a	State Primary (Other)	No	No	Rural Minor Arterial	AAA
5.150	n/a	5.337	KY 496	State Primary (Other)	No	No	Rural Minor Arterial	AAA
5.337	KY 496	7.839	KY 100	State Primary (Other)	No	No	Rural Minor Arterial	AAA
7.839	KY 100	11.273	KY 691	State Primary (Other)	No	No	Rural Minor Arterial	AAA
11.273	KY 691	13.242	n/a	State Primary (Other)	No	No	Rural Minor Arterial	AAA
13.242	n/a	13.630	n/a	State Primary (Other)	No	No	Rural Minor Arterial	AAA
13.630	n/a	14.113	KY 61	State Primary (Other)	No	No	Rural Minor Arterial	AAA
KY 163, Metcalfe County								
0.000	Monroe C/L	2.251	Apple Grove Rd	State Secondary	No	No	Rural Major Collector	AAA
2.251	Apple Grove Rd	3.223	KY 90	State Secondary	No	No	Rural Major Collector	AAA
3.223	KY 90	4.518	Edgar Ford Rd	State Secondary	No	No	Rural Major Collector	AAA
4.518	Edgar Ford Rd	7.100	Robert-Shaw Rd	State Secondary	No	No	Rural Major Collector	AAA
KY 640, Metcalfe County								
0.000	KY 90	16.723	KY 2435 / KY 70	Rural Secondary	No	No	Rural Minor Collector	A

TABLE 1 Existing Highway Systems

Begin MP	Begin Route	End MP	End Route	State System	National Truck Network	National Highway System	Functional Classification	Truck Weight Class
KY 100, Cumberland County								
3.199	KY 3115	7.655	Beech Grove Church Rd	Rural Secondary	No	No	Rural Minor Collector	A
7.655	Beech Grove Church Rd	8.097	KY 90	Rural Secondary	No	No	Rural Minor Collector	A
KY 1312, Cumberland County								
0.000	KY 90	0.944	Metcalfe C/L	Supplemental Rd	No	No	Rural Local	A
KY 2276, Cumberland County								
0.000	KY 90	0.650	n/a	Supplemental Rd	No	No	Rural Local	A
0.650	n/a	1.432	Smith St	Supplemental Rd	No	No	Rural Local	A
1.432	Smith St	1.536	Herd St	Supplemental Rd	No	No	Rural Local	A
1.536	Herd St	1.669	KY 61	Supplemental Rd	No	No	Rural Local	A
KY 3115, Cumberland County								
0.000	KY 100	2.966	Turner Branch Rd	Rural Secondary	No	No	Rural Local	A
2.966	Turner Branch Rd	3.426	KY 90	Rural Secondary	No	No	Rural Local	A
KY 496, Cumberland County								
0.000	KY 90	2.054	Casey Fork Rd	Rural Secondary	No	No	Rural Minor Collector	A
2.054	Casy Fork Rd	2.899	Metcalfe C/L	Rural Secondary	No	No	Rural Minor Collector	A
KY 691, Cumberland County								
5.390	n/a	7.318	KY 90	Rural Secondary	No	No	Rural Minor Collector	A

Source: KYTC *Highway Information System* (HIS)

TABLE 2 Geometric and Traffic Characteristics of Existing Highways

Begin MP	End MP	Length (miles)	No. of Lanes	Lane Width (feet)[1]	Shoulder Width (feet)[1]	%Passing Sight Distance[2]	Speed Limit (mph)	Roadway Type	Terrain Type	Pavement Type	ADT 2005	ADT 2030	ADT percent increase	Truck %	LOS[1] 2005	LOS[1] 2030	Composite Adequacy Rating[3]	Composite Adequacy Percentile[3]
KY 90, Metcalfe County																		
0.000	0.899	0.90	2	9	2	61	55	Undivided	rolling	High Flexible	4,770	9,290	94.8%	17.9	C	D	81.80	67.45
0.899	1.800	0.90	2	9	2	100	55	Undivided	rolling	High Flexible	4,770	9,290	94.8%	17.9	C	D	81.80	67.45
1.800	1.926	0.13	2	9	2	100	55	Undivided	rolling	High Flexible	4,770	9,290	94.8%	17.9	C	D	58.80	22.07
1.926	2.012	0.09	2	9	2	100	45	Undivided	rolling	High Flexible	4,770	9,290	94.8%	17.9	C	D	58.80	22.07
2.012	2.710	0.70	2	9	2	100	35	Undivided	rolling	High Flexible	4,770	9,290	94.8%	17.9	C	D	58.80	22.07
2.710	2.912	0.20	3	9	6	100	35	Undivided	rolling	High Flexible	4,770	9,290	94.8%	17.9	C	D	62.00	28.65
2.912	3.010	0.10	3	9	6	100	45	Undivided	rolling	High Flexible	4,770	9,290	94.8%	17.9	C	D	62.00	28.65
3.010	3.350	0.34	3	9	6	82	55	Undivided	rolling	High Flexible	4,770	9,290	94.8%	17.9	C	D	62.00	28.65
3.350	4.450	1.10	2	9	6	82	55	Undivided	rolling	High Flexible	4,770	9,290	94.8%	17.9	C	D	85.00	74.56
4.450	4.721	0.27	2	10	2	37	55	Divided	rolling	High Flexible	4,770	9,290	94.8%	17.9	C	D	82.80	71.03
4.721	4.850	0.13	2	10	2	100	55	Divided	rolling	High Flexible	3,390	6,600	94.7%	17.9	B	C	82.80	71.03
4.850	5.300	0.45	2	10	2	22	55	Undivided	rolling	High Flexible	3,390	6,600	94.7%	17.9	B	C	82.80	71.03
5.300	5.554	0.25	2	10	2	22	55	Undivided	rolling	High Flexible	3,390	6,600	94.7%	17.9	B	C	77.30	58.38
5.554	5.600	0.05	2	10	2	22	55	Undivided	rolling	High Flexible	3,390	6,600	94.7%	17.9	B	C	72.80	46.00
5.600	6.450	0.85	2	10	2	47	55	Undivided	rolling	High Flexible	2,610	5,080	94.6%	17.9	B	C	77.30	58.38
6.450	7.600	1.15	3	11	6	47	55	Undivided	rolling	High Flexible	2,610	5,080	94.6%	17.9	B	C	95.00	99.98
7.600	8.711	1.11	2	11	6	54	55	Undivided	rolling	High Flexible	2,610	5,080	94.6%	17.9	B	C	95.00	99.98
8.711	11.719	3.01	2	11	6	71	55	Undivided	rolling	High Flexible	2,460	4,790	94.7%	15.6	B	C	89.50	83.41
KY 90, Cumberland County																		
0.000	1.994	1.99	2	9	4	20	55	Undivided	rolling	High Flexible	2,460	4,790	94.7%	15.6	C	C	70.00	41.75
1.994	3.919	1.93	2	10	4	68	55	Undivided	rolling	High Flexible	3,320	6,460	94.6%	15.6	C	C	82.00	69.06
3.919	4.415	0.50	2	10	8	68	35	Undivided	rolling	High Flexible	3,320	6,460	94.6%	15.6	C	C	82.00	69.06
4.415	5.150	0.74	2	10	1	68	35	Undivided	rolling	High Flexible	3,320	6,460	94.6%	15.6	C	C	82.00	69.06
5.150	5.337	0.19	2	10	4	88	55	Undivided	rolling	High Flexible	3,320	6,460	94.6%	15.6	B	C	82.00	69.06
5.337	7.839	2.50	2	10	4	88	55	Undivided	rolling	High Flexible	3,530	6,870	94.6%	16.4	B	C	82.00	69.06
7.839	11.273	3.43	2	10	4	88	55	Undivided	rolling	High Flexible	3,530	6,870	94.6%	16.4	B	C	82.00	69.06
11.273	13.242	1.97	2	10	4	88	55	Undivided	rolling	High Flexible	4,090	7,960	94.6%	16.4	C	C	82.00	69.06
13.242	13.630	0.39	2	10	4	88	45	Undivided	rolling	High Flexible	4,090	7,960	94.6%	16.4	C	C	82.00	69.06
13.630	14.033	0.40	2	10	4	88	45	Undivided	rolling	High Flexible	4,090	7,960	94.6%	16.4	C	C	82.00	69.06
14.033	14.113	0.08	2	10	4	88	45	Undivided	rolling	High Flexible	5,380	10,500	95.2%	18.6	C	D	90.00	83.72
KY 163, Metcalfe County																		
0.000	0.921	0.92	2	11	2	9	55	Undivided	rolling	High Flexible	2,750	4,570	66.2%	13.7	C	C	80.50	74.00
0.921	2.251	1.33	2	11	2	9	55	Undivided	rolling	High Flexible	3,560	5,910	66.0%	12.1	C	C	80.50	74.00
2.251	3.223	0.97	2	11	2	51	55	Undivided	rolling	High Flexible	3,560	5,910	66.0%	12.1	C	C	90.50	93.07
3.223	4.518	1.30	2	9	2	19	55	Undivided	rolling	High Flexible	1,790	2,970	65.9%	12.1	C	C	84.50	85.68
4.518	7.100	2.58	2	9	2	39	55	Undivided	rolling	High Flexible	1,790	2,970	65.9%	12.1	C	C	84.50	85.68

TABLE 2 Geometric and Traffic Characteristics of Existing Highways

Begin MP	End MP	Length (miles)	No. of Lanes	Lane Width (feet)[1]	Shoulder Width (feet)[1]	%Passing Sight Distance[2]	Speed Limit (mph)	Roadway Type	Terrain Type	Pavement Type	ADT 2005	ADT 2030	ADT percent increase	Truck %	LOS[1] 2005	LOS[1] 2030	Composite Adequacy Rating[3]	Composite Adequacy Percentile[3]
KY 640, Metcalfe County																		
0.000	8.678	8.68	2	9	3	**	55	Undivided	rolling	Mixed Bituminous	330	470	42.4%	**	B	B	**	**
8.678	16.723	8.05	2	9	3	**	55	Undivided	rolling	Mixed Bituminous	550	780	41.8%	**	B	B	**	**
KY 100, Cumberland County																		
3.199	7.655	4.46	2	9	2	0	55	Undivided	rolling	Bituminous	290	410	41.4%	**	B	B	**	**
7.655	8.097	0.44	2	9	2	0	55	Undivided	rolling	Bituminous	620	890	43.5%	**	B	B	**	**
KY 1312, Cumberland County																		
0.000	0.944	0.94	2	9	3	**	55	Undivided	rolling	Mixed Bituminous	200	280	40.0%	**	B	B	**	**
KY 2276, Cumberland County																		
0.000	0.650	0.65	2	9	3	**	55	Undivided	rolling	Mixed Bituminous	80	110	37.5%	**	B	B	**	**
0.650	1.432	0.78	2	9	3	**	55	Undivided	rolling	Mixed Bituminous	80	110	37.5%	**	B	B	**	**
1.432	1.536	0.10	2	9	3	**	25	Undivided	rolling	Mixed Bituminous	80	110	37.5%	**	B	B	**	**
1.536	1.669	0.13	2	9	2	**	25	Undivided	rolling	Mixed Bituminous	1,490	2,100	40.9%	**	C	C	**	**
KY 3115, Cumberland County																		
0.000	2.966	2.97	2	8	3	**	55	Undivided	rolling	Mixed Bituminous	210	300	42.9%	**	B	B	**	**
2.966	3.426	0.46	2	8	3	**	55	Undivided	rolling	Mixed Bituminous	210	300	42.9%	**	B	B	**	**
KY 496, Cumberland County																		
0.000	2.054	2.05	2	9	2	**	55	Undivided	rolling	Mixed Bituminous	250	350	40.0%	**	B	B	**	**
2.054	2.899	0.85	2	9	2	**	55	Undivided	rolling	Mixed Bituminous	250	350	40.0%	**	B	B	**	**
KY 691, Cumberland County																		
5.390	7.318	1.93	2	9	3	**	55	Undivided	rolling	Mixed Bituminous	440	610	38.6%	**	B	B	**	**

Source: KYTC *Highway Information System* (HIS). ** Information not available.

[1] Lane and shoulder widths that do not meet current design standards (i.e., less than 12-foot-wide driving lanes and 8-foot-wide shoulders), and unacceptable Level of Service (LOS) ratings (i.e., D, E, F) are shaded.

[2] Percent Passing Sight Distance - the percent of segment length (estimated to the nearest 10%) which has available passing sight distance (as measured from the driver's eye to the road surface) of at least 1,500 feet. This information is only available for Kentucky maintained roads classified as State Primary or State Secondary.

[3] Composite Adequacy Rating is a method being developed by KYTC to assess a roadway's condition and prioritize highway improvements. The ratings are calculated by individual functional class and based upon three roadway components (safety, service, and condition) with each component comprised of several measures. The rating scores 100 as a perfect, or near perfect, highway. The Composite Adequacy Percentile ranks a particular roadway section compared to other Kentucky roads in the same functional class into a percentile. For example, a road section with a composite adequacy percentile of 75.0 means that 25% of the roads are rated better. Composite adequacy data is from the December 22, 2005 update.

By the year 2030, nearly an additional 44 percent of the KY 90 roadway length is expected to deteriorate to LOS C or D, resulting in almost 80 percent of the project length classified as LOS C. About 20 percent would be rated LOS D, with the majority located in the western half of Metcalfe County, and the balance in Burkesville. The intersecting roadway LOS's generally remain unchanged. Without implementing a roadway improvement project, the increasing traffic volume combined with the LOS decreasing to C and D would eventually cause regularly occurring peak hour congestion and its associated delays in accessing businesses, along with increased driver frustration and the likelihood for higher crash rates.

