

Research Report
536

**BICYCLE-MOTOR VEHICLE
ACCIDENTS IN KENTUCKY**

by

Kenneth R. Agent
Research Engineer Chief

Charles V. Zegeer
Formerly Research Engineer Senior

and

Robert C. Deen
Assistant Director

Division of Research
Bureau of Highways
DEPARTMENT OF TRANSPORTATION
Commonwealth of Kentucky

prepared for publication by the
American Society of Civil Engineers

January 1980

BICYCLE-MOTOR VEHICLE ACCIDENTS IN KENTUCKY

by

K. R. Agent¹, C. V. Zegeer², and R. C. Deen³

ABSTRACT

The purpose of this study was to determine the characteristics associated with bicycle-related, motor-vehicle accidents in Kentucky. It was found that cyclists 10 to 14 years of age were involved in the largest number of motor-vehicle related accidents. Males were involved in four times as many accidents as females. Most accidents occurred in urban areas, mostly on residential streets. The majority of accidents resulted from errors by the cyclists. The most common type was the right-angle accident, but the leading types varied with cyclist's age. Several factors were related to age and accident severity. The accidents were summarized by type and maneuver. The highest proportion was found between 3 and 7 p.m. Bicycle-related, motor-vehicle accidents represented under 10 percent of all injury-producing bicycle accidents.

Key words: Accidents, Bicycles, Motor Vehicle, Accident Types, Accident Severity, Age, Sex, Time

¹Research Engineer Chief, Kentucky Department of Transportation, Lexington, Kentucky

²Transportation Engineer, Goodell-Grivas, Inc., Southfield, Michigan

³Assistant Director of Research, Kentucky Department of Transportation, Lexington, Kentucky

INTRODUCTION

The increase in use of bicycles in recent years has resulted in more emphasis on bicycles as a popular transportation mode. Recent upsurges in bicycle use is evidenced by bicycle traffic around college campuses, by neighborhood recreational usage, and by week-day commuters. Therefore, a need for a better understanding of bicycle-related, motor vehicle accidents became apparent. The data set investigated in this study was the motor-vehicle accidents which involved a collision with a cyclist.

The purpose of this study was to determine the characteristics of bicycle-related, motor-vehicle accidents. The study does not address off-street or off-road bikeway accidents. By understanding the causes and other factors associated with these accidents, present design guidelines and operational procedures associated with bicycles may be improved. This type of analysis may also provide useful information for the development of bicycle safety educational programs.

The "bicycle boom", as many people refer to the current upsurge in usage of bicycles, is the largest such increase to occur in the history of the United States. The bicycle appeals to many segments of society for various reasons: the energy crisis, transportation efficiency, ecological considerations, recreation, and health. A dramatic increase in bicycling in the 15-24 and 25-44 age groups has brought about a substantial increase in the number of bicycle-related, motor-vehicle accidents associated with work, school, and shopping trips in urban areas.

Despite the many booms and slack periods, there has been a steady increase in users between 1950 and 1970; bicycle sales in the United States in 1972 exceeded automobile sales for the first time. Accompanying this increased useage and expanded exposure has been an increase in the number of bicycle-related accidents.

Lack of established practice throughout much of the country has created problems concerning bicycle operational procedures and the design of routes to accommodate both motor vehicles and bicycles. Some cities have invested in bicycle routes or trails which are only for the use of cyclists. If bicycle use continues to increase at its present rate, it will be increasingly necessary to consider this mode of travel in the design and operation of all highways and streets on which bicycles are permitted.

From 1960 to 1973, bicycle-related, motor-vehicle fatalities per year in the United States increased from about 450 to 1,150 (1). From 1973 to 1976, bicycle fatalities have decreased to about 900 per year, possibly due to the national emphasis on bicycle safety which would involve such items as changes in design guidelines and operational procedures.

Bicycle-related, motor-vehicle fatalities in Kentucky have fluctuated from 6 to 18 per year between 1969 and 1976.

The number of bicycle fatalities per 100,000 population have averaged about 0.49 in the United States in recent years, compared to 0.31 in Kentucky. In 1976, injuries per 100,000 population were almost the same in Kentucky (19.7) as compared to the United States (19.5). Because of low reporting levels of non-fatal bicycle accidents, accurate statistics are not available on the total number of bicycle-related, motor-vehicle accidents. However, estimates of bicycle injuries nationwide were around 40,000 in 1976 (1).

An analysis of bicycle injury accidents and rates for the United States showed that more than half the accidents involved children from 5 to 14 years old, while the 15-to-24 age group had the next highest number. The highest bicycle accident rate was 61.7 (accidents per 100,000 population) for the 5-to-14 age group -- more than double the rate of 27.4 for the 15-to-24 age group. The next highest rate was the 4-and-under age group with a rate of 11.7. Other age groups had much lower rates.

PROCEDURE

Reports on all bicycle-related, motor-vehicle accidents reported in Kentucky between July 1, 1975, and June 30, 1976, were obtained from police records. For accidents reported by the state police, a computer summary was used to identify the accidents; then the accident reports were located. Accidents reported by other police agencies were searched manually, and copies of all bicycle-related, motor-vehicle accidents were coded, and computer programs were written to analyze the data. All motor-vehicle accidents in which a cyclist was involved were included in this sample. The data were summarized by many categories, and relationships among various types of data were studied.

