TRUCK ROUTE ACCESS EVALUATION

Edmonson County
From Western Kentucky Parkway to I-65

Report No. KTC-98-32

"Freight Movement and Intermodal Access in Kentucky"
SPR 98-189

Lisa Aultman-Hall

with
Ken Agent
Brian Aldridge
Dave Cain
Nicole Lefever
Nick Stamatiadis
Joel Weber

Kentucky Transportation Center and the Department of Civil Engineering
University of Kentucky

September 1998

Table of Contents

Appendices

List of Tables

List of Figures

1.0 Introduction

There are two main objectives of the Freight Movement and Intermodal Access in Kentucky Study (SPR 98-189) that is being undertaken by the Kentucky Transportation Center for the Kentucky Transportation Cabinet (KYTC): 1) evaluation of the access for trucks between intermodal or other truck generating sites and the National Highway System (NHS); and 2) furthering the understanding of freight commodity flows throughout the state. This report is slightly different from the others that summarize the access evaluation to a particular cluster of existing facilities. This route provides access to Edmonson county from the Western Kentucky Parkway (in Grayson county) and from I-65 (in Warren county) as shown on Figure 1. This route is not currently used by many trucks. Edmonson county was recommended for study by the Division of Transportation Planning of the KYTC due to the lack of 102 inch wide truck access. There is also a gross weight limit of 62,000 lbs on the entire route. The route is located in the Barren River Area Development District and is in KYTC Highway District #3. Work on other specific sites as well as the freight commodity flow task of SPR 98-189 are on-going and are documented elsewhere.

Most of the sites to be evaluated in this project were selected from two existing databases (a truck facility survey from 1994 and the intermodal facility inventory) based on ADD and KYTC planner recommendations, geographic location, distance to the National Highway System, and the number of trucks accessing the site. Consideration was also made for the freight type handled and transportation modes used. As indicated above these issues were not considered here as the county was recommended for study based on the lack of truck access.

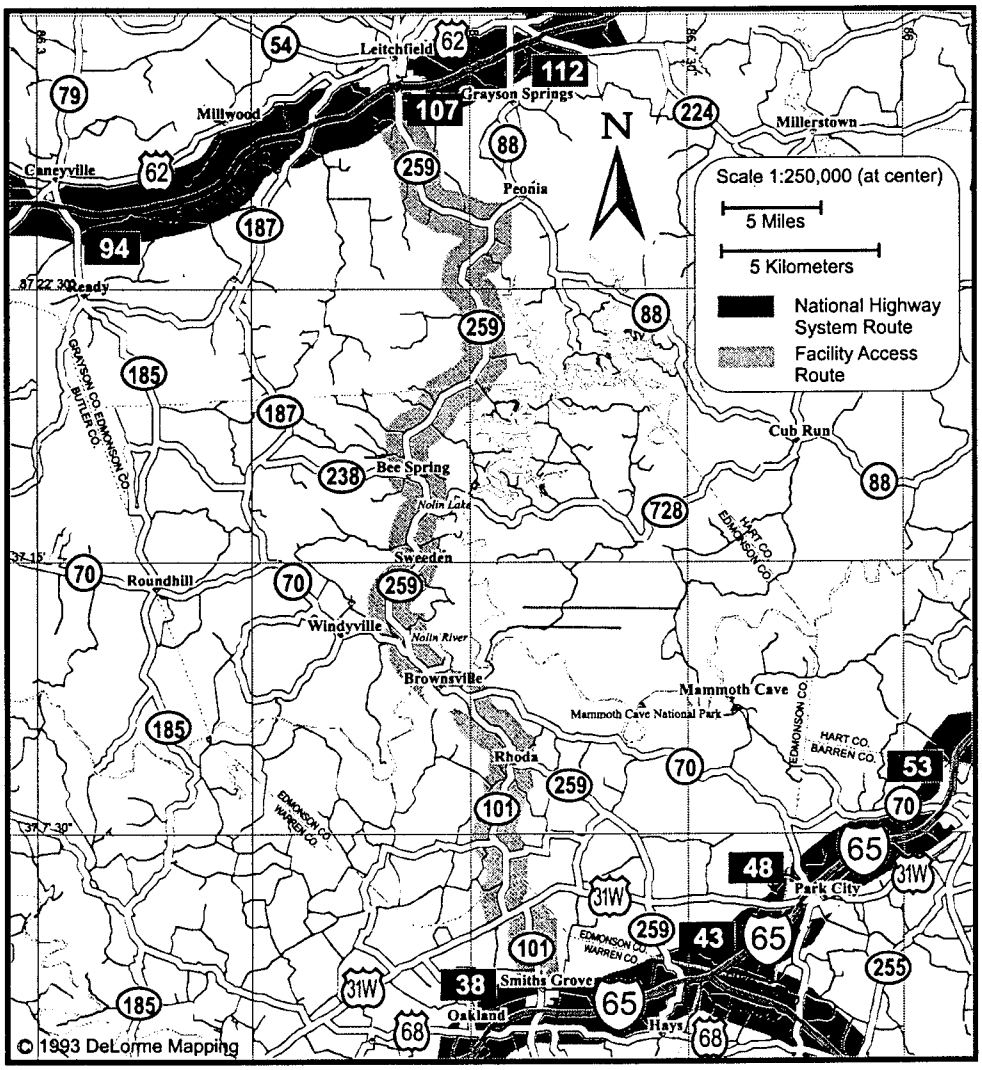
The site was visited several times for data collection and video recording as listed in Appendix A. No facilities that might currently generate significant truck traffic were observed. Large numbers of trucks were noted near the interchange with I-65 due to truck stops. The access to these sites was deemed good. The area surrounding the route is generally rural although it travels through several small towns and also Brownsville which is a larger community. The phone survey which was conducted for other truck routes under evaluation was not conducted here due to the lack of current facilities. In the other cases studied during this project, the largest truck currently using the route was considered for evaluation of features such as off-tracking, grade, and turning radii. In this case, these trucks do not necessarily use this route, but access for a 48 foot tracker trailer was evaluated.

2.0 Characteristics of Route

There is no National Highway System segment in Edmonson county. A truck traveling from the Western Kentucky Parkway (NHS) to the north would have to use KY 259. Likewise, a truck accessing Edmonson county from the south at I-65 could use KY 101, US 31W and KY 259. Although it is unlikely trucks would use these segments as a complete route (particularly at the south through the small town, Smith's Grove, the complete route from I-65 to the Western Kentucky Parkway is evaluated here as a single route. Two alternative routes from the south, taking US 31W from Bowling Green or Park City where there are interchanges with I-65 depending on direction of origin, were also subjectively evaluated. Although these routes are

better than KY 101 between US 31W and I-65 they do increase travel on Non-NHS routes. Note that US 31W does not directly intersect with I-65 at Park City. All sections of the route under study were paved two lane two way roads with generally rural character with less than "preferred" lane widths and shoulders. The terrain is generally rolling, and there were numerous horizontal curves and grades. There are no traffic signals on the route.