2.4 Crash Analysis

Safety along KY 90 in the project study area was analyzed using crash analysis. Crash analysis is an analysis tool for finding roadway sections with abnormally high crash rates and, therefore, sections with potentially correctable hazards to traffic safety. Historical crash data from the five-year period January 2000 – December 2004 was used to identify KY 90 study area roadway sections with abnormally high crash rates, thus indicating a possible need for safety improvements. Only crashes with a valid mile-point listing were considered in the analysis. Crash analysis procedures involve assigning reported crashes to roadway locations by mile-point. Crashes are normally 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. Generally, the analysis procedure 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 or segments depending on their length — sections less than 0.30 miles are classified as a spot location, and sections over 0.30 miles are classified as a segment. Roadway section crash rates were normalized for comparison by either hundred-million-vehicle-miles traveled (HMVM) for segments, or millions-of-vehicles (MV) for spots. Using the average crash rate, the critical crash rate is obtained from Kentucky Transportation Research Center's (KTRC) *Analysis of Traffic Crash Data in Kentucky (2000-2004)*. 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 average daily traffic (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 rate factor (CRF), 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 CRF is greater than 1.0), then that section is classified as a high crash location. In other words, if the CRF exceeds 1.0, then that highway section has more crashes than is statistically probable based on random occurrence. If the CRF is between 0.90 and 1.0, then that section is considered a potentially high crash location, with the potential increasing as 1.0 is approached.

Table 3, *Crash Analysis Summary*, lists the high crash locations for the project area. Appendix C, KY 90 Crash Analysis, contains the detailed crash analysis for the entire length of KY 90 in the project study area. Exhibit 2, *Traffic and Crash Locations*, provides a graphic presentation of the crashes. Metcalfe County had a recorded 130 crashes along nearly 12 miles of KY 90, while Cumberland County recorded 107 crashes along 15 miles (237 total crashes). A visual examination of Exhibit 2 reveals that while crashes tend to occur throughout the project length, there are areas of concentration and relative absence of crashes. The section of KY 90 east of Beaumont and nearly to the Cumberland County line (previously mentioned as having a more favorable typical section) has comparatively few crash incidents. The largest number of crashes occurs west and east of Summer Shade, roughly from the Barren-Metcalfe County line to KY 163. Another concentrated area of crashes begins about the base of Burkesville Hill (*i.e.*, KY 2276) and extends to KY 61 in Burkesville. Only two high crash spot locations were identified, and both are located in Metcalfe County: one in the vicinity of KY 640 in Summer Shade; and the other is in the vicinity of the KY 90/KY 163 intersection. No potentially high crash locations were identified in Metcalfe or Cumberland Counties. Of the 237 crashes reported, 4 resulted in fatalities (3 in Metcalfe County, 1 in Cumberland County). None of the fatalities occurred at the two high crash locations.

Table 3 Crash Analysis Summary

Begin MP	End MP	Length (miles)	ADT (veh/day)	Number Lanes	Rural / Urban	Functional Class Rate	Crashes				MV	HMVM	Rates				Critical Rate	Critical Rate Factor[1]
							Fatal	Injury	PDO	Total			Fatal	Injury	PDO	Total		
KY 90, Metcalfe County																		
0.000	**11.719**	**11.719**	**3,460**	**2**	**R**	**239.00**	**3**	**62**	**65**	**130**	**6.3145**	**0.740**	**4.05**	**83.78**	**87.84**	**175.68**	**285.97**	**0.61**
vicinity KY 640 in Summershade																		
2.100	2.400	0.300	4,680	2	R	0.72	0	2	12	14	8.541	0.026	0.00	0.23	1.40	1.64	1.53	**1.07**
2.200	2.500	0.300	4,680	2	R	0.72	0	2	11	13	8.541	0.026	0.00	0.23	1.29	1.52	1.53	**1.00**
2.300	2.600	0.300	4,680	2	R	0.72	0	9	9	18	8.541	0.026	0.00	1.05	1.05	2.11	1.53	**1.38**
vicinity KY 163																		
4.500	4.800	0.300	4,680	2	R	0.72	0	23	5	28	8.541	0.026	0.00	2.69	0.59	3.28	1.53	**2.15**
4.600	4.900	0.300	3,200	2	R	0.72	0	23	5	28	5.84	0.018	0.00	3.94	0.86	4.79	1.71	**2.80**
4.700	5.000	0.300	3,200	2	R	0.72	0	25	5	30	5.84	0.018	0.00	4.28	0.86	5.14	1.71	**3.00**
KY 90, Cumberland County																		
0.000	**15.000**	**15.000**	**3,760**	**2**	**R**	**239.00**	**1**	**48**	**58**	**107**	**6.862**	**1.029**	**0.97**	**46.63**	**56.35**	**103.95**	**278.74**	**0.37**

Source: KYTC Highway Information System (HIS). Research period is January 2000 to December 2004.

[1] Critical Rate Factors that are statistically high (i.e., equal to or greater than 1.00) are shaded.

The KY 90/KY 640 intersection in Summer Shade is a T-intersection, marked by route signs. The intersection has poor geometrics and restricted visibility. KY 640 connects to the north side of KY 90, with an open field directly to the south, a gas station occupying the entire northwest corner, and a church occupying the northeast corner. Immediately east of the church is a curve to the north, further restricting sight distance.

The KY 90/KY 163 intersection is a four-way intersection, with flashing overhead lights ("caution" for KY 90, and "stop" for KY 163), "stop" signs for KY 163 traffic, and left turn lanes for east and west bound KY 90 traffic. Northbound KY 163 drivers approach KY 90 uphill from rolling terrain, with the intersection essentially located on a hilltop with restricted visibility to the west. Southbound KY 163 approaches the intersection downhill following a curve. Eastbound KY 90 drivers approach the intersection after cresting a small hilltop immediately before the intersection, while westbound traffic approaches the intersection uphill.

Table 4, *Crash Type Statistics*, lists factors contributing to crashes on the KY 90 roadway by county in terms of percentage of all crashes. The two high crash locations in Metcalfe County are also presented. Exhibit 2, *Traffic and Crash Locations*, provides a graphic presentation of the crashes. To reflect current conditions as closely as possible, only the most recent data available (*i.e.*, from January 2000 through December 2004) was used in this analysis. These crash factors can be used in analyzing crash causes and indicating potential solutions. Examining Table 4 reveals the majority of crashes are occurring on dry roads, which tends to exclude weather conditions as a major contributing factor affecting the safety on KY 90 in the study area. Additionally, about 85 percent of crashes are occurring during daylight hours, which tends to reduce the importance of low light conditions as a contributing factor affecting safety.

Fixed object crashes are generally the most common type of crash reported on a county wide basis (Metcalfe County 35 percent, Cumberland County 30 percent), and typically involves a single vehicle impacting immobile objects such as a tree, utility pole, fence, guardrail, earth embankment or ditch, signpost, animal, etc. When crashes occurring at the two high crash locations (predominantly right-angle crashes) are factored out, then 50 percent of all crashes in Metcalfe County are fixed object crashes. Contributing factors to fixed object crashes include excessive speed for existing conditions, and poor highway geometrics.

Rear end crashes typically occur because of congestion and large differentials in travel speed (*e.g.*, stop and go driving; turning into/out of access drives or roads). These types of crashes are the most common in Cumberland County (32 percent), and the third most frequent in Metcalfe County (19 percent). However, it is the most frequent type at the KY 640 intersection near Summer Shade (41 percent), identified as a high crash location.

Right-angle crashes occur most frequently at intersections (*e.g.*, crossroads or driveways) due to right-of-way conflicts, or limited visibility and large speed differences. Right-angle crashes are the second most frequent crash type in Metcalfe County (23 percent), and the third most frequent in Cumberland County (14 percent). The KY 163 intersection in Metcalfe County exhibits the highest crash rate of all crash types in the study area, with 81 percent right-angle crashes. Comments from local citizens attributed the high crash rate to north- and southbound KY 163 drivers failing to yield the right-of-way to KY 90 traffic. KY 163 drivers mistakenly believe the intersection is a four-way stop, expect KY 90 traffic to stop, and subsequently enter the intersection into the traffic flow.

Sideswipe crashes in the study area tend to implicate roadway geometric issues are involved, with Metcalfe County having more "opposite direction" sideswipes (12 percent), and Cumberland County having more "same direction" sideswipe crashes (10 percent). Same direction sideswipe crashes are commonly due to drivers changing lanes without checking the adjacent lane for traffic, and mainly occur on multi-lane roadways in congested areas. Since the majority of the KY 90 roadway has only one-driving lane in each direction, other factors must be

considered. Cumberland County exhibits a higher percentage of head-on crashes than Metcalfe County (*i.e.*, 6 percent versus 2 percent, or about three times higher), and head-on crashes could be interpreted as a more severe type of opposite direction sideswipe crash. Contributing factors to both sideswipe crashes and head-on crashes can be attributed either to drivers failing to maintain control and staying within their driving lane, or to improper passing procedures. Both of these contributing factors can be heavily influenced by roadway geometrics (*e.g.*, sharp curves, steep hills, limited visibility, limited passing opportunities). As Table 2, *Geometric and Traffic Characteristics of Existing Highways*, indicates, both counties have significant sections of roadway where the passing sight distance is insufficient to provide safe passing opportunities.

The traffic crash analysis indicates two roadway sections in the project study area are experiencing high crash rates. Poor/restricted visibility, speed differentials between vehicles, traffic congestion, and limited passing opportunities — combined with a roadway not meeting current design standards — are the likely leading factors for crash rates on KY 90. This argument is supported by the documented poor visibility on these roadways (see Table 2). Any roadway improvement satisfying the project goal of improving visibility and roadway geometrics will, in turn, satisfy the goal of increasing the KY 90 roadway's safety.

Table 4 Crash Type Statistics

Begin MP	End MP	Length (miles)	Total Crashes	Crashes		Type of Crash							
				During Daylight Hours	On Dry Roadway	Right-Angle	Backing	Head On	Opposing Left Turn	Rear End	Sideswipe Opposite Direction	Sideswipe Same Direction	Fixed Object
KY 90, Metcalfe County													
0.000	**11.719**	**11.719**	**130**	**86%**	**79%**	**23%**	**1%**	**2%**	**0%**	**19%**	**12%**	**7%**	**35%**
vicinity KY 640 in Summer Shade													
2.10	2.60	0.50		86%	82%	32%	5%	0%	0%	41%	9%	0%	14%
vicinity KY 163													
4.5	5.0	0.50		88%	75%	81%	0%	6%	0%	6%	0%	0%	6%
KY 90, Cumberland County													
0.000	**15.000**	**15.000**	**107**	**84%**	**71%**	**14%**	**1%**	**6%**	**5%**	**32%**	**2%**	**10%**	**30%**

Source: KYTC Highway Information System (HIS). Research period January 2000 to December 2004

2.5 Environmental Overview

This environmental overview identifies KY 90 project study area issues likely to require consideration during this and future studies. It summarizes the results of several environmental investigations, based primarily upon literature, archival, known database, and map research. Limited amounts of fieldwork were conducted, consisting mainly of windshield surveys to confirm identified sites, and visually identify previously unknown sites. Additional information was collected through correspondence with other state and federal agencies. This environmental overview does not provide a detailed analysis and assessment of any potential impacts. The study area is about 26 miles long, and typically extends about 2,000-feet from each side of the existing KY 90 centerline, as indicated by the highlighted area on Exhibits 1 and 3. Refer to Exhibits 1 and 3 in Appendix A, and Appendix B, color photographs of existing KY 90, for the following environmental discussions concerning the study area.

2.5.1 Topography and Geology. Both counties are located in the Pennyrile physiographic region of the state, which is a Mississippian plateau with a large karst region. Elevation in the study area ranges from about 560 to 1,120 feet above mean sea level. Northwestern Metcalfe County contains karst topography with abundant sinkholes, while the study area is mostly a well-dissected, rolling to hilly upland plateau. Cumberland County shares the same dissected plateau characteristics, with the Grider-Waterview area somewhat less rugged with low rolling

hills. The area is underlain by consolidated sedimentary rocks of Ordovician (limestone), Devonian (black shale), and Mississippian (sandstone and siltstone) age, and from unconsolidated sediments of Quaternary age (along larger streams and rivers). The study area crosses two river basins. At the Metcalfe/Barren County line is the fairly small Skaggs Creek Watershed, which is part of the Barren River Watershed. To the east is the larger Marrowbone Creek Watershed, which is part of the Upper Cumberland River Basin. Physiographic patterns and relief are mostly dictated by the drainage patterns of the surface waters, and Marrowbone Creek is the dominant surface drainage waterway and a major tributary to the Cumberland River. Topography is generally rolling ridge tops and deep valleys, with relief ranging from very steep on the side slopes to flat in the floodplains. One known cave is in the study area – Harvey Cave, located northeast of the KY 90/KY163 intersection. Land use within the study area is predominantly undeveloped wooded and open land, agricultural, with widely scattered rural-residential dwellings and limited commercial uses outside the built-up areas.

Any roadway improvement could possibly encounter and impact one or more of these features. This is especially true for surface and ground water sources, and karst features. Any future project development and/or design studies will need to take these features into consideration.

2.5.2 Culturally Sensitive Locations. This preliminary study identified the following culturally sensitive locations in the study area: 7 cemeteries, 13 churches, and 1 hospital. Two public schools are located in the study area: the Summer Shade Elementary School, and Cumberland County-Burkesville Elementary School (near KY 61). The Cumberland County High and Middle Schools are located just northeast of, and outside, the study area boundaries. The Cumberland County Hospital is located on the south side of KY 90, near KY 61. Two public parks were identified: a small roadside park located at the western city limits of Marrowbone between KY 90 and Marrowbone Creek; and Bransetter Park, located in the southwest quadrant of the KY 90/KY 163 intersection. Branstetter Park is a community run, non-profit park established in 1926, located about 0.5 mile south of KY 90 on Old Trace Road. No recreational areas are located within the study area.

These culturally sensitive locations vary from having local community significance to possible regional significance with state and/or federal jurisdictional responsibilities. Any future roadway improvements proposed should thoroughly consider potential impacts to these resources.

2.5.3 Historic, Archaeological, and Cultural Resources. The study area contains one National Register of Historic Places (NRHP) listing — the Marrowbone Historic District (listed 1983) in Cumberland County. Researching State Historic Preservation Office (SHPO) files revealed hundreds of sites previously documented with survey forms throughout both counties, however only one NRHP listed site is within the study area. A windshield survey and preliminary assessment identified an additional 23 individual historic sites, and 6 districts (including 12 expansion contributing properties in the Marrowbone Historic District), which appear potentially eligible to meet NRHP criteria. The sites are generally located along the KY 90 roadway, with most of the sites in Cumberland County. The potentially eligible sites are on the following page, and identified on the exhibits as National Register Potential. (A number in parentheses indicates the county site number of a previously identified site.) Preliminary NRHP boundaries for individual sites and districts follow the property lines on record at the respective PVA offices.