To determine differences in severity of various types of accidents, a severity index was used (2). The severity index (SI) formula places a value on the average severity of a group of accidents. Accident severity increases as the severity index increases. Using the cost of each type of accident or injury and the number of such accidents or injuries, a weighting factor for each type of accident was obtained. Fatal accidents and A-injury accidents were grouped; although fatal accidents are much more costly, they are also much rarer in occurrence. Accidents classified as B- or C-injury types were also grouped. The formula used in Kentucky is as follows:

$$SI = [9.5 (K + A) + 3.5 (B + C) + PDO] / N$$
 where K = number of cyclists killed,
 A = number of cyclists with an incapacitating injury,
 B = number of cyclists with a non-incapacitating injury,
 C = number of cyclists with a possible injury,
 PDO = number of cyclists not injured (property damage only), and
 N = total bicycle-related, motor-vehicle accidents.

RESULTS

There was a total of 762 bicycle-related, motor-vehicle accidents in Kentucky during the one-year study period. They are summarized in the following discussions.

Cyclist Characteristics

The distributions of bicycle-related, motor-vehicle accidents by age and sex of the cyclist are given in Table 1. The 10- to 14-year olds had the highest number of accidents; nearly one-half (45 percent) of all accidents involved cyclists in this age group. Only 11 percent of the cyclists involved in accidents were over 19 years old.

In terms of accidents per 100, 000 people, the highest accident frequency was also in the 10-to-14-years category for both males and females. The 5-to-9- and the 15-to-19-years categories also had high accident frequencies compared to other ages. The accident frequency for males (36.9 per 100,000 people) was found to be four times that for females (8.8 per 100,000 people). Total mileage ridden by males and females was not available so that accident rates in terms of accidents per miles ridden could not be calculated. However, a 1971 study in North Carolina (3) found that the miles per year ridden by males was about twice that for females in the 5-to-19-years category. If the assumption were made that males ride twice as many miles a females, the accident rate for males would be approximately twice that for females. Mileage rates were also given as a function of age in that study. Using those rates, the 10-to-14-years category had a much higher accident rate in terms of accidents per mile ridden than the others.

A comparison was made between age of the cyclist and several variables relating to the accident (Table 2). Following is a summary of the major findings from these comparisons.

- A much higher percentage of accidents involving young cyclists occurred in residential areas; the percentage of accidents involving older cyclists increased in

business areas. There was a higher percentage of accidents in each age group in residential areas than in business areas.

- Young cyclist were involved in more accidents while riding against traffic.
- Older cyclists were involved in more accidents during darkness.
- Accidents on sidewalks were limited to cyclists under 20 years of age. The highest percentage was in the 5 years or younger ages.
- The percentage of accidents at intersections increased slightly with age.
- The percentage of accidents in which the cyclists was not a contributing factor increased markedly with age. Failure to yield right of way was the leading error for all age categories except the 20-years-and-over category. Disregarding traffic controls was much more predominant among older cyclists.
- There was a slight overall decrease in bicycle defects as the cyclist's age increased.
- The right-angle accident was highest among all age categories; however, the frequency was lower among older cyclists. The percentage of overtaking and rear-end accidents increased with the cyclists' ages; head-on accidents decreased.
- The general trend was for a higher involvement of younger cyclists in rural areas; older cyclists tended to be involved in more accidents in higher populated areas.
- Young cyclists were involved in a much higher percentage of accidents during the weekend.

The injury sustained was also compared to the age of the cyclists; accident severity tended to decrease as age increased. The highest severity index (4.59) was found in the 6-to-9-years category; the lowest severity (3.27) was in the 20-years-and-over category.

Motorist Characteristics

A comparison was made between the distribution of age and sex of drivers involved in bicycle-related accidents and drivers involved in all motor-vehicle accidents (Table 3) to determine if motorists involved in bicycle-related accidents differed from the general population of motorists. The results showed that the drivers had very similar characteristics. The percentage of motorists under 30 years of age involved was identical. Also, there was less than a one-percent difference in the distribution by sex for the two categories.

Variation with Time

The percentage of bicycle accidents which occurred during various time periods, days, and months were determined. Since mileage figures were not available, rates in terms of miles ridden could not be determined. About one-half (49 percent) of all bicycle-related,

motor-vehicle accidents occurred between 3:00 and 7:00 p.m., which corresponds to the evening rush hour and recreation period. The peak occurrence of such accidents was between 4:00 and 5:00 p.m. Between 10:00 p.m. and 7:00 a.m., less than one percent of the accidents occurred during any hour. A small increase was found between 7:00 and 9:00 a.m., corresponding to the time for bicycle trips to school and work.

As expected, the summer months had the highest numbers of bicycle accidents -- attributed to increased riding during those months. The greatest percentage (approximately 17 percent each) occurred during July and August. Other months with high numbers included June, May, April, and September. The fewest accidents occurred in December and January (less than two percent each).

Bicycle accidents appeared to be distributed evenly over the week. The percentages ranged from about 11 percent on Sundays to 16 percent on Tuesdays. A secondary low occurred on Wednesdays at 12 percent.

Since most bicycle riding is done during daylight hours, 85 percent of the bicycle accidents occurred during daylight conditions. This compares closely with accidents in North Carolina and California where 82 percent and 87 percent, respectively, occurred during daylight (4, 5). Four percent of the accidents occurred during dawn or dusk; the remaining 11 percent occurred in darkness.

Accidents by County and City Size

Kentucky cities were grouped by population to determine rates of bicycle accidents as a function of city size. The accident frequency increased from 4.8 accidents per 100,000 population in rural communities to 69.1 accidents per 100,000 population in cities of over 50,000 population.

Bicycle accidents were also summarized for various county populations (Table 4). The number of accidents per county ranged from 0.6 in the least populated counties (under 10,000) to 288 in heavily populated Jefferson County. A plot of accident frequency versus county population showed that the accident frequency increased as the county size increased (Figure 1). As with city size, this was probably due to the relatively high percentage of people who ride bicycles in urban areas combined with the added probability of accidents on city streets.

