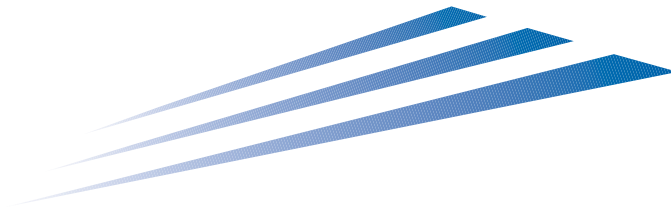


KENTUCKY TRANSPORTATION CENTER

College of Engineering

**EVALUATION OF US 119 PINE MOUNTAIN SAFETY IMPROVEMENTS
(Interim Report)**



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Kentucky Transportation Cabinet
Commonwealth of Kentucky

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EXECUTIVE SUMMARY

The safety improvement project for a section of US 119 across Pine Mountain in Letcher County was initiated as an interim effort to address safety issues related to roadway geometrics and specific problems related to truck traffic. The project involves sections of the road being improved over a 7.2-mile length at a cost of approximately \$36 million.

The Transportation Center at the University of Kentucky was requested to perform an evaluation of the safety improvement project on US 119 to determine whether the types of improvements undertaken have affected the overall safety of the roadway. Specific objectives were as follows; 1) to determine the effects of a ban on truck traffic that was implemented in March 2001, 2) to determine if the types of improvements undertaken as part of the project are applicable to other locations, and 3) to determine if the use of flexible design was successful by allowing the Transportation Cabinet to remove the truck restriction by permitting trucks with dimensions up to the WB-50 design to travel across the mountain and be able to track within their own lane. This interim report documents crash data prior to and after implementation of the truck ban and during construction.

The section of US 119 where the truck ban was placed had a crash rate of 430C/100MVM prior to the start of the truck ban with a critical rate factor (CRF) of 1.31 for this type of road and traffic volume. The adjacent section of US 119, which has a similar cross section but less grade and sharp curvature, had a rate of 161 C/100MVM which is less than the statewide average. The injury crash rate for the truck ban section was 91 C/100MVM which is almost identical to the statewide average. There were no fatal crashes in this section. About 61 percent of the crashes in this section have involved a truck (compared to a statewide percentage of about 7 percent). Over the study period about 59 percent of the truck crashes have involved an opposite direction sideswipe with about 37 percent a single vehicle crash. The truck ban reduced the total number of crashes by about 38 percent and the number of truck crashes by 55 percent in the two years after the start of the ban. The reductions in the first year after the start of the reconstruction, along with the truck ban, were 62 percent in total crashes and 86 percent in truck crashes. There have been 15 truck crashes in the truck ban section after the start of the ban with 10 involving an out-of-state driver. The locations with the highest number of truck crashes were at locations with a sharp curve.

1.0 INTRODUCTION AND BACKGROUND

The possibility of improvements to the section of US 119 in Letcher County crossing Pine Mountain had been discussed and studied on several occasions for nearly 30 years prior to initiating the current project that has the goal of improving safety by addressing roadway geometrics. Cost estimates had been prepared in 1991 as part of a submittal to the Appalachian Development Highway System (ADHS) representing the alternative to tunnel through Pine Mountain. Another cost estimate was prepared in 1997 outlining an alternative to pursue relocating the roadway along the existing corridor.

The Pine Mountain Crossing Task Force (PMCTF) was formed in 1997 to represent public interests and provide recommendations in the development of reconstruction alternatives for US 119 over Pine Mountain. The Task Force was comprised of local and regional elected officials, resource agencies, and environmental groups. After meetings in 1997 and 1998, no consensus could be reached and the Task Force became inactive. During the summer of 2000, additional public pressure led to reviving the Task Force with the addition of 15 members representing a citizens advisory group resulting in a total of 41 members. To ensure that a “publicly owned project” was developed, the Task Force was given the following mission:

To jointly and collectively engage in a series of open and honest conversations that address the challenges of providing a safe, environmentally sound, and fiscally responsible roadway from Oven Fork to Whitesburg in Letcher County. These conversations and those engaged in them will strive to respect the differing views and opinions of the individuals participating, while at the same time working toward a common goal.

In addition, the Task Force was given the assignment to recommend an alignment (by consensus) that was sensitive to both the human and natural environment. There were three alternatives evaluated and given consideration as a means of creating an improved and safe US 119 across Pine Mountain. Those alternatives were as follows:

1. Reconstruct US 119 along the existing alignment (Reconstruct Alternative)
2. Relocate US 119 to a corridor near the existing alignment (Relocate Alternative)
3. Tunnel through Pine Mountain under the existing road (Tunnel Alternative)

A series of Task Force meetings were conducted and facilitated by the Kentucky Transportation Cabinet (KYTC). There were also several individual meetings involving the Transportation Cabinet project team, resource agencies, and various local and state elected officials. As a result of the meetings, the alternative to tunnel through Pine Mountain was determined to be the only long-term solution. This conclusion was confirmed with the signing of a resolution by members of the Task Force on July 10, 2001. This resolution was presented to the Transportation Cabinet on July 24, 2001; endorsed by the Cabinet, and announced by means of a Public Notice in local newspapers.