Figure 1: Location of Route



3.0 Route Data Collection and Evaluation

The route features that are to be evaluated in this study are shown in Table 1 along with a brief description of the evaluation method. While some of these features require only subjective evaluation by the engineer during site inspection, others required quantitative measurement in order to label the particular point or section as "preferred", "adequate" or "less than adequate" for truck access. The guidelines for labeling a point or section into one of these three descriptive categories are provided in both the interim and final report for this project. In several cases measurements were only taken where subjective evaluation indicated a problem might exist as "preferred" type sections and points do not contribute to an increase in the problem truck points or miles that are summed for the route (see section 4).

3.1 Traffic Operations and Level of Service

Because phone surveys were not conducted with managers of facilities attracting truck traffic, no traffic operations and level of service issues were brought to the attention of the study team. It seems unlikely given the rural character of the area that traffic congestion problems exist at any time. However, a travel time study was conducted consisting of three trips in each direction. Data is shown in Appendix B. The level of service was found to be C in both directions assuming as generally level terrain.

3.2 Accident History

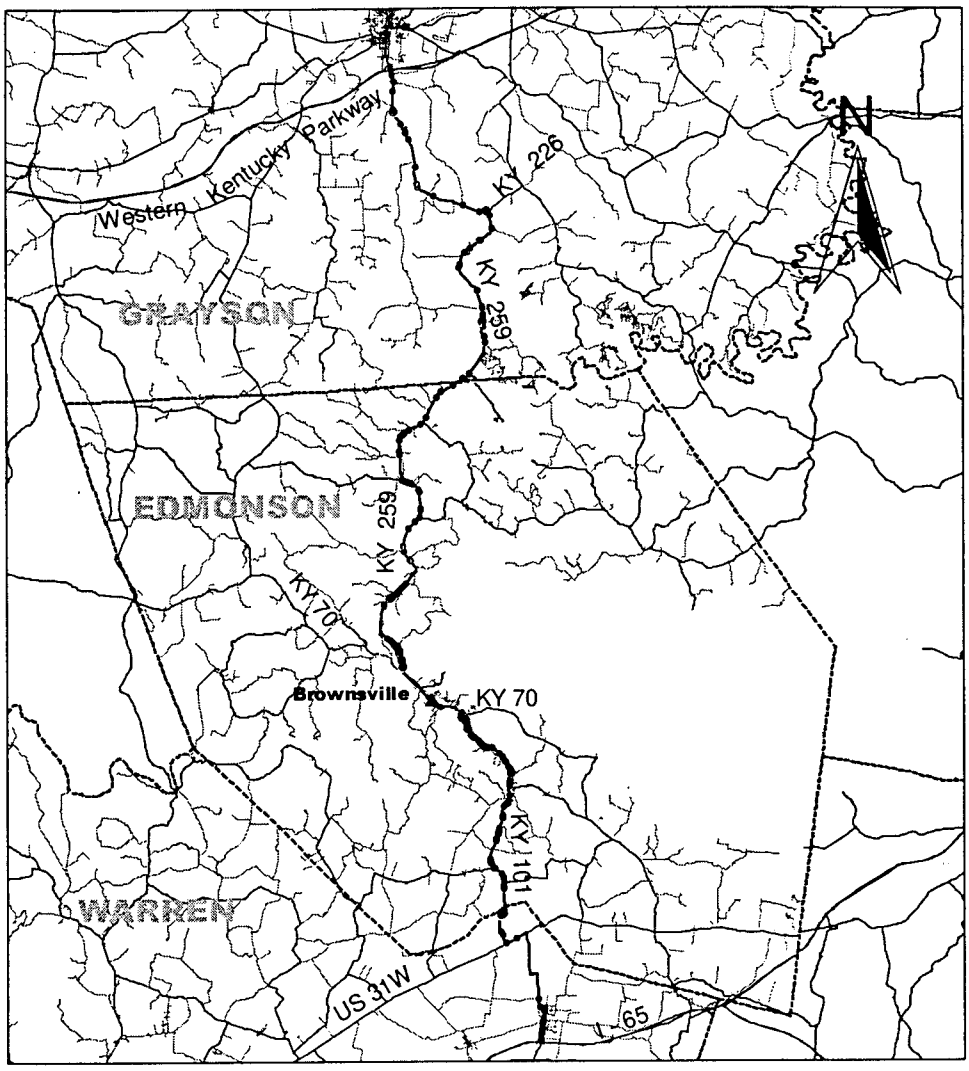
In 1997 the Kentucky Transportation Center studied all state-maintained roads throughout Kentucky and determined average truck accident rates for different types of road sections. A critical accident rate was then calculated using the average accident rate for a specific highway type along with an assumed level of statistical significance and exposure (vehicles miles traveled). No sections along this route had truck accident rates higher than the critical rate for that particular highway type.

Figure 2 shows the locations of accidents during the years 1994, 1995 and 1996. Three sections are of note on Figure 2. First, the stop controlled intersection of KY 259 and KY 226 in Grayson county, which is also described in section 3.7 of this report due to poor sight distance, has a high number of accidents. Second, the town of Brownsville and the intersection of KY 259 with KY 70 have a large number of accidents. This is likely due to larger traffic volumes in this area. Finally, the curvy grade near the Edmonson Warren county line is shown to have a large number of accidents. This section of road is also discussed in section 3.4 of this report as the grade is of concern for truck access. A summary of the accidents along the entire truck route is shown in Table 2 for the same three year period. Truck accidents do not represent a significant portion of the overall accidents along this route. While the total number of accidents is large relative to the traffic volumes on these routes, it does not seem that trucks alone are the concern.

Table 1: Route Features and Method of Evaluation

Feature	Methodology	Team Consensus based on Committee Meeting and Draft Report Feedback	Feature Type
Offtracking	Lane Width with formula based on wheel and axle spacing	Evaluate where observation of trucks indicates possible offtracking - use HIS data and collect in field	Point
Max. Safe Speed on a Curve	Ball Bank Indicator Reading	Evaluate complete route due to ease of data collection	Point
Grade	Speed Reduction Tables with Percent Grade and Direct Observation	Evaluate where observation of trucks indicates speed reduction occurs using HIS data and collect in field as needed	Continuous
Lane Width	HIS data and field measurement	Review complete route due to ease of data collection	Continuous
Clear Zone	Observation	Subjective evaluation	Subjective
Shoulders	HIS data and field measurement	Evaluate where HIS data is available and estimate based on observation elsewhere	Continuous
Pavement Condition	Observation	Subjective evaluation	Subjective
Truck Stopping Sight Distance	Field measurements	Measure only when observation indicates possible problem	Point
Turning Radii	Field measurements and observations of trucks	Measure only when observation indicates possible problem	Point
Accident History	Accident data files and KTC High Truck Accident Report	Do for entire route	Subjective
Intersection LOS	Traffic counts	Only where problems are indicated by facility managers	Point
Route LOS	Traffic counts and travel time studies	Only where problems are indicated by managers	Continuous
RR Crossings	Field Observation	Evaluate all level crossings	Point
Bridges	KYTC Sufficiency Rating	Evaluate all bridges	Point

Figure 2: Accident Locations (1994-1996)



LEGEND

- Facility
- Accidents: 1 - 2
- Accidents: 3 - 4
- Accidents: 5
- Freight Access Route
- State Highway System
- Other Roads
- County Border

Scale - 1:260000

2 0 2 4 6 Miles

5000 0 5000 10000 Meters

Table 2: Accident Types along Edmonson County Truck Route

	Non-Truck Accidents	*Truck Accidents*	*Percent Trucks*
Total	270	16	5.6
Fatal Accidents	1	0	0.0
Injury	102	4	3.8
Intersection	34	1	2.9

3.3 Cross Section Features

Figures 3 and 4 illustrate the sections of the route having different widths of lanes and shoulders. Except for the route section along US 31W the lane widths are considered "less than adequate" for truck traffic. The shoulders (except at intersections) ranged from 2 to 4 feet of either gravel or turf and are considered "less than adequate" for truck traffic.