Accident frequency in terms of number of accidents and accidents per 100,000 population were calculated for all of Kentucky's 120 counties as well as for cities which had three or more bicycle accidents in the study period. This permitted the identification of

those counties and cities which had the greatest need for improvement programs.

Accident Location

Almost 80 percent of the accidents occurred in urban areas on local streets. Sixteen percent occurred on state and federal highways; only four percent occurred on county or local roads. Slightly over 50 percent of all accidents were in residential areas. Almost 30 percent of the accidents were in business areas. Only 12 percent were in rural areas, and less than four percent were at schools or parks. Such summaries of accident locations indicate where the emphasis should be placed in programs to reduce these accidents.

The highest number of accidents occurred at stop signs (Table 5). A large number also occurred at traffic signals.

Accident Type

The classification of accidents according to diagrams on accident-reporting forms was shown in the accident description variable in Table 2. The most common type of accident was the right-angle collision; almost one-half of the accidents were classified in this way. Rear-end and overtaking accidents each accounted for approximately 12 percent of the total. From six to nine percent of the accidents were classified as head-on, left-turn, side-swipe, and right-turn accidents.

This summary, however, did not provide much detail concerning the accident. Therefore, a more detailed summary of the accidents according to the type of accident and maneuver (Table 6) was made by a methodology similar to the one cited in Reference 6. The accident types shown in Table 6 were ordered by number of accidents, from highest to lowest. The accident types with the higher numbers were generally those involving an error by the cyclist.

The most common type involved a cyclist failing to stop or yield at a controlled intersection. In a few instances (less than ten percent), the accident report indicated that the cyclist stopped and then pulled into the path of a motorist. The second most frequent accident type involved a cyclist exiting a driveway into the path of motorists. Further, in most cases, there was no parking on the street to reduce sight distance. Also, the motorist was in the near traffic lane in most instances. The third common type resulted when the cyclist made an improper left turn; most of these accidents involved the cyclist turning left from the right edgeline into the path of a motorist going the same direction as the cyclist. Several accidents involved a cyclist riding on the wrong side of the street; the large majority of this type were non-intersection accidents. The most common accident involving error by the

motorist was colliding with the rear of the bicycle. This resulted when the motorist did not give the cyclists a proper share of the traffic lane. Several accidents resulted when the motorist failed to stop or yield at a controlled intersection. About 20 percent of the accidents of this type involved a cyclist proceeding from a sidewalk. Most accidents involving a motorist making an improper right turn were at intersections and resulted when a motorist made a right turn into the path of a cyclist proceeding along the right edgeline. In slightly less than one-half of the accidents involving a motorist exiting a driveway, the cyclist was on the sidewalk. There was no pattern to the accidents in parking lots or accidents involving the cyclist making an improper right turn or colliding with the rear of the vehicle.

The type of accident by maneuver also was compared to the age of the cyclist (Table 6). For the youngest age group (5 years or younger), most accidents resulted from the cyclist exiting a driveway into the path of the motor vehicle. For cyclists between 6 and 14 years old, the highest number of accidents involved failure of the cyclist to stop or yield at a controlled intersection and also exiting a driveway into a motorist's path. The leading error for cyclists over 14 years of age was failure to stop or yield at a controlled intersection. The most common accident for the 20-years-and-older age group involved a vehicle colliding with the rear of the bicycle.

The type of accident by maneuver was also compared to degree of injury sustained by the cyclist (Table 6). Accidents resulting from an error by the cyclist were the most severe. Failure of the cyclist to yield right of way at a driveway or intersection resulted in the most severe accidents. Accidents involving a cyclist riding on the wrong side of the road were also severe. In general, accident severity tended to decrease as cyclist age increased. A more detailed analysis of severity by type of accident showed that severity for the specific accident types were higher for younger cyclists.

Accident Severity

A comparison of injuries in bicycle-related, motor-vehicle accidents and all motor-vehicle accidents is given in Table 7. As would be expected, the percentage of cyclists injured was very high. Also, bicycle-related, motor-vehicle accidents were less severe for the driver compared to all motor-vehicle accidents.

Injury to the cyclists was compared to several variables (Table 8). Head-on accidents were the most severe type; right-angle and rear-end accidents were second in severity. Accidents in rural areas were more severe than those in urban areas. This was probably due to the higher traffic speeds. Accidents in which the cyclist was riding against traffic

were more severe than when the cyclist was riding with the traffic. This was expected since head-on accidents were the most severe accident type.

Accidents involving a cyclist on a sidewalk were less severe than when the cyclist was traveling in the roadway. The normally low speed of the motor vehicle involved in the sidewalk collision was probably the major contributing factor in lessening severity. Surprisingly, non-intersection accidents were more severe than intersection accidents. Past results have shown many of the more severe types occurred at intersections; however, when all intersection accidents are combined, the accidents are not as severe. Also, the non-intersection accidents resulting from a cyclist riding on the wrong side of the road and a motorist colliding with the rear of a bicycle were found to be severe.

The highest severity was for accidents which occurred during dawn and dusk. Basically, these were accidents during dusk since almost 90 percent of the total in this category were during dusk.

Accident Fault

A comparison was made between fault and several variables in accidents (Table 9). It was found that cyclists were at fault in most accidents (71 percent). However, the percentage of cyclists at fault decreased with increasing age. For cyclists 20 years and older, the motorist was at fault in the majority of cases. A slightly higher percentage of male cyclists were at fault than females. It was also found that the percentage of cyclists at fault tended to be higher in the more severe accidents. The youngest and oldest driver categories had the highest percentage at fault. This would be expected because of the general relationship between driving record and age (7). There was not a large difference between the percentage of male and female drivers at fault; female drivers were at fault a slightly higher percentage of the time.