An additional 19 sites were surveyed for documentation only (*i.e.*, no apparent NRHP potential; identified on the exhibits as Surveyed Historic Site). The study area historic site survey included buildings visible from public roads only; buildings or structures inaccessible due to locked gates or farm fields were not included in the survey. No buildings were inspected in detail. This preliminary assessment was based primarily on Criterion C, architecture. NRHP eligibility determination will require additional research, photography, physical examination, and evaluation relative to integrity standards established by similar properties in Metcalfe and Cumberland Counties, and consultation with the SHPO.

Individual Historic Sites **Historic Districts**

Metcalfe County

Site	Description	Site	Description
QQQ	Willow Shade Church of Christ (MC-123)	RRR	Beaumont Historic District (NRP)
		Summer Shade Historic District (NRP):	
		SSS	Tom Riggs House (MC-177)
		TTT	Bowman House (MC-178)
		UUU	Swope House (MC-179)
		VVV	Perkins House (MC-180)
		WWW	Black School (MC-181)
		XXX	Barber-Toomey House (MC-176)
		YYY	Commercial Building (MC-175)
		ZZZ	Witty House Site (MC-172)
		AAAA	Cumberland House
		BBBB	Funeral Home
		CCCC	Foursquare
		DDDD	Medford Bowman House (MC-170)
		EEEE	Knipp House (MC-171)
		FFFF	Bowman Office (MC-172)
		GGGG	Five Bay House (MC-183)
		HHHH	Huffman School (MC-184)
		IIII	Commercial Building (MC-173)
		JJJJ	Commercial Building (MC-174)

Cumberland County

Site	Description	Site	Description
B	First Christian Church (CUB-6)	A	Burkesville Public Square Historic District (NRP): Cumberland County Courthouse (CUB-1), Sam Smith Building (CUB-2), Sam Smith Building (CUB-3), Curtis Dry Goods (CUB-4), Parkway Hotel (CUB-8)
E	Alexander Talbott House (CUB-13)		
G	Burkesville Methodist Church (CUB-15)		
H	Allie Keen House (CUB-17)		
I	Huddleston House (CUB-18)	P	North Main Street Historic District (NRP) in Burkesville: Shepherd House (CUB-31), McGee-Norris Funeral Home (CUB-34), Coe House (CUB-35), First Baptist Church (CUB-32)
L	Grundy Methodist Chapel (CUB-22)		
N	Owsley House (CUB-27)		
O	Winfrey House (CUB-29)		
R	Alpine Motel and Restaurant	Waterview Historic District (NRP):	
S	Curtis Farm (CU-110)	CC	Cumberland and Presbyterian Church (CU-138)
T	Les Dickens House (CU-111)	DD	Triple Wall-Gabled House (CU-139)
U	William Hurt Farm (CU-130)	EE	Joe Henry Alexander Farm (CU-145)
X	Dewitt's Grocery	FF	Marrowbone Iron Bridge (CU-140)
Z	Titus Allen House (CU-133)	HH	Giddian Alexander Farm (CU-147)
AA	Jim Lewis House (CU-190)	II	Waterview Church of Christ (CU-146)
BB	Allen Farm (CU-175)	JJ	J.O. Alexander (CU-149)
PP	Ingram Alexander Farm (CU-144)	KK	Turner House and Store (CU-150)
QQ	James Wade Farm (CU-152)	Marrowbone Historic District (NR District CU-8-10) expansion contributing properties (NRP):	
RR	Gerhart Farm (CU-153)		
LLL	Marrowbone Baptist Church (CU-159)	TT	Marrowbone Colored School (CU-174)
MMM	Chism Farm (CU-161)	UU	Marrowbone Methodist Church (CU-155)
OOO	Anderson Grocery (CU-162)	VV	Cumberland Presbyterian Church
		WW	Martha Norris Memorial High School (CU-180)
		XX	Sidney Pace House (CU-167)
		YY	Cornelia Davis House (CU-166)
		ZZ	Nunn House (CU-173)
		DDD	Gray and Son Grocery (CU-172)
		EEE	Stover's Grocery (CU-171)
		FFF	Masonic Lodge (CU-170)
		GGG	Leon Garmon House (CU-165)
		HHH	Sammy Graves Store

The archaeological overview revealed the study area to be largely uninvestigated, with relatively few sites in the two counties assessed for NRHP eligibility. The overview identified 7 previous professional archeological surveys conducted between 1951 and 2002, with 13 known archaeological sites within the study area. Nine of the known sites were considered not eligible for the NRHP, and 4 sites were not assessed. The precise locations and current conditions of the sites were not field-verified for this study; therefore, additional archaeological investigation will be needed if a site is impacted by roadway improvements. Many of the previous assessments were based only on surface surveys and informant data (*i.e.*, no shovel testing or deep testing conducted). Consequently, the NRHP assessment for some sites was not based upon currently accepted methods for evaluating site significance, and the NRHP eligibility should be considered as "not assessed." KY 90 improvements would not impact 7 of the 13 known sites. Of the remaining 6 archaeological sites, 4 are near the existing KY 90 roadway where: 2 of the sites were assessed as not potentially NR eligible using inadequate methods and are now considered to have the potential to contain significant buried archaeological deposits; and 2 sites are in upland settings and the NRHP eligibility has not been assessed. Existing KY 90 appears to cross the remaining 2 sites. One of those sites was originally considered not eligible for the NRHP after testing in 1983 using inadequate methods, and is now considered to have the potential to contain significant buried archaeological deposits. The other site was tested in 1985, and it was determined the portion impacted by KY 90 contained no significant deposits. The remainder of this site was not assessed for NR eligibility and is now considered to have the potential to contain significant buried archaeological deposits.

Because little data was available concerning archaeological site eligibility in Metcalfe and Cumberland Counties, soils were used to predict the likely locations of significant sites. Soil series areas mapped as Chagrin (Cg), Elk (EkA and EkB), Huntington (Hg and Hu), Lawerence (La), Newark (Nk), Robinsonville (Rf), and Sensabaugh (Se and SgB) are likely to have the greatest potential to contain significant prehistoric archaeological sites. These soils generally consist of fine-grained alluvial sediments located along floodplains and terraces. The greatest potential for buried archaeological deposits occurs in areas undisturbed through historic and modern land uses (*i.e.*, agricultural plowing, construction activities).

Historic mapping review indicated no published nineteenth or early twentieth century maps that included the study area. The only historic maps of the study area were Kentucky Department of Highways maps from the 1930s through 1950s. The highway maps provided little information concerning possible significant historic sites, which would contain significant archaeological deposits. The earliest county highway maps (1949 for Metcalfe, 1937 for Cumberland) were used to identify 57 possible historic sites (PHS), with most containing multiple structures, and 7 cemeteries. Some PHSs are co-located with known archaeological sites, or standing structures recorded with the Kentucky Heritage Council (KHC). A review of KHC files identified 115 historic structures and one historic district within the study area, with several co-located with known archaeological sites. The extent and significance of the PHS and historic structure locations cannot be determined without additional investigation.

If improvements to KY 90 are implemented which require an environmental document, then impacted study area portions should be subjected to a Phase I level archaeological investigation (*i.e.*, shovel test probe excavations in accessible areas) and a historic structure survey.

2.5.4 Aquatic Resources. Topographic maps of the study area indicate the presence of numerous blue-line streams, with several perennial (water always present) and intermittent (water present except in late summer and fall) streams. Up to 49 streams could be impacted by structures (bridges, culverts) or rechannelization. A windshield survey indicated numerous potential ephemeral streams (water present only during or immediately after precipitation events) present in both counties. Several headwater ephemeral streams may be present in ravines, particularly in Cumberland County.

Potential perennial and intermittent stream impacts include the following, listed by county:

Metcalfe County: Glover Creek, Marrowbone Creek including the tributaries of Flood Catcher Hollow, Jobe Branch, Stillhouse Branch, Hurt Hollow, Leamon Hollow, Anderson Hollow, Garman Branch, Sulphur Spring Hollow, Stillhouse Hollow, Slate Creek, Cave Branch, Branstetter Branch, and 8 unnamed tributaries.

Cumberland County: Marrowbone Creek, Leatherwood Creek, Humphrey Hollow Branch, Pitman Creek, Ferris Fork Creek, Clark Hollow Creek, Davis Hollow Branch, White Hollow Branch, Casey Fork Creek, Franklin Branch, German Branch, Dutch Creek, Allen Creek, Haggard Branch, and several other unnamed tributaries.

No aquatic macro-invertebrates, fishes, or water quality sampling was conducted. If KY 90 improvements are implemented, then all streams in the study area may be impacted by sedimentation resulting from roadway construction improvements. Soil from exposed and erodible surfaces may directly enter surface water, temporarily increasing turbidity levels. Surface and ground water may also experience temporary increases in specific conductance, suspended solids, and nutrients. Streams could experience a loss of riparian vegetation and habitat for aquatic species. Rechannelization could disturb stream flow and water quality.

Located along the study area are several streams being impacted by agricultural and residential uses such as: farm animal access to streams, field cultivation resulting in riparian vegetation loss, manure discharge into streams, and “straightline” pipe discharge from residential wastes.

Jurisdictional waters, as defined by the United States Army Corps of Engineers (USACE), are located within the study area. Potential ephemeral stream impacts will require assessment prior to submission of a permit packet to USACE. Section 404 and Section 401 permits may be required. On-site stream impact mitigation may require consideration for this project. Potential restoration, mitigation, and/or in-lieu fees (average $150-200 per linear foot of disturbance) may be required.

Kentucky Division of Water (KDOW) will require a non-point source pollution control plan, and an erosion control plan. Application of Kentucky Transportation Cabinet’s (KYTC) *Specific Specifications for Road and Bridge Construction* and the Federal Highway Administration’s (FHWA) *Best Management Practices for Erosion and Sediment Control* can be used to alleviate most sedimentation problems.

No nationally listed wild and scenic rivers are located within the study area. No other rivers or streams are listed on the Kentucky Wild River System. No “special use” designated waters are located within the study area.

The KDOW recently implemented a policy change and now regards the location of municipal water supplies and groundwater protection areas as classified information. Therefore, only a limited amount of information is available, which mainly originates from other public information sources. No wellhead protection areas are located within, or adjacent to, the study area. No outstanding resource waters were identified in the study area.

According to the Kentucky Geological Survey’s (KGS) Ground-Water Resources website (http://www.uky.edu/KGS/water/library/webintro.htm) and the Water Resource Development Commission reports on county water-supply infrastructure accessible through the KGS county reports, the following information is known. About seventy percent of Metcalfe County households have public treated water available to them. Edmonton Water Works services the study area length along KY 90, and purchases all its water from the Glasgow Water Company, which obtains its water from the Barren River Reservoir. In the southern third of Metcalfe County, few wells yield enough water for domestic use. The KGS Kentucky’s Water Wells

website (http://kgsmap.uky.edu/website/kgsgw/viewer.htm) indicated only one recorded domestic water well along KY 90 in Metcalfe County. Public treated water is provided to about ninety-four percent of Cumberland County's residents. Burkesville Water Works and Cumberland County Water District service the KY 90 study area, and all water is obtained from the Cumberland River. Wells will not produce enough water for domestic use in most of Cumberland County, except for a few in lowland areas bordering streams. The KGS Kentucky's Water Wells website indicated only two recorded domestic water wells along KY 90 in Cumberland County.

A limited amount of floodplain information is available for the study area. Flood Insurance Rate Maps (FIRM) developed by the Federal Emergency Management Agency (FEMA) were consulted for information regarding floodplains. According to the FEMA website, no published information is available for Metcalfe County; however, it is likely floodplain impacts would be similar to those in Cumberland County. All Cumberland County floodplain areas potentially affected are listed as 100-year flood areas with no special flood hazard areas determined (*i.e.*, Zone A areas, FIRM 210060 panels 0003 and 0004, effective date December 16, 1977). Potential floodplain encroachment impacts are general in nature, and include loss of riparian vegetation, disturbance of habitat, and the potential for increased sedimentation into the streams. Any construction in floodplains on new alignment would have greater impact than construction on existing alignment. In certain locations, improvements to the existing roadway could create floodplain concerns. Therefore, floodplain issues are possible with this project.

2.5.5 Wetlands and Ponds. National Wetland Inventory (NWI) map reconnaissance revealed 108 wetlands and ponds within the study area. Palustrine wetlands were the most common, and defined as wetlands: (1) less than 20 acres in size, (2) not dependent or affected by erosive natures of wind and water, (3) water depth less than 2 meters at low water, and (4) salinity less than 0.5%. Typical palustrine wetlands include small, shallow, permanent or intermittent ponds. Palustrine wetlands in the study area are permanently flooded, and diked, excavated, or impounded in some manner.

Riverine wetlands, the second most numerous on the NWI maps, are defined as wetlands and deepwater habitats contained within a channel that is bounded by upland, a channel bank (natural or man-made), or an adjacent wetland dominated by trees, shrubs, and persistent emergent vegetation. A riverine wetland will usually have flowing water, but it is not a requirement. The riverine wetlands are permanently, semi-permanently, or temporarily flooded. One forested wetland was identified using the NWI map system.

No field investigations were conducted, nor a determination of size, jurisdictional, or non-jurisdictional wetland made. Farm ponds may be considered jurisdictional if they have a surface connection to a surface tributary. More intensive field surveys would be required to confirm and delineate NWI map wetlands, as well as identify any wetlands not appearing on the maps, and determine jurisdictional status.

Wetlands should be avoided if possible, or impacts minimized, during project development. If wetlands cannot be avoided and mitigation is required, then an evaluation of potential locations for on-site, in-kind mitigation should be considered. If on-site mitigation cannot be accomplished, then consider using a wetland bank for mitigation. According to KYTC District 8, impacts in the Marrowbone Creek Watershed (Upper Cumberland River Basin) can be mitigated at the Wayne County Wetland Restoration Site near the Betsy community in Wayne County. The KYTC is in the process of acquiring a Butler County parcel (Exel Clark) that will function as a mitigation bank for all of the Green River Basin.