Clear zone issues existed along many sections of the route. Residences, utility poles, trees, fences, parking and bridge rails were found in several sections within 10 to 15 feet of the road edge. Two such sections are illustrated in Figures 5 and 6. The pavement was good along the whole route. The section of KY 101 south of US 31W had been resurfaced between the June and July site visits.

3.4 Curvature Features

Grades are considered problematic if they cause trucks to slow down excessively. One significant grade can be considered "less than adequate" on this route as shown in Figure 7. Approximately 1.3 miles north of US 31W on KY 101, there is a windy curve of approximately 2.0 miles in total length, consisting of sections as steep as 6%. Although trucks slowing on the upgrade is a concern, in this case, the more serious issues are fast speeds and offtracking on the downgrade. At numerous locations throughout the route vertical curvature also creates sight distance problems.

No turning radii were approximated in the field as subjective evaluation indicated no problems.

Locations where offtracking may occur were estimated using wheel base lengths, horizontal curvature information from the HIS database and lane widths measured in the field. No curve widening was noted in the field. Locations of potential offtracking problems (43 in total) are shown in Figure 8, while details are listed in Appendix B. Many of the horizontal curves on this route also failed the ball bank reading guidelines when traveled at the speed limit or the posted advisory speed for these curves. These locations are shown in Figure 9 and 8. Details for the 31 southbound curves and 39 northbound curves are listed in Appendices C and D respectively. Four ninety degree horizontal curves are found along KY 101 south of US 31W. These preclude truck access along this section.