A more detailed comparison was made between the percentage of cyclists at fault and several additional variables in accidents (Table 10). The highest percentage of cyclists at fault was in rural areas. Also, the percentage of cyclists at fault was higher in daylight than in darkness. A very high percentage of cyclists were at fault in right-angle accidents, the most common accident type, as well as head-on accidents which would usually involve a cyclist traveling on the wrong side of the road. The percentage at fault was lower for rear-end and overtaking accidents which include many accidents in which the motorist did not give the cyclist a proper share of the road. The percentage of cyclists at fault did not vary significantly between intersection and non-intersection accidents or accidents on

one-way compared to two-way streets. However, the percentage of cyclists at fault was much higher for accidents on the roadway compared to those involving a cyclist riding on a sidewalk.

Other Factors

The causes of bicycle-related, motor-vehicle accidents, as determined by the investigating police officers, were summarized. Contributing actions by the cyclist included failure to yield right of way (29 percent), inattention (14 percent), disregarding traffic controls (7 percent), and turning improperly (4 percent). Contributing actions by the motorist included inattention (6 percent), failure to yield right of way (5 percent), and unsafe speed (2 percent).

The distribution of pre-accident actions for cyclists and drivers also were summarized. Cyclists were going straight ahead in 70 percent of the accidents; 9 percent involved making a left turn; 6 percent were turning right; and 3 percent were changing lanes. Motorist actions included going straight ahead (75 percent), turning right (7 percent), and backing (2 percent).

Only 40 bicycle accidents (5 percent) involved a bicycle defect. Of the 40 defects, 18 were brake failures, 12 were defective lighting, one involved steering failure, one resulted from inadequate tires, and one resulted from an excessive load on the bicycle.

An analysis was also made of the roadway defects which contributed to the accidents. Only 42 accidents (6 percent) involved roadway defects. Of those, 24 involved a view obstruction. No other defect was listed more than four times. Based on this analysis, roadway defects were a minor problem in bicycle-related, motor-vehicle accidents.

The road surface condition was dry in 94 percent of all bicycle accidents and wet during 5 percent. There were only two bicycle accidents (0.3 percent) on snow or icy roads. This would be expected since few cyclists ride during inclement weather.

Bicycle accidents occurred on straight-and-level roadway sections 73 percent of the time. Only eight percent of the accidents involved a curve. Almost one-fourth of the accidents occurred on a grade or hillcrest.

The residence of 96 percent of the cyclists involved in accidents was local, compared to 3 percent from elsewhere in the state (another county) and 1 percent from out of state. This would be expected since a greater majority of bicycle trips are short. The data did show one interesting fact: a slightly higher percentage of non-local motorists were involved in bicycle accidents compared to all traffic accidents. This may be due to the fact that

non-local motorists are not as aware of bicycle traffic as local drivers.

While trucks were involved in about 6 percent of all motor-vehicle accidents, they were involved in 11 percent of bicycle-motor vehicle accidents. This may be due to the inability of truck drivers to see cyclists in many instances.

The distribution of type of accident by maneuver was compared to city population. A cyclist making an improper left turn or riding on the wrong side of the street were most common in rural areas and small cities. In larger cities, failure of the cyclist to stop or yield at an intersection were the most common accidents.

SUMMARY

A summary of some of the major findings concerning bicycle-related, motor-vehicle accidents follows:

1. The 10-to-14-years category was involved in the largest number of bicycle-related, motor-vehicle accidents and had the highest accident frequency.
2. Males were involved in four times as many bicycle-related, motor-vehicle accidents as females.
3. Several factors were related to age. For example, young cyclists were involved in more accidents in residential areas; older cyclists had a higher percentage of their accidents in business areas. Also, a higher percentage of young cyclists were involved in accidents while traveling against traffic.
4. Accident severity tended to decrease as age increased.
5. The age and sex distribution of drivers involved in bicycle-related, motor-vehicle accidents was very similar to that for drivers involved in all motor-vehicle accidents.
6. The highest proportion of accidents occurred between 3:00 and 7:00 p.m.
7. The summer months accounted for the highest numbers of bicycle accidents.
8. Accident frequency (accidents per 100,000 population) increased in cities and counties with higher populations.
9. Most bicycle-related, motor-vehicle accidents occurred in residential sections of urban areas.
10. The most common type of accident was the right-angle accident.
11. The most common fault of a cyclist was failure to stop or yield at a controlled intersection. This type of accident was followed in frequency by a cyclist exiting from a driveway into the motorist's path and a cyclist making an improper left turn. The most

common accident involving error by the motorist resulted from the motorist colliding with the rear of the bicycle.

12. The common types of accidents varied with the cyclist's age. For 5 years or younger, most accidents resulted from the cyclist exiting from a driveway into the motorist's path. For 20 years or older, the most common accident type involved a motorist colliding with the rear of a bicycle.

13. Accident severity was found to be related to several factors. Many of the severe types of accidents occurred at intersections; but when all intersection accidents were combined, they were not as severe as non-intersection accidents. Non-intersection accidents resulting from a cyclist riding on the wrong side of the road and a motorist colliding with the rear of a bicycle were severe.

14. The majority of accidents (71 percent) were the result of an error by the cyclist; however, the percentage of cyclists at fault decreased with increasing age.

