

TRUCK ROUTE ACCESS EVALUATION

Paradise Power Plant
Muhlenberg County
Site # 1113

Report No. KTC-98-25

“Freight Movement and Intermodal Access in Kentucky”
Project No. SPR 98-189

by

Kenneth R. Agent

with

Brian Aldridge
Lisa Aultman-Hall
David Cain
Nicole Lefever
Nikiforos Stamatidis
Joel Weber



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

September 1998

Table of Contents

1.0 Introduction	1
2.0 Trucks Routes in Use	1
3.0 Route Data Collection and Evaluation	4
3.1 Traffic Operations and Level of Service	4
3.2 Accident History	4
3.3 Cross Section Features	7
3.4 Curvature Features	7
3.5 Railroad Crossings	11
3.6 Bridges	11
3.7 Sight Distance	11
3.8 Other Route Features	13
4.0 Route Evaluation and Recommendations	13
4.1 Problem Truck Miles and Truck Points	13
4.2 Maintenance Improvement Locations	13
4.3 Overall Route Rating	15

Appendices

Appendix A: Field Site Visit Dates and Activities

Appendix B: Phone Surveys Conducted with Facility

List of Tables

Table 1: Route Features and Method of Evaluation	5
Table 2: Accident Types along Muhlenberg County Truck Route	7
Table 3: Summary of Problem Truck Miles and Points for Entire Route	14
Table 4: Interpretation of the Overall Route Rating	15

List of Figures

Figure 1: Location of Truck Generating Site	2
Figure 2: KY 176	3
Figure 3: US 431	3
Figure 4: Accident Locations	6
Figure 5: Lane Widths	8
Figure 6: Shoulder Widths	9
Figure 7: Grade Adequacies	10
Figure 8: Left turn from Western Kentucky Parkway to US 431	11
Figure 9: Bridge Locations	12
Figure 10. Mud Tracked from Haul Road to KY 176	14

1.0 Introduction

The Freight Movement and Intermodal Access in Kentucky Study (SPR 98-189) is being conducted on behalf of the Kentucky Transportation Cabinet (KYTC). There are two major objectives of the study: evaluation of the access for trucks between intermodal or other truck generating sites and the National Highway System (NHS); and furthering the understanding of freight commodity flows throughout the state. This report summarizes the access evaluation for The Paradise Power Plant facility located in Muhlenberg County in the Pennyriple Area Development District (ADD) and KYTC Highway District # 2. The location of the site is shown in Figure 1. Work on other specific sites as well as the freight commodity flow task are on-going and are documented elsewhere. The sites to be evaluated were selected from two existing databases (a truck facility survey from 1994 and the intermodal facility inventory) based on ADD and KYTC Highway District 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. The Paradise Power Plant was recommended by Highway District # 2.

The site was visited two times for data collection and video recording as listed in Appendix A. The major facility in the area is the power plant. Reed Materials is located along KY 176 near Drakesboro. The surrounding area is generally rural.

A phone survey of the facility manager was conducted early in the study process, and it showed about 120 trucks per day accessing the Paradise Power Plant. However, a 24-hour traffic count taken in August 1998 by KYTC recorded 437 trucks on KY 136 so this volume was used. The total traffic volume was 1,943 giving 22.5 percent trucks. The site trucks are generally semi tractor trailers which were five axle coal trucks with a 32-foot trailer. The largest trucks are six axle lowboys. The phone survey information can be found in Appendix B.

2.0 Trucks Routes in Use

There is currently only one primary route for trucks to reach the National Highway System. The Paradise Power Plant is located at the west end of KY 176 on the Green River. The trucks travel from an access road to the power plant west on KY 176 (about 3 miles) to US 431 and then travel north to the Western Kentucky Parkway (about 6 miles) which is a total distance of about 9 miles (as shown in Figure 1). There is a distance of about 2 miles from the access road to the end of KY 176 at the power plant. Both KY 176 (Figure 2) and US 431 (Figure 3) are two lane roadways through a rural area except where they intersect in Drakesboro.

A few potential problems were listed as a result of the phone survey. The problems noted were: 1) the haul road, which is a private road parallel to KY 176, was poorly maintained and there was poor visibility at its intersection with KY 176 for drivers leaving the plant and 2) the bridge on KY 176 near Drakesboro was in need of repair. An additional comment from the survey was that truck speeds contributed to safety concerns.