Figure 3: Lane Widths

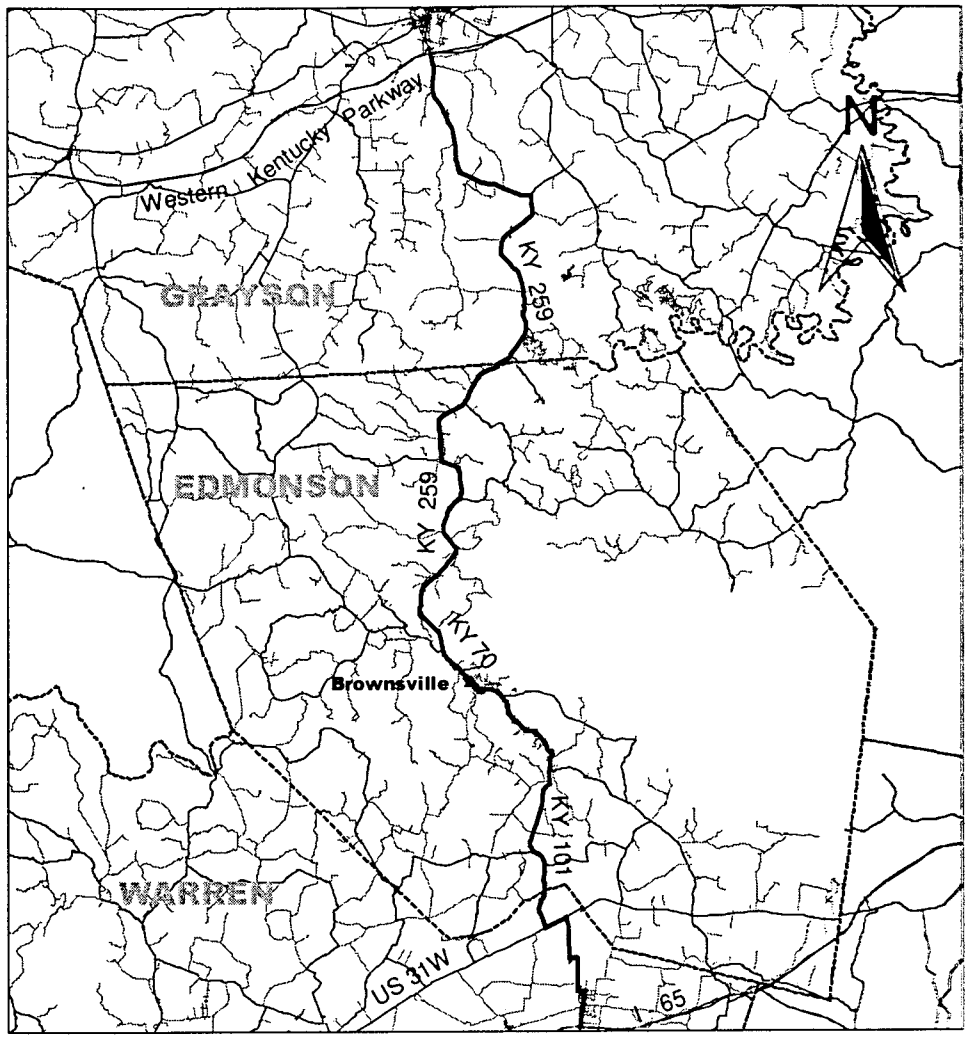


Figure 4: Shoulder Widths

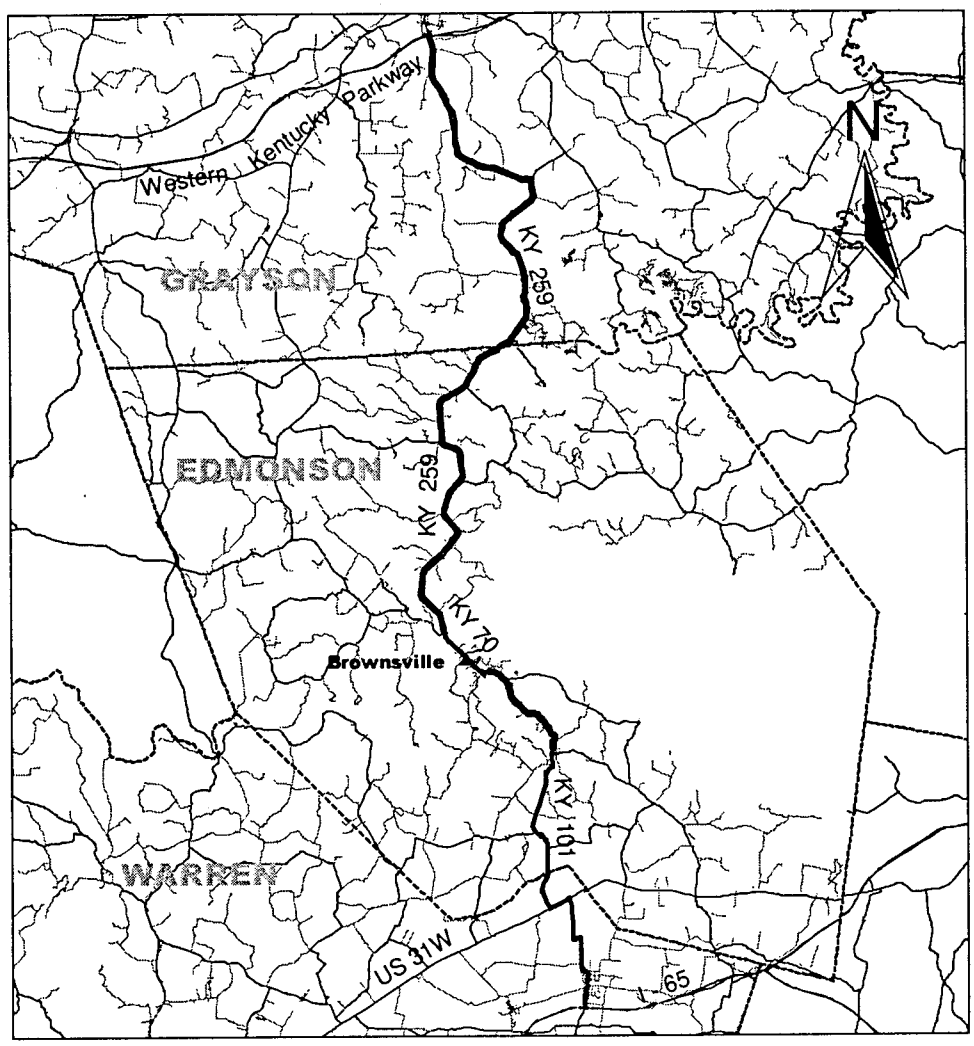
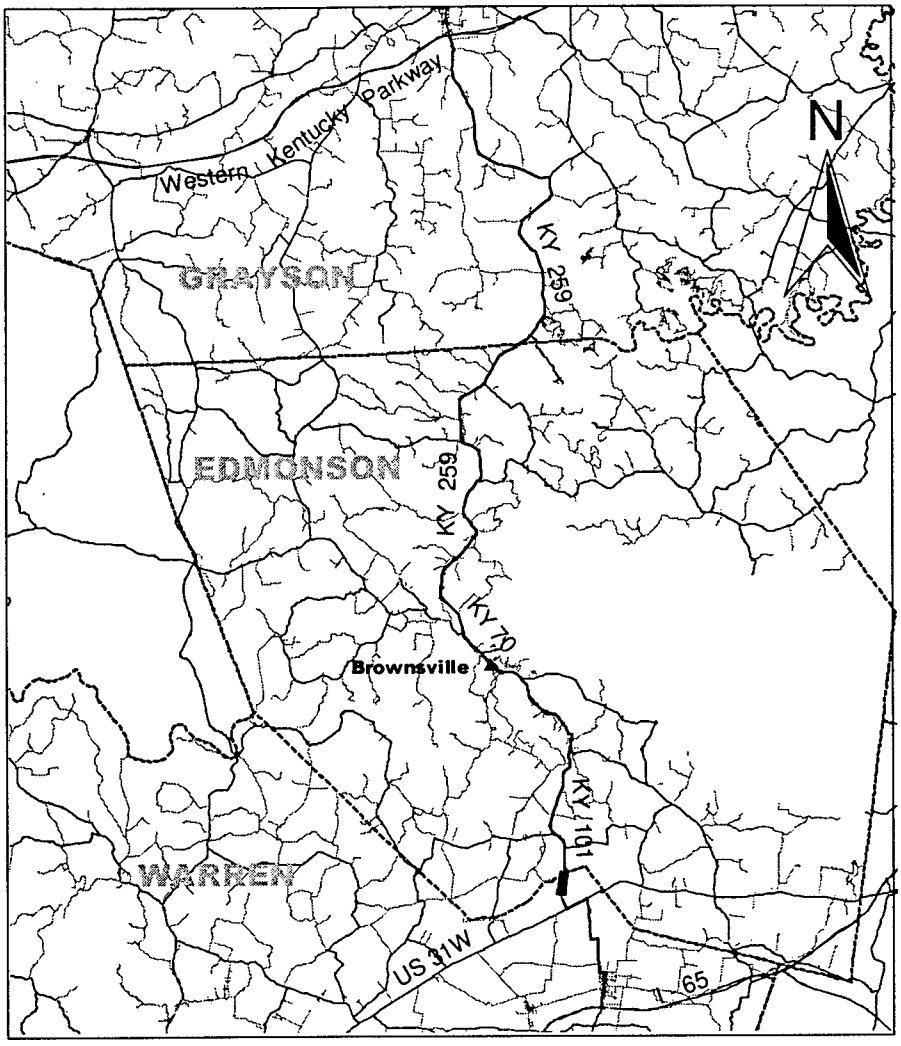


Figure 5: Clear Zone Limitations KY 259 South of Brownsville (MP 9.9)

Figure 6: Clear Zone Limitations KY 101 North of Smith's Grove South of US 31W

Figure 7: Locations of Problematic Grades



LEGEND

- Facility
- Grade Problem Areas
- Freight Access Route
- State Highway System
- Other Roads
- County Borders