IMPLEMENTATION

One of the results of this study was a listing of counties and cities which had the highest frequency of bicycle-related, motor-vehicle accidents. This listing provided the basis for a similar listing in the problem identification section of Kentucky's annual highway safety plan. Counties and cities identified as high-accident locations may be eligible for grants for implementation of safety improvement programs.

Bicycle transportation plans have been developed for several Kentucky cities. The statewide accident statistics developed in this report have been used for comparison to determine where bicycle accidents in a given city vary from the statewide norm.

The summaries provided in this report should provide useful information for the development of bicycle safety educational programs. For example, a table giving the distribution of accidents by maneuver related to the grade level of the cyclist was developed (Table 11). This table shows the grade level at which training should be administered to prevent or minimize certain types of accidents.

REFERENCES

1. **Accident Facts**, 1977 Edition, National Safety Council.
2. Agent, K. R.; *Evaluation of the High-Accident Location Spot-Improvement Program in Kentucky*, Division of Research, Kentucky Department of Transportation, February 1973.

3. Campbell, B. J.; Foley, J. P.; and Pascarella, E. A.; *Bicycle Riding and Accidents among Youths -- A Summary Report*, The University of North Carolina Highway Safety Research Center, July 1971.
4. Waller, P. F.; and Reinfurt, D. W.; *Bicycles: An Analysis of Accidents in North Carolina*, The University of North Carolina Highway Safety Research Center, February 1969.
5. *California Bicycle Accidents -- Their Relationship to Enforcement and Equipment Factors*, California Highway Patrol, November 1974.
6. Anacapa Sciences, Inc., Presentation at Bicycle Safety Seminar, California Office of Traffic Safety, Sacramento, California, June 18, 1974.
7. Agent, K. R.; *Characteristics of Kentucky Drivers*, Division of Research, Kentucky Department of Transportation, December 1974.

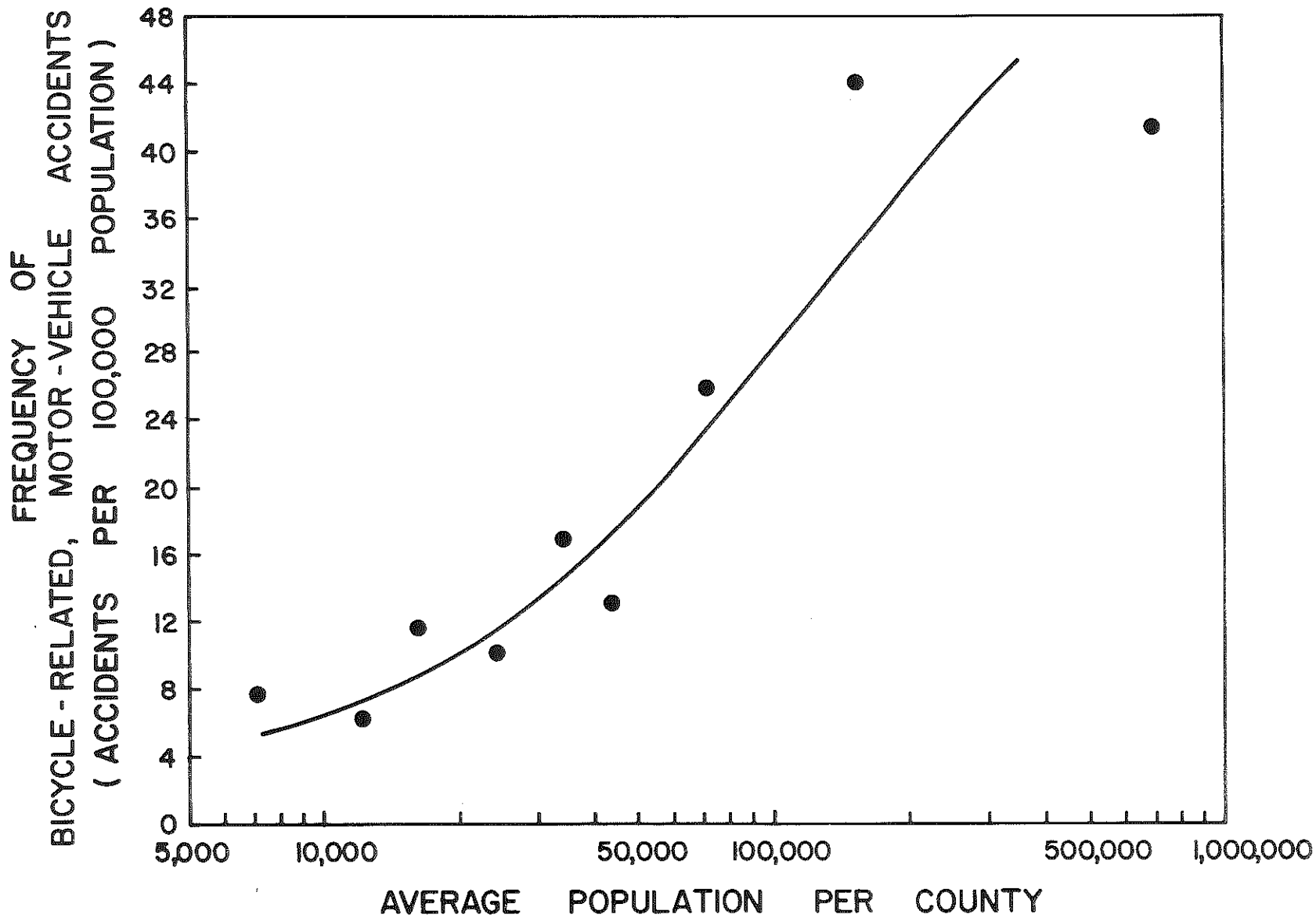


Figure 1. Frequency of Bicycle-Related, Motor -Vehicle Accidents Compared to County Population.