Provided below are additional details which supported justification for the alternative to tunnel through Pine Mountain.

Relocate Alternative:

- The Public Involvement process was not complete at the time of the 1997 ADHS Cost Estimate.
- The stakeholders (Kentucky Nature Preserves, Kentucky Department of Fish and Wildlife, local citizens, and elected officials) made it clear that the Relocate Alternative's impact was unacceptable to land owned by the Kentucky State Nature Preserves Commission (KSNPC) and the Pine Mountain Wildlife Management Area (PMWMA).
- Proposed encroachments of open cuts for the Relocate Alternative into the KSNPC and PMWMA areas would result in the potential loss of various endangered species and plants.
- Proposed waste areas would damage an untouched watershed or the waste areas would have to be relocated, resulting in an increase in cost by more than \$30,000,000.
- The Relocate Alternative had a minimum design speed of 50 MPH but still had many curves and vertical grades near 8 percent that would greatly slow any truck traffic, hindering economic development in the area.
- It was predicted that trucks crossing Pine Mountain would be unable to attain travel speeds of 50 mph as required by Appalachian Regional Commission (ARC) criteria.
- The Task Force concluded that the Tunnel Alternative's minimal impact to the PMWMA and no impact to the KSNPC property, in combination with safety and economic benefits, was preferred. As a result, the Task Force voted to eliminate the Relocate Alternative on April 17, 2001.
- The stakeholders felt that the safety and economic benefits of the Tunnel Alternative were preferred over the other alternatives.

Reconstruct Alternative:

- Input from stakeholders during the public involvement process made it clear that it was desirable to have roadway with safety features as a higher priority than the Reconstruct and Relocate Alternatives were perceived to provide.
- The Reconstruct Alternative had no design speed and basically provided an improvement that constructed passing lanes where feasible and reconstructed all curves so that semi-trucks could stay in their lane as they traversed curves. As a result, the anticipated travel speed on several portions of this roadway would be well under the required ARC criteria of 50 mph.

- The Reconstruct Alternative would result in open face cuts creating undesirable impacts on the Kentucky Nature Preserves and the Pine Wildlife Management Area.
- Proposed waste areas as part of the Reconstruct Alternative would have undesirable impacts and result in a cost of more than \$15,000,000.
- The proposed geometrics were perceived by the stakeholders as not only less safe than the Tunnel Alternative but also a continued barrier for economic opportunities.

Geotechnical Issues:

- Geotechnical investigations made after the 1997 ADHS Cost Estimate made it clear that open cuts on the south side of Pine Mountain would need to have much flatter slopes than originally estimated.
- Although Pine Mountain's unique steeply dipping and fragmented rock structure was known and considered during development of the Relocate Alternative, the core drilling conducted in early 2000 revealed a much steeper dip in rock structure than anticipated. The potential consequence was even greater impacts to land owned by the KSNPC on the south side of Pine Mountain. Results from geotechnical investigations indicated that the slope would extend over 2,000 feet before it could be matched to the original ground.
- It was predicted that there was an extremely high risk for rock failure associated with cutting into the mountain.

Summary

- It was concluded by the KYTC that providing an improved US 119 across Pine Mountain is a very complex project, with many conflicting issues of design criteria, constructability, environmental impacts, and funding.
- In July 2001, a renewed effort to involve all stakeholders in finding a "build alternative" to address and resolve these complex issues resulted in a conclusion that the KYTC estimate made for the 1997 ADHS Cost Estimate was not preferred.
- The three alternatives discussed have been consistently presented throughout more than 30 years by the KYTC as the most feasible alternative for US 119 crossing of Pine Mountain.
- There has been an agreement reached between the KYTC and the PMCTF that the Tunnel Alternative is the only alternative that would provide the region with a safe, environmentally sound and fiscally responsible roadway.

2.0 OVERVIEW OF EVALUATION

The safety improvement project for a section of US 119 across Pine Mountain in Letcher County was initiated as an interim effort to address safety issues related to roadway geometrics and specific problems related to truck traffic. The project involves sections of the road being improved over a 7.2-mile length at a cost of approximately \$36 million. A preliminary evaluation study by a consultant (Bernardin-Lochmueller & Associates) had identified specific problem locations in the greatest need for improvement. As a result, a contract was awarded to begin spot-improvement reconstruction of roadway sections in the summer of 2002. The initial project completion date was October 31, 2003; however, there are other contracts to be awarded to complete the project.