Scale - 1:260000

2 0 2 4 6 Miles

5000 0 5000 10000 Meters

Figure 8: Horizontal Curves with Potential Offtracking Problems

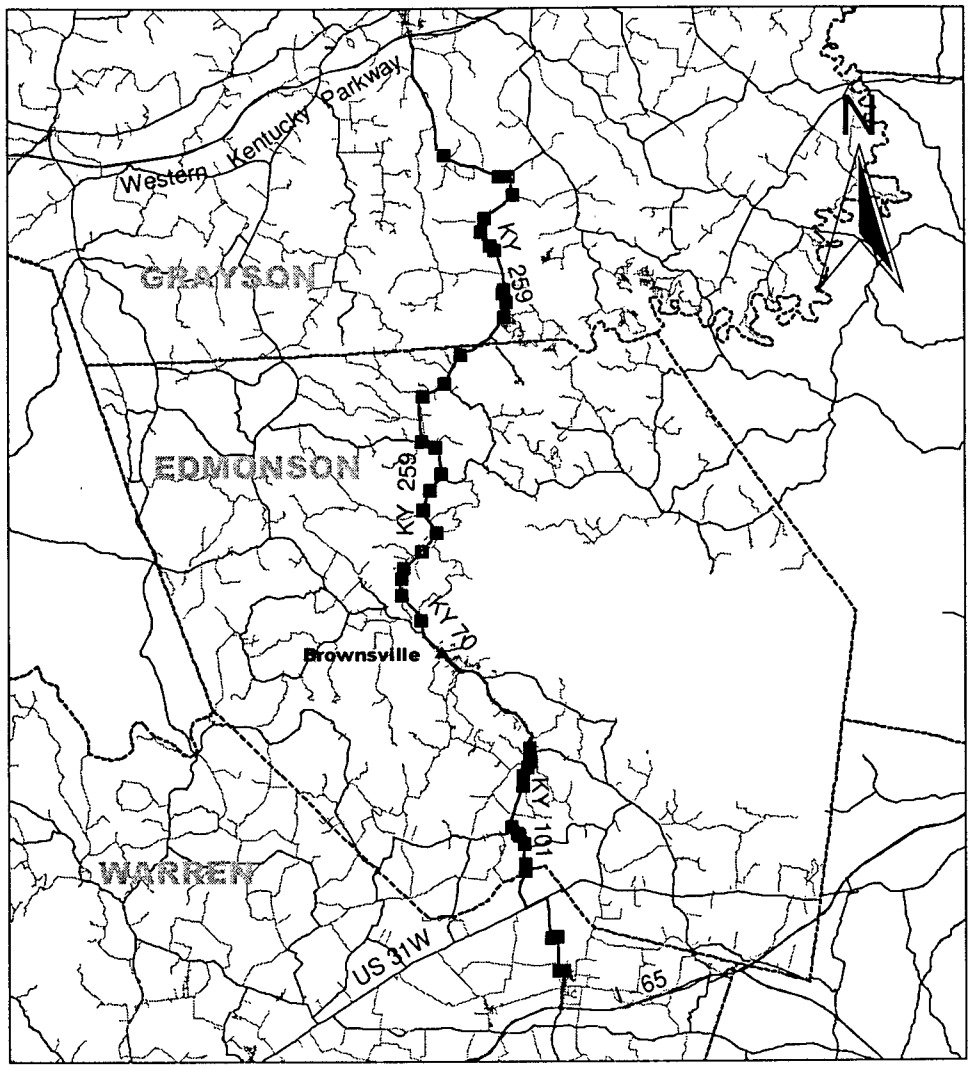
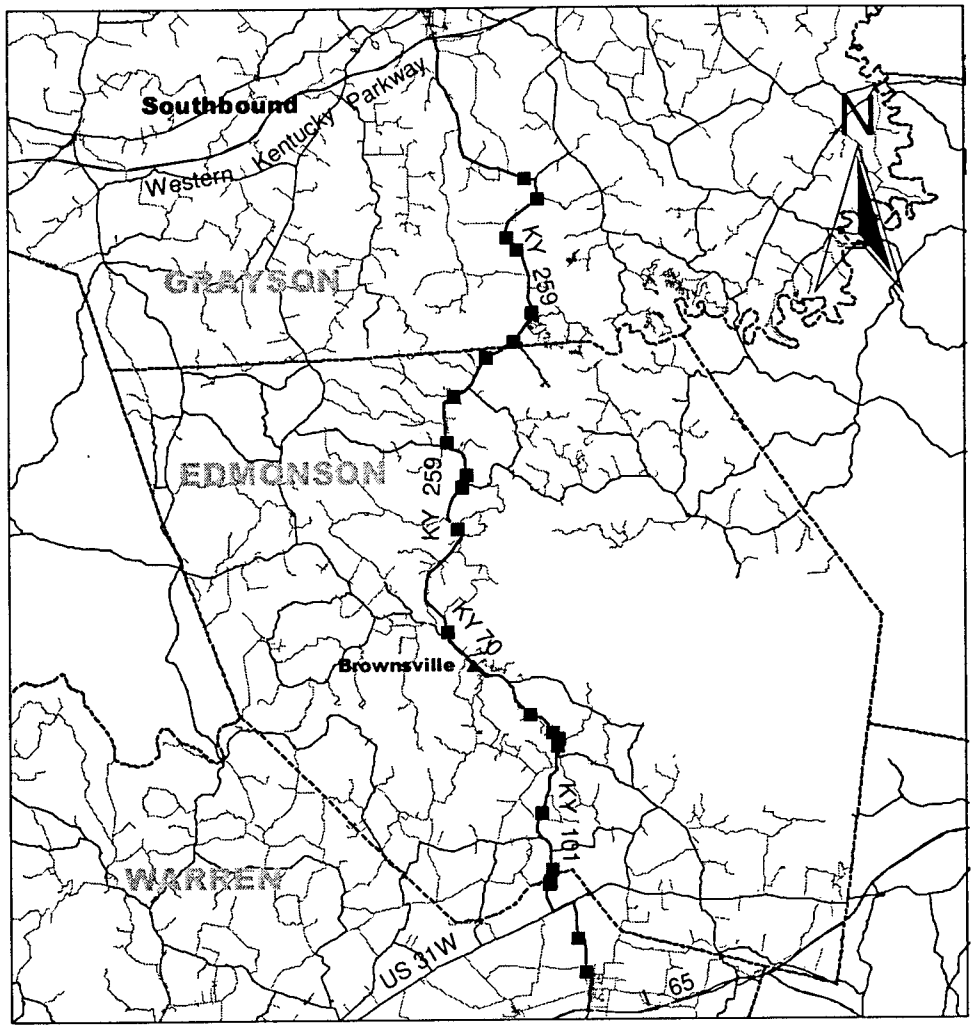


Figure 9: Horizontal Curves with "less than adequate" or "adequate" Ball Bank Indicator Angles (southbound)



LEGEND

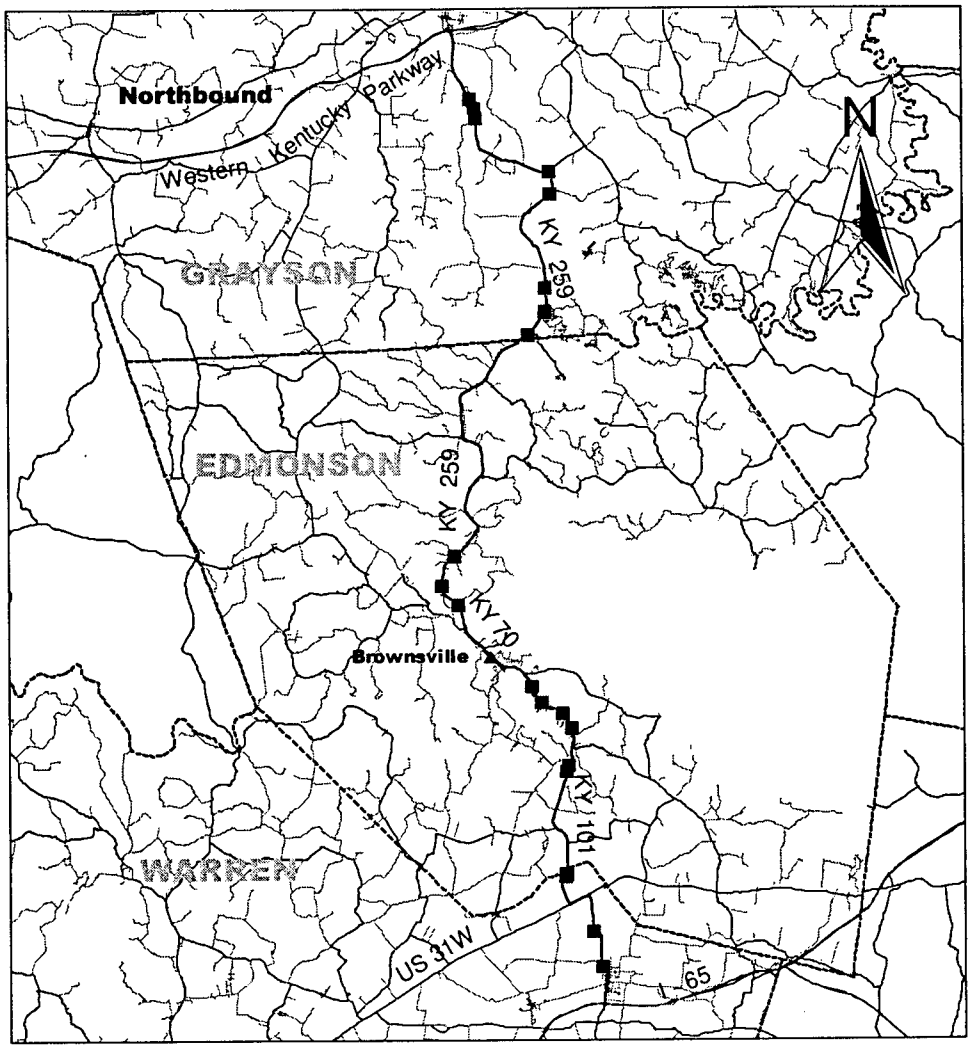
- Facility
- Ball Bank Indicator - Failed
- Acceptable Ball Bank with Speed Reduction
- Freight Access Route
- State Highway System
- Other Roads
- County Borders

