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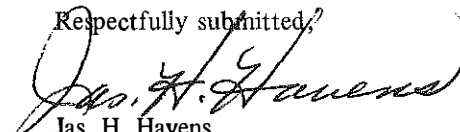
MEMORANDUM TO: A. O. Neiser  
State Highway Engineer  
Chairman, Research Committee

SUBJECT: Research Report; "Accidents at Median  
Crossovers," June 1969; KYP-56

The enclosed report presents an engaging overview of the hazards attributed to so-called median crossovers and offers some thoughtful suggestions and guidelines toward accident minimization.

Mr. Garner has achieved an admirable quality of conciseness and clarity in his treatment of the subject.

Respectfully submitted,



Jas. H. Havens  
Director of Research

JHH:slw

Enclosure

cc's: Research Committee

State Highway Engineer, Chairman	Director, Division of Photogrammetry
All Assistant State Highway Engineers	Director, Division of Planning
Assistant Pre-Construction Engineer	Director, Division of Research
Assistant Operations Engineer	Director, Division of Right of Way
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Director, Division of Materials	Associate Dean for Continuing Education, U. K.

**Research Report**

**ACCIDENTS  
AT  
MEDIAN CROSSOVERS**

**by  
G. R. Garner  
Research Engineer**

**Division of Research  
DEPARTMENT OF HIGHWAYS  
Commonwealth of Kentucky**

**June 1969**

## INTRODUCTION

Safety improvements are often controversial subjects, especially when the subject is highways. Judgments must be made weighing lives and injuries against the hard realities of financing the construction and maintenance of highway systems. Median crossovers on rural and urban freeways and expressways are controversial design features. State police and maintenance forces claim that median crossovers are necessary and essential for their work and that more frequent location of crossovers is desirable. Engineers involved with highway safety maintain that crossovers create accidents, are not necessary, and should be eliminated. When working on an accident study evaluating median type, it became obvious that at times median crossovers were causing frequent accidents, especially in some locations and certain situations.

Crossovers are locations on controlled access roadways where emergency and maintenance vehicles can cross the median to change their direction of travel. However, the motoring public also finds crossovers convenient for their use, even though the maneuver is illegal. This creates an accident producing situation. Accidents at median crossovers involving U-turning vehicles accounted for up to 25 percent of the total accidents on several road sections during some years investigated in this study. For a four year period involving the majority of toll roads and interstate roads in Kentucky, an average of five percent of all accidents were caused by vehicles using median crossovers.

The purpose of this study was to analyze existing crossover locations, usage, and accidents so as to develop criteria on the necessity for and the location of median crossovers. Primarily, three sources of information were used. An inventory of existing crossover locations was obtained to determine the prevailing philosophy, if any, on crossover locations. Secondly, a comprehensive analysis of U-turn accidents at median crossovers was performed. The accident analysis included special study of roads where U-turn accidents were most prevalent. To evaluate crossover usage, interviews were conducted with district highway engineers and questionnaires were given to all state police who patrol interstate or toll roads in Kentucky. The questionnaire also provided an opportunity for the state police to express their opinions concerning the location and necessity for crossovers.

## INVENTORY OF EXISTING CROSSOVER LOCATIONS

An inventory of existing crossover locations was performed by two-man teams who traversed the roads selected for study. Crossovers, interchanges, or other features of significance were logged to the nearest one-tenth mile. These loggings (Appendix A) were then plotted to scale and examined for similarities to see if any philosophy in design governed. Kentucky's traffic guidance manual (2) provides no recommendations about crossover location. The Kentucky Department of Highways Standard Drawing No. 14.04c states:

*"Maintenance Cross-Overs shall be constructed one half to one mile from the end of the acceleration lane taper or de-acceleration lane taper whichever provides for the furthest spacing from the interchange."*

Although not stated, it must be assumed that locating crossovers this close to interchange areas is strictly a convenience for maintenance forces to conduct snow removal work. This philosophy is also reflected in an article which appeared in an ASCE publication (1):

*"Usually crossovers are needed at each end of an interchange area so snow and ice equipment may reverse direction quickly to clear all entrance and exit ramps."*

The suggested pattern of crossover location is not consistently followed on any of the interstate or toll roads in the state. Crossovers are commonly found as near as one-tenth mile and as far as five miles from interchange areas. The average distance between crossovers and(or) interchanges varies from 0.6 mile on the Western Kentucky Parkway and Mountain Parkway to 2.3 miles on I 64 (Lexington to Morehead) (See Table 1). Generally there is at least one crossover between exits when interchange spacing exceeds three miles. The average distance between crossovers and(or) interchanges is about 2.2 miles, with the exception of US 41 in Hopkins County where no consistent spacing between consecutive crossovers or between an interchange and a crossover was found.

## ACCIDENT ANALYSIS

Accident reports for a four-year period were copied from original state police reports for the following controlled-access roads:

I 64

I 65

Bluegrass Parkway (three-year period)

Western Kentucky Parkway

Mountain Parkway

Kentucky Turnpike

US 41 (Madisonville By-pass, Hopkins County)

All U-turn accidents at median crossovers were counted and analyzed. The variables which affect the number of U-turn accidents on a given road were found to be:

1. Volume of traffic on the road,
2. Proximity to urban areas,
3. The presence of major interchanges between controlled access facilities,
4. Number of crossovers,
5. Nearness of crossovers to interchanges,
6. Composition of the traffic stream,
7. Interchange spacing,
8. Width and type of median, and
9. All other roadway, weather, driver, and vehicle variables.

Of these variables, the first three are the most significant. Logically, as traffic volume increases, the probability of a U-turning vehicle coming in conflict with another vehicle increases. This is illustrated in Figure 1.

It is reasonable to assume that the drivers of U-turning vehicles are lost or confused, i.e. they may have made a wrong turn or missed a turn. More persons are likely to get confused in urban areas and in major interchange areas. Therefore, more U-turn accidents are likely to occur at such locations. This is verified by the collision diagrams of U-turn accidents on the Kentucky Turnpike and US 41, as shown in Figures 2, 3, and 4. There have been 34 U-turn accidents in a four-year period involving southbound vehicles on the Kentucky Turnpike (Figure 2). There were:

- 16 at the first crossover south of Louisville,
- 8 at the second crossover south of Louisville,
- 4 at the third crossover south of Louisville,
- 2 at the fourth crossover south of Louisville, and
- 2 at other locations.

In addition, two drivers involved in an accident admitted to be driving too slowly because they were looking for a crossover.

Ten accidents involved northbound vehicles on the Kentucky Turnpike (Figure 3). All of these occurred after the opening of the Bluegrass Parkway in November 1965. There were:

- 5 at the first crossover north of Elizabethtown,
- 2 at the second crossover north of Elizabethtown,
- 1 at the third crossover north of Elizabethtown, and
- 2 at other locations.

Many of these accidents were apparently caused by drivers who became lost or confused at the west end of the Bluegrass Parkway and were going north on the Kentucky Turnpike when they wanted to go south. Other situations where U-turn accidents occur near urban areas or major interchanges exist on I 65 and US 41 in Hopkins County. At the first crossover south of Elizabethtown on I 65, for example, there have been 13 accidents involving southbound U-turning vehicles in a four-year period. The U-turn accidents on US 41 are clustered around the interchange with the Western Kentucky Parkway and the KY 85 interchange leading into Madisonville, as shown in Figure 4.

Further evidence of driver uncertainty in traveling urban or interchange areas being a prime cause of U-turn accidents is supplied by the fact that 48 percent of the drivers of the vehicles making the U-turns were out-of-state drivers. Another 29 percent were in-state drivers, but were out of their home county. Therefore, up to 80 percent of the drivers involved in accidents were probably unfamiliar with the roadway.

Other variables contribute to the accident problem in some locations. In a study by Cribbins, et al (5), it was conclusively shown that for non-controlled access facilities the accident rate increased with the number of openings in the median. An abnormally high number of crossovers on US 41 seems to contribute to the U-turn accident problem on that road.

The severity of U-turn accidents seems to depend roughly on the type of accident, i.e. right-angle, oblique, or rear-end collisions, as shown in Table 2. Right-angle collisions, which account for 39 percent of the total U-turn accidents, caused 59 percent of the severe injuries. This is illustrated in Figure 5. Less severe injuries, codes "B" and "C", resulted primarily from oblique and rear-end accidents. Overall, U-turn accidents are more prone to producing injury, as shown in Figure 6. It is most important to note that, in nearly all of the U-turn accidents studied, at least one *innocent* driver was involved.

## MEDIAN CROSSOVER USAGE

An interview with the district engineers of several highway districts provided information on crossover usage by maintenance vehicles. To evaluate frequency of usage and the necessity of crossovers for state police purposes, a questionnaire was prepared and distributed to all troopers who patrol interstate and toll roads.