A specific roadway design is needed before the type of USACE permit required (*i.e.*, Nationwide or Individual) can be determined. The *Nationwide Permit 14, Linear Transportation Crossings,* (NP 14) only authorizes activities with minimal adverse effects on the aquatic environment. An

Individual Permit (IP) is required if the stream impact is greater than 0.5 acres, or the wetland impact is greater than 0.1 acres; and must include a compensatory mitigation proposal.

The KDOW will probably require a Kentucky Pollutant Discharge Elimination System (KPDES) General Stormwater Permit, a Floodplain Construction Permit if filling within the one-hundred-year floodplain, and a Water Quality Certification.

2.5.6 Terrestrial Resources. The plant and animal life is considered typical for the area with no unique populations present.

2.5.7 Threatened and Endangered Species. In accordance with the provisions of the Fish and Wildlife Coordination Act, and the Endangered Species Act, coordination was made with the appropriate state and federal agencies (see Section 3.4, Resource Agency Coordination, and Appendix H). The following government agency website databases were researched to identify protected species potentially present in the study area: the US Fish and Wildlife Service (USFWS) for lists of federally protected species potentially affected by the project; the Kentucky Department of Fish and Wildlife Resources (KDFWR) to identify threatened or endangered species known to occur in the project vicinity; and the Kentucky State Nature Preserves Commission (KSNPC) for important elements and natural areas in the project vicinity. Table 5, *Protected Species in the Study Area*, lists the protected species identified by the federal and state agencies as potentially occurring in the study area. Database research identified fourteen endangered, threatened, or candidate species. Only one species (gray bat) occurs in Metcalfe County. The bald eagle was identified as threatened, but also noted it was recommended for delisting. All other species are aquatic, consisting of one fish and 11 mussel species.

Only those species with a known historic occurrence within the study area are cited. More detailed field surveys are required to confirm the presence of protected species in the study area, determine the presence or absence of suitable habitat for the species, and ascertain any potential impacts and mitigation requirements. Surveys must be conducted by a qualified biologist who holds the appropriate collection permits. Surveys would not be necessary if sufficient site-specific information was available demonstrating: (1) no potentially suitable habitat exists within the study area or its vicinity; or (2) the species would not be present in the study area or its vicinity due to site-specific factors.

Table 5 Protected Species in Study Area

Common Name	Scientific Name	Federal Status[1]	State Status[1]	County
Vascular Plants				
none				
Insects				
none				
Birds				
bald eagle	*Haliaeetus leucocepalus*	T (PDL)	T	Cumberland
Mammals				
gray bat	*Myotis grisescens*	E	T	Metcalfe
Freshwater Mussels				
purple catspaw pearlymussel	*Epioblasma o. obliquata*	E	E	Cumberland
Cumberland bean pearlymussel	*Villosa trabilis*	E	E	Cumberland
fanshell	*Cyprogenia stegaria*	E	E	Cumberland
oyster mussel	*Epioblasma capsaeiformis*	E	E	Cumberland
Cumberlandian combshell	*Epioblasma brevidens*	E	E	Cumberland
pink mucket	*Lampsilis abrupta*	E	E	Cumberland
ring pink	*Obovaria retusa*	E	E	Cumberland
orangefoot pimpleback	*Plethobasus cooperianus*	E	E	Cumberland
rough pigtoe	*Pleurobema plenum*	E	E	Cumberland
spectaclecase	*Cumberlandia monodonta*	C	E	Cumberland
sheepnose	*Plethobasus cyphyus*	C	E	Cumberland
Fishes				
palezone shiner	*Notropis albizonatus*	E	E	Cumberland

[1] Status: E=endangered; T=threatened; C=candidate; PDL=proposed for delisting.

2.5.8 Managed Land Areas. Managed land areas are under governmental or private regulatory control, typically to encourage environmental protection or resource procurement. No nature preserves, wildlife management areas, state or national forests are located within the study area. No state agricultural districts are located in or near the study area in Metcalfe or Cumberland Counties.

2.5.9 Farmlands. The respective Metcalfe and Cumberland County Natural Resources Conservation Service offices (NRCS) provided the available soil survey maps, and identified farmland, encompassing the study area. Both counties have published United States Department of Agriculture (USDA) Soil Survey maps: Metcalfe in 1967, and Cumberland in 1998.

Metcalfe County has a land area of about 291 square miles (186,175 acres), with 131,990 acres in farms (2002 Agricultural Census, down 2 percent from 1997). Major crops include: pasture (forage and hay), corn, tobacco, and soybeans. According to a color-coded map of *Important Farmland* (dated March 1984) provided by the Metcalfe NRCS, prime farmland totals about 55,500 acres, while statewide importance farmland totals about 38,500 acres. No unique or local importance farmland was reported. Metcalfe County as a whole has about 30 percent of its soil classified as prime farmland, with most of it in the northern and central parts of the county. In the county's southern half (where the study area is located), prime farmland is generally located around the river and creek valleys, and in other valleys. Statewide importance farmland accounts for about 21 percent of the soil, and most of it is in the northern and central parts of the county. Virtually the entire length of existing KY 90 in Metcalfe County crosses prime or statewide important farmland. The Metcalfe County Soil Survey contained a color coded

General Soil Map (dated October 1965), which indicates KY 90 traverses the two soil associations briefly described below.

- Baxter-Crider-Clarksville Association. This association composes about 61 percent of the county, occupying most of the central and western parts. It is characterized by nearly level to moderate steep, well-drained soils, mainly cherty, that formed in material weathered from limestone. This association is present along KY 90 from the Barren County line to just east of Beaumont.

- Dandridge-Westmoreland-Christian Association. This association composes about 20 percent of the county, occupying the southern part. It is characterized by mainly steep or very steep, somewhat excessively drained, shaley, highly dissected, shallow soils on side slopes and very narrow ridgetops. This association is present along KY 90 from just east of Beaumont to the Cumberland County line.

Cumberland County has a total area of about 311 square miles (198,892 acres; includes water area of 4,070 acres), with 89,389 acres in farms (2002 Agricultural Census, down 19 percent from 1997). Major crops include: pasture (forage and hay), corn, soybeans, and tobacco.

According to information provided by the Cumberland NRCS, prime farmland totals about 24,622 acres, while statewide importance farmland totals about 17,850 acres. No unique or local importance farmland was reported. Cumberland County as a whole has about 12.6 percent of its soil classified as prime farmland, generally located around the river and creek valleys, and in other valleys. Statewide importance farmland accounts for about 9.2 percent of the soil. Since KY 90 tends to follow the Marrowbone Creek valley, virtually the entire length of KY 90 in Cumberland County crosses prime or statewide important farmland.

The Cumberland County Soil Survey contained a color coded *General Soil Map* (compiled 1991), which indicates KY 90 traverses the four soil associations briefly described below in order of area crossed.

- Renox-Chagrin-Sensabaugh Association. This association composes about 9 percent of the county, and is scattered throughout the county, generally along tributaries to the Cumberland River. It is characterized by nearly level to very steep, very deep, well-drained soils on flood plains, alluvial fans, foot slopes, and terraces. This association is present along KY 90 from the Metcalfe County line to just west of Burkesville, along Marrowbone Creek and its tributaries.

- Garmon-Newbern-Carpenter Association. This association composes about 58 percent of the county, and is scattered throughout the county. It is characterized by gently sloping to very steep, very deep to shallow, well-drained to excessively well-drained soils on dissected uplands. This association is crossed by KY 90 west of Burkesville.

- Cynthiana-Faywood-Renox-Lowell Association. This association composes about 8 percent of the county, located in the west-central part of the county. It is characterized by gently sloping to very steep, very deep to shallow, well-drained to excessively well-drained soils on dissected uplands. This association is present along or near the central section of KY 90.

- Holston-Monongahela-Waynesboro Association. This association composes about 4 percent of the county, located along the Cumberland River. It is characterized by nearly level to steep, very deep, well-drained or moderately drained soils on flood plains, terraces, and the banks of the Cumberland River. This association is present along KY 90 in the vicinity of Burkesville near the KY 61 intersection.

Because prime farmland generally possesses the same qualities and characteristics desired for the construction of roadways and buildings, it is habitually the preferred construction site. Given the study area's topography, farmland and the existing KY 90 roadway frequently coincide. However, some of the prime and statewide important farmland's value has already been compromised due to residential and commercial development, and roadway construction.

2.5.10 Hazardous Materials Concerns. Land use in the study area is predominantly agricultural, with residential development and some commercial facilities scattered throughout, but concentrated in the urban areas. Relevant data was collected from numerous sources, including federal and state databases, and a windshield survey of the study area. The database search and survey identified 18 possible contamination sites (see Table 6, *Possible Contamination Sites*). Most of these sites involve fuel distribution and/or vehicle/equipment maintenance facilities, and have similar potential contamination concerns (*e.g.*, underground storage tanks (USTs), fuel spills/leaks, soil contamination, waste petroleum products, heavy metals, solvents, corrosives, batteries, tires, 55-gallon drums, miscellaneous debris piles, repair parts, abandoned equipment/vehicles, etc.). Other sources of potential contamination concerns include: pole-mounted electrical transformers (PCBs), aboveground storage tanks (ASTs), and pesticide/herbicide/rodenticide use on farms. Structures with suspected asbestos containing building materials (ACBM) were also observed. Construction activities in and near these sites will require further investigations to determine the risk and extent of any contamination, and may require special procedures and permits.

2.5.11 Air Quality. Metcalfe and Cumberland Counties are located within the South Central Kentucky Intrastate Air Quality Control Region. The study area is designated as an Attainment Area for all transportation-related pollutants, as per the 1990 Clean Air Act Amendments, and transportation control measures would not be required for the project. The project is not expected to adversely impact air quality in the region.

2.5.12 Traffic Noise. The study area land use is mixed, mostly rural in nature, with a more urbanized area at the eastern end. The study area contains clusters of residences, several churches and cemeteries, and small businesses. These land uses almost invariably have direct driveway access to KY 90. The highest potential for noise impacts to properties stems from potential additional right-of-way needs. Properties/residences somewhat removed from the roadway are not anticipated to be adversely affected by traffic noise, and noise impacts could be minimized by the sparse development pattern in the area. It is usually unreasonable to construct noise barriers for single, widely spaced residences, and the need to maintain road access would render any noise barriers ineffective.

2.5.13 Other Concerns. Representatives of the Cumberland County Water District stated water lines generally parallel the south side of KY 90 through Cumberland County. Two water storage tanks are located within the study area: one tank located on a hill top in the southwest quadrant of the KY 90/KY 163 intersection; and one located on a hilltop just north of Marrowbone.

KY 90 within the study area is not associated with any scenic byway or bike route system. However, west of Glasgow and east of Burkesville, KY 90 is part of the scenic byway system. KY 163 north of KY 90 is a scenic byway. KY 61 through Burkesville is part of the Central Heartlands Tour state bicycle route.

One cave is known to be located in study area: Harvey Cave, located northeast of the KY 90/KY163 intersection.

Table 6 Possible Contamination Sites

Site Number	Site Name or Description	Suspected Contaminant or Area of Concern
1	Ed's Express, Inc., 2241 Summer Shade Rd	Possible soil contamination from UST systems usage in the form of heavy metals, volatile organic compounds, and semi-volatile organic compounds.
2	Summer Shade Service, Hwy 90 E	Possible soil contamination from UST systems usage in the form of heavy metals, volatile organic compounds, and semi-volatile organic compounds.
3	Big Meadow Oil Co., 2340 Summer Shade Rd	Possible soil contamination from gasoline spills.
4	Oil Well, Summer Shade Rd	Possible heavy metal, volatile organic compound, and semi-volatile organic compound contamination in soils.
5	Electric Substation, Summer Shade Rd	Possible soil contamination from petroleum products and PCBs from electrical equipment.
6	Traveler's Food Plaza #9, 4770 Summer Shade Rd	Auto repair facility with ASTs, waste oils, used tire stockpiles, batteries, oils, greases and other petroleum products, solvents, corrosives, possible PCBs in older model hydraulic lifts, junk and waste stockpiling, multiple 55-gallon drums with unknown contents, and numerous stored salvage vehicles. Possible soil contamination from on-site operations in the form of volatile organic compounds, semi-volatile organic compounds, heavy metals, and drum contents.
7	Kingsford Manufacturing, 5126 Summer Shade Rd	Possible contamination stemming from fire at the facility.
8	Smith's Grocery, 5501 Summer Shade Rd	Former UST site. Possible soil contamination from heavy metals, volatile organic compounds, and semi-volatile organic compounds.
9	Willow Shade Trading Post, 9517 Summer Shade Rd	Former leaking UST site. Possible soil contamination from heavy metals, volatile organic compounds, and semi-volatile organic compounds.
10	Quik Mart, Glasgow Rd	Possible soil contamination from AST systems usage in the form of heavy metals, volatile organic compounds, and semi-volatile organic compounds.
11	Marathon Gas Station, Glasgow Rd	Possible soil contamination from AST systems usage in the form of heavy metals, volatile organic compounds, and semi-volatile organic compounds.
12	Hunley Gas Co., Glasgow Rd	Possible soil contamination from AST systems usage in the form of heavy metals, volatile organic compounds, and semi-volatile organic compounds.
13	Former Auto Repair Garage, Glasgow Rd	Lacquers, paints, varnishes, solvents, corrosives, combustibles/ flammables, oils, greases, and possibly a variety of other hazardous material storage in the on-site structure interior.
14	Aboveground Storage Tanks, Glasgow Rd	Possible soil contamination from AST systems usage in the form of heavy metals, volatile organic compounds, and semi-volatile organic compounds.
15	Sewell & Co., 6443 Glasgow Rd	Possible soil contamination from AST systems usage in the form of heavy metals, volatile organic compounds, and semi-volatile organic compounds. Former leaking UST site.
16	Hewitt's Grocery, 4278 Glasgow Rd	Former UST site. Possible soil contamination from heavy metals, volatile organic compounds, and semi-volatile organic compounds.
17	Cumberland Co. Hospital, 299 Glasgow Rd	Possible soil contamination from UST systems usage in the form of heavy metals, volatile organic compounds, and semi-volatile organic compounds.
18	Cumberland Kwik Stop, 211 Glasgow Rd	Possible soil contamination from UST systems usage in the form of heavy metals, volatile organic compounds, and semi-volatile organic compounds.
Not Mapped*	Power Pole Mounted Electrical Transformers	Polychlorinated Biphenyls (PCB's)
Not Mapped*	Farming Operations	Petroleum products, pesticides, and herbicides
Not Mapped*	Aboveground Storage Tanks (ASTs)	Heating fuel oils, gasoline, and liquid propane
Not Mapped*	Residential Dwellings and Commercial Buildings	Asbestos Containing Building Material (ACBM)

* Sites are found at various locations within the study area.