TABLE 1. BICYCLE-RELATED, MOTOR-VEHICLE ACCIDENTS BY AGE AND SEX OF CYCLIST

AGE OF CYCLIST (YEARS)	NUMBER OF ACCIDENTS	PERSONS AT THAT AGE*	ACCIDENT FREQUENCY PER 100,000 PEOPLE
MALE CYCLISTS			
0 - 4	8	138,594	5.8
5 - 9	130	162,195	80.2
10 - 14	258	170,433	151.4
15 - 19	120	167,057	71.8
20 - 29	48	231,908	20.7
30 - 39	6	167,663	3.6
40 - 49	6	175,929	3.4
50 - 59	2	154,583	1.3
60 - 69	1	118,037	0.8
70 AND OLDER	3	92,637	3.2
ALL	582	1,579,036	36.9
FEMALE CYCLISTS			
0 - 4	3	132,505	2.3
5 - 9	26	155,048	16.8
10 - 14	70	162,959	43.0
15 - 19	32	151,699	21.1
20 - 29	11	237,571	4.6
30 - 39	3	178,731	1.7
40 - 49	0	187,110	0.0
50 - 59	0	167,814	0.0
60 - 69	0	137,958	0.0
70 AND OLDER	0	128,275	0.0
ALL	145	1,639,670	8.8
ALL CYCLISTS			
0 - 4	11	271,099	4.1
5 - 9	156	317,243	49.2
10 - 14	328	333,392	98.4
15 - 19	152	318,756	47.7
20 - 29	59	469,479	12.6
30 - 39	9	346,394	2.6
40 - 49	6	363,039	1.7
50 - 59	2	322,397	0.6
60 - 69	1	255,995	0.4
70 AND OLDER	3	220,912	1.4
ALL	727	3,218,706	22.6

*DATA FROM 1970 KENTUCKY CENSUS

TABLE 2. COMPARISON OF AGE OF CYCLIST TO SEVERAL VARIABLES

VARIABLE	CATEGORY	PERCENT OF ALL ACCIDENTS IN EACH AGE GROUP				
		AGE OF CYCLIST				
		5 AND UNDER	6 - 9	10 - 14	15 - 19	20 AND OVER
LAND USE/ LOCALITY	RESIDENTIAL	69.2	63.6	49.8	42.4	45.7
	BUSINESS	11.5	20.5	30.4	36.4	35.7
DIRECTION OF TRAVEL	RIDING AGAINST TRAVEL	26.9	15.6	16.2	7.9	15.0
LIGHT CONDITION	DARKNESS	4.2	4.3	10.7	16.7	18.2
ACCIDENT LOCATION	SIDEWALK	4.2	2.9	3.3	3.4	0.0
	INTERSECTION	36.4	54.5	56.9	55.6	51.9
CONTRIBUTING CIRCUMSTANCE	UNSAFE SPEED	0.0	1.7	1.4	2.2	0.0
	FAILED TO YIELD RIGHT OF WAY	38.1	41.0	32.5	19.2	2.9
	FOLLOWING TOO CLOSE	0.0	0.0	0.7	0.7	2.9
	IMPROPER PASSING	0.0	0.0	0.3	1.5	0.0
	DISREGARD TRAFFIC CONTROLS	4.8	6.0	5.9	8.9	4.3
	TURNING IMPROPERLY	0.0	2.6	5.5	5.2	0.0
	INATTENTION	23.8	21.3	15.6	6.7	4.4
	DISTRACTION	0.0	0.0	0.7	1.5	2.9
	OTHERS	4.8	12.0	10.4	12.6	8.7
	NONE	28.5	15.4	27.0	41.5	66.7
BICYCLE DEFECT	BICYCLE WITH DEFECT	8.7	6.6	5.4	5.8	8.2
ACCIDENT DESCRIPTION (DIAGRAM SHOWN ON ACCIDENT FORM)	REAR END	0.0	10.5	9.8	20.9	12.5
	OVERTAKING	0.0	4.2	12.0	15.7	21.9
	LEFT TURN	10.0	1.1	8.4	10.4	14.0
	RIGHT ANGLE	40.0	61.1	47.1	41.8	25.0
	RIGHT TURN	10.0	8.4	7.6	2.6	3.2
	HEAD ON	40.0	8.4	9.8	4.3	10.9
POPULATION	SIDESWIPE	10.0	6.7	5.3	4.3	12.5
	RURAL	27.0	12.1	12.5	10.5	3.8
	2,500 - 10,000	15.4	13.5	11.9	7.2	11.4
	10,001 - 25,000	7.7	7.8	14.7	18.4	16.4
	25,001 - 50,000	3.8	12.0	13.4	9.2	3.8
	50,001 - 100,000	0.0	6.4	8.2	5.3	6.3
100,000 - 200,000	3.8	11.3	6.7	11.2	19.0	
OVER 200,000	42.3	36.9	32.6	38.2	39.3	
DAY OF WEEK	WEEKEND	38.5	28.4	27.1	22.4	15.0

TABLE 3. COMPARISON OF AGE AND SEX OF DRIVERS INVOLVED IN BICYCLE ACCIDENTS TO ALL MOTOR VEHICLE ACCIDENTS

	PERCENT OF TOTAL	
	BICYCLE ACCIDENTS	ALL ACCIDENTS
AGE OF DRIVER		
19 AND UNDER	24.4	18.8
20 - 29	28.5	34.1
30 - 39	16.1	16.7
40 - 49	12.7	11.6
50 - 59	9.3	9.5
60 - 69	6.6	5.9
70 AND OVER	2.4	3.3
SEX OF DRIVER		
MALE	68.3	68.7
FEMALE	31.7	31.3