Maintenance vehicles use crossovers primarily in winter during snow removal. The crossovers are convenient for clearing an interchange area and for turning around at county lines, where maintenance responsibilities end. Other uses by maintenance vehicles are not readily predictable. As an example, when shoulder work is being performed, crossovers are used to lessen the distance which materials may be hauled. There are also special situations, such as separate rest areas serving travelers in either direction of travel, where usually one crew maintains both facilities. Crossovers at each end of the rest areas enable the maintenance personnel to service both without undue inconvenience.

State troopers who patrol interstate and toll roads were given the questionnaire shown in Appendix B. The questionnaire provided much information on state police use of and attitude toward median crossovers. It was designed by the Division of Research in cooperation with the Kentucky State Police. A representative from the Division of Research visited each post and explained the questionnaire. Cooperation from state police personnel was excellent. There were 132 completed responses to the questionnaire. This comprised approximately 95 percent of the troopers solicited.

State troopers use crossovers on a regular basis as illustrated in Figure 7a. Eighty percent of the respondents reported using crossovers at least once a day. Eighty-two percent of the troopers admitted crossing the median at non-designated locations (Figure 7b). Some 19 percent of these cross the medians at other locations *more* than they do at regular crossovers. When responding to an emergency and not being near a crossover, troopers will cut across the median wherever they happen to be. The only time this is not feasible is during periods of snowfall or heavy rain, or when the median is difficult to cross, as for example on the Mountain Parkway.

There were several questions designed to evaluate trooper attitudes toward crossovers. When asked if crossovers were absolutely necessary for state police activities, 84 percent replied that they were necessary. It is interesting to note, however, that of the 16 percent who thought they were not absolutely necessary, the majority were troopers who patrol the Kentucky Turnpike and I 65 where U-turn accidents are more prevalent. Further evidence of a difference in attitude is reflected in Table 3. Among all troopers, there is an obvious majority who favor more frequent spacing of crossovers. On the Kentucky Turnpike and I 65, where there is an accident problem, attitudes shift toward more stringent control of crossover usage. The majority of troopers on the Kentucky Turnpike feel that crossovers should be eliminated entirely. This would seem to indicate a general philosophy that where crossovers frequently cause accidents, their necessity is to be questioned. A notable exception to this is US 41 in Hopkins County, which has a deeply depressed median. Here the troopers have difficulty crossing the median and they take a more forceful stand for the necessity of median crossovers.

## DISCUSSION

All evidence indicates that guidelines and restrictive measures on the location and use of median crossovers are in order. A summary of the reasons for this conclusion follows:

1. Median crossovers are prone to causing accidents.
  2. Crossovers seem to be a convenience, not a necessity, for maintenance activities.
  3. There is no consistent policy being followed for crossover locations.
  4. Crossovers are a necessity for state police activities only during inclement weather and when the median is difficult to cross (82 percent of troopers cross the median at non-designated locations).
  5. When the accident-producing aspect of crossovers is obvious, state police tend to become anti-crossover.
- Furthermore, the AASHO traffic safety committee concluded (3):

*"Any openings in the median can be the scene of unsafe driving, and should therefore, be kept to a minimum."*

On several roads, accidents at median crossovers pose a special problem. These roads warrant separate discussion:

**Kentucky Turnpike** - The combination of narrow median, relatively high traffic volumes, and confusing junctions make the Kentucky Turnpike especially susceptible to U-turn accidents. Because of the accident problem and the corresponding negative attitude of the state police toward median crossovers, crossovers on this facility might well be permanently closed. Crossovers located between bridge piers (see Figure 8) may be an exception. There have not been any accidents at these crossovers. Retaining these crossovers on a conditional basis and noting whether or not they result in accidents could produce evidence on whether or not the hidden crossovers may be a solution to the problem in some locations.

**I 65 (South of Elizabethtown)** - Most crossover accidents on this road occur at one crossover. The first crossover south of Elizabethtown at Milepost 87.3 has been the site of 13 U-turn accidents between 1965-68. If this crossover were eliminated, drivers would have to travel a few more miles and turn around at an interchange.

US 41 (Hopkins County) - The occurrence of U-turn accidents on this road have been clustered around the Western Kentucky Parkway and Madisonville (KY 85) interchanges. From Figure 4 it is apparent that the crossovers are generally located very close to the interchanges. This close spacing contributes to the problem by requiring quick decisions from the driver making the U-turn. Note the number of right-angle accidents (63 percent) caused by drivers turning from the outside lane into the path of another vehicle. To eliminate the abnormal number of U-turn accidents on this road, it would be desirable to eliminate all the crossovers. With interchanges spaced on the average only 2.75 miles apart, elimination of crossovers might be acceptable if it were not for the deeply depressed median which troopers find difficult to cross. An alternate solution would be to eliminate crossovers near interchanges and have only one crossover, at most, between any two interchanges.

Interstate Roads - In general, interstate roads do not need many crossovers. Interchanges are spaced on the average about 5.5 miles apart, and the median can be easily crossed, if necessary. The present spacing is adequate for most purposes. There are, however, some exceptions. Crossovers near interchanges might be eliminated or at least moved. Interchanges and crossovers should be spaced so that there is a fairly uniform distance between two crossovers or an interchange and a crossover. Since crossovers are designed for convenience, it is hard to justify the somewhat erratic spacing now found on many road sections.

Toll Roads - The present spacing of crossovers on most toll roads, with the exception of Kentucky Turnpike, presents few problems. Where the median can be easily crossed, crossovers spaced five miles apart would suffice. On toll roads with deeply depressed medians which can not be easily crossed, closer spacing may be desirable.

Other Considerations - Among those who favor the use of median crossovers, there seem to be two different theories as to crossover locations. The first group maintains that crossovers are going to be used by the general public in any event. Therefore, crossovers should be located in prominent locations, have adequate sight distance and be conspicuously signed. The second group says that crossovers should be hidden from the public eye and not signed. In an article on operational problems on controlled access facilities (1), it is stated:

*"Crossovers should be as inconspicuous as possible to prevent use by the public . . . For enforcement purposes signs prohibiting public use are required, such as "NO U-TURN - FOR OFFICIAL USE ONLY"."*

The policy to place crossovers in inconspicuous locations and then sign them seems contradictory. At the present little effort is made to make crossovers "inconspicuous". However, on the Kentucky Turnpike, there have been no accidents at the crossovers located between the bridge piers during the four years of the study. This would indicate the desirability of using hidden crossovers.

From the questionnaire, it was learned that there is some question as to the wording of the sign FOR EMERGENCY AND MAINTENANCE VEHICLES USE ONLY. Many troopers questioned the length and the message of the sign. It may be in order to study the contrasting effects at crossovers having the present sign, no sign at all, and a sign with a negative connotation like NO U-TURNS or U-TURNS ARE ILLEGAL. It is doubtful that signing changes are a solution, but the possibility should be investigated.

## CONCLUSIONS

The purpose of this study was to examine median crossovers on controlled-access facilities from all viewpoints in an attempt to determine the necessity for them. It must be concluded that, while crossovers are desirable and worthwhile for state police and maintenance uses, crossovers can only be considered as a convenience, not a necessity, and should be eliminated *if an accident problem arises*. With accident prevention foremost in mind, the following criteria appear to be warranted with respect to crossover location:

1. Median crossovers should not be located in or near urban areas, i.e. cities of population 10,000 or greater.
2. Median crossovers should not be located near major interchanges, i.e. the intersection of two controlled access facilities. There should be no crossover between the interchange area and the next interchange on *all* connections, except on some toll roads where distances between interchanges may be prohibitive.
3. Median crossovers should not be located within two or three miles of an interchange.
4. Any median crossover located so that the general public may be tempted to use it will cause accidents and should be eliminated.

Applying more stringent controls to the location and use of median crossovers than now employed may result in a five percent reduction in accidents on interstate and toll roads.

## REFERENCES

1. Noble, C. M., *Special Operational Problems on Controlled Access Facilities*, Proceedings Paper No. 1249, Journal of the Highway Division, American Society of Civil Engineers, Volume 38, No. HW2, May 1957.

2. **Manual on Uniform Traffic Control Devices**, Kentucky Department of Highways, 1967.
3. *Highway Design and Operational Practices Related to Highway Safety*, Special Traffic Safety Committee, American Association of State Highway Officials, 1967.
4. *Standard Drawings*, Kentucky Department of Highways.
5. Cribbins, P. D.; Horn, J. W.; Beeson, F. V. and Taylor, R. D., *Median Openings on Divided Highways: Their Effect on Accident Rates and Level of Service*, Record No.188, Highway Research Board, pp. 140-157, 1967.