2.6 Environmental Justice and Community Impacts

The purpose of an environmental justice report is to identify geographic areas containing disproportionately high concentrations of minority, low-income, or elderly households. *Environmental Justice Executive Order 12898: Federal Actions to Address Environmental Justices in Minority Populations and Low-Income Populations* (signed February 11, 1994), directed federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations.

The Lake Cumberland Area Development District (LCADD) prepared the *KY 90 Corridor Study Environmental Justice Review*, July 2006, and its related issues/concerns. The Environmental Justice Review was based upon US Census Bureau 2000 Census data, field observations, local officials/leaders meetings, and interviews. It focused on portions of the community that could be considered minority, low-income, and elderly (age 65 years and older) population areas, and made efforts to identify any high concentrations of a specific population. The review examined 2000 Census data at the Census Tract, Block Group, and Block levels, comparing national, state, and county averages. The environmental justice review concluded that several minority, low-income, and elderly population concentrations may exist in the study area; however, disproportionate impacts from KY 90 improvements were not anticipated. The environmental justice review recommended performing a subsequent data review after preferred alternatives/alignments are selected to identify specific populations in the project area; and, if any, take steps to insure they are not disproportionately affected by the project. The complete review is in Appendix I.

In general, minority populations in the study area were comparable to, or less than, county and state averages, with one notable exception. One minority population was several times the county average, however it was completely contained within the city limits of Burkesville where improvements to existing KY 90 were considered to have no adverse impacts. Poverty levels throughout Metcalfe and Cumberland Counties tend to be higher than both state and federal averages; therefore it is likely that implementing the improvement project would encounter impoverished populations. Several surrounding counties in this particular portion of southern Kentucky have comparable poverty rates, and the area is often characterized as economically distressed due to high unemployment rates and the unavailability of quality employment opportunities. Local leaders and community members view KY 90 corridor improvements as potentially beneficial for economic growth and development. The elderly population in both counties is generally slightly higher than the state average. The highest concentration occurred in an area adjacent to the study area, and contained a nursing home, which skewed the results. Implementation of the project is not anticipated to have a disproportionate effect on the population aged 65 and over.

2.7 Geotechnical Overview

The KYTC Division of Structural Design, Geotechnical Branch, and the University of Kentucky, Kentucky Geological Survey, provided summary reports of geologic concerns for the study area (see Appendix G).

The Geotechnical Branch report indicates the study area is underlain by alluvium and bedrock of the St Louis Limestone, Salem and Warsaw Limestone, Fort Pain Formation, Chattanooga Shale, Brassfield Dolomite, Cumberland Formation, and Leipers Limestone. Alluvium is along the major streams, at depths of 0-60 feet, and consists of clay, silt, sand, and gravel. Structures constructed along Marrowbone Creek and Cumberland River may require deep foundations. Concern was expressed about the unsuitability of some shaley layers for road aggregate because of their properties to expand when wet and breakdown. Chattanooga Shale can produce acid runoff conditions when exposed to water and air. Karst features such as caves and sinkholes may be encountered, with sinkholes common in the St Louis Limestone, and Salem and Warsaw Limestone. No faulted areas were noted. The study area was considered to have a low potential for liquefaction or slope failure in the unconsolidated sediments at or near streams by bedrock ground motion.

3.0 CABINET, AGENCY, AND PUBLIC INPUT

3.1 Project Team Meetings

The KY 90 pre-design scoping study project team met three times during the course of the study. Each meeting was documented with meeting minutes (see Appendix D). A brief summary of the major topics discussed at each meeting follows:

1. July 17, 2003, at KYTC District 8. This was the team's kick-off meeting where members were introduced, the type of study discussed, and the study's scope and schedule reviewed. Major topics of discussion included: the existing conditions; issues, problems, needs, and goals; alternative development and locations suggested for spot improvement consideration; and a review/discussion of other current, scheduled, and proposed projects near the KY 90 study area. Additional topics addressed included data collection, local officials and stakeholders meetings, and resource agency coordination.

2. April 17, 2006, at KYTC District 8. This was the first team meeting held under the new project item number, 08-136.00. The project was reviewed in terms of the expanded scope of work/project termini. Team members reviewed the environmental footprint/overview, existing highway conditions and crash statistics, public meeting comments summary, draft project goals, and the preliminary improvement alternatives. Exercises were conducted to identify team member's improvement alternative preferences and priorities.

3. October 17, 2006, at KYTC District 8. The project team reviewed the status of the study, the project goals, new information received since the last meeting (environmental justice report and resource agency coordination), and the initial set of improvement opportunities developed. The project team thoroughly discussed and evaluated the relative merits of each improvement opportunity in terms of project goals, safety, traffic volumes, passing opportunities, estimated construction costs, and local knowledge. The discussion and evaluation resulted in some modifications to the original list of improvement opportunities to better satisfy the project goals. The identified improvements were subsequently grouped by type, and the longer-term improvements prioritized. A list of recommended KY 90 improvements was developed and agreed upon. (see Section 6.0)

3.2 Local Officials / Stakeholders Meetings

Local officials (morning session) and stakeholders (afternoon session) meetings were held August 28, 2003, at the Burkesville Fire Department Training Center. Each group's written comments on issues/problems/needs closely paralleled those previously identified by the project team. Roadway geometrics and safety were at the top of each group's list. Each group also identified possible locations for spot improvement consideration. Minimizing impacts to potential historic districts and the Amish community were prime concerns. The meetings were documented with meeting minutes (see Appendix E).

3.3 Public Information Meetings.

Public information meetings were held February 28, 2006, at the Summer Shade Elementary School, and March 2, 2006, at the Cumberland County Middle School. Two hundred and two (202) people attended the meetings (106 at Summer Shade, 96 at Burkesville), and 28 comment forms were submitted, representing 37 people. No oral comments were received. The meetings were conducted to inform the public of the proposed KY 90 improvement project, and to receive their input/comments concerning issues to consider and problems to correct. No improvement alternatives were presented, however areas identified for potential improvement were indicated on the display maps.

Attendees were generally supportive of the project and agreed upon its necessity. Areas the public identified for improvement generally corresponded to those already identified by the project team, including some potential bypasses. Public concerns, expressed either through discussions with project team members or submitted in writing, generally fell into the following common themes: narrow driving lanes and no shoulders; an excessive number of speeding trucks and cars, especially through the towns and other reduced speed areas; large volumes of commercial truck and recreational vehicle traffic; limited opportunities to pass slower vehicles, and when passing is permitted then on-coming traffic frequently prevents the attempt. Poultry trucks were frequently mentioned for speeding, volume, and crash or spillage involvement. Most referred to a need for passing lanes as a remedy for congestion due to slower vehicles (*i.e.*, trucks, recreational vehicles and trailers), and to reduce the amount of improper and risky passing maneuvers. Others claimed a four-lane, divided highway was needed. Comments were received both favoring and opposed to bypassing the towns. Those favoring a bypass primarily envisioned it as a means of removing speeding vehicles and trucks from the town streets, and also maintaining traffic flow at a higher speed. Those opposed were concerned about potential adverse impacts to business establishments. There was a general consensus that any improvements to KY 90 would improve safety and traffic flow, improve local economies, and make it easier to attract businesses to the area.

See Appendix F for the public information meeting comments summary. The Public Involvement Summary Notebook is on file with KYTC.

3.4 Resource Agency Coordination

Appropriate state and federal resource agencies were identified and contacted for their concerns associated with the study area and KY 90 improvements. KYTC sent letters to about 100 agencies and organizations requesting their input and comments on this Pre-Design Scoping Study in order to address their concerns early in the project development process. The 24 agencies responding to the request for input and comments are listed below, along with a brief summary of their comments. See Appendix H for their complete response.

US Army Corps of Engineers, Louisville District: No comments on the general environmental impacts of the project. Agency "not funded or authorized to provide general environmental assessments for all federally related development proposals". Project may impact following waterways under USACE jurisdiction: Marrowbone Creek, Unnamed tributaries of Marrowbone Creek, Ferris Fork Creek, Casey Fork, Dutch Creek, Unnamed tributary of Dutch Creek, Allen Creek, Baggard Branch, and Unnamed tributaries of Baggard Branch. No current or future plans to develop the waterways. No known wetland mapping of the study area. If wetland impacts could occur by the discharge of dredged or fill material, then a wetlands delineation report must be submitted. If project would impact "waters of the United States," including jurisdictional wetlands, then submit a permit application.

US Army Corps of Engineers, Nashville District: Expressed concerns about potential impacts to wetlands and surface waters. Identified Marrowbone Creek as a Kentucky classified Outstanding Resource Water, and encouraged avoiding impacts to the stream and major tributaries[1]. No navigable waters of the United States in the study area. Briefly discussed permit requirements, applicable regulations, and some construction options to avoid/minimize impacts to wetlands and streams.

USDA, Natural Resources Conservation Service: Concerned with the potential impacts to prime and statewide important farmlands. If federal dollars used, submit form AD-1006.

US Department of Health and Human Services: Response provided on their behalf by the Center for Disease Control and Prevention, which had no project specific comments. Provided a list of health topics to consider during the NEPA, and draft and final EIS process.

[1] Kentucky Division of Water website for Special Use Waters does not list Marrowbone Creek as an Outstanding State Resource Water, nor is it listed under any other Special Use Water categories.

US Department of Housing and Urban Development: No issues or concerns affecting project development.

Kentucky Geological Survey, University of Kentucky: Letter summarized geologic characteristics and concerns for the study area. Karst features possible (*e.g.*, sinkholes, caves). No faulted areas, or units prone to landslides. Unconsolidated sediments present. Resource conflicts possible, such as prior ownership of property for quarrying or mining. Pipeline crossing by Stillhouse Branch and Marrowbone Creek. Probable peak ground acceleration due to earthquake ground motion of 0.09g.

KY Commerce Cabinet: The project will not directly impact any of their facilities.

KY Justice and Public Safety Cabinet, Vehicle Enforcement: No issues with the project. "In fact, it appears the [improved] road would…help accommodate the large volume of truck traffic."

KY Cabinet for Health and Family Services: Comments concerned considering impacts to existing septic systems and drainage.

KY Department of Agriculture: Project has no impact on agricultural operations.

KY Department of Fish & Wildlife Resources: State and federal threatened or endangered species are known to occur within close proximity to the project area. Included a list of potentially impacted species, and recommendations concerning several bat species. Provided several recommendations and guidance concerning minimizing wetland and aquatic impacts. Minimum 2:1 mitigation ratio for any permanent loss or degradation of wetland habitats.

KYTC Division of Environmental Analysis, Historic Preservation: Recommended a full baseline for the report, and re-evaluation for eligibility of known sites. Area between Burkesville and Marrowbone part of John Hunt Morgan's last raid, and the Morgan Trail was recently established. Historic structures may be located near project that were not previously identified.

KYTC Division of Environmental Analysis, Archaeology: Little archaeological survey work conducted in study area. No sites evaluated for national register eligibility. No NRHP listed sites. Native American prehistoric sites can be expected within study area, likely located in alluvial areas and rock shelters. Other historic sites possible. Potential for significant sites exists. Identified archaeological concerns/comments for many of the spot improvements. Archaeological work likely required if project proceeds to design.

KYTC Division of Structural Design, Geotechnical Branch: Provided an office review and geological map of the study area, which was summarized in section 2.7.

KY Division of Conservation: No agricultural districts or agricultural conservation easements established in study area. Expressed concerns on minimizing farmland land loss, and using BMPs to minimize soil erosion and sedimentation.

KY Division of Forestry: Most road improvements will have minimal impact to the existing forested areas (generally small forests, or wooded fence rows), and all forested areas consist of common trees for the area. Marrowbone Bypass will have the greatest timberland impact, however the timber is typical for the area and fragmentation is not a concern. Burkesville Bypass will affect hillsides that are very steep and suitable for little else than timber.

KY Division for Mine Reclamation and Enforcement: Active limestone quarry operating about 0.5-mile south of Grider. No abandoned or active underground mines within study area.

KY Division for Air Quality: The following regulations apply: 401 KAR 63:010, Fugitive Emissions; 401 KAR 63:005, Open Burning; Clean Air Act as amended, and transportation planning provisions of Title 23 and Title 49, United States Code. Compliance with local government regulations may also apply.

Kentucky State Police, Post 15 Columbia: Identified several problem locations and/or provided recommendations for spot improvements based upon comments from troopers patrolling KY 90 in study area.

Kentucky Airport Zoning Commission: Proposed project will have no adverse effect on air navigation. If any structure or construction equipment exceeds 200-feet above ground level, then a permit is required.

Kentucky State Nature Preserves Commission: Issues concerning Gray bat and several aquatic species (mussel and fish) may need to be addressed. Most can likely be mitigated by using strict erosion, sediment, and stream crossing control measures.

Metcalfe County Tourism, Cathy Nunn, Director: "...project would be an asset to the community…." "…could lead to economic growth for our county."

Cumberland County Judge Executive, Tim Hicks, submitted by Eugenia Ferguson, Deputy Judge Executive: Stated a "heavily traveled highway," and expressed concern about the volume of large trucks and recreational vehicles on KY 90. Requested project team consider improvements to Burkesville Hill, citing large amount of accidents and many deaths.

Burkesville Police Department, Stevie Wheat, Chief of Police: Requested project team consider improvements to Burkesville Hill, citing large number of accidents and fatalities.