The Transportation Center at the University of Kentucky was requested to perform an evaluation of the safety improvement project on US 119 to determine whether the types of improvements undertaken have affected the overall safety of the roadway. Specific objectives were as follows; 1) to determine the effects of a ban on truck traffic that was implemented in March 2001, 2) to determine if the types of improvements undertaken as part of the project are applicable to other locations, and 3) to determine if the use of flexible design was successful by allowing the Transportation Cabinet to remove the truck restriction by permitting trucks with dimensions up to the WB-50 design to travel across the mountain and be able to track within their own lane.

The evaluation approach involves three phases over a period of approximately three years. Following is a brief description of the three phases.

Phase 1: Detailed analysis of crash data on US 119 prior to beginning the safety improvement projects. Maximum use was made of the crash analysis performed by the engineering consulting firm of Bernardin-Lochmuller and Associates as part of their study completed in February 2001. The focus was on the effects of the ban on truck traffic from this section of US 119 during the period between March 2001 and June 2002. A secondary analysis was to perform an evaluation of types and patterns of crashes, followed by a subjective projection of the anticipated changes in crashes resulting from the improvements.

Phase 2: Application of the Interactive Highway Safety Design Model (IHSDM) to produce an estimate of the changes in number and types of traffic crashes. This analysis requires detailed input of before and after geometric design parameters such as grade, curvature, lane widths, shoulder widths, etc. The IHSDM is used to build a safety baseline using existing conditions and estimate the changes representing the reconstructed geometrics.

Phase 3: Traditional analysis of traffic crashes before and after completion of the spot safety improvement project. It is expected that the analysis will be made using data before the truck restriction, during the truck restriction, and after the project with the restriction extended or removed. This type of analysis requires that the evaluation period

be extended for two years beyond completion of the project. A preliminary summary of crashes will be provided one year after project completion followed by a more detailed analysis extending over a two-year period after project completion.

This interim report will serve as documentation of the first phase of the evaluation. Additional report will be prepared to document the other phases of the evaluation. Phase 3 will be documented after two years of crash data become available and analyses are performed to determine the impacts of the safety improvements

3.0 ANALYSIS PROCEDURE

The crash analysis in the interim report dealt with a review of crash data during the following three phases: 1) before the implementation of the truck ban and the start of the safety improvement construction, 2) after the start of the truck ban and prior to reconstruction, and 3) during reconstruction with the truck ban in effect. The truck ban started in March 2001 with construction starting in June 2002.

The before data were collected from January 1995 through March 12, 2001. The data collection period during the truck ban and prior to construction was from March 13, 2001 through May 2002. The available data during construction with the truck ban in effect was from June 2002 through August 2003.

The location of the crash was determined using milepoint data given on the police report along with other references to distances to an intersection or the nearest town. The milepoint for the truck ban and construction was between milepoints 10.065 and 17.161. As a comparison, crash data on US 119 were obtained between milepoints 1.4 to 10. This section of US 119 has a similar cross section as the portion under reconstruction.

Copies of the police reports were obtained. The reports were reviewed to verify the location and determine whether a truck was involved.

4.0 CRASH DATA ANALYSIS

Crash reports from January 1995 through August 2003 were obtained. The truck ban started in March 2001 with reconstruction starting in June 2002. The location of the crashes was between milepoints 1.4 and 17.161. The truck ban and reconstruction was between milepoints 10.065 and 17.161 with data between milepoints 1.4 and 10 used as a comparison. Crashes involving trucks were identified. The types of crashes were summarized as well as the severity.

Following is a summary of the crash data by date and location.

TIME PERIOD	NUMBER OF CRASHES			
	MILEPOINT 10.065-17.161		MILEPOINT 1.4-10	
	TOTAL	TRUCK	TOTAL	TRUCK
1995	23	15	9	2
1996	18	17	8	0
1997	28	11	7	1
1998	21	11	14	2
1999	24	17	10	2
2000	27	16	9	2
2001	13	8	14	3
2002	16	6	15	0
2003 (1/1-8/30)	9	3	6	0
1 st year after ban	14	8	15	3
2 nd year after ban	15	4	14	0
1 st year after construction	9	2	12	0

There was an average of 23.5 total crashes per year with 14.5 involving a truck in the six years before the truck ban. These numbers decreased to 14.5 total crashes per year with 6 involving a truck in the two years after the truck ban was implemented.

There were 118 total crashes in the truck ban section (milepoint 10.065 to 17.161) in the five-year period of 1996 through 2000. The weighed average daily traffic (ADT) for this section is 2,121 with a crash rate of 430 C/100MVM. This compares to the statewide average rate for rural, two lane highways of 250 C/100MVM (1). The critical rate for this 7.1-mile section would be 328 C/100MVM giving a critical rate factor (CRF) of 1.31.