Figure 1: Location of Truck Generating Site

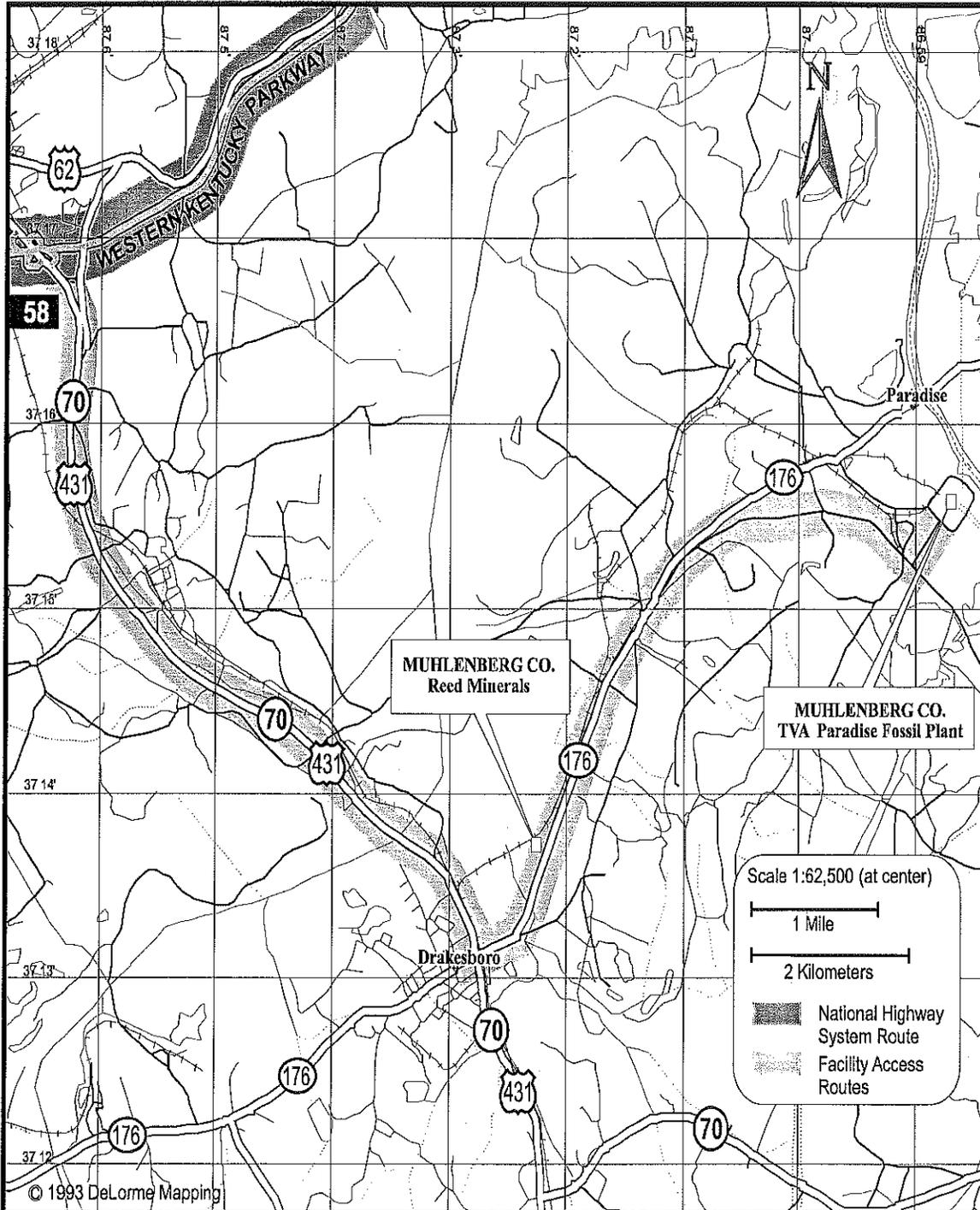


Figure 2: KY 176



Figure 3: US 431



3.0 Route Data Collection and Evaluation

The route features that were 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. This was done since “preferred” type sections and points do not contribute to an increase in the problem truck points or miles so there was no need to collect data for those locations.

3.1 Traffic Operations and Level of Service

The survey of the users of this site indicated that there were no operational problems or concerns. Observations during the site visit confirmed this opinion. Thus, the route was considered to operate at an acceptable level. No level of service calculations were necessary.