4.0 STATEMENT OF PROJECT GOALS

Based upon a consideration of the identified corridor issues, input from local officials, citizens, and resource agencies, and an evaluation of existing and forecasted highway conditions, the project study team generated the following project goals:

- *Improve safety along the KY 90 corridor.*
- *Provide a facility meeting current design standards, capable of serving recent growth, and sustaining current and projected traffic demands.*
- *Improve roadway geometrics to accommodate recreational vehicles and commercial trucks, including possible passing and climbing lanes.*
- *Minimize/avoid impacts to potential historic districts.*
- *Minimize/avoid impacts to communities.*
- *Provide roadway improvements between the Barren County line and Burkesville (KY 61) to compliment the planned Barren County improvements.*
- *Improve accessibility for local people seeking access to the recreational, employment, educational, and health care opportunities in south central Kentucky.*

The rationalization for identifying and selecting these project goals are addressed below by individual project goal. Justification reasons are only briefly explained, since they are supported by information and documentation previously discussed in this study.

Improve safety along the KY 90 corridor.
Safety concerns emerged as the key project issue among those familiar with the roadway, and some resource agencies. Common KY 90 sub-standard characteristics include: narrow driving lanes, narrow to almost non-existent shoulders, sharp curves, steep grades, restricted visibilities, direct driveway access, and crossroads positioned at locations with horizontal and/or vertical deficiencies. Only two high crash locations were identified (one should be corrected through another KYTC scheduled project). Most crashes occur during daylight hours, on dry roadways, and involve a single vehicle impacting a fixed object. Other common crash types included: rear end, right angle, and sideswipe. These types of crashes are typically caused by a combination of factors such as: poor highway geometrics, excessive speed for conditions, restricted visibility, large travel speed differences between vehicles, and improper passing procedures. The existing sub-standard highway geometrics play a significant role in drivers failing to maintain control of their vehicles. Additionally, the heavy bi-directional traffic volume, especially trucks and recreational vehicles, together with the poor highway geometrics, combine to provide few opportunities to pass slower moving vehicles. Frustrated and impatient drivers sometimes exercise improper and risky passing maneuvers, thereby creating new safety hazards. Reduced congestion would result in improved driver safety.

Provide a facility meeting current design standards, capable of serving recent growth, and sustaining current and projected traffic demands.
The existing facility does not meet current design standards. KY 90 is typically a two-lane rural roadway winding through the natural terrain of valleys and hills. It has narrow driving lanes, narrow to virtually no shoulders (sometimes with sharp height differences between the roadway and shoulder; and/or a soft substrate; or shoulders that fall off steeply from the road bed), and poor vertical and horizontal geometrics with reduced speed curves, steep grades, and deep rock cuts. The driver's sight distance is frequently limited or obstructed by terrain features such as hills and curves, and other restrictions. The existing LOS is B and C, with most of the LOS B roadway located between Beaumont and the Metcalfe-Cumberland County line. The KY 90 study area, and the area immediately surrounding it, has experienced limited to modest growth and development in recent years in terms of residences and commercial business. However, commercial/light industry development and tourism/recreational activity outside the study area

has grown considerably, and KY 90 is the conduit to those activity centers. Traffic forecasts indicate traffic will increase about 95 percent on KY 90 by 2030, reducing the LOS to C and D.

Improve roadway geometrics to accommodate recreational vehicles and commercial trucks, including possible passing and climbing lanes.
KY 90 carries about 16-19 percent commercial truck traffic, plus a significant amount of recreational vehicles (*i.e.*, boats, camper trailers) enroute to the state parks and lakes. KY 90 traffic flow is restricted by narrow lanes, low speed limits through the small towns, sharp curves, steep grades, restricted sight distances, and limited opportunities to pass slower vehicles. Even though most of KY 90 has a posted speed limit of 55-mph, the existing roadway geometrics can require frequent speed reductions and hamper traffic movement. The highway's steep grades and sharp curves cause trucks and other large vehicles to repeatedly reduce their travel speed and prevent them from driving 55-mph. Passenger vehicles meeting an approaching large, wide-bodied truck on the narrow lanes may also reduce their speed as a precaution. Passenger size vehicles following behind the trucks and recreational vehicles also experience an increase in travel time because of limited opportunities to safely pass the slower moving trucks. Wider driving lanes, shoulders, and passing/truck climbing lanes at strategic locations would help improve traffic flow.

Minimize/avoid impacts to potential historic districts.
Historic cultural resources in the area are considered valuable and significant links to the past, and represent a rich cultural heritage. Discussions with local officials and citizens indicated a desire to preserve these areas along with the aesthetic qualities and the traditions they represent. Minimizing/avoiding impacts to cultural resources is also a goal of this proposed project.

Minimize/avoid impacts to communities.
Local officials and citizens also expressed a desire to minimize/avoid impacting established residential communities. Minimizing/avoiding impacts to communities is also a goal of this proposed project. Efforts will be made to avoid community impacts, and to minimize property impacts in general by following property lines to the maximum extent possible. Natural resources are also recognized as valuable commodities, important not only to the communities themselves, but to the health of the natural environment. State and federal guidelines will be followed to minimize impacts to the natural resources.

Provide roadway improvements between the Barren County line and Burkesville (KY 61) to compliment the planned Barren County improvements.
Improvements to KY 90 in Barren County are programmed under KYTC Item Number 3-108.50, reconstruct KY 90 from east of Glasgow to the Metcalfe County line. Typical sections from 3-108.50 were consulted to ensure a smooth transition at the Metcalfe-Barren County line, and provide the driver with a sense of roadway continuity.

Improve accessibility for local people seeking access to the recreational, employment, educational, and health care opportunities in south central Kentucky.
Glasgow, located west of the study area, and Burkesville, located at the eastern terminus, are the regional economic activity, employment, health care, retail, and educational centers. Major state recreational areas (Barren River Lake, Dale Hollow Lake, and Lake Cumberland) are located west and east of the study area. KY 90 is the major connector between these sites, both counties, and to other destinations beyond. Commuters in and surrounding the study area have limited opportunities for other north-south, and east-west travel. Consequently, KY 90 attracts a substantial amount of commuter, employee, tourist, and commercial traffic from Metcalfe and Cumberland Counties, and even the surrounding counties and communities, seeking the opportunities available only in the major activity centers. An improved KY 90 would help relieve traffic congestion, thereby, improving local commuters' access to the opportunities available in the urban activity centers.

5.0 STUDY ALTERNATIVES / IMPROVEMENT OPTIONS CONSIDERED

The following alternatives / improvement options were developed to address the goals and objectives formulated through the study process.

5.1 Do Nothing

This alternative involves no action to improve the facility. The Do Nothing alternative would leave the existing roadway essentially as is, other than routine roadway maintenance (*e.g.*, resurfacing, restriping, patching, etc.). In the short-term, the Do Nothing alternative is the least expensive improvement option, since no funds would be expended for right-of-way acquisition, displacement of residences or businesses, utility relocations, or improvement construction. There would also be no construction period traffic disruptions, or construction-induced environmental impacts. However, the Do Nothing alternative should not be construed as a continuation of the status quo. Traffic volumes and characteristics, as well as development inside and outside the project area, will change. Normal growth in the area would contribute to increases in traffic volumes. Traffic from existing and future development, as well as through traffic, would continue to use the existing roadway. Traffic forecasts conducted for this study show an increase in the 2030 traffic volume on KY 90 of approximately 95 percent over the 2005 volume. The Do Nothing alternative would leave the area with a transportation system that progressively becomes more incapable of handling the increased traffic demands, and fails to address safety concerns identified by the project team and area citizens. The existing geometric deficiencies would remain. Additional traffic congestion and an increased potential for crashes could be expected. This alternative was presented and discussed by the project team members, who concluded it was not in the public's best interests because the long-term benefits from implementing proposed improvement option(s) are expected to be substantially greater than any negative factors associated with their construction and operation. The Do Nothing alternative was not recommended because it did not address the project goals.

Even though the Do Nothing alternative does not meet the project goals, it does provide the decision making team with a basis for comparing the impacts and benefits of other improvement opportunities considered throughout the project development process, and will be referred to as appropriate for baseline comparisons.

5.2 Transportation System Management

Transportation System Management (TSM) involves relatively low-cost improvements, but effective in nature, that can be quickly implemented through roadway maintenance activities. TSM improvements generally refer to such things as signing at critical locations, traffic lights at intersections, lighting, and simple roadway improvements such as pavement stripping, removing vegetation to improve visibility, or improving the radius of a street corner. Due to KY 90's numerous horizontal and vertical geometric deficiencies, and rural nature, limited opportunities exist for TSM improvements. Caution and warning signs are generally already present at critical locations, and the pavement is striped.

KY 90/KY 163 intersection as seen by northbound KY 163 drivers.

KY 90/KY 163 intersection as seen by eastbound KY 90 drivers.

Only one TSM opportunity was identified: the KY 90/KY 163 intersection (see Appendix B, photos 14-19). This intersection is a high crash location, with predominantly right-angle (*i.e.*, side-impact) crashes. Even though this intersection is scheduled for reconstruction with KYTC Item No. 3-276.50, installation of warning signs alerting north and southbound KY 163 drivers that cross traffic does not stop could reduce the number of crashes.

5.3 Improvement Opportunities Considered

The improvement opportunities defined in this study, taken in their entirety, essentially improve the entire length of KY 90 from the Barren-Metcalfe County line to Burkesville. Individually, each improvement opportunity is intended to correct either: 1) a specific roadway alignment deficiency, 2) replace an existing bridge, 3) improve the existing roadway to current design standards for lane and shoulder width, or 4) improve the roadway's operational performance (such as the addition of passing lanes). Improvement opportunities were identified sequentially from west to east, with either a *number* (improvements involving bypasses, curve or intersection realignment, bridge replacement, or curb and gutter through towns), or a *letter* (reconstructing existing mainline road sections). Improvements that include the addition of a passing lane are indicated by the suffix "*-P*." Improvements would consist of 12-foot wide driving lanes and 8-foot shoulders, and are intended to compliment the planned KY 90 improvements in Barren County (see Exhibit 4, *Typical Sections*). Curb and gutter improvements through the towns are within the existing right-of-way to avoid impacting private property and historic sites. Each improvement's beginning and ending point is an approximation used for planning purposes only. More detailed design is required to accurately identify the start and end points of each improvement.

Throughout the planning process, the project team identified, considered, evaluated, and revised a variety of improvement opportunities, as documented in the meeting minutes (see Appendix D). Table 7, *KY 90 Improvement Opportunities*, lists and briefly describes the final set of improvement opportunities, and provides the estimated length of each improvement, estimated construction cost, and the number of the color photo in Appendix B illustrating the existing condition. Refer to Exhibit 3, *Environmental Footprint and Improvement Opportunities*, in Appendix A for the improvement locations. Table 8, *Comparison Matrix of KY 90 Improvements*, presents a summary comparison of the improvements. Construction costs were based upon 2006 estimated bid prices. Preliminary roadway alignments and grades were used to estimate earthwork construction cost for each improvement opportunity. Varying terrain features associated with each improvement opportunity were considered in the calculations; therefore, seemingly similar improvements may have very different cost estimates. Improvement opportunity 3 — the KY 90/KY 163 intersection, identified as a high crash location — was removed from the final list of improvement opportunities because it is scheduled for reconstruction under KYTC item number 3-276.50.

5.3.1 Operational Improvements

Operational improvements are relatively short distance improvements addressing immediate and short-term needs, generally involving roadway reconstruction to correct horizontal and vertical deficiencies. Operational improvements typically require greater expense and capital investment than TSM improvements. KY 90's roadway deficiencies provide many opportunities for operational improvements.

The project team believed it unwise and unsafe to potentially have individual operational improvement sections meeting current design standards interconnected by substandard roadway sections. The team was cautious not to create conditions where an improved section of roadway only served to speed motorists into a deficient section, nor possibly convey false expectations of the roadway's safety. Therefore, the project team carefully considered each operational improvement's termini (*i.e.*, the numbered improvements). Additionally, the project team considered the existing roadway between each operational improvement as a mainline reconstruction improvement (*i.e.*, the lettered improvements, discussed in Section 5.3.2). For planning purposes, this approach offered the advantage of studying KY 90 improvements along the entire project length, including documenting estimated project costs for all identified improvements. This approach allows future improvements to be selected based upon need and available funding.

5.3.2 Roadway Reconstruction

Roadway reconstruction generally involves longer-term roadway construction on new alignment, or reconstruction of existing mainline roadway sections of longer lengths. Roadway reconstruction can include bypasses, a new road on new alignment, or a new typical section to bring an existing road up to current design standards. Roadway reconstruction is usually the most expensive roadway improvement option and incurs greater capital investment than either TSM or operational improvements.

The project team discussed the relative merits of a total reconstruction of KY 90 from the Metcalfe-Barren County line to Burkesville (23 miles) versus numerous individual improvement opportunities. During the public information meetings, a number of people expressed a desire for a four-lane divided highway typical section, frequently citing Tennessee SR 111 as an example. The project team considered both a four-lane divided highway, and a two-lane total reconstruction option. The project team discussed a four-lane divided highway total reconstruction and considered it as unjustified based upon current and projected traffic volumes, high costs, right-of-way impacts, and environmental impacts. Therefore, the project team did not recommend a four-lane divided highway total reconstruction of KY 90. The project team favorably considered a two-lane total reconstruction of KY 90 to current design standards. However, given the project corridor length and the current availability of funding, implementing a two-lane total reconstruction as one project was considered to be cost prohibitive. Consequently, the project team decided to recommend individual improvement opportunities, focusing on the most critical locations (*i.e.*, high crash locations, sharp curves, steep hills, restricted/limited visibilities, limited passing opportunities).

One type of reconstruction improvement opportunity considered was a bypass around existing communities. Bypasses of Summer Shade, Beaumont, Marrowbone, and Waterview were considered for a variety of reasons. The characteristic urban features of reduced speed limits, some narrow streets, on-street parking, sharp curves, numerous cross street intersections and direct access, consumer traffic, and congestion combine to slow down and restrict traffic flow (see Table 2). A bypass can have both positive and negative effects on a small community. For example, a bypass would facilitate moving traffic through the area to its destination; however, a bypass would also remove traffic flow and potential customers from the business establishments in town. Additionally, a bypass could detract from the current aesthetic appeal of a rural, small-town area and potential historic district. The town businesses may rely heavily upon daily commuters; therefore, a bypass could be met with resistance from business owners and public officials.