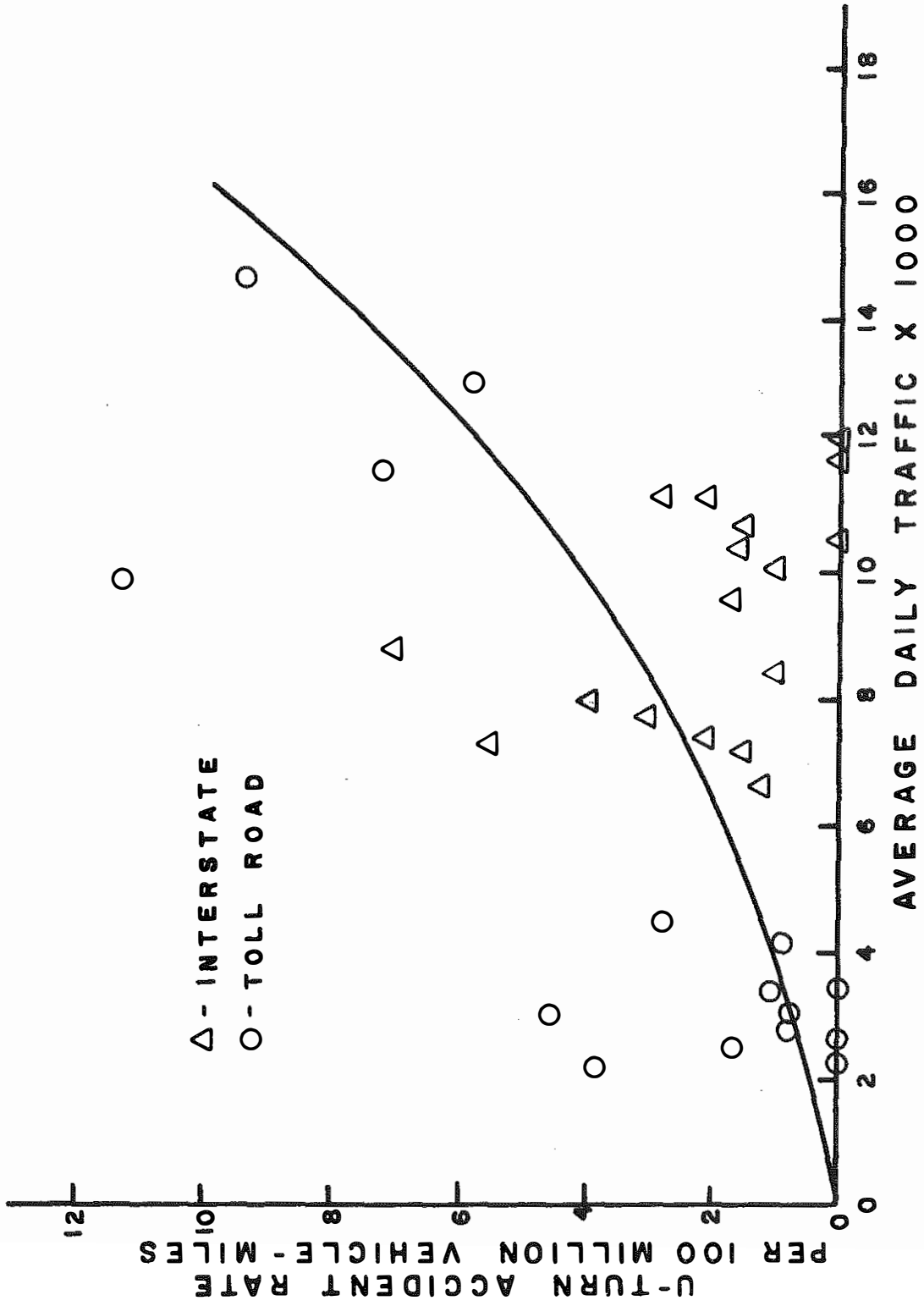


Figure 1 - U-turn accident rate versus volume



# KENTUCKY TURNPIKE COLLISION DIAGRAM FOR U-TURN ACCIDENTS 1965 ---- 1968

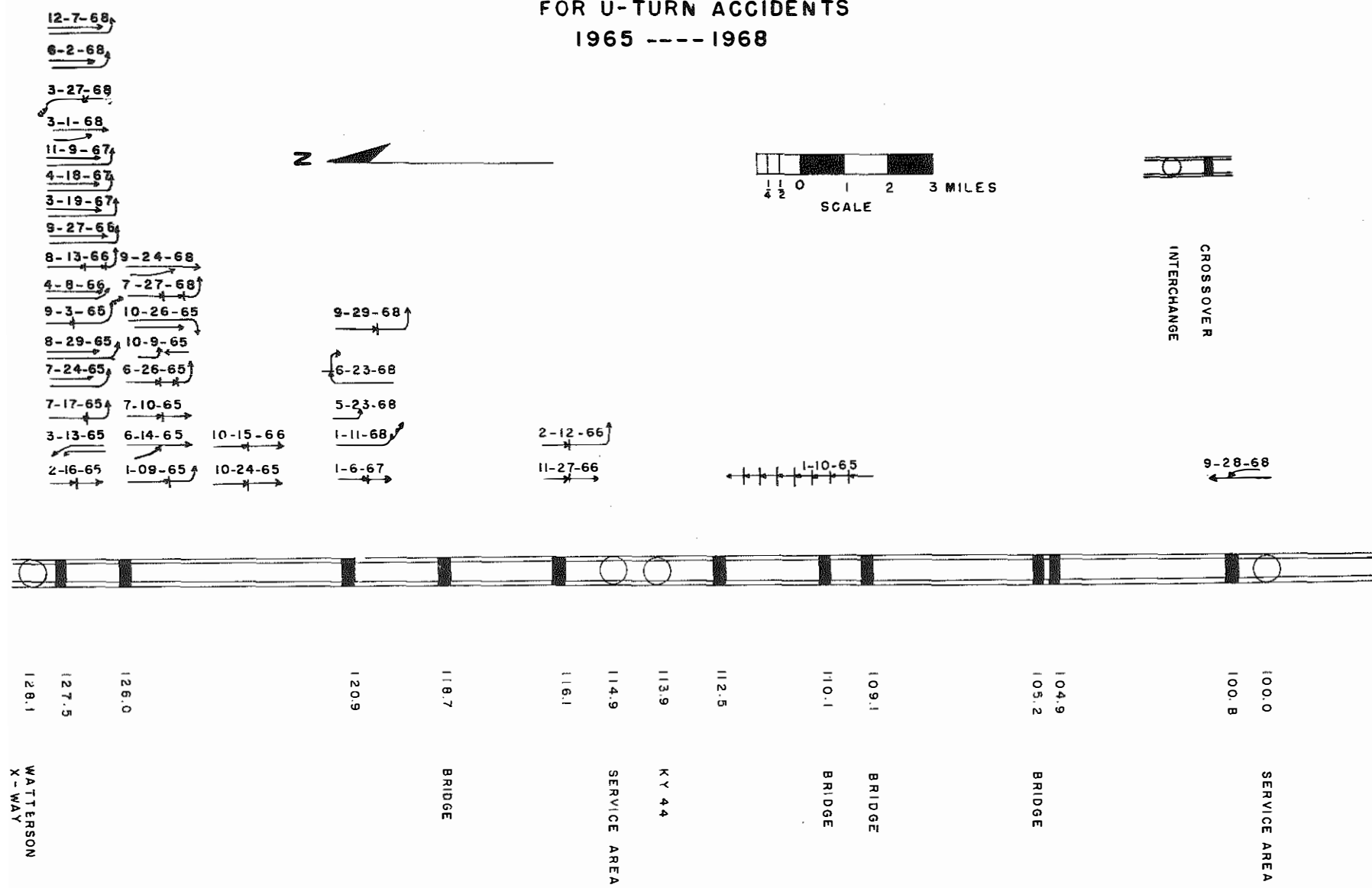


Figure 2 - U-turn accidents on northern half of the Kentucky Turnpike

# KENTUCKY TURNPIKE COLLISION DIAGRAM FOR U-TURN ACCIDENTS 1965 ---- 1968

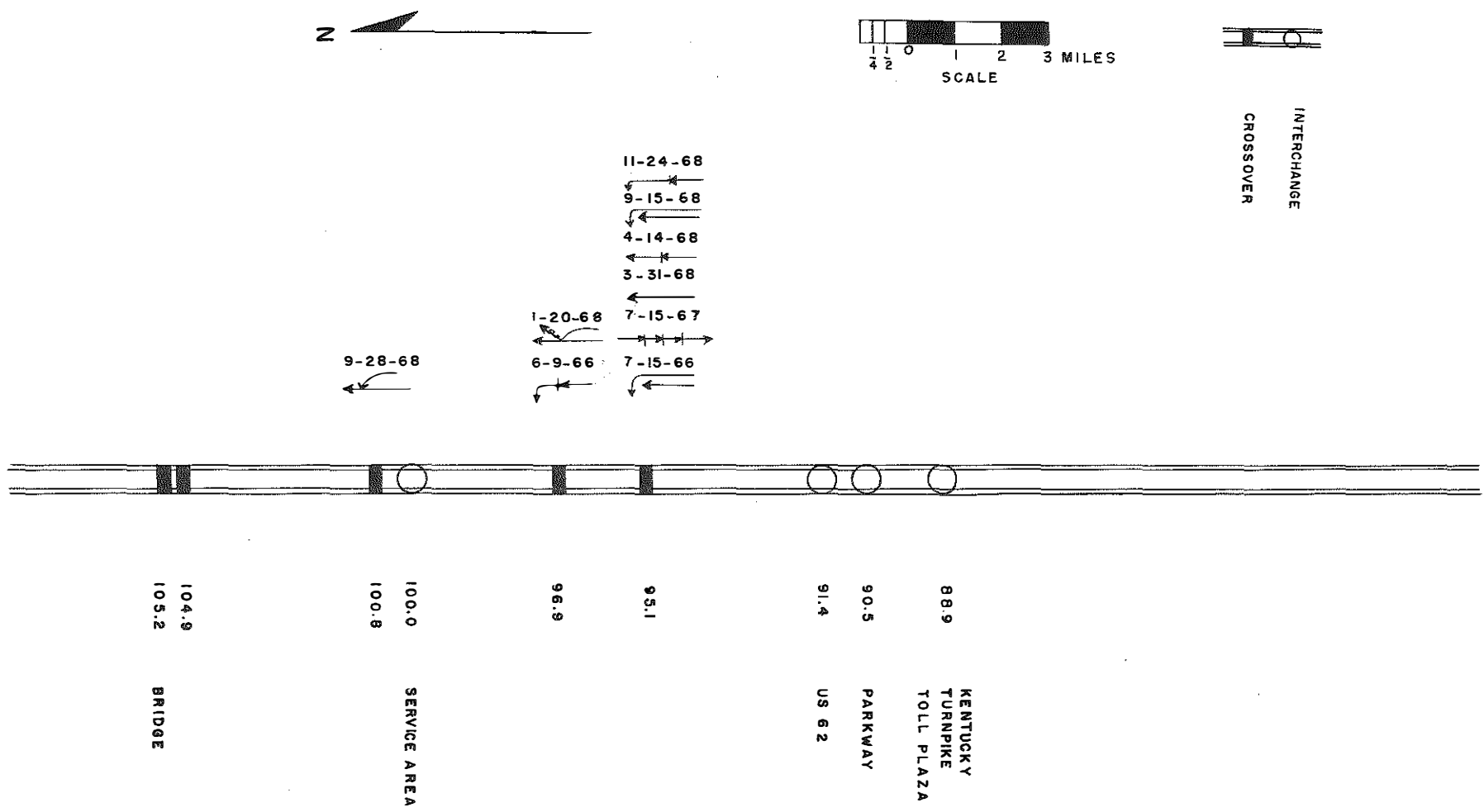