3.2 Accident History

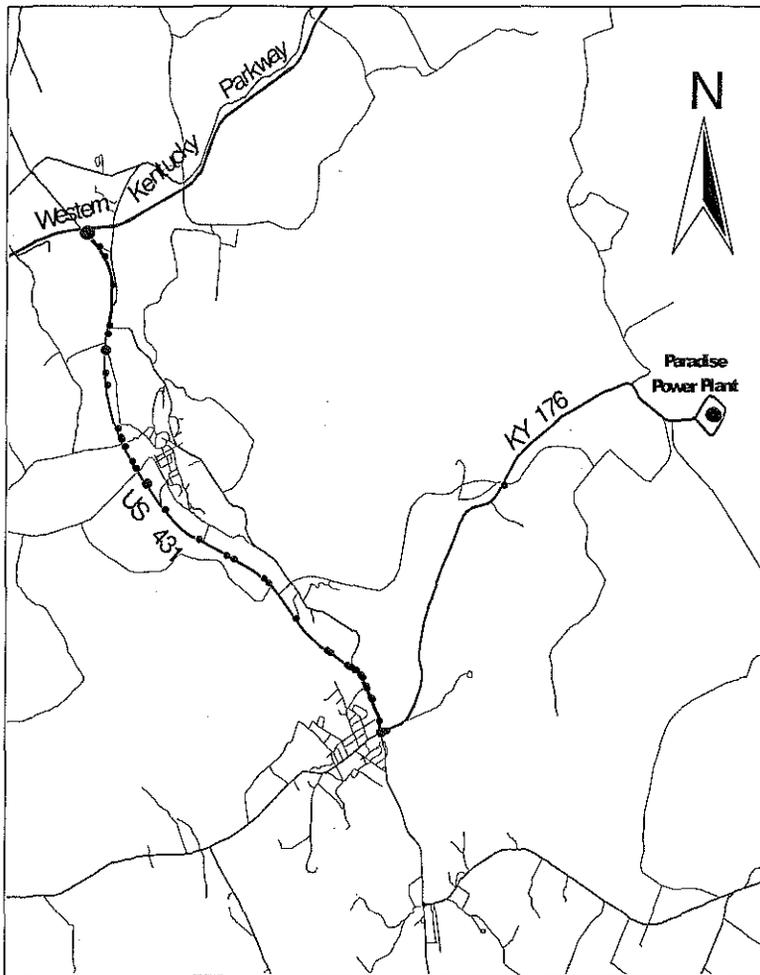
In 1997 the Kentucky Transportation Center studied all state-maintained roads throughout Kentucky and determined average truck accident rates for different types of road sections. The three-year period of 1994 through 1996 was used. A critical accident rate was then calculated using the average accident rate for a specific highway type along with an assumed level of statistical significance and exposure (vehicles miles traveled). Two sections along this Muhlenberg County truck route had a truck accident rate higher than the critical rate for that particular highway type. One section was between milepoints 11.458 and 12.082 on US 431. Five truck accidents occurred on this section during the three-year period with a critical rate factor of 1.15. The intersection with KY 176 is at milepoint 11.467. Of the five accidents, three were rear end collisions and two were an opposite direction sideswipe. The other section was on US 431 between milepoints 16.609 and 17.484. Six truck accidents occurred on this section giving a critical rate factor of 1.74. Three of the accidents in this section occurred at milepoint 17.484 which was at the Western Kentucky Parkway. Of the six accidents, four involved a rear end collision while the remaining two involved a same direction sideswipe.

Figure 4 shows the locations of all accidents during the years 1994, 1995 and 1996. The two sections with a critical accident rate are identified. A summary of the accidents along the entire truck route (for all roads not just state-maintained roads) is shown in Table 2 for the same three year period. Truck accidents represent a significant portion of the overall accidents along this route. The 18.7 percent of accidents involving trucks compares to 9.0 percent trucks along US 431. Of the 14 accidents, nine involved a rear end collision while two were a same direction sideswipe and two were an opposite direction sideswipe. The fatal accident was an opposite direction sideswipe.