Redesigning/improving KY 90 with curbs and gutters through these towns may also be difficult. These towns contain either a potential historic district, or an already designated National Register historic district. The existing physical location of buildings and roadway geometrics offers few opportunities for improving the roadway outside its existing boundaries. The town's historic nature may be an obstacle to obtaining approval of roadway improvements through town. Additionally, improving the roadway through town may serve to increase the speed at which traffic flows through the town, thereby potentially generating new problems of excessive speed and volume. On the positive side, improving KY 90 through the town would retain traffic flow and potential customers, is a less expensive improvement because it reconstructs existing roadways, and maintains the rural, "small-town" historic atmosphere of the area.

Bypassing a town requires the consideration of many issues. Included are specific details on town historic property locations and property boundaries, and the potential impacts on these properties by any improvement construction in or around the town. Any town bypass may also have adverse impacts to the residents and business establishments, and therefore requires careful consideration.

The bypass improvement opportunities indicated on Exhibit 3 were selected after a consideration of the existing conditions, constraints, and potential impacts surrounding the bypassed location. In each case, an "alternative bypass" to the north or south of a particular indicated bypass location was deemed to be impractical because of increased impacts, physical/natural barriers, and/or expense compared to the bypass shown. Increased impacts included potential residential relocations, potential historic properties, and environmental resources. In some cases, the indicated bypass is simply the most direct and expedient route, or the logical path given the existing KY 90 roadway. The decision-making rationale for selecting a particular bypass location, based upon a planning study level of effort, is described below.

- Summer Shade. A review of aerial photography and existing conditions indicated a northern bypass had a greater number of potential residential relocations than a southern bypass. Additionally, the existing roadway geometry and the large electric substation (hazmat Site 5) east of Summer Shade favors a southern bypass.

- Beaumont. A southern bypass is the most geometrically practical engineering option. A northern bypass could impact a large light industrial complex (hazmat Site 7), have more residential relocations, be significantly longer, and cause alignment difficulties with the programmed KY 163 improvements.

- Marrowbone. A northern bypass is the shortest distance around Marrowbone, with the fewest potential impacts. A southern bypass could be significantly longer, and involve potential environmental impacts to Marrowbone Creek, wetland impacts, residential relocations, and impacts to historic properties/district.

- Waterview. A northern bypass offers the shortest distance and fewest potential impacts. A southern bypass involves potential environmental impacts to Marrowbone Creek, and impacts to historic properties/district.

- Burkesville. A southern bypass offers the most direct route to the Cumberland River Bridge, traverses less rugged terrain (minimizes excavation), and removes truck and through traffic from downtown Burkesville. A northern bypass would cross more rugged terrain, is potentially a longer alignment with increased residential relocations and impacts, and does not resolve the KY 90/KY 61 intersection issues in Burkesville.

An issue consistently brought up by the public was the limited passing opportunities along KY 90. Passing opportunities on KY 90 are limited due to roadway geometry and oncoming traffic, and were considered an important safety issue by both the project team and the public. Public comment indicated a strong desire for, and an expectation of, passing opportunities. While passing lanes could conceivably be located anywhere along the roadway, the existing topography, town locations, and safety considerations were key factors in selecting passing lane locations for improvement opportunities. The project team did not want to create situations where vehicles were potentially accelerating just before entering a populated area (town) with reduced speed limits. Additionally, logical pairings of east-west passing lanes around selected locations was a desired feature. Passing lane opportunities for the mainline and bypasses are identified and indicated on Exhibit 3.

Table 7 KY 90 Improvement Opportunities

Exhibit Item	Improvement Description	Length (miles)	Est. Cost* (million dollars)	Photo Ref No
	Metcalfe County			
1	Bypass Summer Shade to the south:			
1-1 (yellow)	Summer Shade Bypass 1. Begin west of Hill Top VW Road, curve southeast on new alignment to proceed east to bypass Summer Shade to the south, and reconnect with KY 90 east of Ernie Ferrell Road. This improvement is more expensive and longer than 1-2, and crosses more varying terrain features, but positions the roadway further from residential dwellings.	2.31	11.1	
1-1-P	Summer Shade Bypass 1 with an eastbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows.	2.31	11.7	
1-2 (orange)	Summer Shade Bypass 2. Begin east of Big Jack Road, curve southeast on new alignment to proceed east to bypass Summer Shade to the south, and reconnect with KY 90 about Ernie Ferrell Road. This improvement costs less and is shorter than 1-1, but locates the roadway closer to residential dwellings.	1.76	4.9	
2	Reconstruct KY 90 through Summer Shade with curb and gutter, and sidewalks, using the existing right-of-way. Includes reconstructing the intersections at Bronston Howard Road (access road to Summer Shade Elementary School) and KY 640.	0.14	0.2	6, 7, 8, 9, 10, 11
4	Bypass Beaumont to the south:			
4-1 (blue)	Beaumont Bypass 1. Begin from the scheduled KY 163 improvement, proceed almost due east on new alignment to bypass Beaumont to the south, and rejoin KY 90 east of Beaumont.	0.893	1.6	20
4-2 (orange)	Beaumont Bypass 2. Begin from the scheduled KY 163 improvement, curve southeast on new alignment to bypass Beaumont to the south, and rejoin KY 90 east of Beaumont.	0.916	2.0	20
	Cumberland County			
D + 5	Roadway section from the Metcalfe-Cumberland County line to the curve at Anderson Lane (item 5). Reconstruct curve just east of the Metcalfe-Cumberland County line near Anderson Lane to meet current design standards.	0.291	0.4	23
E + 6	Roadway section from the end of the curve at Anderson Lane (item 5) to the beginning of the curve near Pitman Creek (item 6). Reconstruct curve west of Pittman Creek Road to meet current design standards.	0.633	1.0	23
7	Bypass Marrowbone to the north:			
7-1 (red)	Marrowbone Bypass 1. Begin east of Hominy Creek Road, proceed east to bypass Marrowbone to the north on new alignment, and curve southeast to reconnect with KY 90 in the vicinity of KY 496.	2.02	35.2	
7-2 (blue)	Marrowbone Bypass 2. Begin east of Hominy Creek Road, proceed east to bypass Marrowbone to the north on new alignment, and curve southeast to reconnect with KY 90 in the vicinity of KY 496. 7-2 follows the same alignment as 7-1, except the mid-section curves south of 7-1 on new alignment.	2.03	39.0	
8	Reconstruct KY 90 through Marrowbone with curb, gutter, and sidewalks, using the existing right-of-way. Includes reconstructing the KY 3115 intersection to more favorable geometrics.	0.72	0.6	24, 25, 26, 27
8.1	Reconstruct the KY 90/KY 3115 intersection in Marrowbone.	0.22	0.3	
9	Replace existing bridge over Wisdom Creek.	--	0.5	28, 29
10	Bypass Waterview to the north:			
10-1 (orange)	Waterview Bypass 1. Begin from the curve west of Waterview's limits, proceed northeast, curving east to bypass Waterview to the north on new alignment, then curving southeast to reconnect with KY 90 in the vicinity of Taylor Road.	2.15	7.7	
10-1-P	Waterview Bypass 1 with a westbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 1.15 miles long, estimated construction cost is $2.9 million.	2.15	10.6	
10-2 (yellow)	Waterview Bypass 2. Begin from the curve west of Waterview's limits, proceed in a more direct eastern alignment to bypass Waterview to the north and reconnect with KY 90 west of Dutch Creek Road. Improvement 10-2 crosses within the potential National Register Historic District boundaries.	1.52	5.1	
11	Reconstruct the KY 90/KY 100 intersection. The existing intersection would be shifted west and KY 100 realigned to provide a more favorable geometry with KY 90. Turning lanes would be added to KY 90.	0.29	0.4	30, 31

Exhibit Item	Improvement Description	Length (miles)	Est. Cost* (million dollars)	Photo Ref No
12	Replace existing bridge at Dutch Creek.	--	0.7	32, 33, 34
13	Replace existing bridge west of Allen Creek Road.	--	0.6	35, 36
14	Curve at Allen Creek. Reconstruct curve east of Allen Creek Road and near Grider to meet current design standards.	0.25	0.6	
15	Norris Branch Road to Owens Road. Relocate KY 90 on new alignment to eliminate curve at KY 691. Begin east of Norris Branch Road, proceed east on new alignment to reconnect with KY 90 in the vicinity of Owens Road.	0.92	10.3	
16 + 18	Reconstruct KY 90 from Burkesville Hill Road/Saw Mill Cut to the KY 90/KY 61 intersection. Begin east of the KY 90/KY 2276 intersection, follow the existing alignment east to the first curve, continue northeast on new alignment, curving east to reconnect with KY 90 near the hilltop and end near the county hospital. Continue by widening KY 90 to 3-lanes, and constructing curb, gutter and sidewalks from near the county hospital to the intersection; reconstructing the elementary school entrance and exit roads; and adding a right hand turn lane on KY 61 southbound.	1.29	9.1	43, 44, 45, 46, 47, 48, 49, 50, 51
17	Burkesville Bypass. Begin near the KY 90/KY 2276 intersection, proceed southeasterly on new alignment to bypass Burkesville on the south, and reconnect with KY 90 at the KY 90/KY 61 intersection west of the Cumberland River Bridge. Includes reconstructing the KY 90/KY 2276 intersection.	1.57	21.7	
17-P	Burkesville Bypass with an eastbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 0.73 miles long, estimated construction cost is $8.1 million.	1.57	29.8	
18.1	Reconstruct the KY 90/KY 61 intersection in Burkesville. Add a right turn lane on KY 61 southbound.	0.17	0.3	50, 51
	Reconstruct existing KY 90 roadway to 12-foot wide lanes, 8-foot shoulders.			
A-P	Roadway section A with a westbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 1.25 miles long, estimated construction cost is $0.8 million.	1.69	3.1	1, 2
B	Roadway section from the end of the Summer Shade Bypass 1-2 to the scheduled KY 163 improvement.	1.32	2.2	1, 2
C-P	Roadway section C with an eastbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 1.36 miles long, estimated construction cost is $1.1 million.	5.67	10.3	21, 22
F-P	Roadway section F with a westbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 1.00 miles long, estimated construction cost is $1.0 million.	2.26	5.7	
F.1	Roadway section F between White Road and Ferris Fork Creek. Improve typical section safety and rock wall slope immediately north of roadway.	0.35	1.7	
G + 9	Roadway section from the end of the Marrowbone Bypass (item 7) to the beginning of the Waterview Bypass (item 10). Replace existing bridge over Wisdom Creek.	1.24	2.5	28, 29
H-P	Roadway section H with an eastbound passing lane beginning just east of Waterview (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane is 1.22 miles long, estimated construction cost is $0.9 million.	1.22	2.7	37
I	Roadway section from the end of the curve at Allen Creek (item 14) to near Norris Branch Road (beginning of item 15).	0.63	1.1	
J + K	Roadway section from Owens Road (end of item 15) to beginning of the Burkesville Bypass (item 17). Roadway section from the beginning of the Burkesville Bypass (item 17) to the beginning of the Burkesville Hill Road reconstruction (item 16).	0.88	1.5	42, 43

* Cost estimate is for construction only, based upon 2006 estimated bid costs. It does not include utility and right-of-way costs.

Table 8 Comparison Matrix of KY 90 Improvement Opportunities

County	Improvement Opportunity																		
	Metcalfe	Metcalfe	Metcalfe	Metcalfe	Metcalfe	Metcalfe	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland
	1-1	1-1-P	1-2	2	4-1	4-2	D + 5	E + 6	7-1	7-2	8	8.1	9	10-1	10-1-P	10-2	11	12	13
Improvement Description	Bypass	Bypass	Bypass	Intersection Reconstruction	Bypass	Bypass	Mainline/Curve Reconstruction	Mainline/Curve Reconstruction	Bypass	Bypass	Curb and Gutter	Intersection Reconstruction	Bridge Replacement	Bypass	Bypass	Bypass	Intersection Reconstruction	Bridge Replacement	Bridge Replacement
Passing Lane	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No
Length (miles)	2.31	2.31	1.76	0.14	0.893	0.916	0.291	0.633	2.02	2.03	0.72	0.22	--	2.15	2.15	1.52	0.29	--	--
Estimated Cost (dollars)																			
Construction[1]	11,100,000	11,700,000	4,900,000	200,000	1,630,000	1,950,000	410,000	1,000,000	35,200,000	39,000,000	600,000	300,000	500,000	7,700,000	10,600,000	5,100,000	400,000	700,000	600,000
Community Impacts																			
Potential Relocations	1	1	0	0	2	2	0	2	3	3	0	0	0	4	4	2	0	0	0
Bypass (town)	Yes Summer Shade	Yes Summer Shade	Yes Summer Shade	No Summer Shade	Yes Beaumont	Yes Beaumont	No	No	Yes Marrowbone	Yes Marrowbone	No Marrowbone	No Marrowbone	No	Yes Waterview	Yes Waterview	Yes Waterview	No	No	No
Historic District	No	No	No	Yes	No	No	No	No	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes	No
Environmental Justice Issue	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Potential Environmental Concerns																			
USGS Streams	1	1	1	0	0	0	1	1	3	3	0	0	1	2	2	1	0	1	1
Wetlands/Ponds	1	1	1	0	1	0	0	1	0	0	0	0	0	3	3	0	0	0	0
Historic	0	0	0	District	0	0	0	1	0	0	District	District	0	0	0	District	District	District	0
Archaeologic	Likely	Likely	Likely	Unlikely	Unlikely	Unlikely	Likely	Likely	Likely	Likely	Unlikely	Unlikely	Unlikely	Likely	Likely	Likely	Unlikely	Unlikely	Unlikely
Meets Project Goals																			
Improve Safety	Yes	Yes	Yes	Limited	Yes	Yes	Yes	Yes	Yes	Yes	Limited	Limited	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Current Design Standards	Yes	Yes	Yes	Limited	Yes	Yes	Yes	Yes	Yes	Yes	Limited	Limited	Yes	Yes	Yes	Yes	Limited	Yes	Yes
Accommodate Rec Vehicles, Trucks	Yes	Yes	Yes	Limited	Yes	Yes	Yes	Yes	Yes	Yes	Limited	Limited	Yes	Yes	Yes	Yes	Limited	Yes	Yes
Avoid Potential Historic Districts	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No	Yes
Avoid Communities	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes
Compliment Barren Co Hwy	Yes	Yes	Yes	Limited	Yes	Yes	Yes	Yes	Yes	Yes	Limited	Limited	Yes	Yes	Yes	Yes	Limited	Yes	Yes
Improve Accessibility, Connectivity	Yes	Yes	Yes	Limited	Yes	Yes	Yes	Yes	Yes	Yes	Limited	Limited	Yes	Yes	Yes	Yes	Limited	Yes	Yes

[1] Estimated construction costs are based upon 2006 estimated bid costs. Cost does not include design, right-of-way acquisition, or utilities relocation.