Scale - 1:260000

2 0 2 4 6 Miles

5000 0 5000 10000 Meters

Figure 10: Horizontal Curves with "less than adequate" or "adequate" Ball Bank Indicator Angles (northbound)



LEGEND

- Facility
- Ball Bank Indicator - Failed
- Acceptable Ball Bank with Speed Reduction
- Freight Access Route
- State Highway System
- Other Road
- County Borders

Scale - 1:260000

2 0 2 4 6 Miles

5000 0 5000 10000 Meters

3.5 Railroad Crossings

There was one at-grade railway crossing (one track) along this route at milepoint 8.562 on KY 101 in Warren county in the town of Smith's Grove (See Figure 11). There are warning lights and gates. However, the "humped" nature of the crossing makes it inappropriate for some trucks. Therefore, this crossing is rated "less than adequate".

3.6 Bridges

The locations of the bridges along this route are shown in Figure 12. Bridge sufficiency ratings were available from the KYTC Division of Transportation Planning as shown in Table 3. Table 3 indicates how these sufficiency ratings translate into the adequacy indicators used in this project.

Figure 11: Railway Crossing in Smith's Grove

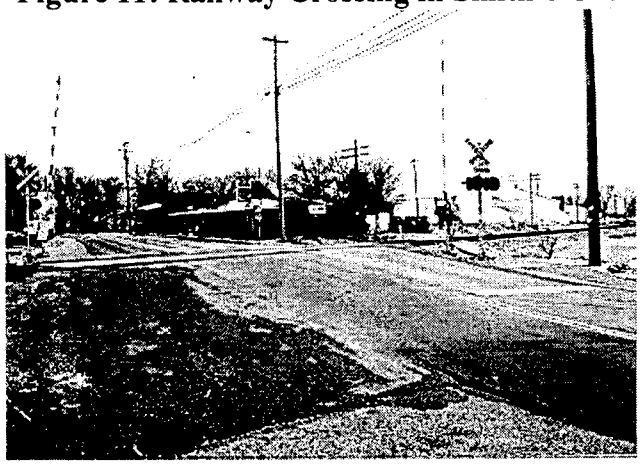


Table 3: Bridge Sufficiency Ratings

County	Route & MP	Bridge #	Sufficiency Rating	Truck Access Rating
Edmonson	KY 101 3.995	B00007	96.5	"Preferred"
Edmonson	KY 259 9.412	B00006	74.1	"Adequate"
Edmonson	KY 101 12.08	B00005	73.2	"Adequate"
Warren	KY 259 11.946	B00010	95.7	"Preferred"
Warren	KY 259 9.223	B00011	60.2	"Adequate"
Warren	KY 259 12.116	B00009	62.7	"Adequate"
Warren	KY 101 7.805	B00008	89.7	"Preferred"

3.7 Sight Distance

Only one intersection was deemed to have sight distance problems. As shown in Figure 13, KY 259 makes a 90 degree turn at an intersection with KY 226. KY 259 southbound forms a T-intersection with KY 226 and the continuation of KY 259. The southbound approach of KY 259 is stop controlled. The northbound approach of KY 259 is on a moderate upgrade, while the intersection is mid way through a horizontal curve on KY 226 and the continuation of KY 259. Sight distance problems (approximately 200 feet) exist for both the southbound and northbound KY 259 traffic. All way stop control and/or a flashing beacon might be considered for this location. Discussion with the local store owner at this corner indicated that locals feel concerned about the traffic control in this location.