Figure 3 - U-turn accidents on southern half of the Kentucky Turnpike

**US 41  
COLLISION DIAGRAM  
FOR U-TURN ACCIDENTS  
1965 --- 1969**

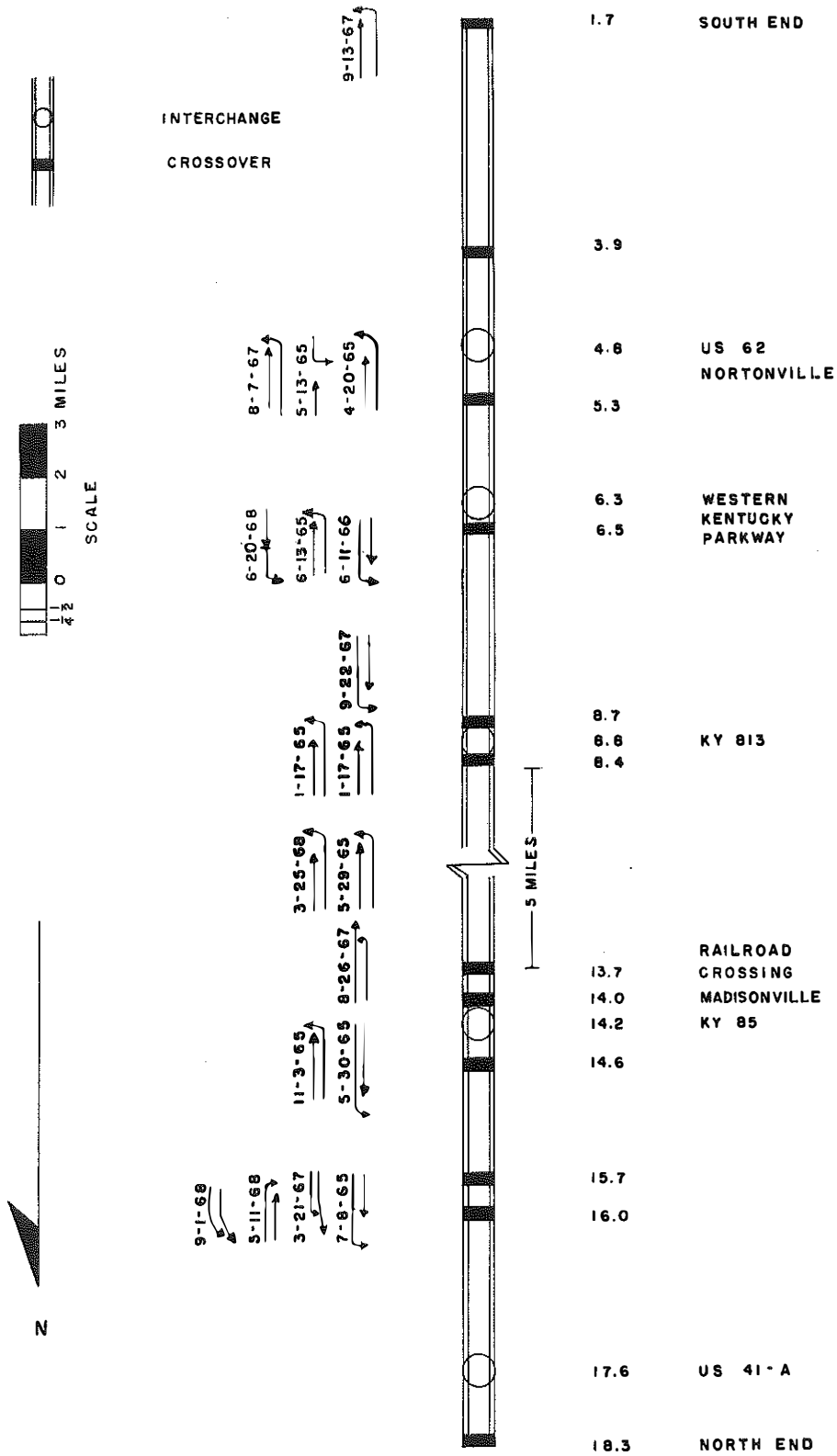


Figure 4 - U-turn accidents on US 41, Madisonville By-pass

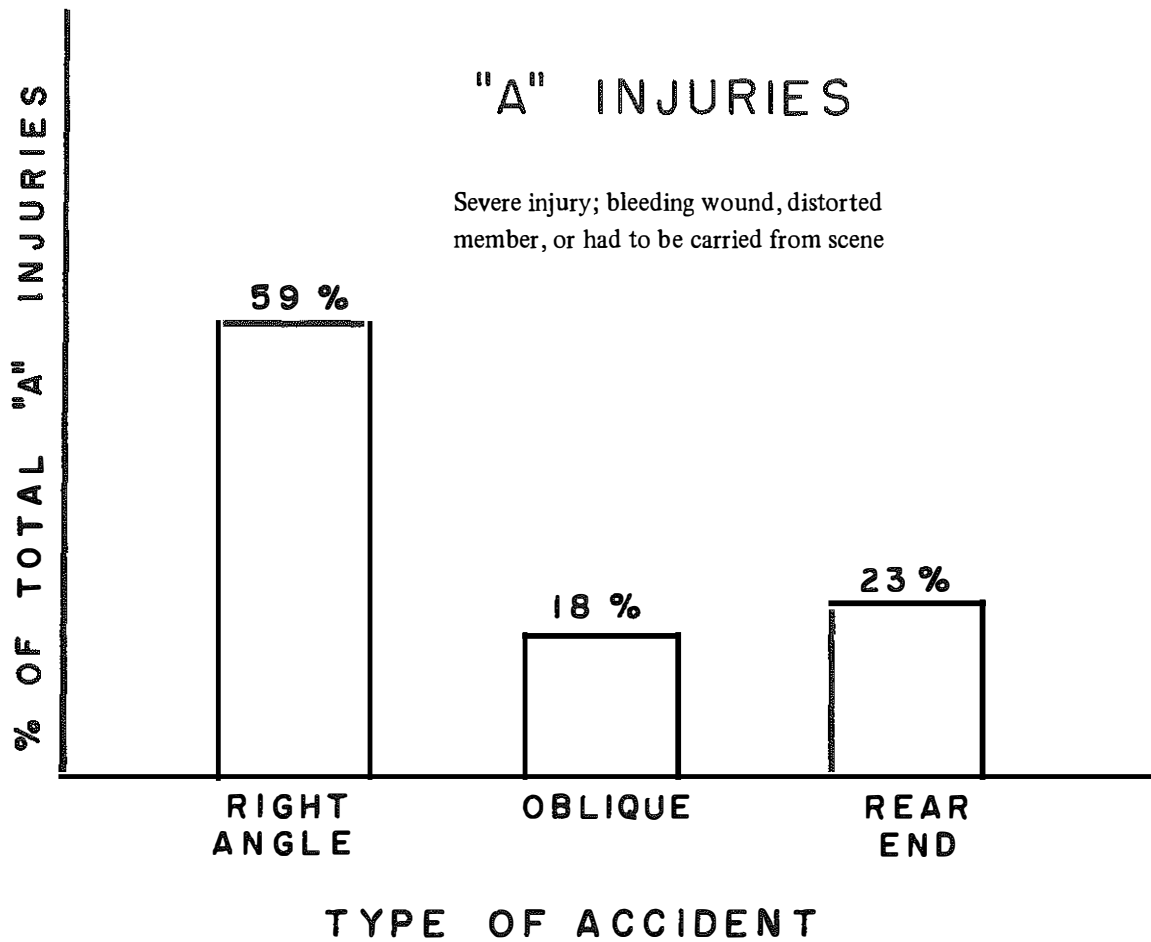


Figure 5 - Severe injuries by type of U-turn accident

### Kentucky State Police Injury Coding Scheme

K - Death