TABLE 4. BICYCLE ACCIDENTS BY COUNTY POPULATION

GROUP NUMBER	COUNTY POPULATION	NUMBER OF COUNTIES	NUMBER OF BICYCLE ACCIDENTS	NUMBER OF BICYCLE ACCIDENTS PER COUNTY	AVERAGE POPULATION PER COUNTY (EST. 1975)	BICYCLE ACCIDENTS PER 100,000 POPULATION
1	0 - 10,000	29	18	0.6	7,183	7.9
2	10,001 - 15,000	31	23	0.7	12,197	6.1
3	15,001 - 20,000	20	41	2.1	17,465	11.7
4	20,001 - 30,000	14	33	2.4	24,400	9.7
5	30,001 - 40,000	11	62	5.6	34,164	16.5
6	40,001 - 60,000	5	29	5.8	44,600	13.0
7	60,001 - 100,000	7	133	19.0	71,357	26.6
8	100,001 - 200,000	2	134	67.0	152,412	44.0
9	200,001 - 800,000	1	288	288.0	700,700	41.1

TABLE 5. DISTRIBUTION OF BICYCLE
ACCIDENTS BY TYPE OF
TRAFFIC CONTROL

TYPE OF TRAFFIC CONTROL	NUMBER OF ACCIDENTS	PERCENT OF TOTAL
STOP SIGN	153	23.4
CENTERLINE	143	21.8
ADVISORY SPEED LIMIT	88	13.4
STOP AND GO SIGNAL	71	11.0
NO PASSING ZONE	31	4.7
MEDIAN	16	2.4
YIELD SIGN	4	0.6
RAILROAD SIGNS OR SIGNALS	3	0.5
FLASHING LIGHT	2	0.3
CURVE SIGN	2	0.3
OFFICER OR FLAGMAN	1	0.1
OTHER	141	21.5

TABLE 6. BICYCLE ACCIDENTS BY TYPE OF MANEUVER,
AGE OF CYCLIST, AND SEVERITY OF ACCIDENT

TYPE OF ACCIDENT BY MANEUVER	NUMBER OF ACCIDENTS	PERCENT OF TOTAL	PERCENT OF ALL ACCIDENTS					AVERAGE AGE OF CYCLIST	SEVERITY INDEX		
			AGE OF CYCLIST (YEARS)						AGE OF CYCLIST (YEARS)		
			5 AND UNDER	6-9	10-14	15-19	20 AND OVER		LESS THAN 16	16 AND OLDER	ALL CYCLISTS
CYCLIST FAILED TO STOP OR YIELD AT CONTROLLED INTERSECTION	160	21.7	8.0	30.9	23.8	17.0	9.3	12.4	4.53	3.64	4.34
CYCLIST EXITED DRIVEWAY INTO MOTORIST'S PATH	120	16.3	60.0	30.2	15.3	6.8	2.7	10.1	4.51	3.00	4.38
CYCLIST MADE IMPROPER LEFT TURN	91	12.4	4.0	11.0	16.3	10.9	6.7	12.8	4.55	3.30	4.29
CYCLIST RODE ON WRONG SIDE OF STREET	67	9.1	16.0	8.8	9.7	6.8	9.3	13.8	4.45	4.31	4.34
MOTORIST COLLIDED WITH REAR OF CYCLIST	59	8.0	0	2.2	5.0	17.0	18.6	18.7	3.90	3.77	3.83
MOTORIST FAILED TO STOP OR YIELD AT CONTROLLED INTERSECTION	37	5.0	0	4.4	3.1	10.2	8.0	16.2	4.62	3.25	4.03
MOTORIST MADE IMPROPER LEFT TURN	34	4.6	0	0	4.1	6.1	14.7	17.9	3.07	3.00	3.04
MOTORIST MADE IMPROPER RIGHT TURN	34	4.6	0	0	4.1	6.8	10.7	18.5	2.56	2.50	2.52
MOTORIST EXITED DRIVEWAY INTO CYCLIST'S PATH	27	3.7	12.0	2.2	4.4	2.7	2.7	13.2	3.74	2.25	3.39
PARKING LOT	27	3.7	0	1.5	4.7	2.7	4.0	14.9	3.28	2.43	2.98
CYCLIST MADE IMPROPER RIGHT TURN	13	1.8	0	2.2	2.2	1.4	0	11.0	3.58	*	3.58
CYCLIST COLLIDED WITH REAR OF MOTORIST	12	1.6	0	0.7	1.3	2.7	2.7	15.2	2.67	3.20	2.75
MOTORIST OPENED CAR DOOR INTO CYCLIST'S PATH	9	1.2	0	0	1.6	2.1	1.3	15.3	2.83	1.83	2.50
OTHER	46	6.3	0	5.9	4.4	6.8	9.3	15.5	5.15	4.07	4.57

*NO DATA

TABLE 7. INJURIES TO CYCLISTS AND DRIVERS INVOLVED IN BICYCLE-RELATED, MOTOR VEHICLE ACCIDENTS AND DRIVERS INVOLVED IN ALL ACCIDENTS

INJURY	PERCENT OF TOTAL		
	BICYCLE ACCIDENTS		ALL ACCIDENTS
	CYCLIST	DRIVER	
FATAL	1.3	0.1	0.2
INCAPACITATING INJURY	17.5	0.0	2.2
NON-INCAPACITATING INJURY	28.5	1.0	4.8
POSSIBLE INJURY	28.2	1.3	5.4
NONE DETECTED	24.5	97.0	87.4