Figure 12: Bridge Locations

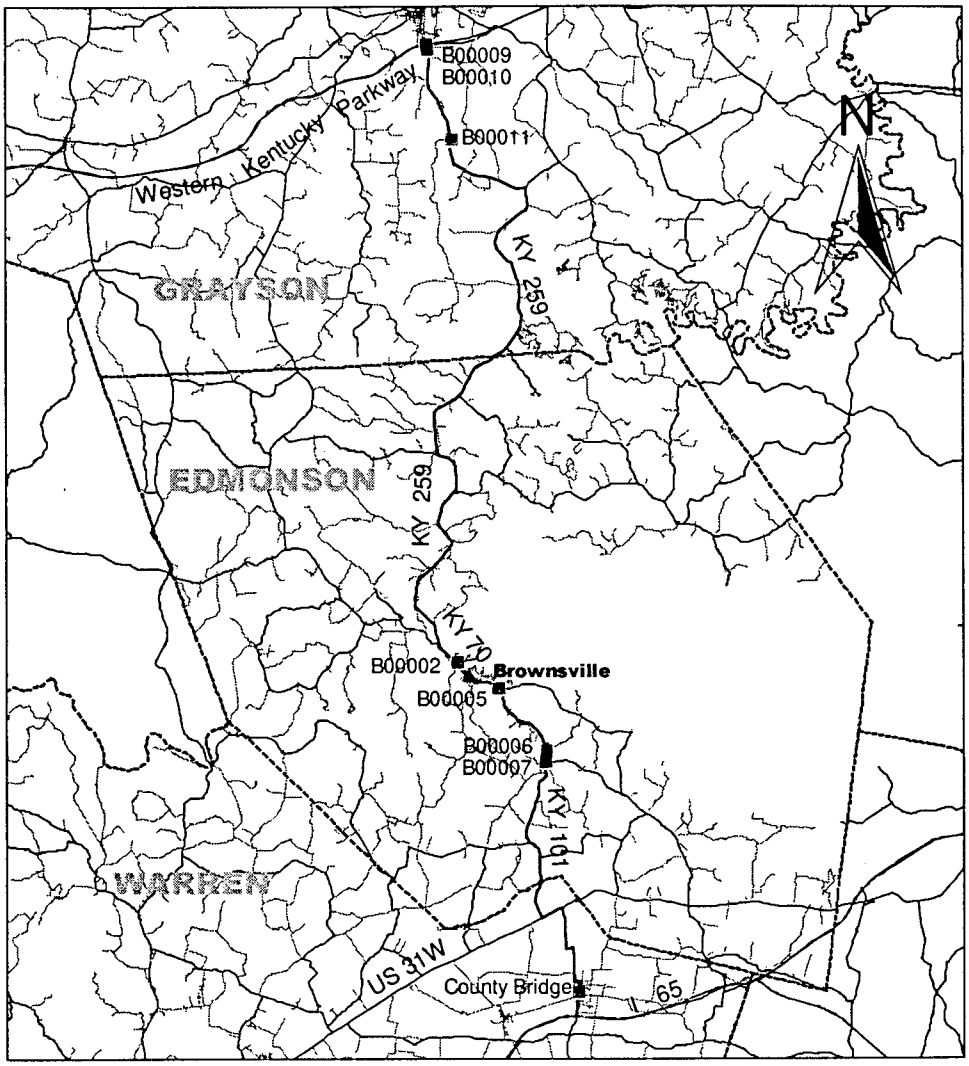
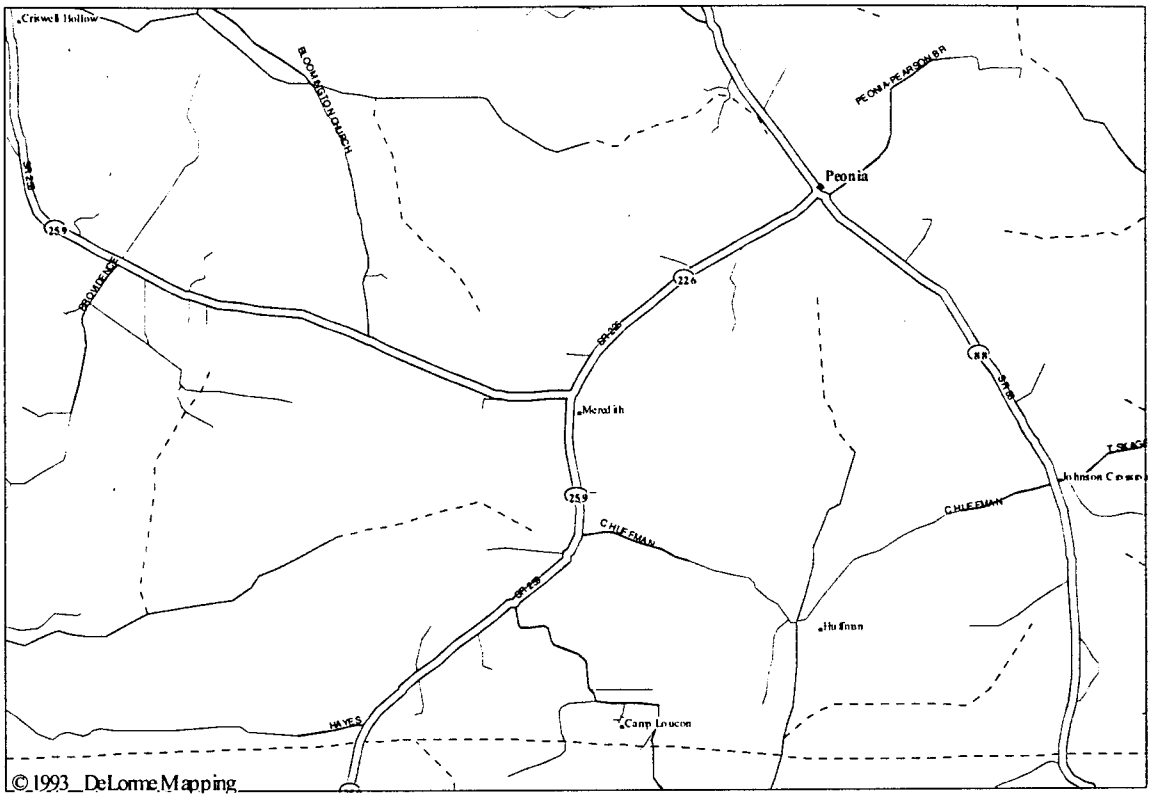


Figure 13: Intersection of KY 259 and KY 226



4.0 Composite Route Evaluation and Recommendations

4.1 Problem Truck Miles and Truck Points

In order to compare different routes to consider relative urgency of needed route improvements the features rated "preferred", "adequate" and "less than adequate" along a route are to be normalized for the number of miles, number of points and number of trucks using the route section. For this route, 7 features that were evaluated quantitatively have sections or points that are considered only "adequate" or "less than adequate". A section or point that is considered "less than adequate" is weighted two times that of an "adequate" point or section. Less than "preferred" sections are weighted by length as well as the number of trucks passing that point. Table 4 contains the total problem truck miles and total problem points for this route. The rating of this route relative to others evaluated will be reported in the final report. Truck volumes from 1994 were provided by the KYTC Division of Transportation Planning.

Table 4: Summary of Problem Truck Miles and Problem Truck Points for Entire Route

Feature	Road	Location	Points*	Length (miles)	Trucks (/day)	Truck points	Truck Miles
Offtracking**						**12396**	
Safe Speed***		Southbound				**2628**	
		Northbound				**3618**	
Lane Width	KY 101		2	5	170		1700
	KY 259		2	35	140		9800
Total							**11500**
Shoulders	KY 101		2	5	170		1700
	KY 259		2	35	140		9800
Total							**11500**
Grade	KY 101		2	2	170		**680**
Sight Distance	KY 259	KY 226	2		140	**280**	
Bridge Ratings	KY 259	B00006	1		140	140	
	KY 101	B00005	1		170	170	
	KY 259	B00011	1		140	140	
	KY 259	B00009	1		140	140	
Total						**590**	
Railway Crossing	KY 101		2		170	**340**	

*1 point for "adequate" features and 2 points for "less than adequate" features (0 points for "preferred" features not shown)

** See Appendix B for individual information and locations

*** See Appendices C and D for locations and details

4.2 Maintenance Improvement Locations

Several features noted during the site work could be addressed during routine maintenance programs by either the state or county and therefore could improve truck access without requiring major construction or expense. In this case three such items were found. First, all-way stop control could be considered for the intersection of KY 226 and KY 259 in Edmonson county. Second, a warning sign is needed just north of Smith's Grove in Warren county at one of the ninety degree turns on KY 101. Finally, several of the horizontal curves which failed the ball bank indicator angle test did not have advisory speed signs (as listed in Appendices C and D). Installation of advisory speed signs could be considered.

4.3 Overall Route Rating

In order to account for both the subjectively and objectively evaluated route features along truck routes throughout the state, a panel of UK engineers who studied the route and its features either during a site visit or by viewing a video of trucks using the routes will score the overall access on a scale of 1 through 10. The interpretation for these ratings is shown in Table 5. The route in Edmonson, Warren and Grayson counties was given an overall rating of 2 indicating that major construction would be required to improve this route.