There were 45 total crashes in the 8.6-mile section immediately west of the truck ban section over these five years. The weighted ADT for this section is 1,776 with a crash rate of 161 C/100MVM which is below the statewide average. The only fatal crash which occurred during these years was in this section.

There were only 9 injury crashes and no fatal crashes in the truck ban section between 1996 and 2000. The injury crash rate was 91 C/100MVM which is very similar to the statewide average of 86 C/100MVM. The critical injury crash rate for this section is 134 C/100MVM with a CRF of 0.68.

There were 104 truck crashes identified in the truck ban section from January 1995 through August 2003. Of those crashes, 15 involved an injury with no fatal crashes. The most common type of crash involved an opposite direction sideswipe (61 crashes) with 38 being single vehicle. Almost all (101 crashes) were in a curve and on a grade. Only 19 crashes occurred during darkness. The milepoints of the truck crashes (as given on the

police report) were analyzed to identify the high crash locations. Following is a list of the 0.3-mile spots with the highest number of truck crashes.

<u>LOCATION (MILEPOINT RANGE)</u>	<u>NUMBER OF TRUCK CRASHES</u>
16.427-16.508	12
15.435-15.476	8
15.800-15.900	6
12.196-12.265	5
10.600-10.700	4
11.696-11.700	4
15.176-15.276	4
15.278-15.308	4
15.939-16.294	4

The locations with the highest number of truck crashes were at spots where there was a very sharp curve.

Locations on US 119 in Pike County were identified in a previous research report which analyzed truck crashes (2). Three of the top ten CRFs for one mile sections on rural, two lane roads across Kentucky were on US 119 in Letcher County (milepoint ranges 15.0 to 16.0, 11.8 to 12.5, and 16.3 to 16.8) with the ranges of 16.3 to 16.8 and 10.7 to 11.6 also identified as having a high CRF. Several sections along this road were identified as having a high number of opposite direction sideswipe collisions.

There has been 15 truck crashes in the truck ban section after the start of the ban (March 13, 2001) through August 31, 2003 with four involving an injury and no fatalities. The truck driver was cited in 12 of these crashes. Ten of the 15 truck drivers were out-of-state with four from Virginia which is adjacent to Letcher County. Twelve were an opposite direction sideswipe collision with three single vehicle. The direction of travel of the truck was almost equal with eight northbound and seven southbound.

There was approximately 14.5 months between the start of the truck ban and start of the reconstruction. There were 23 crashes during this time period with 11 involving a truck. There has only been 13 total crashes with four truck crashes in the 15 months from the start of the reconstruction through August 2003.

The high percentage of truck crashes shows that the most effective method of reducing total crashes would be to either upgrade the roadway cross section to allow for the offtracking of trucks in the sharp curves or to reduce the number of trucks. Statewide for 1996 through 2002, truck crashes represented about 7 percent of all crashes (3) while trucks were involved in about 61 percent of all crashes in the truck ban section. The truck ban has reduced the total number of crashes by about 38 percent and the number of truck crashes by 55 percent in the two years after the start of the ban. The reductions in the first year after the start of reconstruction, along with the truck ban, were 62 percent in total crashes and 86 percent in truck crashes.

5.0 SUMMARY OF RESULTS

Following is a summary of the current analysis of the crash data.

- The section of US 119 where the truck ban was placed had a crash rate of 430 C/100MVM prior to the start of the truck ban with a critical rate factor (CRF) of 1.31.
- The adjacent section of US 119, which has a similar cross section but less grade and sharp curvature, had a rate of 161 C/100MVM which is less than the statewide average.
- The injury crash rate for the truck ban section was 91 C/100MVM which is almost identical to the statewide average. There were no fatal crashes in this section.
- About 61 percent of the crashes in this section have involved a truck (compared to a statewide percentage of about 7 percent).
- Over the study period about 59 percent of the truck crashes have involved an opposite direction sideswipe with about 37 percent a single vehicle crash.
- The truck ban reduced the total number of crashes by about 38 percent and the number of truck crashes by 55 percent in the two years after the start of the ban.
- The reductions in the first year after the start of the reconstruction, along with the truck ban, were 62 percent in total crashes and 86 percent in truck crashes.
- There have been 15 truck crashes in the truck ban section after the start of the ban with 10 involving an out-of-state driver.
- The locations with the highest number of truck crashes were at locations with a sharp curve.

6.0 REFERENCES

1. Agent, K.R.; Pigman, J.G.; and Barrett, M.L.; “Analysis of Traffic Crash Data in Kentucky (1996-2000),” KTC-01-25/KSP2-01-1F, September 2001.
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