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 4: Accident Locations (1994-1996)



LEGEND

- Facility
- Accidents: 1-2
- Accidents: 3-4
- Accidents: 5-9
- Accidents: 10-13
- Critical Accident Rate
- Freight Access Route
- State Highway System
- Other Roads

Scale - 1:80000



Table 2: Accident Types along Muhlenberg County Truck Route

	<i>Non-Truck Accidents</i>	<i>Truck Accidents</i>	<i>Percent Trucks</i>
Fatal Accidents	0	1	100.0
Injury	21	5	19.2
Intersection	22	4	15.4
Total	61	14	18.7

3.3 Cross Section Features

Figures 5 and 6 illustrate the sections of the route having different widths of lanes and shoulders. While the 12-foot lanes on US 431 are considered “preferred” for trucks, the 11-foot lanes on KY 176 are only rated as “adequate”. A 0.4-mile section of US 431 at the Western Kentucky Parkway has a 10-foot paved shoulder which is considered “preferred”. The 1.5-foot paved shoulders on the remaining portion of US 431 and the 2-foot paved shoulder on KY 176 are considered “less than adequate”.

The clear zone on US 431 is limited (trees, embankments) with a little more clear zone on KY 176. There are two bridges on US 431 and one on KY 176 without a full width shoulder.

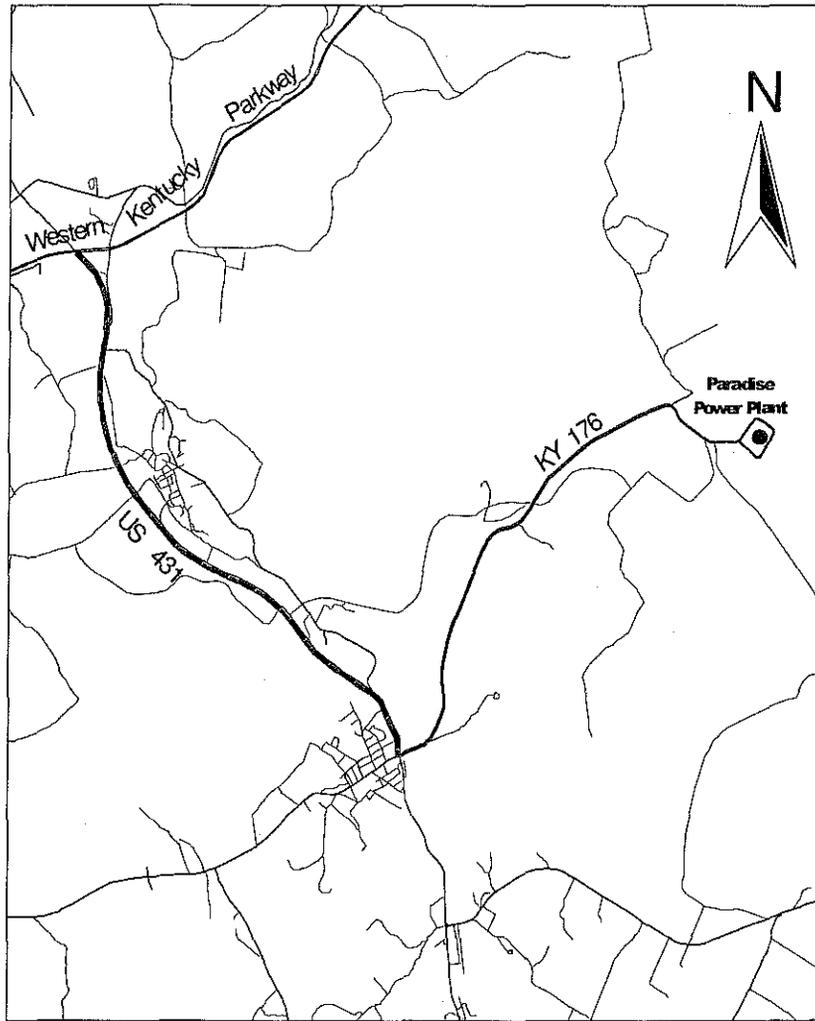
3.4 Curvature Features

There were no curves on the route which would result in offtracking into the opposing lane. There were curve signs with no advisory speed. These curves could be driven at the speed limit with a ball bank reading of less than 12 degrees so no problems related to safe speeds on curves are expected.

Grades are considered problematic if they cause trucks to slow excessively. Observations showed there were two grades on US 431 which caused trucks to slow (Figure 7). One section between milepoints 16.5 and 16.9 could cause a speed reduction of 6 to 10 mph (“adequate” rating) while the other grade around milepoint 13 would cause a reduction of less than 5 mph (“preferred”). There were no problem grades on KY 176 between US 431 and the plant haul road.