A - Severe injury; bleeding wound, distorted member, or had to be carried from scene

B - Other visible injury as bruises, abrasions, swelling, limping, etc.

C - No visible injury, but complaint of pain

O - No injury; property damage only

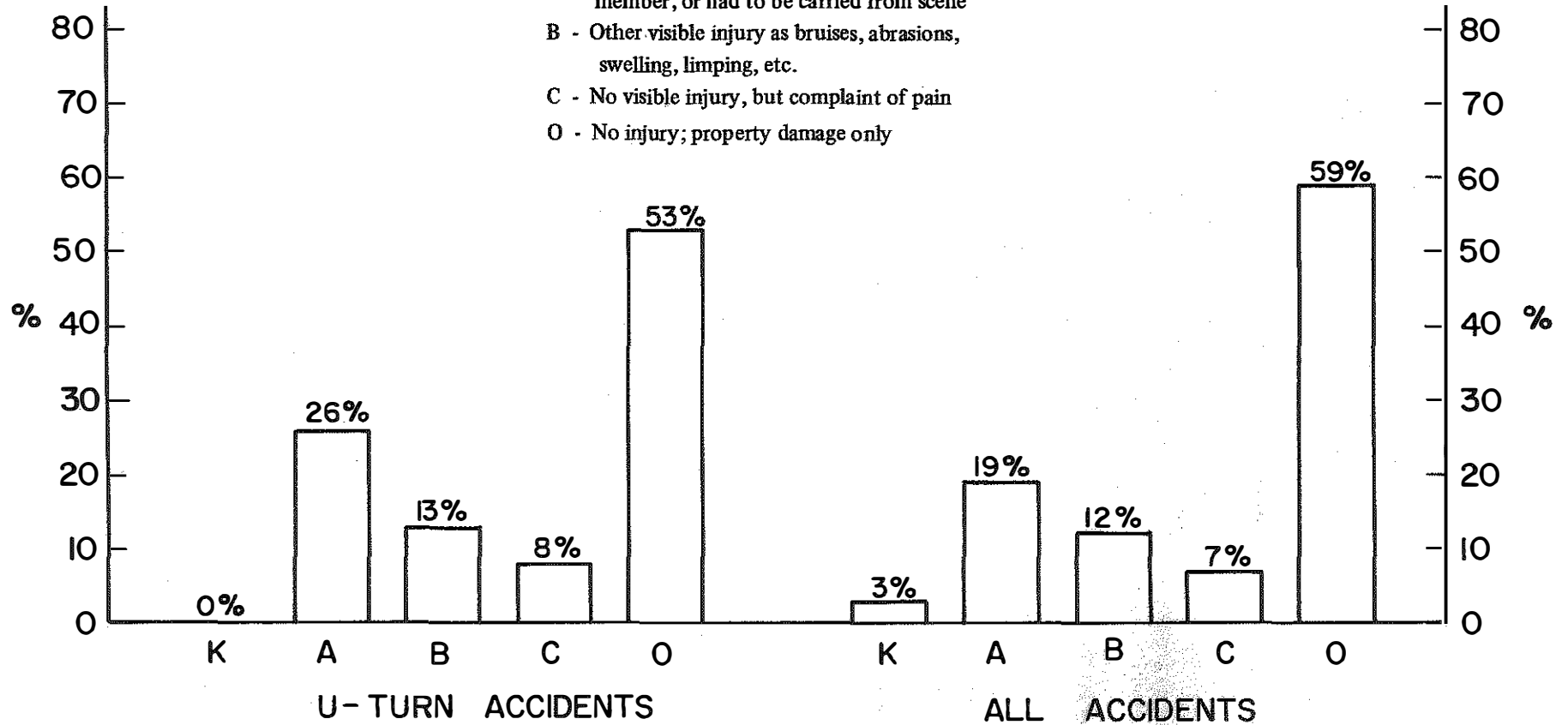


Figure 6 - Injuries associated with U-turn accidents (%) compared with injuries associated with all accidents