Table 5: Interpretation of the Overall Route Rating

Overall Route Rating	Qualitative Interpretation of Rating
1	Trucks should not be using this route
2	Major construction is required to improve this route
3-5	Minor improvements are required on this route
6-8	Minor improvements could improve this route
9	Minor problems exist that do not seriously impede truck access
10	Trucks are served with reasonable access

Appendices

Appendix A: Field Site Visit Dates and Activities

May 19, 1998 -route video taped
June 11, 1998 - route characterization, data collection
July 16, 1998 - final data collection
January 3, 1999 - final pictures and travel time study

Appendix B: Travel Time Data

WK prkwy to I-65		I-65 to WK prkwy	
Pass	Time (min)	Pass	Time (min)
1	44:09:00	1	49:08:00
2	46:35:00	2	44:36:00
3	43:41:00	3	45:55:00
Avg (sec)	2688.3	Avg (sec)	2793.0

Distance = 34.3 miles

Average Speed SB 45.9 mph
Average Speed NB 44.2 mph

LOS SB = C
LOS NB = C

Appendix C: Horizontal Curves with Potential Offtracking Problems

County	Route	Milepoint	Points	Volume	Total
Edmonson	KY 101	0.1	2	170	340
Edmonson	KY 101	0.3	2	170	340
Edmonson	KY 101	0.9	2	170	340
Edmonson	KY 101	1.2	2	170	340
Edmonson	KY 101	1.3	2	170	340
Edmonson	KY 101	1.6	2	170	340
Edmonson	KY 101	2.9	2	170	340
Edmonson	KY 101	3.2	2	170	340
Edmonson	KY 101	3.5	2	170	340
Edmonson	KY 101	3.7	2	170	340
Edmonson	KY 101	3.9	2	170	340
Edmonson	KY 101	4.0	2	170	340
Edmonson	KY 101	4.1	2	170	340
Edmonson	KY 259	12.4	2	140	280
Edmonson	KY 259	13.4	2	140	280
Edmonson	KY 259	13.9	1	140	140
Edmonson	KY 259	14.2	2	140	280
Edmonson	KY 259	15.0	2	140	280
Edmonson	KY 259	15.7	2	140	280
Edmonson	KY 259	16.5	2	140	280
Edmonson	KY 259	17.1	2	140	280
Edmonson	KY 259	17.7	2	140	280
Edmonson	KY 259	18.5	2	140	280
Edmonson	KY 259	19.0	2	140	280
Edmonson	KY 259	20.3	2	140	280
Edmonson	KY 259	21.1	2	140	280
Edmonson	KY 259	22.1	2	140	280
Grayson	KY 259	1.2	1	140	140
Grayson	KY 259	1.6	1	140	140
Grayson	KY 259	1.9	1	140	140
Grayson	KY 259	2.0	1	140	140
Grayson	KY 259	3.2	1	140	140
Grayson	KY 259	3.4	1	140	140
Grayson	KY 259	3.9	2	140	280
Grayson	KY 259	4.3	2	140	280
Grayson	KY 259	5.5	1	140	140
Grayson	KY 259	6.1	2	140	280

Grayson	KY 259	6.4	1	140	140
Grayson	KY 259	8.4	1	140	140
Warren	KY 101	9.0	2	262	524
Warren	KY 101	9.2	2	262	524
Warren	KY 101	10.2	2	262	524
Warren	KY 101	10.4	2	262	524
Total					**12396**

Appendix D: Horizontal Curves that Failed the Ball Bank Reading Test (southbound)

County	Route	Advisory Speed	Approx. MP	Points*	Trucks per day	Total Points
Grayson	KY 259	45	6.4	1	70	70
Grayson	KY 259	45	5.4	1	70	70
Grayson	KY 259	45	3.8	1	70	70
Grayson	KY 259	none	3.3	1	70	70
Grayson	KY 259	45	2.0	1	70	70
Grayson	KY 259	50	1.4	2	70	140
Grayson	KY 259	45	0.4	1	70	70
Edmonson	KY 259	45	22.1	2	70	140
Edmonson	KY 259	45	20.5	2	70	140
Edmonson	KY 259	45	19.1	1	70	70
Edmonson	KY 259	45	17.8	2	70	140
Edmonson	KY 259	45	17.4	2	70	140
Edmonson	KY 259	45	16.0	1	70	70
Edmonson	KY 259	35	12.2	2	70	140
Edmonson	KY 259	none	10.9	1	70	70
Edmonson	KY 259	35	9.9	1	70	70
Edmonson	KY 259	none	9.6	2	70	140
Edmonson	KY 259	35	9.4	1	70	70
Edmonson	KY 259	35	8.8	1	70	70
Edmonson	KY 259	35	8.5	2	70	140
Edmonson	KY 259	35	7.7	1	70	70
Edmonson	KY 101	45	2.8	1	85	85
Edmonson	KY 101	55	2.5	1	85	85
Edmonson	KY 101	45	2.2	2	85	170
Edmonson	KY 101	45	0.3	2	85	170
Warren	KY 101	40	12.7	2	11	22
Warren	KY 101	40	12.6	2	11	22
Warren	KY 101	40	12.6	2	11	22
Warren	KY 101	none	10.5	1	11	11
Warren	KY 101	15	9.2	1	11	11
Total						**2628**

*Note that a curve with an advisory speed receives one point for being "adequate" while a curve that fails the ball bank indicator receives two points for being "less than adequate".

Appendix E: Horizontal Curves that Failed the Ball Bank Reading Test (northbound)

County	Route	Advisory Speed	MP	Points*	Trucks per day	Total Points
Warren	KY 101	15	10.5	1	11	11
Warren	KY 101	40	9.2	1	11	11
Warren	KY 101	40	12.7	2	11	22
Warren	KY 101	40	12.6	2	11	22
Warren	KY 101	none	12.6	2	11	22
Edmonson	KY 101	45	3.2	1	85	85
Edmonson	KY 101	35	3.4	1	85	85
Edmonson	KY 259	35	0.1	1	70	70
Edmonson	KY 259	45	0.4	1	70	70
Edmonson	KY 259	35	0.6	2	70	140
Edmonson	KY 259	none	1.1	2	70	140
Edmonson	KY 259	25	1.3	1	70	70
Edmonson	KY 259	25	1.6	2	70	140
Edmonson	KY 259	35	1.8	2	70	140
Edmonson	KY 259	none	2.1	2	70	140
Edmonson	KY 259	35	2.4	1	70	70
Edmonson	KY 259	none	2.6	1	70	70
Edmonson	KY 259	none	3.3	1	70	70
Edmonson	KY 259	45	3.4	1	70	70
Edmonson	KY 259	35	4.4	2	70	140
Edmonson	KY 259	none	5.5	2	70	140
Edmonson	KY 259	35	6.4	1	70	70
Edmonson	KY 259	45	6.9	2	70	140
Edmonson	KY 259	45	8.5	2	70	140
Edmonson	KY 259	45	9.8	2	70	140
Edmonson	KY 259	45	10.3	2	70	140
Edmonson	KY 259	none	11.1	1	70	70
Edmonson	KY 259	45	11.7	1	70	70
Edmonson	KY 259	45	12.8	2	70	140
Edmonson	KY 259	45	13.6	2	70	140
Edmonson	KY 259	none	14.6	2	70	140
Grayson	KY 259	50	0.3	1	70	70
Grayson	KY 259	40	1.2	2	70	140
Grayson	KY 259	50	1.9	1	70	70
Grayson	KY 259	50	5.3	1	70	70
Grayson	KY 259	none	6.1	1	70	70

Grayson	KY 259	50	9.4	1	70	70
Grayson	KY 259	50	9.7	1	70	70
Grayson	KY 259	none	10.0	2	70	140
Total						**3618**

*Note that a curve with an advisory speed receives one point for being "adequate" while a curve that fails the ball bank indicator receives two points for being "less than adequate".