The turning radius from the Western Kentucky Parkway to US 431 was determined as well as the radius at the intersection of US 431 and KY 176. At the parkway, the turn is made onto a four-lane section with trucks turning typically into the right southbound lane (Figure 8). The left turn from southbound on US 431 to eastbound on KY 176 has a radius of about 75 feet and can be made without crossing into the opposing lane although a few trucks were observed crossing into the opposing lane. The radius has been widened for the right turn from KY 176 westbound to US 431 northbound to allow this turn to be made without crossing into the opposing lane.

Figure 5: Lane Widths



LEGEND

- Facility
- Lane Width: 11 Feet
- Lane Width: 12 Feet
- Freight Access Route (No Lane Width Data)
- State Highway System
- Other Roads

Scale - 1:80000

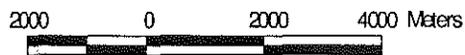
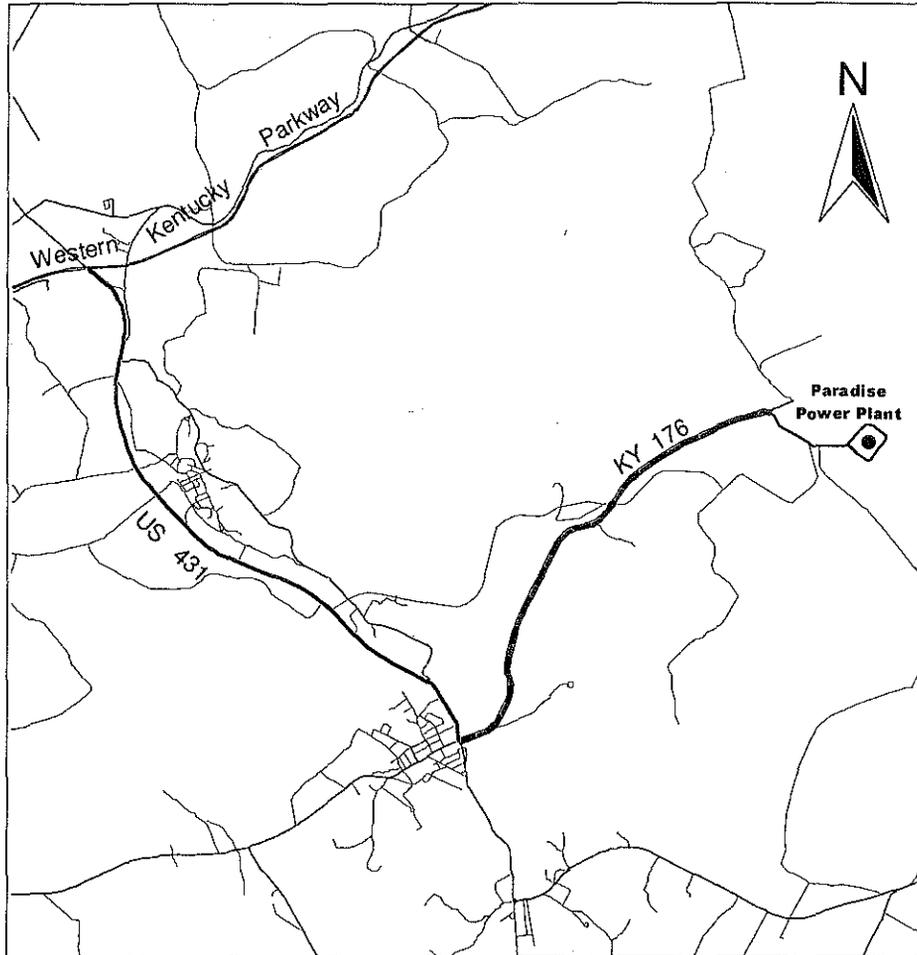


Figure 6: Shoulder Widths



LEGEND

- Facility
- Shoulder Width: 1.5 Feet
- Shoulder Width: 2 Feet
- Shoulder Width: 10 Feet
- Freight Access Route (No Shoulder Width Data)
- State Highway System
- Other Roads