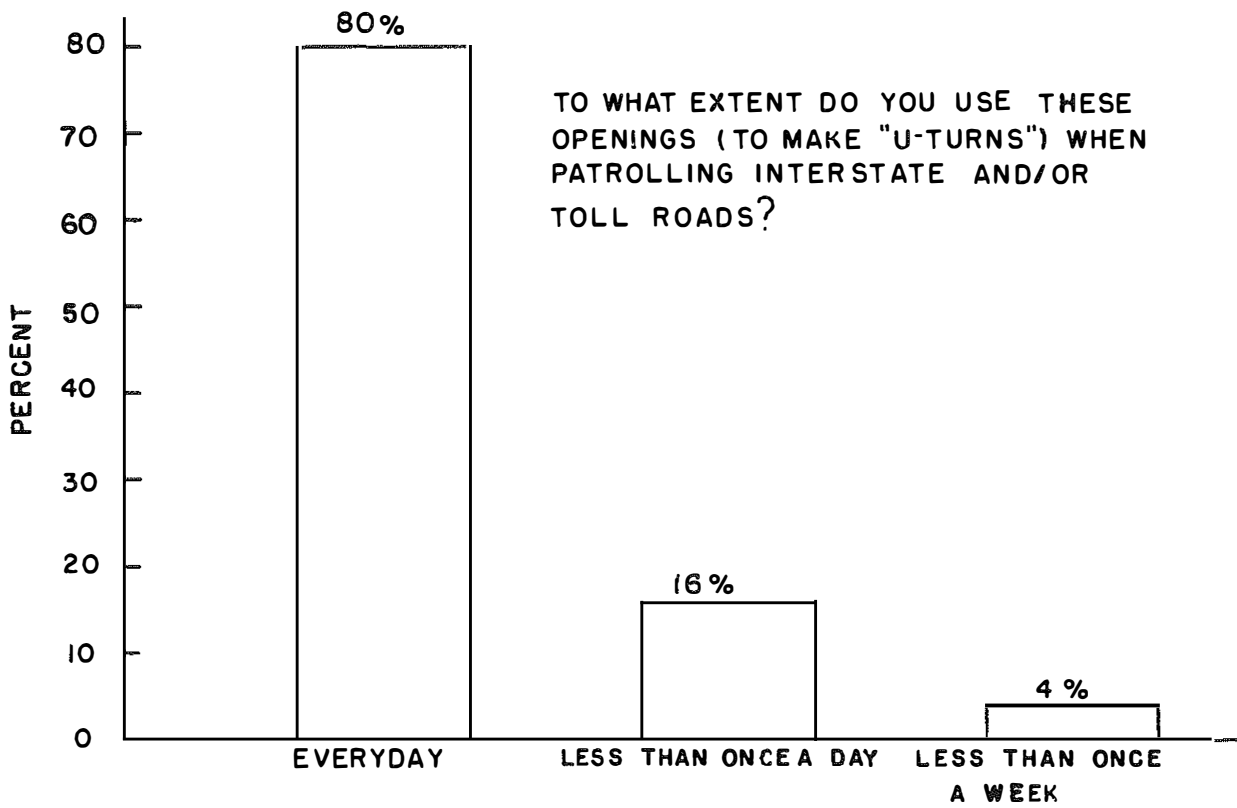


Figure 7a - Frequency of usage of crossovers by state police

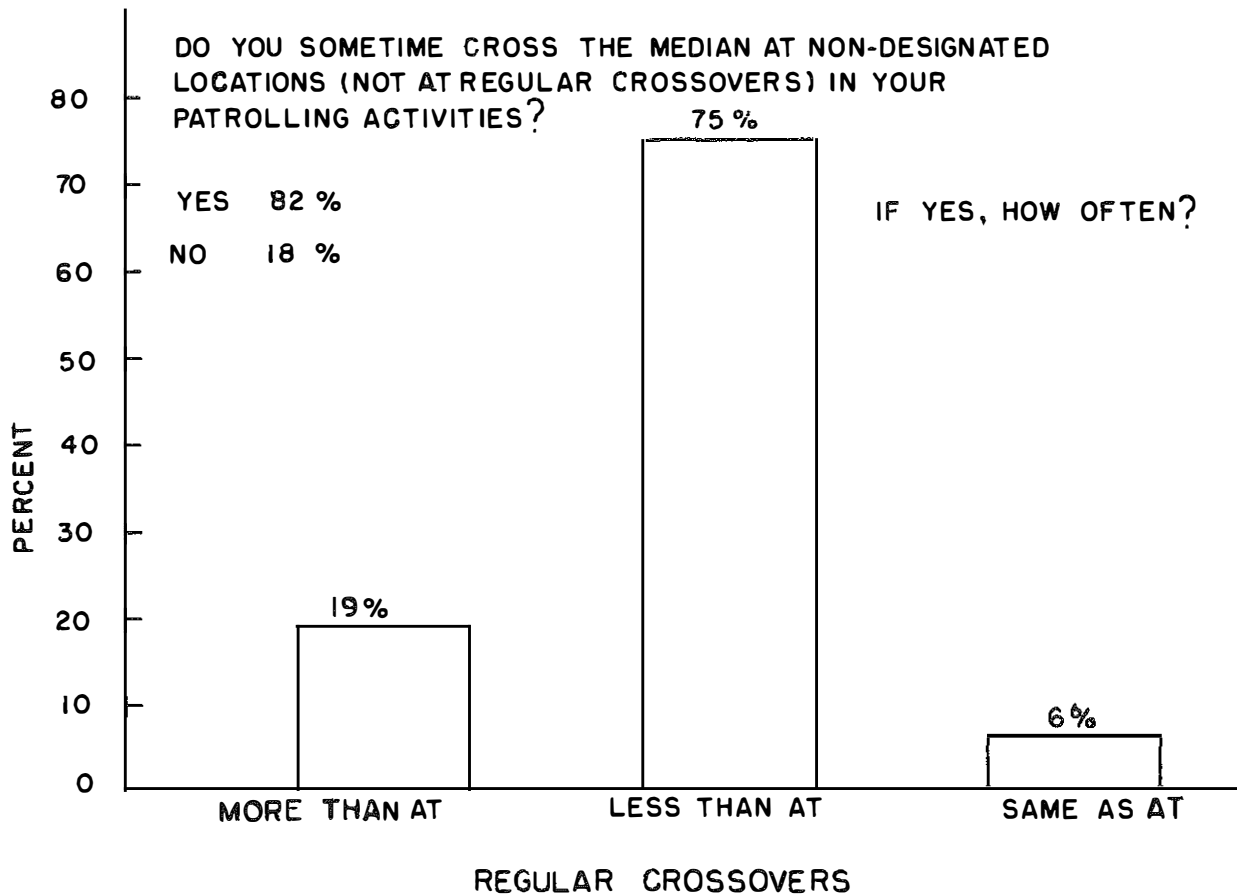
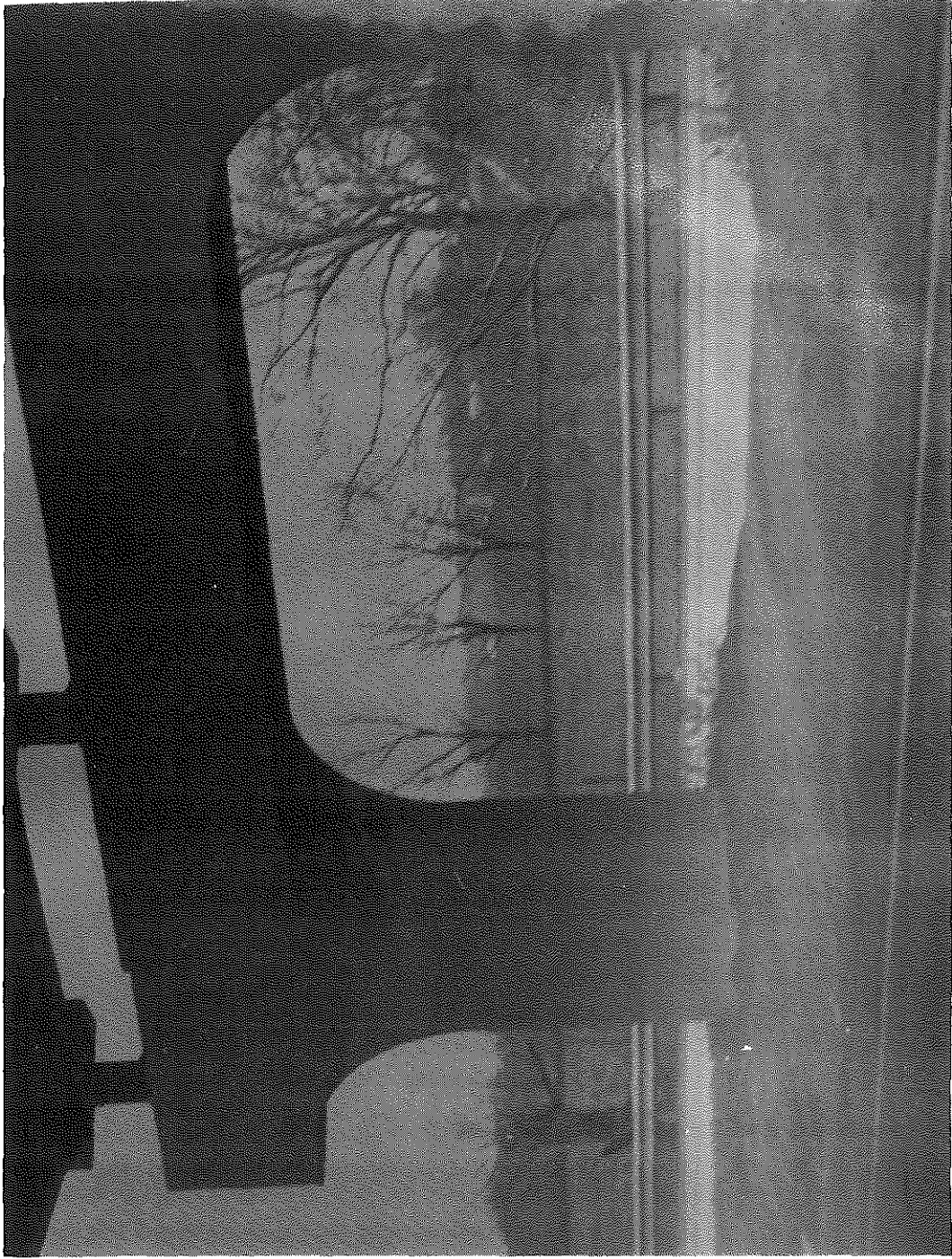


Figure 7b - Questionnaire results indicating the magnitude of crossing the median at other locations than crossovers by state police



**Figure 8 - Crossover located between bridge piers**

**TABLE 1. CROSSOVER SPACING AND LOCATION**

<b>ROAD NAME</b>	<b>AVERAGE DISTANCE BETWEEN X-OVERS AND (OR) INTERCHANGES</b>	<b>AVERAGE DISTANCE OF X-OVERS FROM INTERCHANGES</b>	<b>AVERAGE DISTANCE BETWEEN INTERCHANGES</b>	<b>AVERAGE NUMBER OF X-OVERS BETWEEN INTERCHANGES</b>
I 64 (Lexington to Morehead)	2.6	2.3	5.5	1.3
I 64 (Frankfort to Louisville)	2.1	1.8	5.0	1.4
I 65 (Cave City to Elizabethtown)	2.4	2.0	5.7	1.4
Kentucky Turnpike	2.2	1.5	18.4	3.7
Blue Grass Parkway	2.3	1.9	14.8	5.4
Western Kentucky Parkway	2.2	0.6	14.4	6.4
Mountain Parkway	1.7	0.6	8.4	3.3
U.S. 41	1.0	0.7	2.7	1.5