Table 8 Comparison Matrix of KY 90 Improvement Opportunities, continued

County	Improvement Opportunity															
	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland		Metcalfe	Metcalfe	Metcalfe	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland	Cumberland
	14	15	16 + 18	17	17-P	18.1		A-P	B	C-P	F-P	F.1	G + 9	H-P	I	J + K
Improvement Description	Curve Reconstruction	Bypass	Curve/Mainline Reconstruction	Bypass	Bypass	Intersection Reconstruction		Mainline Reconstruction	Mainline Reconstruction	Mainline Reconstruction	Mainline Reconstruction	Spot Improvement	Mainline Recon Bridge Replace	Mainline Reconstruction	Mainline Reconstruction	Mainline Reconstruction
Passing Lane	No	No	No	No	Yes	No		Yes	No	Yes	Yes	No	No	Yes	No	No
Length (miles)	0.25	0.92	1.29	1.57	1.57	0.17		1.69	1.32	5.67	2.26	0.35	1.24	1.22	0.63	0.88
Estimated Cost (dollars)																
Construction[1]	550,000	10,300,000	9,100,000	21,700,000	29,800,000	250,000		3,100,000	2,200,000	10,300,000	5,700,000	1,700,000	2,500,000	2,700,000	1,100,000	1,500,000
Community Impacts																
Potential Relocations	3	0	0	0	0	0		0	0	0	0	0	0	0	0	0
Bypass (town)	No	No	No	Yes Burkesville	Yes Burkesville	No		No	No	No	No	No	No	No	No	No
Historic District	No	No	No	No	No	No		No	No	No	No	No	No	No	No	No
Environmental Justice Issue	No	No	No	No	No	No		No	No	No	No	No	No	No	No	No
Potential Environmental Concerns																
USGS Streams	0	3	0	1	1	0		1	0	5	4	0	2	1	0	3
Wetlands/Ponds	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
Historic	2	0	0	1	1	0		0	0	0	0	0	1	1	0	2
Archaeologic	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely		Likely	Likely	Likely	Likely	Likely	Likely	Likely	Unlikely	Likely
Meets Project Goals																
Improve Safety	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Current Design Standards	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Accommodate Rec Vehicles, Trucks	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Avoid Potential Historic Districts	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Avoid Communities	No	Yes	No	Yes	Yes	No		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Compliment Barren Co Hwy	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Improve Accessibility, Connectivity	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Limited	Yes	Yes	Yes	Yes	Yes	Yes

[1] Estimated construction costs are based upon 2006 estimated bid costs. Cost does not include design, right-of-way acquisition, or utilities relocation.

6.0 RECOMMENDATIONS

6.1 KY 90 Improvement Recommendations

The project team members made a careful review and consideration of the existing conditions, cultural and environmental constraints, and engineering considerations. After thoroughly discussing the various TSM, operational, and roadway reconstruction improvement opportunities, and their relative merits in terms of satisfying project goals, the project team made several decisions. Ultimately, the project team decided to categorize the improvement opportunities into one of three types to facilitate implementation strategies, as described below. The project team's list of final recommended KY 90 improvement opportunities are in Table 9, *Recommended KY 90 Improvement Opportunities*, by category, along with their lengths, estimated construction costs, and priority for the mainline reconstruction improvements.

- Bridge Replacements. Candidate bridges will be selected by the District as warranted by bridge condition and safety considerations.
- Operational Improvements. This includes improvements addressing immediate and short-term needs. The project team made no attempt to prioritize these improvement opportunities, believing it was best to allow the District to select the improvement(s) to implement based upon available funding and needs.
- Roadway Reconstruction Improvements. Consists of longer-term roadway mainline reconstruction and bypass improvements. The project team prioritized these improvements based upon considerations of safety, traffic volumes, passing opportunities, estimated construction costs, and local knowledge.

6.2 Project Phases and Cost Estimates

Due to the relatively short length and nature of each recommended improvement, each improvement would be expected to be completed in one construction phase. Project construction cost estimates are in Table 9, and range from $200,000 to $39,000,000.

The Enacted Six-Year Highway Plan FY 2007-2012 authorized funding for Design, some of which was used to fund the Pre-Design Scoping Study. The Enacted Six-Year Highway Plan FY 2007-2012 provides additional funding for KY 90 improvements in Metcalfe and Cumberland Counties as follows:

Item No.	Length	Description	Funding	Phase	Year	Amount
08-136.00	25.000	Spot improvements along KY-90 between Barren County line and Burkesville. (Replaces 2002 SYP Item No. 3-112.00) Milepoints: From: 0 To: 11.719 Milepoints: From: 0 To: 14.113 Purpose and Need: Reliability/Spot Improvements(O)	SP	D	2006	$3,250,000
			SP	R	2008	$7,000,000
			SP	U	2008	$2,800,000
			SP	C	2008	$10,000,000
					Total	$23,050,000
08-136.01	25.000	Spot improvements along KY-90 between Barren County line and Burkesville. (Additional Funding for C Phase.) Milepoints: From: 0 To: 11.719 Milepoints: From: 0 To: 14.113 Purpose and Need: Reliability/Prefinanced Convrsn(O)	SP	C	2008	$10,000,000
					Total	$10,000,000
08-136.02	25.000	Spot improvements along KY-90 between Barren County line and Burkesville. (Additional Funding for C Phase.) Milepoints: From: 0 To: 11.719 Milepoints: From: 0 To: 14.113 Purpose and Need: Reliability/Prefinanced Convrsn(O)	SP	C	2008	$12,000,000
					Total	$12,000,000

Table 9 Recommended KY 90 Improvement Opportunities

Priority	Exhibit Item	Improvement Description	Length (miles)	Est. Cost* (million dollars)
Bridge Replacements (no priority)				
	9	Replace existing bridge over Wisdom Creek.	--	0.5
	12	Replace existing bridge at Dutch Creek.	--	0.7
	13	Replace existing bridge west of Allen Creek Road.	--	0.6
Operational Improvements (no priority)				
	2	Reconstruct the KY 90 intersection at Bronston Howard Road (access road to Summer Shade Elementary School) in Summer Shade using the existing right-of-way.	0.14	0.2
	8.1	Reconstruct the KY 90/KY 3115 intersection in Marrowbone.	0.22	0.3
	D + 5	Roadway section from the Metcalfe-Cumberland County line to the curve at Anderson Lane (item 5). Reconstruct curve just east of the Metcalfe-Cumberland County line near Anderson Lane to meet current design standards.	0.291	0.4
	E + 6	Roadway section from the end of the curve at Anderson Lane (item 5) to the beginning of the curve near Pitman Creek (item 6). Reconstruct curve west of Pittman Creek Road to meet current design standards.	0.633	1.0
	F.1	Roadway section F between White Road and Ferris Fork Creek. Improve typical section safety and rock wall slope immediately north of roadway.	0.35	1.7
	11	Reconstruct the KY 90/KY 100 intersection. Existing intersection would be shifted west and KY 100 realigned to provide a more favorable geometry with KY 90. Turning lanes would be added to KY 90.	0.29	0.4
	14	Curve at Allen Creek. Reconstruct curve east of Allen Creek Road and near Grider to meet current design standards.	0.25	0.6
	18.1	Reconstruct the KY 90/KY 61 intersection in Burkesville. Add a right turn lane on KY 61 southbound.	0.17	0.3
	A-P	Passing lane only on this mainline section.	1.25	0.8
	C-P	Passing lane only on this mainline section.	1.36	1.1
	F-P	Passing lane only on this mainline section.	1.00	1.0
	H-P	Passing lane only on this mainline section.	1.22	0.9
Prioritized Mainline Road Reconstruction (priority order as indicated)				
1	Summer Shade Bypass: (1-1-P, 1-1, 1-2)			
	1-1-P	Summer Shade Bypass 1 with an eastbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 0.86 miles long, estimated construction cost is $0.6 million.	2.31	11.7
	1-1	Summer Shade Bypass 1. Begin west of Hill Top VW Road, curve southeast on new alignment to proceed east to bypass Summer Shade to the south, and reconnect with KY 90 east of Ernie Ferrell Road. This improvement is more expensive and longer than 1-2, and crosses more varying terrain features, but positions the roadway further from residential dwellings.	2.31	11.1
	1-2	Summer Shade Bypass 2. Begin east of Big Jack Road, curve southeast on new alignment to proceed east to bypass Summer Shade to the south, and reconnect with KY 90 about Ernie Ferrell Road. This improvement costs less and is shorter than 1-1, but locates the roadway closer to residential dwellings.	1.76	4.9
2	16 + 18	Reconstruct KY 90 from Burkesville Hill Road/Saw Mill Cut to the KY 90/KY 61 intersection. Begin east of the KY 90/KY 2276 intersection, follow the existing alignment east to the first curve, continue northeast on new alignment, curving east to reconnect with KY 90 near the hilltop and end near the county hospital. Continue by widening KY 90 to 3-lanes, and constructing curb, gutter and sidewalks from near the county hospital to the intersection; reconstructing the elementary school entrance and exit roads; and adding a right hand turn lane on KY 61 southbound.	1.29	9.1
3	15	Norris Branch Road to Owens Road. Relocate KY 90 on new alignment to eliminate curve at KY 691. Begin east of Norris Branch Road, proceed east on new alignment to reconnect with KY 90 in the vicinity of Owens Road.	0.92	10.3

Priority	Exhibit Item	Improvement Description	Length (miles)	Est. Cost* (million dollars)
4	Waterview Bypass with a passing lane: (10-1-P, 10-1, 10-2)			
	10-1-P	Waterview Bypass 1 with a westbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 1.15 miles long, estimated construction cost is $2.9 million.	2.15	10.6
	10-1	Waterview Bypass 1. Begin from the curve west of Waterview's limits, proceed northeast, curving east to bypass Waterview to the north on new alignment, then curving southeast to reconnect with KY 90 in the vicinity of Taylor Road.	2.15	7.7
	10-2	Waterview Bypass 2. Begin from the curve west of Waterview's limits, proceed in a more direct eastern alignment to bypass Waterview to the north and reconnect with KY 90 west of Dutch Creek Road. Improvement 10-2 crosses within the potential National Register Historic District boundaries.	1.52	5.1
5	A-P	Roadway section A with a westbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 1.25 miles long, estimated construction cost is $0.8 million.	1.69	3.1
6	8	Reconstruct KY 90 through Marrowbone with curb, gutter, and sidewalks, using the existing right-of-way. Includes reconstructing the KY 3115 intersection to more favorable geometrics.	0.72	0.6
7	J + K	Roadway section from Owens Road (end of item 15) to beginning of the Burkesville Bypass (item 17). Roadway section from the beginning of the Burkesville Bypass (item 17) to the beginning of the Burkesville Hill Road reconstruction (item 16).	0.88	1.5
8	I	Roadway section from the end of the curve at Allen Creek (item 14) to near Norris Branch Road (beginning of item 15).	0.63	1.1
9	H-P	Roadway section H with an eastbound passing lane beginning just east of Waterview (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane is 1.22 miles long, estimated construction cost is $0.9 million.	1.22	2.7
10	B	Roadway section from end of Summer Shade Bypass (item 1) to the scheduled KY 163 improvement.	1.32	2.2
11	G + 9	Roadway section from the end of the Marrowbone Bypass (item 7) to the beginning of the Waterview Bypass (item 10). Replace existing bridge over Wisdom Creek.	1.24	2.5
12	Beaumont Bypass: (4-1, 4-2)			
	4-1	Beaumont Bypass 1. Begin from the scheduled KY 163 improvement, proceed almost due east on new alignment to bypass Beaumont to the south, and rejoin KY 90 east of Beaumont. This improvement is more direct and slightly shorter than 4-2.	0.893	1.6
	4-2	Beaumont Bypass 2. Begin from the scheduled KY 163 improvement, curve southeast on new alignment to bypass Beaumont to the south, and rejoin KY 90 east of Beaumont.	0.916	2.0
13	F-P	Roadway section F with a westbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 1.00 miles long, estimated construction cost is $1.0 million.	2.26	5.7
14	Burkesville Bypass: (17, 17-P)			
	17	Burkesville Bypass. Begin near KY 90/KY 2276 intersection, proceed southeasterly on new alignment to bypass Burkesville on the south, and reconnect with KY 90 at the KY 90/KY 61 intersection west of the Cumberland River Bridge. Includes reconstructing KY 90/KY 2276 intersection.	1.57	21.7
	17-P	Burkesville Bypass with an eastbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 0.73 miles long, estimated construction cost is $8.1 million.	1.57	29.8
15	C-P	Roadway section C with an eastbound passing lane (*i.e.*, 3-lane typical section). Passing lanes are located only between the points indicated by the arrows. Passing lane only is 1.36 miles long, estimated construction cost is $1.1 million.	5.67	10.3
16	Marrowbone Bypass: (7-1, 7-2)			
	7-1	Marrowbone Bypass 1. Begin east of Hominy Creek Road, proceed east to bypass Marrowbone to the north on new alignment, and curve southeast to reconnect with KY 90 in the vicinity of KY 496.	2.02	35.2
	7-2	Marrowbone Bypass 2. Begin east of Hominy Creek Road, proceed east to bypass Marrowbone to the north on new alignment, and curve southeast to reconnect with KY 90 in the vicinity of KY 496. 7-2 follows the same alignment as 7-1, except the mid-section curves south of 7-1 on new alignment.	2.03	39.0

* Estimated construction cost based upon 2006 estimated bid costs. Does not include utility and right-of-way costs.