Scale - 1:80000

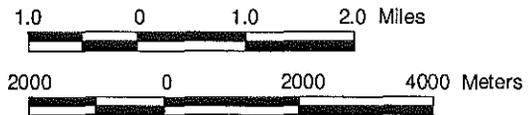
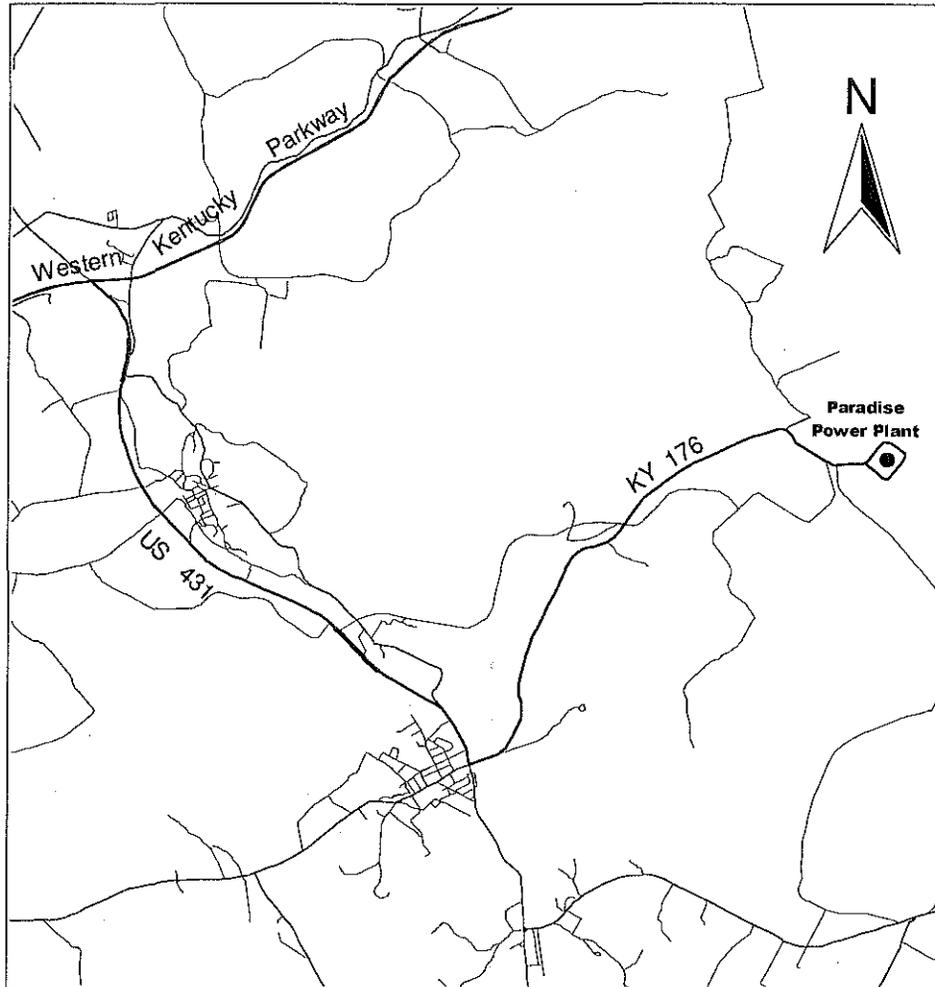


Figure 7: Grade Adequacies



LEGEND

- Facility
- Grade Causing Speed Reduction
- Freight Access Route
- State Highway System
- Other Roads

Scale - 1:80000

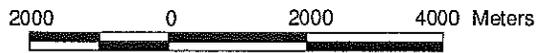


Figure 8: Left turn from Western Kentucky Parkway to US 431



3.5 Railroad Crossings

There was one at-grade railroad crossing on US 431 and one on KY 176. Both crossings had gate protection and no sight distance or surface condition problems were observed. The crossings would be rated as “preferred”.