**TABLE 2. TYPE AND SEVERITY OF U-TURN ACCIDENTS**

Road Name	Type of Accident				Injury			
	Right Angle	Oblique	Rear-End	Other	A	B	C	O
Kentucky Turnpike	16 36%	17 38%	11 25%	1 2%	12 27%	5 11%	4 9%	24 53%
US 41	12 63%	7 37%	0 0%	0 0%	5 26%	4 21%	0 0%	10 53%
I 65 (South of Elizabethtown)	2 14%	8 57%	3 21%	1 7%	3 21%	1 7%	2 14%	8 57%
<b>TOTAL</b>	<b>30 39%</b>	<b>32 41%</b>	<b>14 18%</b>	<b>2 2%</b>	<b>20 26%</b>	<b>10 13%</b>	<b>6 8%</b>	<b>42 53%</b>

**INJURY CODE**

- A - Broken bones, visible cuts and lacerations; had to be carried from scene - severe injuries
- B - Cuts and bruises of minor nature, need not be hospitalized
- C - Complaint of injuries; none visible
- O - No injuries

**TABLE 3. QUESTIONNAIRE RESULTS INDICATING ATTITUDE SHIFT OF STATE TROOPERS WHEN ACCIDENT PROBLEM EXISTS**

If criteria were to be developed for the location of median openings or cross-overs, do you feel that they should be:	Kentucky Turnpike		
	All Troopers	I 65	Kentucky Turnpike
1. Located more frequently.	65%	60%	0%
2. Located less frequently.	2%	4%	10%
3. Eliminated entirely.	7%	12%	50%
4. Eliminated near interchanges and located very sparingly between interchanges.	19%	20%	30%
5. Other ..	7%	4%	10%

**APPENDIX A**  
**INVENTORY OF CROSSOVER LOCATIONS**

## BLUE GRASS PARKWAY

Crossover or Interchange	Distance Between Respective Locations (miles)
Elizabethtown (Start)	
Crossover	1.9
Crossover	2.2
Crossover	1.7
Crossover	3.3
Crossover	1.2
Crossover	1.8
Crossover	3.4
Crossover	3.9
Crossover	1.7
Bardstown	
Crossover	1.8
Crossover	3.9
Crossover	2.8
Crossover	4.6
Springfield	
Crossover	2.6
Crossover	3.1
Crossover	1.9
Crossover	1.7
Crossover	2.7
Crossover	0.9
Crossover	2.1
KY 53	
Crossover	0.9
Crossover	5.8
Crossover	3.4
Crossover	1.6
Harrodsburg	
Crossover	2.0
Crossover	1.3
Crossover	1.1

<b>Crossover</b>	<b>1.2</b>
<b>Crossover</b>	<b>1.8</b>
<b>Crossover</b>	<b>4.0</b>
<b>Crossover</b>	<b>1.5</b>
<b>Crossover</b>	<b>0.1</b>
<b>US 60 (End)</b>	
<b>Total Distance</b>	<b>73.9</b>
<b>Average Distance Between Locations</b>	<b>2.3</b>
<b>Average Distance of Crossover from Interchange</b>	<b>1.9</b>
<b>Average Distance Between Crossovers</b>	<b>14.8</b>

## I 64 (FRANKFORT TO LOUISVILLE)

Crossover or Interchange	Distance Between Respective Locations (miles)
Frankfort (Start)	0.5
Crossover	4.1
Crossover	0.1
US 127	0.4
Crossover	3.0
Crossover	1.9
Lawrenceburg	1.4
Crossover	3.0
KY 395	5.1
Crossover	3.1
KY 53	0.9
Crossover	2.4
KY 55	2.2
Crossover	2.1
Veechdale Road	4.1
Crossover	2.6
Crossover	1.6
Crossover	0.4
KY 841	3.4
Crossover	0.6
KY 1747	2.0
Crossover	0.5
Louisville (Watterson Expressway) (End)	
Total Distance	45.4
Average Distance Between Locations	2.1
Average Distance of Crossover from Interchange	1.8
Average Distance Between Interchanges	5.0

## I 64 (LEXINGTON TO MOREHEAD)

Crossover or Interchange	Distance Between Respective Locations (miles)
I 75 (Start)	
	0.4
Crossover	
	1.2
Crossover	
	3.7
Crossover	
	0.5
Lexington Army Depot	
	2.0
Crossover	
	4.6
Winchester, KY 1958	
	2.0
Winchester, Paris	
	2.7
Crossover	
	2.7
US 60	
	3.9
Crossover	
	3.9
Mount Sterling, Flemingsburg	
	2.8
Mount Sterling	
	3.0
Crossover	
	2.6
Crossover	
	3.0
Frenchburg	
	1.8
Owingsville	
	1.3
Crossover	
	4.8
Crossover	
	4.4
Crossover	
	2.8
Crossover	
	0.5
Morehead (End)	
Total Distance	54.6
Average Distance Between Locations	2.6
Average Distance of Crossover from Interchanges	2.3
Average Distance Between Interchanges	5.5

## I 65 (CAVE CITY TO ELIZABETHTOWN)

Crossover or Interchange	Distance Between Respective Locations (miles)
Cave City (Start)	
Crossover	1.3
Crossover	3.0
Crossover	0.6
Horse Cave	1.0
Crossover	2.6
Crossover	3.7
Munfordville	1.1
Crossover	4.6
Crossover	1.1
Bonnieville	0.8
Crossover	3.2
Crossover	1.1
Upton	1.9
Crossover	2.9
Sorora	5.3
Glendale	2.9
Crossover	2.9
Elizabethtown (End)	
Total Distance	40.0
Average Distance Between Locations	2.4
Average Distance of Crossover from Interchange	2.0
Average Distance Between Interchanges	5.7

## KENTUCKY TURNPIKE (LOUISVILLE TO ELIZABETHTOWN)

Crossover or Interchange	Distance Between Respective Locations (miles)
Louisville (Watterson Expressway) (Start)	0.6
Crossover	6.6
Crossover	2.2
Crossover (between bridge piers)	2.6
Crossover	1.2
Service Area	1.0
KY 44	1.4
Crossover	2.4
Crossover (between bridge piers)	1.0
Crossover (between bridge piers)	3.9
Crossover (between bridge piers)	0.3
Crossover	4.1
Crossover	0.8
Service Area	3.1
Crossover	1.8
Crossover	3.7
US 62	0.9
Blue Grass Parkway	1.6
Elizabethtown (Toll Plaza) (End)	
Total Distance	39.2
Average Distance Between Locations	2.2
Average Distance of Crossover from Interchange	1.5
Average Distance Between Interchanges	9.8



**MOUNTAIN PARKWAY (WINCHESTER TO CAMPTON)**

<b>Crossover or Interchange</b>	<b>Distance Between Respective Locations (miles)</b>
<b>I 64 (Winchester) (Start)</b>	
	1.0
<b>Crossover</b>	2.9
<b>Crossover</b>	2.5
<b>Crossover</b>	5.6
<b>Crossover</b>	2.3
<b>Crossover</b>	0.1
<b>Crossover</b>	1.5
<b>KY 15</b>	0.9
<b>Crossover</b>	4.7
<b>Crossover</b>	0.2
<b>KY 213</b>	0.3
<b>Crossover</b>	3.0
<b>Crossover</b>	3.7
<b>Crossover</b>	3.2
<b>Crossover</b>	0.1
<b>KY 11</b>	0.1
<b>Crossover</b>	1.2
<b>Crossover</b>	1.1
<b>Crossover</b>	0.7
<b>Crossover</b>	0.2
<b>Crossover</b>	3.5
<b>Crossover</b>	0.7
<b>KY 15</b>	0.4
<b>Crossover</b>	1.5
<b>Crossover</b>	0.4
<b>Campton (End Four-lane Section) (End)</b>	

<b>Total Distance</b>	<b>41.8</b>
<b>Average Distance Between Locations</b>	<b>1.7</b>
<b>Average Distance of Crossover from Interchange</b>	<b>0.6</b>
<b>Average Distance Between Interchanges</b>	<b>8.4</b>

## US 41

Crossover or Interchange	Distance Between Respective Locations (miles)
South End (Start)	
	2.2
Crossover	
	0.9
US 62	
	0.5
Crossover	
	1.0
Western Kentucky Parkway	
	0.2
Crossover	
	1.9
Crossover	
	0.2
KY 813	
	0.1
Crossover	
	5.0
Crossover (at railroad crossing)	
	0.3
Crossover	
	0.2
KY 85, KY 70	
	0.4
Crossover	
	1.1
Crossover	
	0.3
Crossover	
	1.5
US 41-A	
	0.7
North End (End)	
Total Distance	16.5
Average Distance Between Crossovers	1.0
Average Distance of Crossover from Interchanges	0.7
Average Distance Between Interchanges	2.8