TABLE 8. COMPARISON OF CYCLIST'S INJURY
TO SEVERAL VARIABLES

VARIABLE	CATEGORY	SEVERITY INDEX
ACCIDENT DESCRIPTION (DIAGRAM SHOWN ON ACCIDENT FORM)	LEFT TURN	3.10
	RIGHT ANGLE	4.13
	RIGHT TURN	3.70
	HEAD-ON	4.22
	SIDESWIPE	3.47
	REAR-END	4.13
	OVERTAKING	3.78
POPULATION	RURAL	5.40
	2,501- 10,000	3.96
	10,001- 25,000	3.66
	25,001- 50,000	4.17
	50,001-100,000	3.26
	100,001-250,000 OVER 250,000	4.03 3.81
RIDING WITH OR AGAINST TRAFFIC	WITH TRAFFIC	3.66
	AGAINST TRAFFIC	4.27
ACCIDENT LOCATION	INTERSECTION	3.85
	NON-INTERSECTION	4.27
	ROADWAY	4.27
	SIDEWALK	2.70
	DRIVEWAY	4.00
LIGHT CONDITION	DAYLIGHT	4.00
	DAWN/DUSK	4.56
	DARKNESS	3.94

TABLE 9. COMPARISON OF FAULT AND SEVERAL VARIABLES IN ACCIDENTS

VARIABLE	CATEGORY	PERCENT AT FAULT
VEHICLE	CYCLIST	71
	DRIVER	29
CYCLIST'S AGE	5 AND UNDER	88
	6-9	87
	10-14	76
	15-19	55
	20 AND OLDER	34
CYCLIST'S SEX	MALE	72
	FEMALE	63
CYCLIST'S INJURY	FATAL	90
	INCAPACITATING	82
	NON-INCAPACITATING	72
	POSSIBLE INJURY	68
	NONE DETECTED	66
DRIVER'S AGE	19 AND UNDER	44
	20-29	27
	30-39	20
	40-49	17
	50-59	21
	60-69	30
	70 AND OLDER	39
DRIVER'S SEX	MALE	27
	FEMALE	31

TABLE 10. COMPARISON OF PERCENT OF CYCLISTS AT FAULT AND SEVERAL VARIABLES IN ACCIDENTS

VARIABLE	CATEGORY	PERCENT OF CYCLISTS AT FAULT
LAND USE/ LOCALITY	RURAL	85
	RESIDENTIAL	73
	PRIVATE PROPERTY	71
	BUSINESS	68
	SCHOOL	63
	INDUSTRIAL	50
	PARK	40
POPULATION	RURAL (UNDER 2500)	83
	2,500 - 10,000	65
	10,001 - 25,000	68
	25,001 - 50,000	76
	50,001 - 100,000	72
	100,001 - 250,000	64
	OVER 250,000	69
LIGHT CONDITIONS	DAYLIGHT	74
	DAWN/DUSK	58
	DARKNESS	54
ACCIDENT DESCRIPTION (DIAGRAM SHOWN ON ACCIDENT FORM)	REAR END	42
	OVERTAKING	58
	LEFT TURN	42
	RIGHT ANGLE	80
	RIGHT TURN	72
	HEAD-ON	89
	SIDESWIPE	70
ACCIDENT LOCATION	INTERSECTION	71
	NON-INTERSECTION	67
	ROADWAY	73
	SIDEWALK	27
	ONE-WAY STREET	74
	TWO-WAY STREET	71

TABLE 11. DISTRIBUTION OF ACCIDENTS BY MANEUVER
RELATED TO GRADE LEVEL OF CYCLIST

TYPE OF ACCIDENT BY MANEUVER	K*	PERCENT OF ACCIDENTS OCCURRING THROUGH A GIVEN GRADE LEVEL											
		GRADE LEVEL											
		1	2	3	4	5	6	7	8	9	10	11	12
CYCLIST FAILED TO STOP OR YIELD AT CONTROLLED INTERSECTION	1	7	11	19	29	41	46	57	68	79	86	91	91
CYCLIST EXITED DRIVEWAY INTO MOTORIST'S PATH	12	18	28	37	47	56	72	77	85	90	93	96	97
CYCLIST MADE IMPROPER LEFT TURN	0	3	10	14	17	24	35	43	59	76	83	89	91
CYCLIST RODE ON WRONG SIDE OF STREET	6	8	14	20	25	31	45	55	64	73	80	83	84
MOTORIST COLLIDED WITH REAR OF CYCLIST	0	0	0	0	5	5	10	16	21	33	47	57	62
MOTORIST FAILED TO STOP OR YIELD AT CONTROLLED INTERSECTION	0	0	3	5	16	19	27	32	41	43	57	62	73
MOTORIST MADE IMPROPER LEFT TURN	0	0	0	0	0	6	6	15	27	39	45	55	61
MOTORIST MADE IMPROPER RIGHT TURN	0	0	0	0	0	0	6	13	23	42	52	61	65
MOTORIST EXITED DRIVEWAY INTO CYCLIST'S PATH	0	12	12	16	20	24	32	48	60	76	76	76	80
PARKING LOT	4	4	4	8	12	20	20	24	40	72	72	80	88
CYCLIST MADE IMPROPER RIGHT TURN	0	15	31	31	31	38	46	54	54	85	100	100	100
CYCLIST COLLIDED WITH REAR OF MOTORIST	0	0	0	9	9	27	27	27	45	45	55	73	73
MOTORIST OPENED CAR DOOR INTO CYCLIST'S PATH	0	0	0	0	0	0	0	0	33	56	67	67	67

*KINDERGARTEN