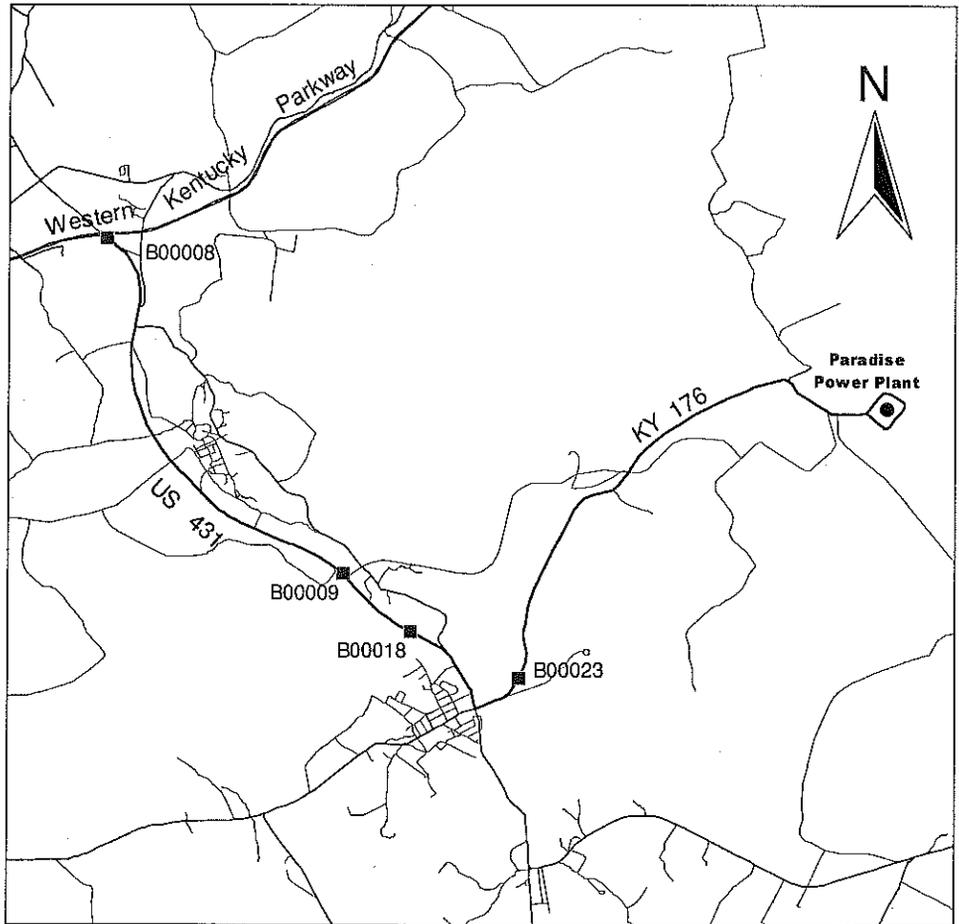
3.6 Bridges

The locations of the four bridges are shown on Figure 9. The bridge on US 431 near milepoint 17.5, at the Western Kentucky Parkway, has a sufficiency rating (provided by the Division of Operations of the KYTC) of 73.5 (out of a possible 100) which is considered as “adequate”. The bridge on US 431 at milepoint 13.3 has a sufficiency rating of 88.6 which is considered “preferred” while the bridge at milepoint 12.4 has a rating of 64.5 which is considered “adequate”. The bridge on KY 176 at milepoint 8.5 has a sufficiency rating of 89 which is “preferred”.

3.7 Sight Distance

There were no sight distance problems at the intersections of the Western Kentucky Parkway and US 431 and at US 431 and KY 176. The only potential problem would be for trucks exiting the private haul road to the power plant to observe westbound traffic on KY 176. Unloaded trucks would be exiting the haul road.

Figure 9: Bridge locations



LEGEND

- Facility
- B00023 Bridges - Bridge Number
- Freight Access Route
- State Highway System
- Other Roads

Scale - 1:80000



3.8 Other Route Features

Trucks were observed exiting and entering the Western Kentucky Parkway from US 431. Numerous brakelight conflicts were noted for vehicles southbound on US 431 from trucks turning left from the exit ramp to proceed southbound on US 431.

Site visits were made after a rain had occurred. Tracking of mud from the haul road onto KY 176 was noted.

The pavement condition on US 431 was good. The pavement on KY 176 would be described as poor with numerous patches.

4.0 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 were normalized for the number of miles, number of points, and number of trucks using the route section. In the case of this Muhlenberg County route, four features (lane width, shoulders, grades, and bridges) that were evaluated quantitatively have sections or points that are considered only "adequate" or "less than adequate." The turning radii at two intersections were borderline but was not included since truck drivers could make the turn without encroaching into other lanes. A section or point that is considered "less than adequate" is weighted two times that of an "adequate" point or section. Sections which are not rated as "preferred" are weighted by length as well as the number of trucks on the section.

Table 3 contains the total problem truck miles and total problem points for lane width, shoulders, grades, and bridges along this route. The rating of this route relative to others evaluated will be reported in the final report.