**WESTERN KENTUCKY PARKWAY (ELIZABETHTOWN TO PRINCETON)**

<b>Crossover or Interchange</b>	<b>Distance Between Respective Locations (miles)</b>
<b>Elizabethtown</b>	
Crossover	0.2
Crossover	5.8
Crossover	6.0
Crossover	3.7
Crossover	1.8
Crossover	1.5
Crossover	1.5
Crossover	1.8
Crossover	1.7
Crossover	1.8
Crossover	3.2
Crossover	2.6
Crossover	0.1
<b>Leitchfield</b>	
Crossover	1.1
Crossover	1.5
Crossover	1.0
Crossover	3.5
Crossover	3.7
Crossover	2.3
Crossover	2.0
Crossover	5.1
Crossover	2.5
Crossover	4.1
Crossover	2.2
Crossover	2.2
Crossover	2.5
Crossover	0.7

Service Area	0.8
Crossover	0.3
US 231	0.5
Crossover	3.1
Crossover	3.0
Crossover	3.4
Crossover	3.5
Crossover	3.4
Crossover	0.1
US 431	0.1
Crossover	3.0
Crossover	2.8
Crossover	3.6
Crossover	3.6
Crossover	2.9
Crossover	3.6
Crossover	0.1
US 41	0.3
Crossover	2.9
Crossover	3.0
Crossover	1.3
Crossover	3.2
Crossover	3.0
Crossover	0.1
KY 109	0.1
Crossover	3.1

Crossover	3.0
Crossover	2.5
Crossover	0.8
Crossover	2.8
Crossover	0.5
KY 139	0.5
Crossover	1.0
Princeton (End)	
Total Distance	129.8
Average Distance Between Locations	2.2
Average Distance of Crossover from Interchange	0.6
Average Distance Between Interchanges	14.4

**APPENDIX B**  
**QUESTIONNAIRE RESULTS**



Eugene Goss  
COMMISSIONER OF HIGHWAYS

COMMONWEALTH OF KENTUCKY  
DEPARTMENT OF HIGHWAYS  
FRANKFORT, KENTUCKY 40601

ADDRESS REPLY TO  
DEPARTMENT OF HIGHWAYS  
DIVISION OF RESEARCH  
533 SOUTH LIMESTONE STREET  
LEXINGTON, KENTUCKY 40508  
Telephone 606-258-4475

January 27, 1969

Dear Trooper,

The purpose of the attached questionnaire is to provide information for use by personnel in the Kentucky Department of Highways Division of Research. The information provided will be used in a research study evaluating accident severity, which hopefully will provide information to enable us to build safer roads. These questionnaires will be used for research purposes only. In no way is this to be construed as an evaluation of state police methods or personnel.

We ask you to fill out this questionnaire as you see fit. Opinions and comments are welcomed. The information provided will be of great value to us in our research study.

We thank you for your time and trouble.

Sincerely,

A handwritten signature in cursive script, reading "James H. Havens".

James H. Havens, Director  
Division of Research

GRG:lct



**QUESTIONNAIRE TO BE FILLED OUT BY STATE TROOPERS WHO SPEND ALL OR PART OF THEIR TIME PATROLLING INTERSTATE OR TOLL ROADS**

	All Troopers	164	165	171	175	Kentucky Turnpike	Mountain Parkway	Western Kentucky Parkway	Blue Grass Parkway	US41
1. What criteria do you use to decide upon the extent of injuries to an injured person in an accident? In other words, what general types of injuries (i.e. broken bones, minor cuts, severe bleeding, etc.) are coded as:										
a. 'A' injuries?										
b. 'B' injuries?										
c. 'C' injuries?										
d. Are 'A' injuries always hospitalized?										
1) Yes	59									
2) No	73									
e. Comments:										
2. Is it sometimes necessary to rely on witnesses' accounts to determine injuries to persons who have left the scene of an accident?										
a. Yes	82									
b. No	50									
c. If yes, how often?										
1) 1/4 of the time	10									
2) Less than 1/4 of the time	67									
3) More than 1/4 of the time	5									
3. Concerning median openings or crossovers (signed "For Emergency and Maintenance Vehicles Only") on interstate and toll roads:										
a. To what extent do you use these openings (to make "U-turns") when patrolling interstate and/or toll roads?										
1) Frequently (everyday)	105	25	19	9	32	4	4	13	7	4
2) Occasionally (less than once a day)	21	1	3	0	6	4	1	4	2	1
3) Seldom (less than once a week)	6	0	2	0	1	2	0	1	0	1
4) Never	0	0	0	0	0	0	0	0	0	0
b. Do you always use these median openings to reach the scene of an accident or to apprehend violators (when these occur in opposing direction of travel)?										
1) Yes	44	17	3	6	15	0	4	4	3	4
2) No	88	9	22	3	24	10	1	14	6	2
c. Do you sometime cross the median at non-designated locations (not at regular crossovers) in your patrolling activities?										
1) Yes	108	18	24	8	33	9	1	16	7	5
2) No	24	8	1	1	6	1	2	2	2	1
3) If yes, how often?										
a) More often than at regular crossovers	20	0	9	0	0	7	0	3	0	1
b) Less often than at regular crossovers	81	18	12	7	32	1	1	13	6	4
c) The same as at regular crossovers	7	0	3	1	1	1	0	0	0	0
d. Do you feel that these median openings are absolutely essential for state police and emergency vehicles to reach the scene of an accident or to conduct normal enforcement procedures?										
1) Yes	111	24	17	9	36	4	5	17	8	6
2) No	19	2	8	0	2	6	0	1	1	0
3) Comments:	2	1	0	0	1	0	0	0	0	0

e.	If criteria were to be developed for the location of median openings or crossovers, do you feel that they should be:										
	1) Located more frequently	86	15	15	9	35	0	0	11	9	6
	2) Located less frequently	3	0	1	0	0	1	0	0	0	0
	3) Eliminated entirely	9	1	3	0	1	5	0	1	0	0
	4) Eliminated near interchanges and located very sparingly between interchanges	25	8	5	0	2	3	5	2	0	0
	5) Other (specify):	9	2	1	0	1	1	0	4	0	0
f.	What level of enforcement is currently being followed for vehicles making "U-turns" on interstate and toll roads?										
	1) Rigidly enforced - citation issued whenever violation is observed	97	18	19	8	36	10	5	5	4	1
	2) Sometimes enforced - citation issued when U-turning vehicle causes an accident or potential accident	18	5	2	1	1	0	0	9	1	5
	3) Citations generally not issued but warning given	0	3	4	0	1	0	0	4	2	0
	4) No action taken - not enforced	1	0	0	0	0	0	0	0	1	0
	5) Other:	2	0	0	0	1	0	0	0	1	0
g.	Are citations issued to U-turning vehicles which cause an accident or must U-turn be observed by yourself before citation can be issued?										
	1) Issued if cause of accident										
	2) Cannot be issued unless U-turn observed										

4. How many hours in an average week do you spend patrolling the interstate and/or toll roads in your area? If you patrol two or more interstate and/or toll roads please indicate time spent on each.

a. hour per week on

(Road)

See Following Table for Summary

b. hours per week on

(Road)

5. Please rank the following roadway and driver improvements, as you think, that, if implemented, would result in a reduction in the severity of accidents on interstate and toll roads. Use the following scale:

1 - most important

2 - very important

3 - somewhat important

4 - not important

Roadway:

	Most Important	Very Important	Somewhat Important	Not Important	No Response
end treatment to guardrails	54	37	23	8	10
wider, gentler sloping medians	18	32	47	24	11
better design of interchange areas (lesser curves, etc.)	37	27	47	11	10
improved signing techniques (especially at interchange areas)	23	39	51	7	12
guardrail in the median on high volume roads	33	30	39	20	10
guardrail around bridge piers	52	38	23	9	10
skid resistant bridge surfaces	73	35	9	6	9
improve night visibility of signs, bridges, etc.	25	47	36	13	11
improve night, wet weather visibility of signs, bridges, etc.	27	58	25	10	12

Driver:

reduce number of intoxicated drivers	109	10	4	1	8
mandatory driver education	40	55	23	6	8
include experience with control of skidding vehicle in driver education programs	24	52	42	5	9
periodic re-examining (physical, mental, and driving skill) of all drivers	75	32	15	2	8
other:					

Total Other Comments - 19

**SUMMARY OF PATROL TIME (MAN-HOURS PER WEEK)**

ROAD NAME	TROOP NUMBER										TOTALS	
	2	3	4	5	6	7	8	11	12	16		
Western Kentucky Parkway	88										31	119
I 65		289	130									419
Kentucky Turnpike				325								325
Blue Grass Parkway			20							53		73
US 41	88											88
I 71				96	37							133
I 75					507	115		145	156			923
I 64						35	100		265			400
Mountain Parkway						10	53					63
<b>Totals</b>	<b>176</b>	<b>289</b>	<b>475</b>	<b>96</b>	<b>544</b>	<b>160</b>	<b>153</b>	<b>145</b>	<b>474</b>	<b>31</b>		<b>2543</b>