4.2 Maintenance Improvement Locations

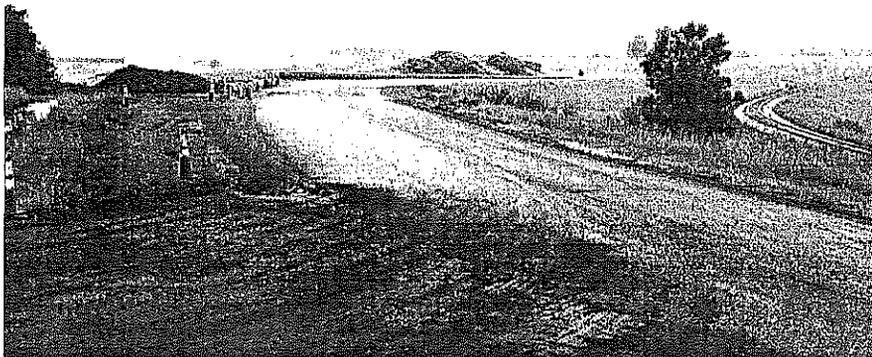
This type of improvement could be addressed during routine maintenance programs by either the state of county and therefore could improve truck access without requiring major construction or expense. A potential maintenance problem was observed on KY 176 at the haul road. The haul road is not paved and debris is tracked on the road. An observation after a heavy rain found a substantial amount of mud tracked onto KY 176 from the haul road (Figure 10).

Table 3: Summary of Problem Truck Miles and Points for Entire Route

Feature	Road	Location	Points*	Length (miles)	Trucks (/day)	Truck-points	Truck-miles
Lane Width	KY 176	Length	1	2.7	437		1,180
Shoulders	US 431	WK Parkway to KY 176	2	5.6	437		4,894
	KY 176	Length	2	2.7	437		2,360
Total							7,254
Bridge ratings	US 431	MP 17.5	1		437	437	
	US 431	MP 12.4	1		437	437	
Total						874	
Grade	US 431	MP 16.5-16.9	1	0.4	437		175
TOTAL						874	8,609

*1 point for “adequate” and 2 points for “less than adequate” features

Figure 10: Mud Tracked from Haul Road to KY 176



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 rated the overall access on a scale of 1 through 10. The interpretation for these ratings is shown in Table 4. The route in Muhlenberg County between the Western Kentucky Parkway and Paradise Power Plant (on US 431 and KY 176) was given an overall rating of 6 indicating that minor improvements could improve the truck access along this route.

Table 4: 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 <u>required</u> on this route
6-8	Minor improvements could <u>improve</u> 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

January 15, 1998 - initial site visit, facility identification, photographs, and video taping

May 26, 1998 - field data collection

Appendix B: Phone Surveys Conducted with Facility

<u>Facility ID</u>	<u>Facility Name</u>	<u>Location / City</u>	<u>County</u>	<u>ADD</u>
1113	Paradise Fossil Plant	Drakesboro	Muhlenbrg	Pennyrile
<u>Contact Name</u>	<u>Title</u>	<u>Phone</u>	<u>Fax</u>	
David Simms		502-476-3490	502-476-3493	

1. Is the location of your facility on the map correct?
2. Our information shows about 120 trucks per day access your facility. Is that correct?
If not, fill in correct volume. Yes
3. Is the truck traffic to and from your facility seasonal or mostly constant? Constant
4. *(If truck traffic is seasonal)* Is the trucks/day for the peak season?
5. What is the most common size truck operating at your facility? 32' Semitrailer, Coal 5-axles
6. What is the largest truck operating at your facility? 6-Axles (lowboy)
7. What type of freight or commodity is shipped, and is incoming and outgoing freight different?
(one may be an empty truck) In - Coal 90%, rock (limestone) 10%
Out - Fly ash, tri-axle 7:00 a.m. - 3:30 p.m., 5 days a week
8. Does the truck traffic peak at specific times of the day? (e.g., out in the morning and return in the afternoon) Fly ash 4-axle out 7:00 a.m. - 3:30 p.m., 5 days a week
9. What traffic congestion and delay problems along the routes are you aware of, or feel need improvement?
Location (route segment, intersection, etc.) Time and Day of Week
Haul road parallel to KY 176 poorly maintained intersection with KY 176.
10. Where do trucks at your facility go to and come from? (This may be an interstate, cities, general direction-N,S,E,W)
KY 176 to US 431 to WK Pkwy. (All trucks) (truck depot at Beachmont).
To W. KY mine (Madisonville area) (not Litchfield).
11. Do you have any other problems or concerns along the route you would like us to consider?
Leaving plant - poor visibility, bridge near Drakesboro bad repair.
Truck speeds contribute to safety concerns.
12. Would you like a copy of the final report (roadway/route evaluation ???) Yes

NOTES/COMMENTS: