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SUBJECT: Research Report 498; "Characteristics of Bicycle-Related, Motor Vehicle Accidents in Kentucky;" KYP-76-80; HPR-PL-1(14), Part III-B.

The study from which the enclosed report issues is entitled "Safety and Design Innovations for Bicycle Travel." It began FY '77. This report completes the major task planned. In some respects, the report provides essential statistics and gives latitudes for improvement of safety. The report does not address off-street or off-road bikeways -- only bicycle-related, motor vehicle accidents, which are mostly on-street and on-road encounters.

Respectfully submitted,

Jas. H. Havens
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Enclosure
cc's: Research Committee

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Study Title: Characteristics of Bicycle-Related, Motor Vehicl e Accidents in Kentucky

16. Abstract

The purpose of this study was to determine the characteristics associated with bicycle-related, motor vehicle accidents. Bicycle-related, motor vehicle accidents in Kentucky were analyzed. A sample of injury-producing bicycle accidents was also analyzed.

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.

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Research Report
498

CHARACTERISTICS OF BICYCLE-RELATED, MOTOR VEHICLE ACCIDENTS IN KENTUCKY

KYP-76-80; HPR-PL-1(14), Part III-B

by

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INTRODUCTION

The increase in use of bicycles in recent years has resulted in more emphasis on bicycles as a viable transportation mode. Recent upsurges in bicycle use throughout Kentucky is evidenced by bicycle traffic around college campuses, by neighborhood recreational usage, and by weekday commuters. In the governor's 1976-1978 biennial budget, $2 million were allocated for the development of bikeways or related facilities. Planning for bicycle traffic in urban areas became a function of the Department's Division of Urban and Regional Planning in 1975. Therefore, a need for a better understanding of bicycle-related, motor vehicle accidents became apparent.

The purpose of this study was to determine the characteristics of bicycle-related, motor vehicle 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.

BACKGROUND

Many articles and reports have dealt with the bicycle as a transportation mode. Guidelines and criteria for bikeway planning, developed in California in April 1972, were later reprinted and distributed by the Federal Highway Administration for use in bikeway planning *(1)*. In July 1974, a state-of-the-art report on bikeways was distributed by the Federal Highway Administration. This report focused on planning and design practices, reviewed successes and failures, outlined practices which improved bikeway usage and safety, and identified design pitfalls *(2)*. A guide for bicycle routes was published by AASHTO in 1974 and included discussions of bikeway laws, planning considerations, design criteria, maintenance aspects, and administrative considerations *(3)*.

Some studies have dealt specifically with an analysis of accident records. Several state highway agencies have conducted in-depth analyses. In February 1969, a report covered an analysis of 2,453 bicycle accidents in North Carolina over a three-year period (July 1965 through June 1968) *(4)*. A follow-up study was conducted in North Carolina in July 1971 to determine accident frequency and rates associated with various bicycle, human, and environmental characteristics *(5)*. Actual mileage exposure of several hundred cyclists was measured with cyclometers. In Idaho in 1973, statistics were compiled concerning the frequency, locations, and causes of bicycle and pedestrian accidents *(6)*. The California Highway Patrol in November 1974 evaluated its Bicycle Enforcement Program. The report included an analysis of over 10,000 bicycle-vehicle accidents occurring in 1973 *(7)*.

An analysis of bicycle accidents in Milwaukee included 298 accidents reported during 1971 and 1972. Summaries were completed separately for intersections and midblocks *(8)*. In Santa Barbara, California, an analysis was made of 495 bicycle accidents from 1970 through 1972, and participants in collisions were interviewed. Also, about 3,000 cyclists and motorists were interrogated to determine the attitudes of motorists and cyclists toward each other *(9)*. The accidents were classified into several types based upon the accident-precipitating behavior and the situation in which the accident occurred *(10)*.

Analyses of bicycle accidents have also been completed by several other agencies in recent years. In a 1974 study by the Insurance Institute for Highway Safety, 888 injury-producing bicycle-motor-vehicle accidents were evaluated for causal factors *(11)*. An in-depth analysis of 170 bicycle accidents treated in emergency rooms was conducted in 1972 by the Food and Drug Administration (U. S. Department of HEW). Accident causes related to the bicycle, such as loss of control, riding double, stunt riding, bicycle design features, foot slippage on pedal, and component failure, were evaluated. Types of injuries to cyclists were studied, and recommendations were made for improving bicycles to minimize risks *(12)*. In 1967, the National Safety Council studied bicycle accidents involving school-aged children so that meaningful countermeasures could be developed *(13)*.

An analysis of 1,100 casualty accidents involving bicycles was conducted for the state of Victoria, Australia, in 1968 *(14)*. A study of 275 accidents in Toronto, Canada, to identify selected rider, bicycle, and environmental factors *(15)* was completed in 1970. Special emphasis was placed on child cyclists. In Sweden, a 1971 study of bicycle injuries focused primarily on the pre-crash through post-crash circumstances of the accidents *(16)*.

BICYCLE SAFETY PROBLEM

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-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. In addition, bicycle sales in the United States in 1972 exceeded automobile sales for the first time. Accompanying this increased usage 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 towns have developed entire bicycle transportation systems to encourage an efficient and smooth flow of both motor vehicles and bicycles. Other cities have invested large sums of money in the construction of bicycle routes or trails which are only for the use of cyclists. If bicycle use continues to increase at its present rate, it will soon be necessary to not only construct bicycle trails but also to require consideration of 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, as shown in Figure 1 *(17)*. From 1973 to 1976, bicycle fatalities have decreased to about 900 per year, possibly due to the national emphasis on bicycle safety. Bicycle-related, motor vehicle fatalities in Kentucky have fluctuated from 6 to 18 per year between 1969 and 1976, as shown in Table 1.

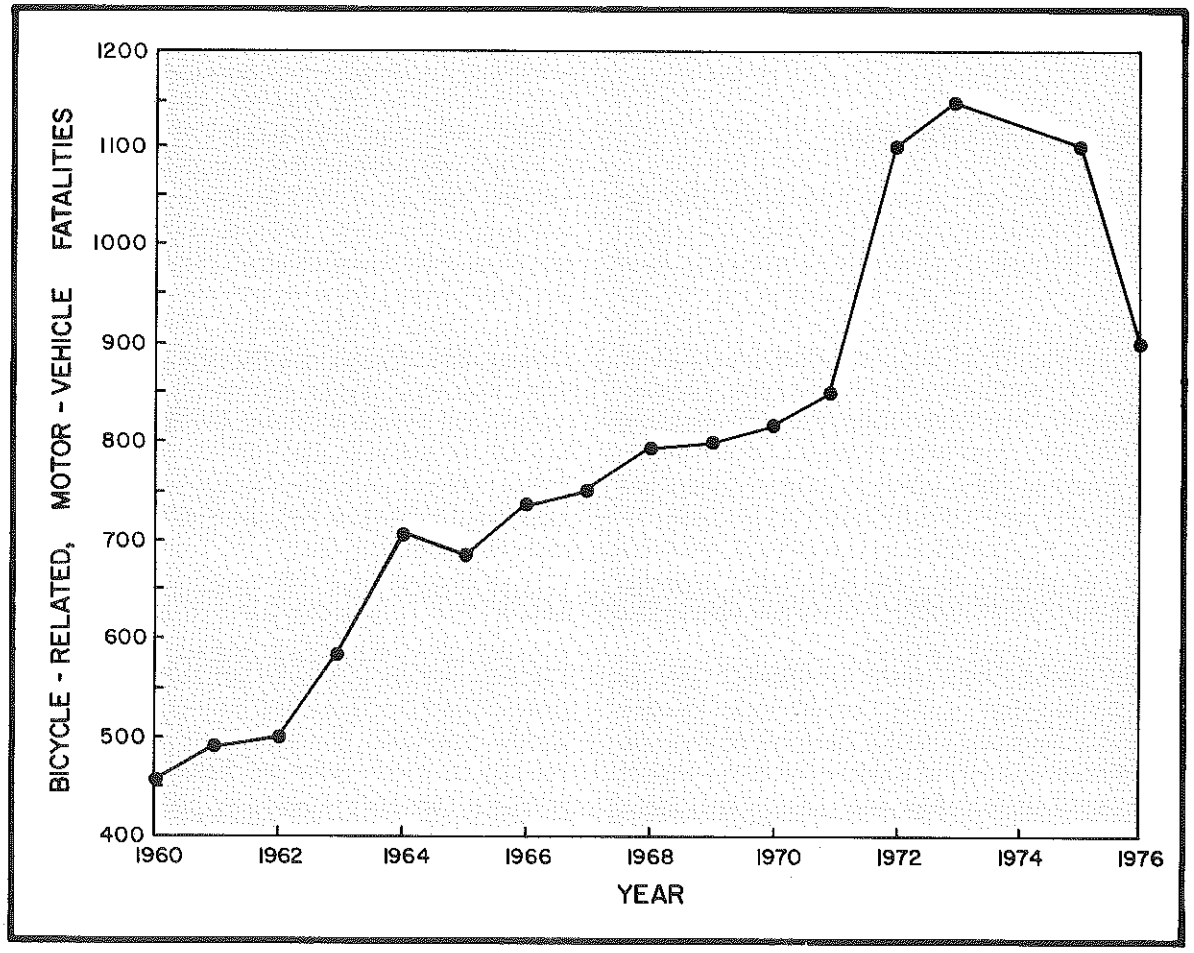

Figure 1. Motor-Vehicle-Related Bicycle Fatalities in the United States (1960-1976).

TABLE 1. BICYCLE FATALITIES IN KENTUCKY (1969-1976)

YEAR	NUMBER OF BICYCLE FATALITIES
1969	11
1970	12
1971	11
1972	9
1973	18
1974	13
1975	6
1976	10

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 *(17)*.

The ages of cyclists involved in injury accidents in the United States in 1976 are given in Table 2. 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 bicycle accident rate was 61.7 (accidents per 100,000 population) for the 5-to-14 age group -- more than double the rate for the 15-to-24 age group. The next highest rate was the 4-and-under age group. Other age groups had much lower rates.

PROCEDURE

All bicycle-related, motor vehicle accidents between July 1, 1975, and June 30, 1976, were obtained from police records. The police report was obtained for each accident. For accidents reported, by the state police a computer summary was used to identify the accidents; and then the accident reports were located. All of the accidents reported by others were searched manually, and copies of all bicycle-related accidents were obtained. Information from the bicycle-related, motor vehicle accidents were coded, and computer programs were written to analyze the data. The data were summarized into many categories, and relationships among various types of data were studied.

TABLE 2. BICYCLE INJURY ACCIDENTS AND RATES BY AGE (UNITED STATES)

AGE OF CYCLIST (YEARS)	NUMBER OF BICYCLE ACCIDENTS	1970 POPULATION (THOUSANDS)	ACCIDENTS PER 100,000 POPULATION
0- 4	2,000	17,167	11.7
5-14	25,100	40,688	61.7
15-24	10,000	36,493	27.4
25-44	1,400	48,413	2.9
45-64	1,000	41,938	2.4
65-74	200	12,482	1.6
75 AND OVER	300	7,695	3.9

To determine differences in severity of various types of accidents, a severity index was used *(18)*. 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. The formula used 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, and
- N = total bicycle-motor vehicle accidents.

A summary of data relating to bicycle accidents collected in 1976 through the Kentucky Electronic Injury Surveillance System was also obtained. This provided a sample of all injury-producing bicycle accidents.

RESULTS

ALL BICYCLE-RELATED ACCIDENTS

The Kentucky Electronic Injury Surveillance System has been developed by the Kentucky Department for Human Resources to study the safety of consumer products. Emergency room records of injuries resulting from consumer products are collected at 12 hospitals throughout the state. Using this sample, projections are made concerning total accidents in a year. Accidents involving bicycles are included. In 1975, bicycles were number one on the product hazard index; an estimated 5,000 injuries occurred. In 1976, bicycles were number two on the hazard index (an estimated 7,300 injuries). Copies of the emergency room information concerning bicycle-related injuries were obtained for the accidents reported in 1976. The data showed that bicycle-related, motor vehicle accidents represented under ten percent of all injury-producing bicycle accidents. A detailed analysis of all injury-producing bicycle accident as well as a comparison to bicycle-related, motor vehicle accidents is given in APPENDIX A.

BICYCLE-RELATED, MOTOR VEHICLE ACCIDENTS

There was a total of 762 bicycle-related, motor vehicle accidents during the one-year study period. They are summarized as follows:

Bicyclist Characteristics

The distribution of bicycle-related, motor vehicle accidents by age of the cyclist is given in Table 3. The 10- to 14-year olds had the highest number of accidents. Nearly one-half of all accidents involved cyclists in this age group. Only 11 percent of the cyclists involved in accidents were over 19 years old. The distribution of accidents by sex of the bicyclist (Table 4) showed that males were involved in four times as many bicycle accidents as females.

Bicycle accident frequency, given in terms of accidents per 100,000 people, was also related to the bicyclists' ages (Table 5) and sex (Table 6). The age categories were varied slightly in these tables because they had to conform to categories given in population summaries. The highest accident frequency was found again in the 10-to-14-years category. This was true 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 was found to be four times that for females. 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.

TABLE 3. DISTRIBUTION OF BICYCLE-RELATED, MOTOR VEHICLE ACCIDENTS BY AGE OF CYCLIST

AGE OF CYCLIST (YEARS)	NUMBER OF ACCIDENTS	PERCENT OF TOTAL
5 AND UNDER	26	3.6
6- 9	141	19.4
10-14	328	45.1
15-19	152	20.9
20-29	59	8.1
30-39	9	1.3
40-49	6	0.8
50-59	2	0.3
60-69	1	0.1
70 AND OLDER	3	0.4

TABLE 4. BICYCLE-RELATED, MOTOR VEHICLE ACCIDENTS BY SEX OF CYCLIST

SEX OF CYCLIST	NUMBER OF ACCIDENTS	PERCENT OF TOTAL
MALE	608	80
FEMALE	148	20

TABLE 5. BICYCLE-RELATED, MOTOR VEHICLE ACCIDENT FREQUENCY BY AGE OF CYCLIST

AGE OF CYCLIST (YEARS)	NUMBER OF ACCIDENTS	PERSONS AT THAT AGE*	ACCIDENT FREQUENCY PER 100,000 PEOPLE
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	220,512	1.4

*DATA FROM 1970 KENTUCKY CENSUS

TABLE 6. BICYCLE-RELATED, MOTOR VEHICLE ACCIDENT FREQUENCY BY AGE AND SEX OF CYCLIST

AGE OF CYCLIST (YEARS)	NUMBER OF ACCIDENTS	PERSONS AT THAT AGE*	ACCIDENT FREQUENCY PER 100,000 PEOPLE
MALE			
4 AND UNDER	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			
4 AND UNDER	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

*DATA FROM 1970 KENTUCKY CENSUS

However, a 1971 study conducted in North Carolina found that the miles per year ridden by males was about twice that for females. This was in the 5-to-19-years category. If the assumption were made that males ride twice as many miles as females, the accident rate for males would be approximately twice that for females. Mileage rates were given as a function of age *(5)*. Using these rates, the 10-to-14-years category had a much higher accident rate than the others.

A comparison was made between age of the cyclist and several variables relating to the accident (Table 7).

TABLE 7. 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
	SIDESWIPE	10.0	6.7	5.3	4.3	12.5
POPULATION	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

Following is a summary of the variables which were studied and their relationship:

VARIABLE	RELATIONSHIP
1. Land Use/Locality	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.
2. Riding With or Against Traffic	Young cyclists were involved in more accidents while riding against traffic.
3. Light Conditions	Older cyclists were involved in more accidents during darkness.
4. Accident Location (Roadway or Sidewalk)	Accidents on sidewalks were limited to cyclists under 20 years of age. The highest percentage was in the 5 years or younger ages.
5. Accident Location (Intersection or Non-Intersection)	The percentage of accidents at intersections increased slightly with age.
6. Contributing Circumstances	The percentage of accidents in which the cyclist 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.
7. Bicycle Defect	There was a slight overall decrease in bicycle defects as the cyclist's age increased.
8. Accident Description (Diagram Shown on Accident Form)	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.
9. Population	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.
10. Day of Week	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 cyclist (Table 8). Accident severity tended to decrease as age increased. The highest severity was found in the 6-to-9-years category; the lowest severity 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 motor vehicle accidents (Table 9). This was done 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

About one-half (49 percent) of all bicycle accidents occurred between 3:00 and 7:00 p.m., which corresponds to the evening rush hour and recreation period. 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 (Figure 2).

TABLE 8. COMPARISON OF AGE OF CYCLIST TO INJURY SUSTAINED

AGE OF CYCLIST	NUMBER OF FATAL ACCIDENTS	PERCENT FATAL OR INCAPACITATING ACCIDENTS	SEVERITY INDEX
5 AND UNDER	1	19.2	4.27
6 - 9	2	25.5	4.59
10 - 14	4	20.7	4.24
15 - 19	3	14.6	3.58
20 AND OLDER	0	11.3	3.27

TABLE 9. 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

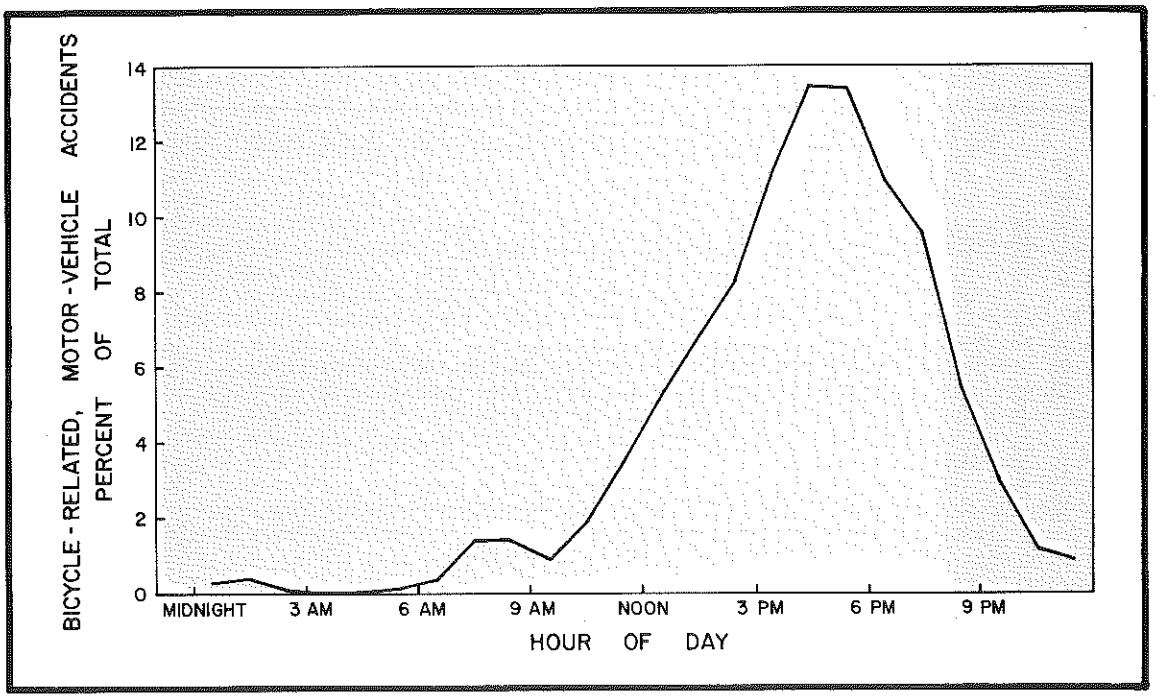

Figure 2. Distribution of Bicycle-Related, Motor Vehicle Accidents by Hour of Day.

As expected, the summer months had the highest numbers of bicycle accidents -- attributed to increased riding during those months (Figure 3). The greatest percentage occurred during July and August. Other months with high numbers included June, May, April, and September. The fewest accidents occurred in December and January.

Bicycle accidents appeared to be distributed evenly over the week as shown in Figure 4. The percentages ranged from about 10.5 percent on Sundays to 16.1 percent on Tuesdays.

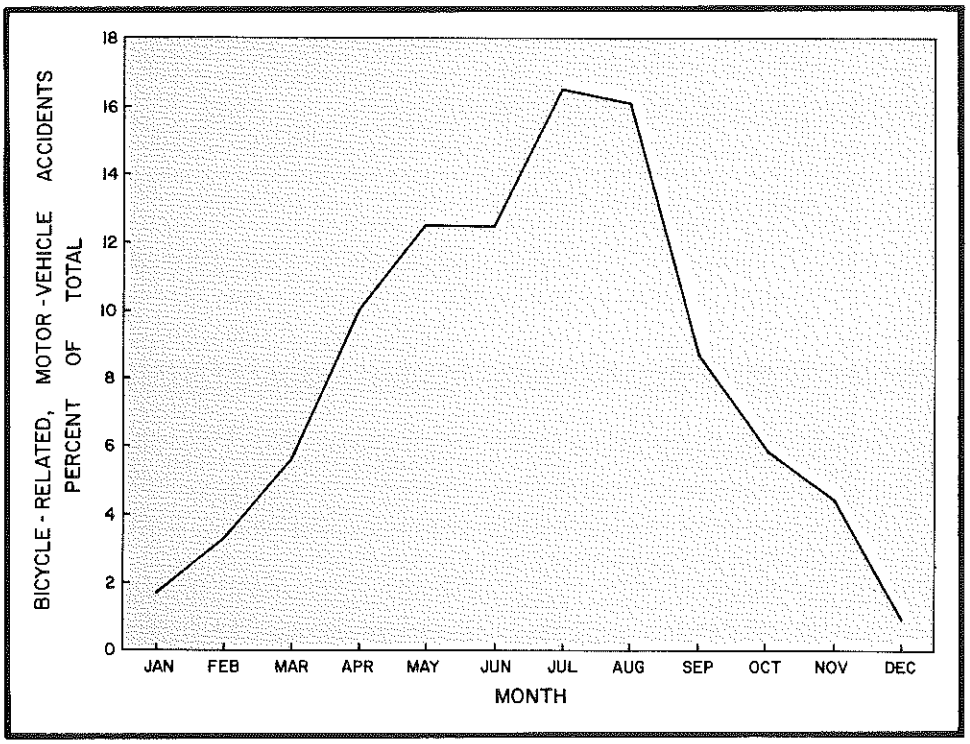

Figure 3. Distribution of Bicycle-Related, Motor Vehicle Accidents by Month.

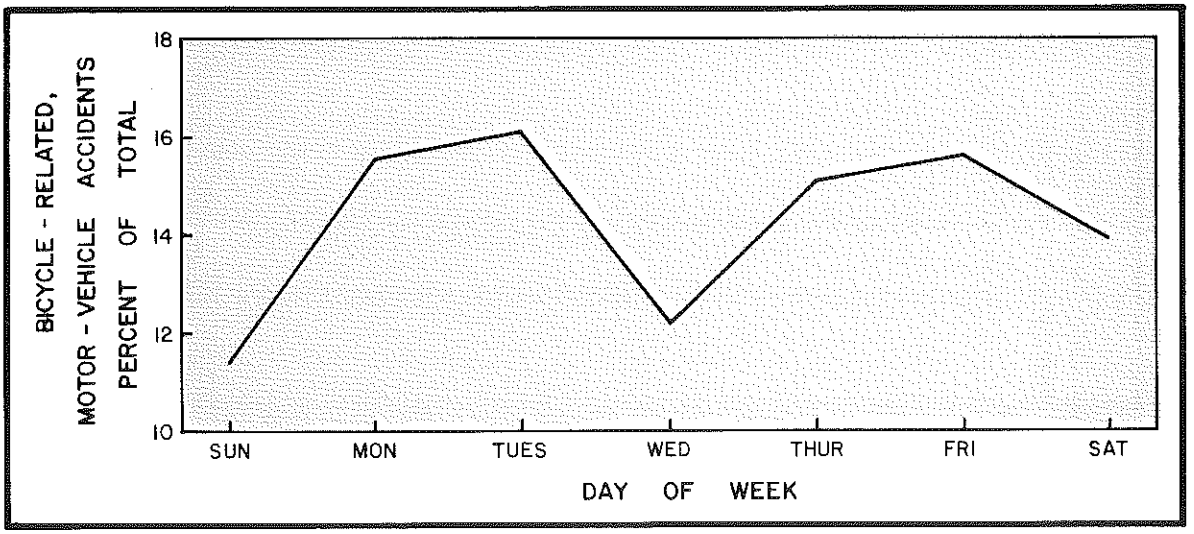

Figure 4. Distribution of Bicycle-Related, Motor Vehicle Accidents by Day of Week.

The distribution of bicycle accidents by light conditions is shown in Table 10. Due to the fact that most bicycle riding is done during daylight hours, 84.8 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, 7)*.

TABLE 10. DISTRIBUTION OF BICYCLE ACCIDENTS BY LIGHT CONDITION

LIGHT CONDITIONS	NUMBER OF CASES	PERCENT OF TOTAL
DAYLIGHT	643	84.8
DAWN/DUSK	31	4.1
DARKNESS	84	11.1

TABLE 11. BICYCLE ACCIDENT FREQUENCY BY CITY POPULATION

POPULATION	NUMBER OF BICYLCE ACCIDENTS (1976)	NUMBER OF CITIES	TOTAL POPULATION (1973)	BICYCLE ACCIDENTS PER 100,000 POPULATION
RURAL	88		1,845,311	4.8
2,500-10,000	87	70	324,942	26.8
10,001-25,000	107	23	359,384	29.8
25,001-50,000	84	7	235,812	35.6
OVER 50,000	395	3	571,654	69.1

Accidents by County and City Size

Kentucky cities were grouped by population to determine rates of bicycle accidents as a function of city size (Table 11). The frequency increased as the city population increased. The accident frequency increased from 4.8 accidents per 100,000 population in rural areas 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 12). The number of bicycle accidents per county was found and divided by the average county population to determine the number of bicycle accidents per 100,000 population. The number of accidents per county ranged from 0.62 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 5). 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.

A listing was made of each Kentucky city which had three or more bicycle accidents in the one-year study period and the corresponding number of bicycle accidents (APPENDIX B). The greater numbers occurred in Louisville (260), Lexington (77), Owensboro (54), and Covington (35). Accident frequencies were also calculated.

TABLE 12. 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

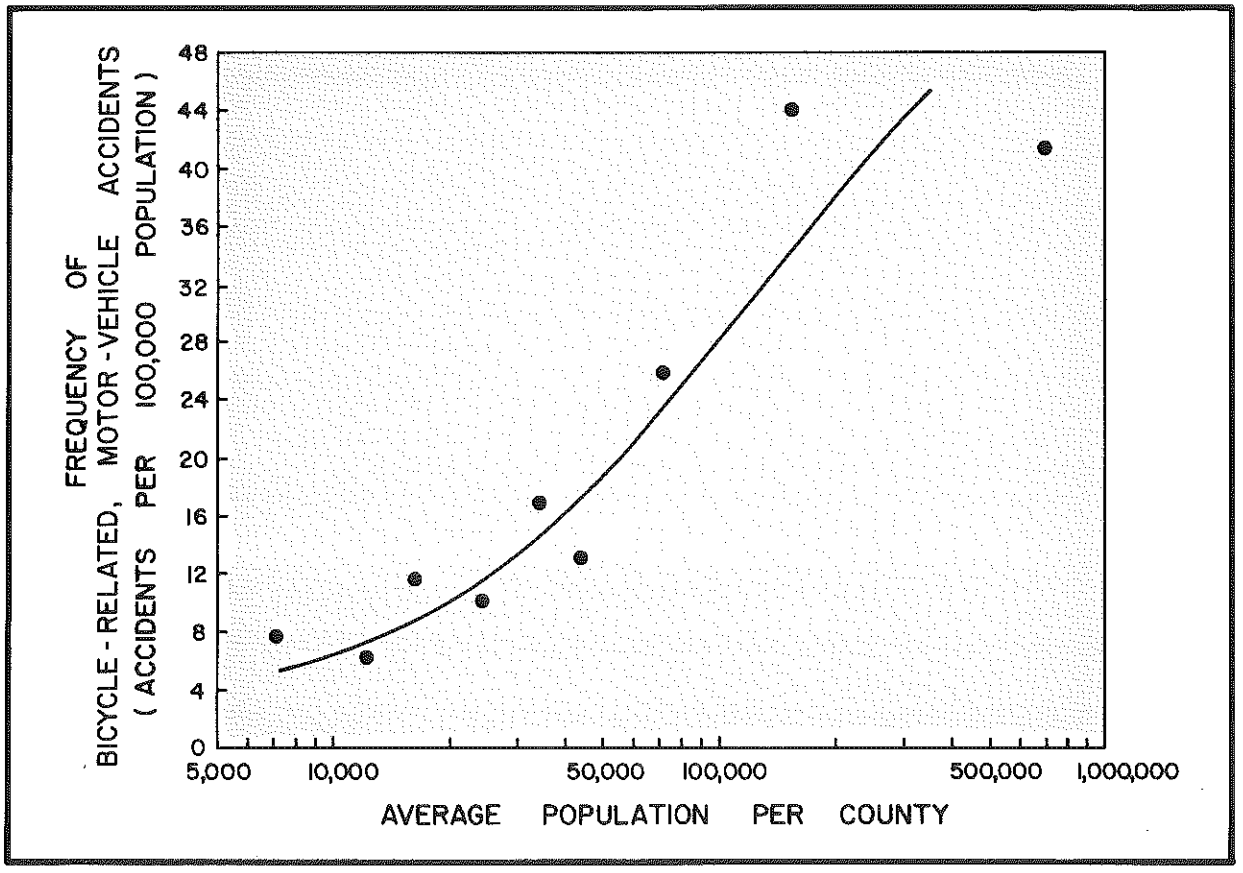

Figure 5. Frequency of Bicycle-Related, Motor Vehicle Accidents Compared to County Population.

The number of bicycle accidents in each county is also given in APPENDIX B. County populations were used to calculate frequencies. The higher accident occurrences were in Jefferson (288), Fayette (77), Kenton (57), Daviess (54), and Campbell (30). There were 25 counties with only one and 43 with none. Counties with the higher frequencies (bicycle accidents per 100,000 population) included Daviess (66.5), Trimble (53.6), Carroll (46.5), Mercer (45.5), Kenton (43.7), and Fayette (40.6).

Accident Location

Almost 80 percent of the accidents occurred in urban areas on local streets (Table 13). Slightly over 50 percent of all accidents were in residential areas (Table 14). Almost 30 percent of the accidents were in business areas. Only 11.9 percent were in rural areas, and only 3.6 percent were at schools or parks.

TABLE 13. DISTRIBUTION OF BICYCLE ACCIDENTS BY HIGHWAY TYPE

HIGHWAY TYPE	NUMBER OF ACCIDENTS	PERCENT OF TOTAL
LOCAL STREET	578	79.2
STATE ROUTE	76	10.4
FEDERAL ROUTE	45	6.2
COUNTY OR LOCAL ROAD	30	4.1
INTERSTATE	1	0.1

TABLE 14. DISTRIBUTION OF BICYCLE ACCIDENTS BY LAND USE OR LOCALITY

AREA	NUMBER OF ACCIDENTS	PERCENTAGE OF TOTAL
RESIDENTIAL	353	51.1
BUSINESS	206	29.8
RURAL	82	11.9
PRIVATE PROPERTY	21	3.0
SCHOOL	20	2.9
PARK	5	0.7
INDUSTRIAL	4	0.6

The highest number of accidents occurred at stop signs (Table 15). A large number also occurred at traffic signals.

Accident Type

The classification of accidents according to diagrams given on the accident-reporting form is given in Table 16. The most common type was the right-angle collision; almost one-half of the accidents were classified in this way. This summary, however, did not provide much detail concerning the accident. Therefore, the accidents were summarized according to the type of accident and maneuver (Table 17). Summaries contained in several reports were reviewed before the methodology was selected. The method of summarizing the accidents corresponded closely to the method cited in Reference 10. The accident types shown in Table 17 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. Diagrams and percentages of the major types are shown in APPENDIX C. The percentages indicate the proportion of all accidents of a particular type which occurred as shown. A more detailed analysis follows.

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 cyclist 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 left turn resulted when the motorist made a left turn from an opposing lane into the path of the bicycle. 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 bicyclist 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.

TABLE 15. 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 16. CLASSIFICATION OF ACCIDENT DESCRIPTIONS (FROM DIAGRAM ON ACCIDENT FORMS)

ACCIDENT DESCRIPTION	NUMBER OF ACCIDENTS	PERCENT OF TOTAL*
RIGHT ANGLE	245	46.3
REAR END	66	12.5
OVERTAKING	64	12.1
HEAD ON	47	8.9
LEFT TURN	43	8.2
SIDESWIPE	32	6.0
RIGHT TURN	32	6.0

*FOR 30 PERCENT OF THE ACCIDENTS, A DESCRIPTION WAS NOT GIVEN

TABLE 17. CLASSIFICATION OF BICYCLE ACCIDENTS BY THE TYPE OF ACCIDENT AND MANEUVER

TYPE OF ACCIDENT BY MANEUVER	NUMBER OF ACCIDENTS	PERCENT OF TOTAL
CYCLIST FAILED TO STOP OR YIELD AT CONTROLLED INTERSECTION	160	21.7
CYCLIST EXITED DRIVEWAY INTO MOTORIST'S PATH	120	16.3
CYCLIST MADE IMPROPER LEFT TURN	91	12.4
CYCLIST RODE ON WRONG SIDE OF STREET	67	9.1
MOTORIST COLLIDED WITH REAR OF CYCLIST	59	8.0
MOTORIST FAILED TO STOP OR YIELD AT CONTROLLED INTERSECTION	37	5.0
MOTORIST MADE IMPROPER LEFT TURN	34	4.6
MOTORIST MADE IMPROPER RIGHT TURN	34	4.6
MOTORIST EXITED DRIVEWAY INTO CYCLIST'S PATH	27	3.7
PARKING LOT	27	3.7
CYCLIST MADE IMPROPER RIGHT TURN	13	1.8
CYCLIST COLLIDED WITH REAR OF MOTORIST	12	1.6
MOTORIST OPENED CAR DOOR INTO CYCLIST'S PATH	9	1.2
OTHER	46	6.3

The type of accident by maneuver was compared to the age of the cyclist (Table 18). 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 of age, the highest number of accidents involved failure of the bicyclist 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 19). 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.

TABLE 18. COMPARISON OF TYPE OF ACCIDENT BY MANEUVER AND AGE OF CYCLIST

	PERCENT OF ALL ACCIDENTS					
	AGE OF CYCLIST					
TYPE OF ACCIDENT BY MANEUVER	5 AND UNDER	6-9	10-14	15-19	20 AND OVER	AVERAGE AGE OF CYCLIST
CYCLIST FAILED TO STOP OR YIELD AT CONTROLLED INTERSECTION	8.0	30.9	23.8	17.0	9.3	12.4
CYCLIST EXITED DRIVEWAY INTO MOTORIST'S PATH	60.0	30.2	15.3	6.8	2.7	10.1
CYCLIST MADE IMPROPER LEFT TURN	4.0	11.0	16.3	10.9	6.7	12.8
CYCLIST RODE ON WRONG SIDE OF STREET	16.0	8.8	9.7	6.8	9.3	13.8
MOTORIST COLLIDED WITH REAR OF CYCLIST	0	2.2	5.0	17.0	18.6	18.7
MOTORIST FAILED TO STOP OR YIELD AT CONTROLLED INTERSECTION	0	4.4	3.1	10.2	8.0	16.2
MOTORIST MADE IMPROPER LEFT TURN	0	0	4.1	6.1	14.7	17.9
MOTORIST MADE IMPROPER RIGHT TURN	0	0	4.1	6.8	10.7	18.5
MOTORIST EXITED DRIVEWAY INTO CYCLIST'S PATH	12.0	2.2	4.4	2.7	2.7	13.2
PARKING LOT	0	1.5	4.7	2.7	4.0	14.9
CYCLIST MADE IMPROPER RIGHT TURN	0	2.2	2.2	1.4	0	11.0
CYCLIST COLLIDED WITH REAR OF MOTORIST	0	0.7	1.3	2.7	2.7	15.2
MOTORIST OPENED CAR DOOR INTO CYCLIST'S PATH	0	0	1.6	2.1	1.3	15.3
OTHER	0	5.9	4.4	6.8	9.3	15.5

TABLE 19. COMPARISON OF TYPE OF ACCIDENT BY MANEUVER AND CYCLIST'S INJURY

TYPE OF ACCIDENTY BY MANEUVER	SEVERITY
CYCLIST EXITED DRIVEWAY INTO MOTORIST'S PATH	4.38
CYCLIST FAILED TO STOP OR YIELD AT CONTROLLED INTERSECTION	4.34
CYCLIST RODE ON WRONG SIDE OF STREET	4.34
CYCLIST MADE IMPROPER LEFT TURN	4.29
MOTORIST FAILED TO STOP OR YIELD AT CONTROLLED INTERSECTION	4.03
MOTORIST COLLIDED WITH REAR OF CYCLIST	3.83
CYCLIST MADE IMPROPER RIGHT TURN	3.58
MOTORIST EXITED DRIVEWAY INTO CYCLIST'S PATH	3.39
MOTORIST'S MADE IMPROPER LEFT TURN	3.04
PARKING LOT	2.98
CYCLIST COLLIDED WITH REAR OF MOTORIST	2.75
MOTORIST MADE IMPROPER RIGHT TURN	2.52
MOTORIST OPENED CAR DOOR INTO CYCLIST'S PATH	2.50
OTHER	4.57

In general, accident severity tended to decrease as bicyclist age increased (Table 8). A more detailed analysis of severity by type of accident showed that severity for the specific accident types were higher for older cyclists (Table 20). Ranking of the severity of accident types showed similarities between the two age groups. Severity of accidents involving a cyclist riding on the wrong side of the street was very high for both groups.

The distribution of type of accident by maneuver was related to cyclist's age. Grade level was used instead of age in the summary table (Table 21). The percentage of accidents occurring through a given grade level can be determined for any accident type. This type of analysis was used in a previous report *(10)*. This table shows the grade level at which training should be administered to children to prevent or minimize certain types of accidents. Ten percent of the accidents was used in the reference report. This type of analysis provides information for the development of bicycle safety educational programs.

Accident Severity

A comparison of injuries in bicycle-related, motor vehicle accidents and all motor vehicle accidents is given in Table 22. 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 cyclist was compared to several variables (Table 23).

TABLE 20. COMPARISON OF TYPE OF ACCIDENT BY MANEUVER TO INJURY AND AGE OF CYCLIST

TYPE OF ACCIDENT BY MANEUVER	SEVERITY INDEX	
	AGE OF CYCLIST (YEARS)	
	LESS THAN 16	16 AND OVER
CYCLIST EXITED DRIVEWAY INTO MOTORIST'S PATH	4.51	3.00
CYCLIST FAILED TO STOP OR YIELD AT CONTROLLED INTERSECTION	4.53	3.64
CYCLIST RODE ON WRONG SIDE OF STREET	4.45	4.31
CYCLIST MADE IMPROPER LEFT TURN	4.55	3.30
MOTORIST FAILED TO STOP OR YIELD AT CONTROLLED INTERSECTION	4.62	3.25
MOTORIST COLLIDED WITH REAR OF CYCLIST	3.90	3.77
CYCLIST MADE IMPROPER RIGHT TURN	3.58	*
MOTORIST EXITED DRIVEWAY INTO CYCLIST'S PATH	3.74	2.25
MOTORIST MADE IMPROPER LEFT TURN	3.07	3.00
PARKING LOT	3.28	2.43
CYCLIST COLLIDED WITH REAR OF MOTORIST	2.67	3.20
MOTORIST MADE IMPROPER RIGHT TURN	2.56	2.50
MOTORIST OPENED CAR DOOR INTO CYCLIST'S PATH	2.83	1.83
OTHER	5.15	4.07

*NO DATA

TABLE 21. DISTRIBUTION OF ACCIDENTS BY MANEUVER RELATED TO GRADE LEVEL OF CYCLIST

	PERCENT OF ACCIDENTS OCCURING THROUGH A GIVEN GRADE LEVEL												
	GRADE LEVEL												
TYPE OF ACCIDENT BY MANEUVER	K*	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	0	0	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

*KINDERGARDEN

TABLE 22. INJURIES TO CYCLISTS AND DRIVERS INVOLVED IN BICYCLE-RELATED, MOTOR VEHICLE ACCIDENTS AND DRIVERS INVOLVED IN ALL ACCIDENTS

	PERCENT OF TOTAL		
	BICYCLE ACCIDENTS		
INJURY	CYCLIST	DRIVER	ALL ACCIDENTS
FATAL	1.3	0.1	0.2
INCAPACITATING INJURY	17.5	0.6	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 23. 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	4.03
	OVER 250,000	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

Following is a summary of the variables which were studied and their relationship to injuries:

VARIABLE	RELATIONSHIP
1. Accident Description (Diagram Shown on Accident Form)	Head-on accidents were the most severe; right-angle and rear-end accidents were second in severity.
2. Population	Accidents in rural areas were most severe. This was probably due to the higher traffic speeds.
3. Riding with or Against Traffic	Accidents in which the cyclist was riding against traffic were the most severe. This was expected since head-on accidents were the most severe accident type.
4. Accident Location (Roadway or Sidewalk)	Accidents involving a cyclist on a sidewalk were the less severe. The normally low speed of the motor vehicle involved in this type of collision was probably the major contributing factor in lessening severity.
5. Accident Location (Intersection or Non-Intersection)	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.
6. Light Conditions	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 24). 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 *(19)*. 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.

TABLE 24. 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-INCAPACI-TATING	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

A more detailed comparison was made between the percentage of cyclists at fault and several additional variables in accidents (Table 25). 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 bicyclists 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.

TABLE 25. 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

Other Factors

Following is a summary of results found relating to these factors. The tables referred to are presented in APPENDIX D.

The causes of bicycle-related, vehicle accidents, as determined by the investigating police officers, were summarized (Table D1). Contributing actions by the cyclist included failure to yield right of way (29 percent), inattention (14 percent), disregarding traffic controls (6.5 percent), and turning improperly (4 percent). Contributing actions by the motorist included inattention (6.3 percent), failure to yield right of way (5.3 percent), and unsafe speed (1.6 percent).

The distribution of pre-accident actions for bicyclists and drivers are summarized in Table D2. Cyclists were going straight ahead in 69.8 percent of the accidents; 8.8 percent involved making a left turn; 6.3 percent were turning right; and 3.0 percent were changing lanes. Motorist actions included going straight ahead (75.0 percent), turning right (6.5 percent), turning left (6.0 percent), parked (2.1 percent), stopped in traffic (2.0 percent), and backing (1.5 percent).

Only 40 bicycle accidents (5.4 percent) involved a bicycle defect (Table D3). 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 (5.6 percent) involved roadway defects (Table D4). Of those, 24 involved a view obstruction. No other defect was listed more than four times. Based on this analysis, roadway defects were found to be a minor problem in bicycle-related, motor vehicle accidents.

The road surface condition was dry in 94.3 percent of all bicycle accidents and wet during 5.4 percent. There were only two bicycle accidents (0.3 percent) on snow or icy roads (Table D5). This would be expected since few cyclists ride during inclement weather.

Bicycle accidents occurred on straight-and-level roadway sections 72.6 percent of the time (Table D6). 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 bicyclists involved in accidents was local, compared to 3.4 percent from elsewhere in the state (another county) and 0.6 percent from out of state. This would be expected since a great 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 (Table D7).

While trucks were involved in about 6.3 percent of all motor vehicle accidents, they were involved in 11.3 percent of bicycle-motor vehicle accidents (Table D8). 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 (Table D9). 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 cyclist to stop or yield at an intersection were the most common accidents.

SUMMARY

Bicycle-related, motor vehicle accidents represented less than ten percent of all injury-producing bicycle accidents. An analysis of a sample of injury-producing accidents involving a bicycle is given in APPENDIX A. 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 corresponded to 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 accident was found to involve a cyclist failing to stop or yield at a controlled intersection. This type of accident was followed in frequency by a bicyclist 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.
15. A table giving the distribution of accidents by maneuver related to the grade level of the cyclist was developed. This table summarized information pertaining to when specific types of training should be administered.

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

ALL BICYCLE-RELATED ACCIDENTS

In 1976, there were 190 bicycle-related injury accidents coded through the Kentucky Electronic Injury Surveillance System at 12 hospitals throughout the state. Based on this data, the projection was made that 7,301 injury-producing bicycle accidents occurred in 1976. There were eight bicycle-related, motor vehicle accidents coded which represented 4.2 percent of the total. However, up to one-half of the accidents had information missing, meaning that bicycle-related, motor vehicle accidents probably represent between four and eight percent of all injury-producing bicycle accidents. This would be approximately 300 to 600 accidents out of the total of 7,301 in 1976. Police records showed 645 injury-producing, bicycle-related, motor vehicle accidents in 1976, representing 8.8 percent out of the estimated total of 7,301 bicycle accidents.

Age and sex of bicyclists involved in all bicycle accidents and the bicycle-related, motor vehicle accidents showed some differences (Tables A1 and A2). Cyclists involved in accidents with motor vehicles tended to be older compared to all cyclists involved in accidents. The percentage of cyclists over 14 involved in bicycle-related, motor vehicle accidents was twice that for cyclists in all accidents. Also, the percentage of males involved in bicycle-related, motor vehicle accidents was higher than the percentage involved in all accidents. The results in Table A3 show that, for both males and females, the cyclists involved in motor vehicle accidents tended to be older compared to all cyclists involved in accidents.

The distribution of accidents by location type was summarized (Table A4). The majority of the bicycle accidents occurred at home. The second leading location type was highways or streets. Although only eight accidents involved a motor vehicle, 22 accidents (20.9 percent of all bicycle accidents) occurred on a highway or street. The other category with a significant number of accidents was "other public locations" such as schools or parks.

The disposition of the patient (cyclist) was coded as to whether hospitalization was necessary (Table A5). The bicyclist was admitted to the hospital in 5.3 percent of all the accidents. In two of the eight motor vehicle accidents (25 percent), hospitalization was necessary. Also, accidents occurring on highways or streets required a higher proportion of hospitalization than accidents at home. None of the bicycle accidents at other public places such as schools or parks required hospitalization.

The distribution of injuries to various parts of the body was also tabulated (Table A6). Injuries to the lower leg (including knee and ankle), the lower arm (including wrist and elbow), and the face (including nose) were the most common. The injury diagnosis of the bicycle accidents was also summarized (Table A7). The most common injury involved a laceration followed by contusion or abrasions. The most common severe injury involved a fracture.

Using the combination of injury diagnosis and body part injured, a severity value was determined for each accident. The average severity value could then be determined for all accidents or any particular group of accidents (Table A8). Bicycle-related, motor vehicle accidents were the most severe category of accidents. Accidents involving male cyclists were more severe than those involving females. There was not a large difference in severity with age, but cyclists in the age category of 10 through 19 years had the highest average severity.

TABLE A1. DISTRIBUTION OF ALL BICYCLE ACCIDENTS AND BICYCLE-RELATED, MOTOR VEHICLE ACCIDENTS BY AGE OF CYCLIST

AGE RANGE (YEARS)	PERCENT OF ALL ACCIDENTS	
	ALL BICYCLE ACCIDENTS	BICYCLE-MOTOR VEHICLE ACCIDENTS
0- 4	7.9	1.5
5- 9	38.9	21.5
10-14	37.9	45.1
15-19	9.5	20.9
20-29	4.2	8.1
30 AND OLDER	1.6	2.9

TABLE A2. DISTRIBUTION OF ALL BICYCLE ACCIDENTS AND BICYCLE-RELATED, MOTOR VEHICLE ACCCIDENTS BY SEX OF CYCLIST

	PERCENT OF ALL ACCIDENTS	
SEX	ALL BICYCLE ACCIDENTS	BICYCLE-MOTOR VEHICLE ACCIDENTS
MALE	63	80
FEMALE	37	20

TABLE A3. DISTRIBUTION OF ALL BICYCLE ACCIDENTS AND BICYCLE-RELATED, MOTOR VEHICLE ACCIDENTS BY AGE AND SEX OF CYCLIST

	PERCENT OF ALL ACCIDENTS			
	MALE		FEMALE	
AGE RANGE (YEARS)	ALL BICYCLE ACCIDENTS	BICYCLE-MOTOR VEHICLE ACCIDENTS	ALL BICYCLE ACCIDENTS	BICYCLE-MOTOR VEHICLE ACCIDENTS
0- 4	4.8	1.4	9.1	2.1
5- 9	34.7	22.3	43.9	17.9
10-14	42.0	44.3	30.3	48.3
15-19	15.3	20.6	6.1	22.0
20-29	1.6	8.3	9.1	7.6
30 AND OLDER	1.6	3.1	1.5	2.1

TABLE A4. DISTRIBUTION OF ACCIDENTS BY LOCATION TYPE

LOCATION TYPE	PERCENT OF ALL BICYCLE ACCIDENTS*
HOME	67.6
FARM	1.0
HIGHWAY OR STREET	20.9
OTHER PUBLIC LOCATION (SCHOOL, INSTITUTIONAL FACILITY, ETC)	10.5

*INCLUDES ALL ACCIDENTS FOR WHICH A LOCATION TYPE WAS LISTED. ALMOST ONE-HALF OF THE ACCIDENTS DID NOT HAVE A LOCATION TYPE LISTED.

TABLE A5. DISPOSITION OF THE CYCLIST PATIENT

TYPE OF ACCIDENT	NUMBER OF ACCIDENTS	PERCENT OF CYCLISTS ADMITTED TO HOSPITAL
AT HOME	71	5.6
ON HIGHWAY OR STREET	22	9.1
AT OTHER PUBLIC PLACES SUCH AS SCHOOL OR PARK	11	0.0
WITH MOTOR VEHICLE	8	25.0
ALL	190	5.3

TABLE A6. DISTRIBUTION OF INJURIES TO BODY PARTS IN BICYCLE ACCIDENTS

BODY PART INJURIED	NUMBER OF OCCURRENCES	PERCENT OF ALL ACCIDENTS
LOWER LEG[a]	40	21.1
LOWER ARM[b]	37	19.5
FACE[c]	33	17.4
HEAD	19	10.0
FOOT	12	6.3
FINGER	12	6.3
UPPER TRUNK[d]	9	4.8
MOUTH[e]	8	4.2
LOWER TRUNK[f]	7	3.7
HAND	6	3.2
UPPER LEG	2	1.0
TOE	2	1.0
NECK	2	1.0
UPPER ARM	1	0.5

[a]INCLUDING KNEE AND ANKLE
[b]INCLUDING WRIST AND ELBOWS
[c]INCLUDING NOSE
[d]INCLUDING SHOULDERS
[e]LIPS, TONGUE, TEETH
[f]INCLUDING HIPS

TABLE A7. INJURY DIAGNOSIS OF BICYCLE ACCIDENTS

INJURY DIAGNOSIS	NUMBER OF OCCURRENCES	PERCENT OF ALL ACCIDENTS
LACERATION	81	42.6
CONTUSIONS/ ABRASIONS	54	28.4
FRACTURE	32	16.8
STRAIN OR SPRAIN	16	8.4
DISLOCATION	3	1.6
CONCUSSION	2	1.1
AVULSION	2	1.1

TABLE A8. AVERAGE SEVERITY VALUES FOR VARIOUS CATEGORIES OF ACCIDENTS

CATEGORY OF ACCIDENTS	AVERAGE SEVERITY VALUE
ALL	22
BICYCLE-MOTOR VEHICLE	34
ON HIGHWAY OR STREET	20
AT HOME	23
AT OTHER PUBLIC PLACE (SCHOOL, PARK, ETC.)	17
MALE CYCLIST	24
FEMALE CYCLIST	17
CYCLIST'S AGE - LESS THAN 10	20
CYCLIST'S AGE - 10 THROUGH 19	24
CYCLIST'S AGE - 20 AND OLDER	20

APPENDIX B

BICYCLE ACCIDENTS BY COUNTY AND CITY

TABLE B1. BICYCLE ACCIDENT FREQUENCY OF SEVERAL CITIES*

CITY	NUMBER OF ACCIDENTS	CITY POPULATION (1973 ESTIMATED)	ACCIDENT FREQUENCY (ACCIDENTS PER 100,000 PEOPLE)
LOUISVILLE	260	335,696	77.5
LEXINGTON	77	184,603	41.7
OWENSBORO	54	51,355	105.2
COVINGTON	35	48,754	71.8
PADUCAH	17	30,191	56.3
BOWLING GREEN	15	36,151	41.5
RICHMOND	12	18,358	65.4
SHIVELY	10	19,000	52.6
ASHLAND	10	28,935	34.6
NEWPORT	9	23,968	37.6
HENDERSON	9	23,275	38.7
FRANKFORT	9	22,224	40.5
HARRODSBURG	8	6,522	122.7
FORT THOMAS	8	16,678	48.0
DANVILLE	7	11,767	59.4
BELLEVUE	7	8,557	81.8
ST. MATHEWS	6	14,239	42.1
MURRAY	6	12,876	46.6
HOPKINSVILLE	6	25,607	23.4
MAYFIELD	5	10,123	49.4
FLORENCE	5	13,276	37.7
CAMPBELLSVILLE	5	7,675	61.1
SHELBYVILLE	4	4,120	97.1
LUDLOW	4	5,645	70.9
INDEPENDENCE	4	4,958	80.7
ELIZABETHTOWN	4	14,354	27.9
CARROLLTON	4	3,890	102.8
BARDSTOWN	4	6,186	64.7
WINCHESTER	3	15,352	19.5
SHEPHERDSVILLE	3	3,044	98.6
MORGANFIELD	3	3,382	88.7
MIDDLESBORO	3	12,165	24.7
MADISONVILLE	3	16,324	18.4
LOUISA	3	1,898	158.1
LEBANON	3	5,471	54.8
JEFFERSONTOWN	3	12,058	24.9
DAYTON	3	8,260	36.3

*CITIES WHICH HAD THREE OF MORE BICYCLE ACCIDENTS IN THE STUDY PERIOD

TABLE B2. BICYCLE ACCIDENT FREQUENCY BY COUNTY

COUNTY NAME	NUMBER OF ACCIDENTS	COUNTY POPULATION (1975 ESTIMATED)	ACCIDENT FREQUENCY (ACCIDENTS PER 100,000 POPULATION)
ADAIR	1	14,400	6.9
ALLEN	0	13,600	0
ANDERSON	2	10,800	18.5
BALLARD	0	8,400	0
BARREN	3	30,700	9.8
BATH	0	9,300	0
BELL	5	32,800	15.2
BOONE	9	37,100	24.2
BOURBON	1	18,900	5.3
BOYD	10	52,300	19.1
BOYLE	8	22,800	35.1
BRACKEN	0	7,400	0
BREATHITT	1	15,700	6.4
BRECKINRIDGE	0	15,100	0
BULLITT	4	33,500	11.9
BUTLER	0	10,100	0
CALDWELL	2	13,500	14.8
CALLOWAY	6	29,100	20.6
CAMPBELL	30	85,000	35.3
CARLISE	0	5,600	0
CARROLL	4	8,600	46.5
CARTER	1	21,700	4.6
CASEY	0	14,100	0
CHRISTIAN	6	69,800	8.6
CLARK	3	26,400	11.4
CLAY	2	20,900	9.6
CLINTON	0	8,600	0
CRITTENDEN	0	9,000	0
CUMBERLAND	0	6,800	0
DAVIESS	54	81,200	66.5
EDMONSON	1	9,500	10.5
ELLIOT	0	5,700	0
ESTILL	1	13,300	7.5
FAYETTE	77	189,700	40.6
FLEMING	0	12,000	0
FLOYD	2	40,100	5.0
FRANKLIN	9	37,300	24.1
FULTON	1	9,500	10.5
GALLATIN	1	4,400	22.7
GARRARD	2	10,000	20.0

TABLE B2. (CONT.)

COUNTY NAME	NUMBER OF ACCIDENTS	COUNTY POPULATION (1975 ESTIMATED)	ACCIDENT FREQUENCY (ACCIDENTS PER 100,000 POPULATION)
GRANT	2	11,700	17.1
GRAVES	8	32,300	24.8
GRAYSON	0	18,200	0
GREEN	0	10,800	0
GREENUP	3	33,800	8.9
HANCOCK	0	7,400	0
HARDIN	9	72,000	11.0
HARLAN	5	39,800	8.4
HARRISON	1	14,600	6.8
HART	0	14,700	0
HENDERSON	11	36,900	29.8
HENRY	0	11,500	0
HICKMAN	1	6,500	15.4
HOPKINS	3	42,900	7.0
JACKSON	0	10,500	0
JEFFERSON	288	700,700	41.1
JESSAMINE	2	22,100	9.0
JOHNSON	0	20,500	0
KENTON	57	130,500	43.7
KNOTT	0	16,800	0
KNOX	0	26,300	0
LARUE	1	11,600	8.6
LAUREL	3	31,300	9.6
LAWRENCE	1	12,100	8.3
LEE	0	7,000	0
LESLIE	0	12,500	0
LETCHER	0	26,600	0
LEWIS	0	12,700	0
LINCOLN	1	17,700	5.6
LIVINGSTON	1	8,700	11.5
LOGAN	2	22,100	9.0
LYON	0	5,900	0
MCCRACKEN	17	60,300	28.2
MCCREARY	2	14,300	14.0
MCLEAN	1	10,200	9.8
MADISON	13	47,400	27.4
MAGOFFIN	0	11,400	0
MARION	3	16,600	18.1
MARSHALL	2	22,300	9.0
MARTIN	3	10,800	27.8

TABLE B2. (CONT.)

COUNTY NAME	NUMBER OF ACCIDENTS	COUNTY POPULATION (1975 ESTIMATED)	ACCIDENT FREQUENCY (ACCIDENTS PER 100,000 POPULATION)
MASON	3	16,000	17.9
MEADE	2	17,800	11.2
MENIFEE	0	4,400	0
MERCER	8	17,600	45.5
METCALFE	0	8,400	0
MONROE	0	12,100	0
MONTGOMERY	2	17,200	11.6
MORGAN	0	10,500	0
MUHLENBERG	2	30,300	6.6
NELSON	4	24,400	16.4
NICHOLAS	0	6,800	0
OHIO	1	20,000	5.0
OLDHAM	1	18,400	5.4
OWEN	0	7,900	0
OWSLEY	1	5,200	19.2
PENDLETON	0	10,400	0
PERRY	0	28,000	0
PIKE	2	68,800	2.9
POWELL	1	8,600	11.6
PULASKI	1	40,300	2.5
ROBERTSON	0	2,300	0
ROCKCASTLE	1	12,800	7.8
ROWAN	3	17,100	17.5
RUSSELL	0	11,500	0
SCOTT	1	18,900	5.3
SHELBY	4	19,700	20.3
SIMPSON	0	14,100	0
SPENCER	1	5,700	17.5
TAYLOR	5	18,200	27.5
TODD	0	11,000	0
TRIGG	1	9,000	11.1
TRIMBLE	3	5,600	53.6
UNION	5	16,400	30.5
WARREN	15	67,400	24.0
WASHINGTON	1	10,400	9.6
WAYNE	0	15,600	0
WEBSTER	4	14,100	28.4
WHITLEY	3	28,400	10.6
WOLFE	0	6,100	0
WOODFORD	0	16,600	0

APPENDIX C
DIAGRAMS AND PERCENTAGES OF MAJOR ACCIDENT TYPES

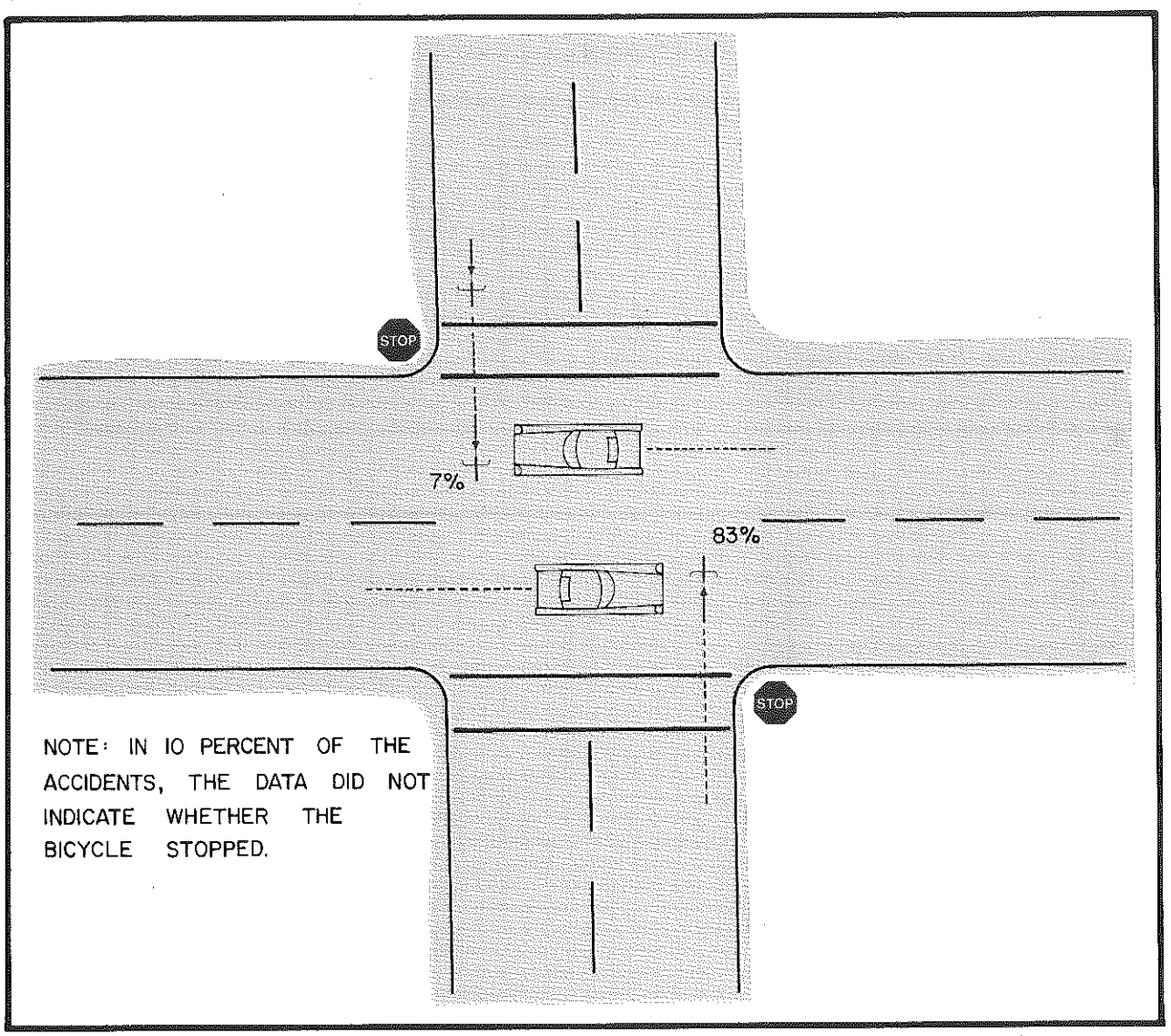
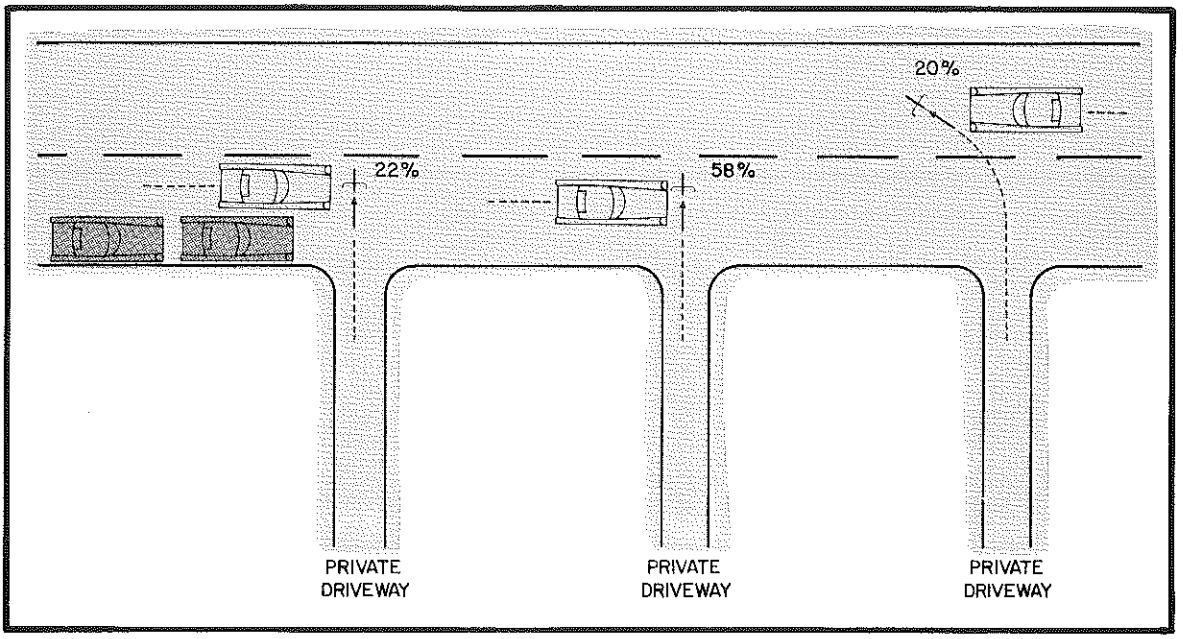


Figure C1. **Cyclist Failed to Stop or Yield at Controlled Intersection (21.7 Percent of All Accidents).**

Figure C2. Cyclist Exited Driveway into Motorist's Path (16.3 Percent of All Accidents).



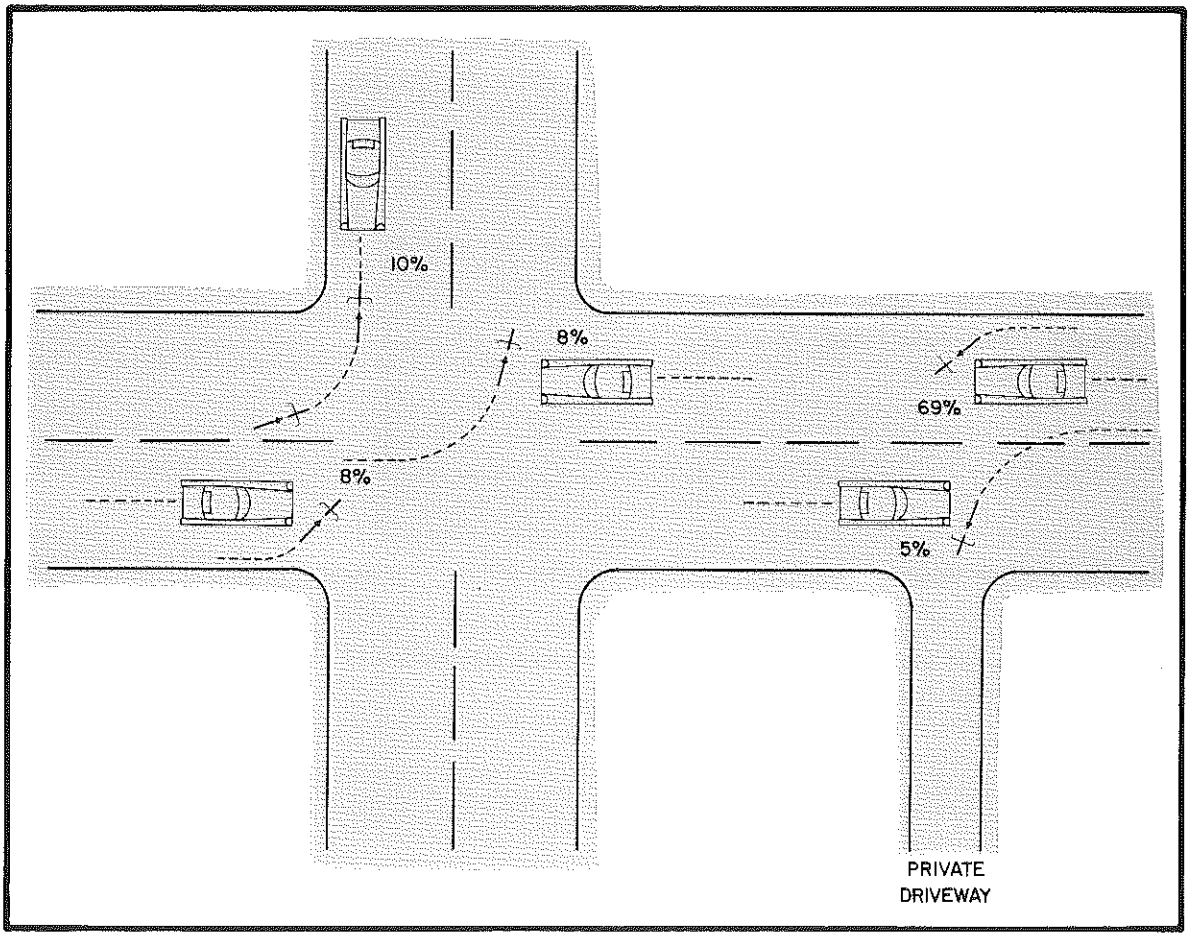
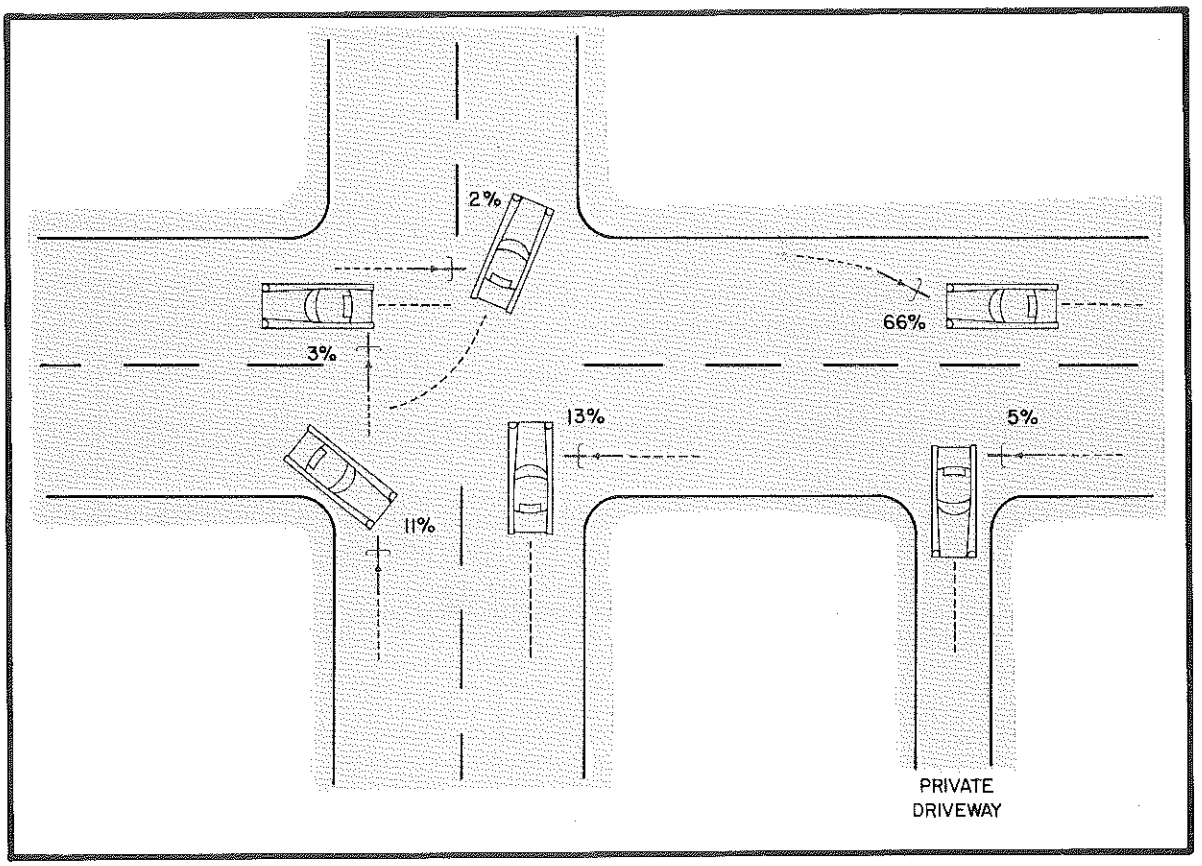


Figure C3. Cyclist Made Improper Left Turn (12.4 Percent of All Accidents).

Figure C4. Cyclist Rode on Wrong Side of Street (9.1 Percent of All Accidents).



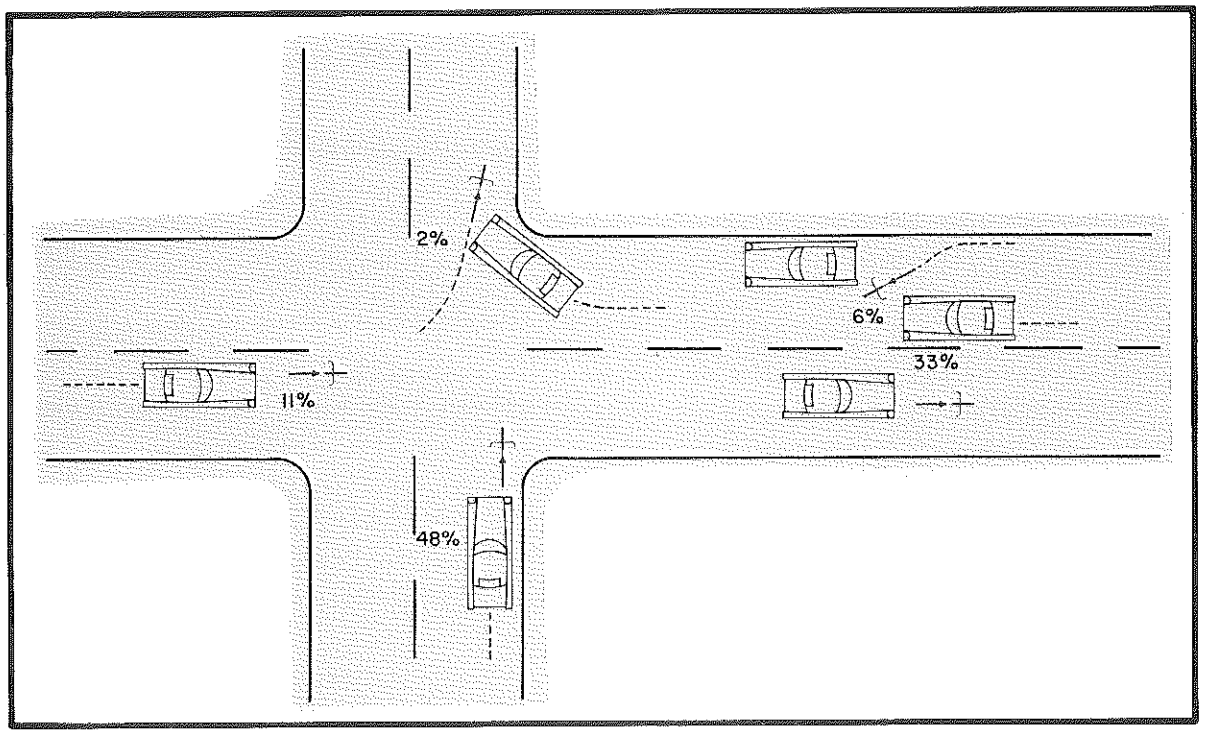
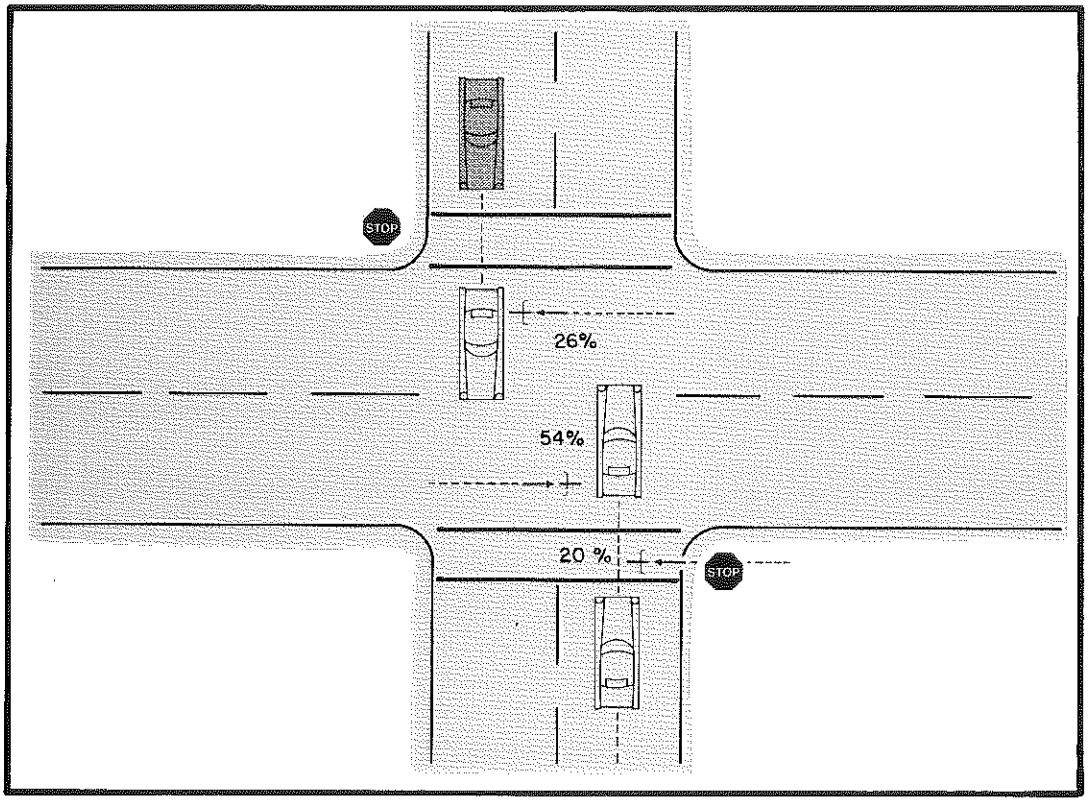


Figure C5. Motorist Collided with Rear of Cyclist (8.0 Percent of All Accidents).

Figure C6. Motorist Failed to Stop or Yield at Controlled Intersection (5.0 Percent of All Accidents).



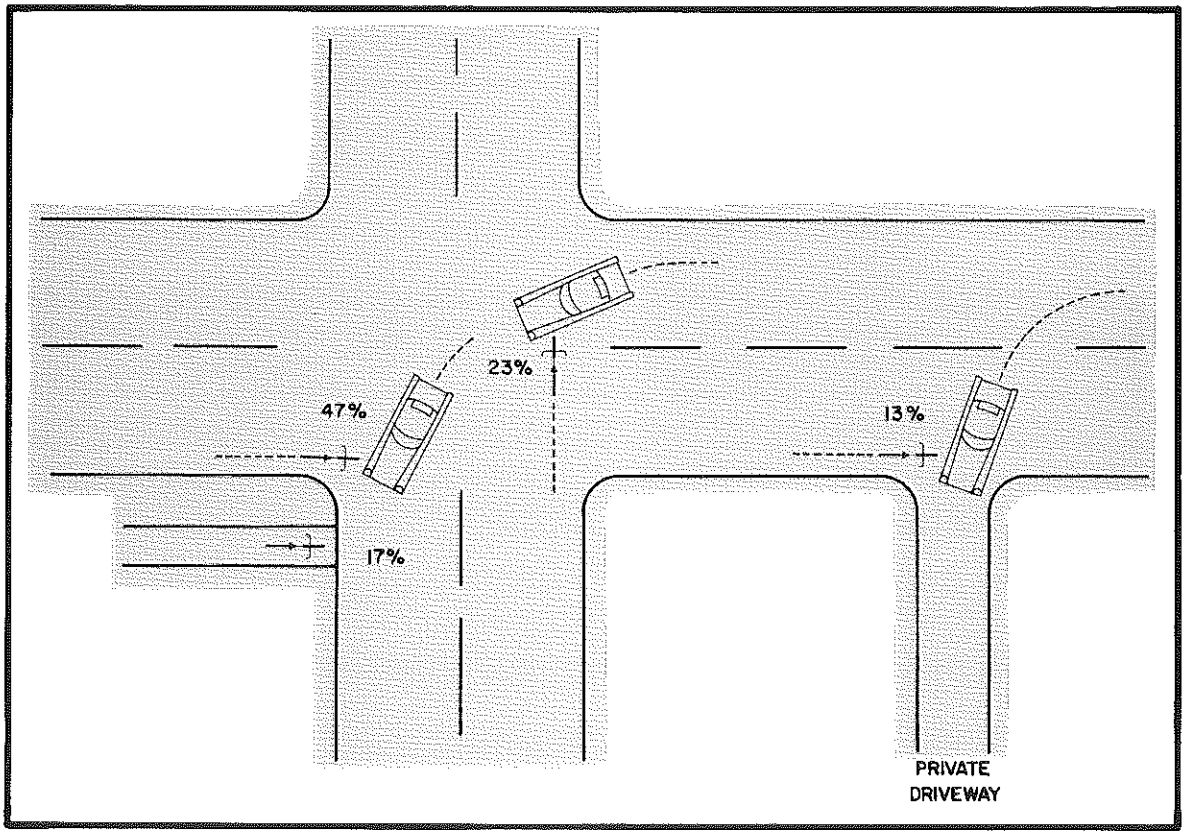
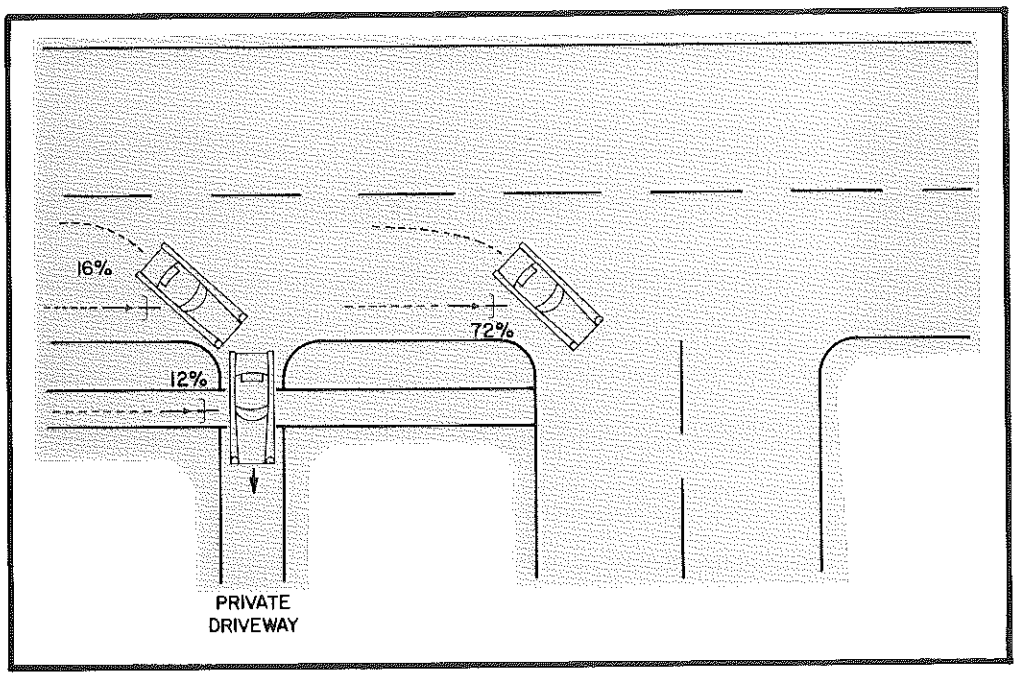


Figure C7. Motorist Made Improper Left Turn (4.6 Percent of All Accidents).

Figure C8. Motorists Made Improper Right Turn (4.6 Percent of All Accidents).



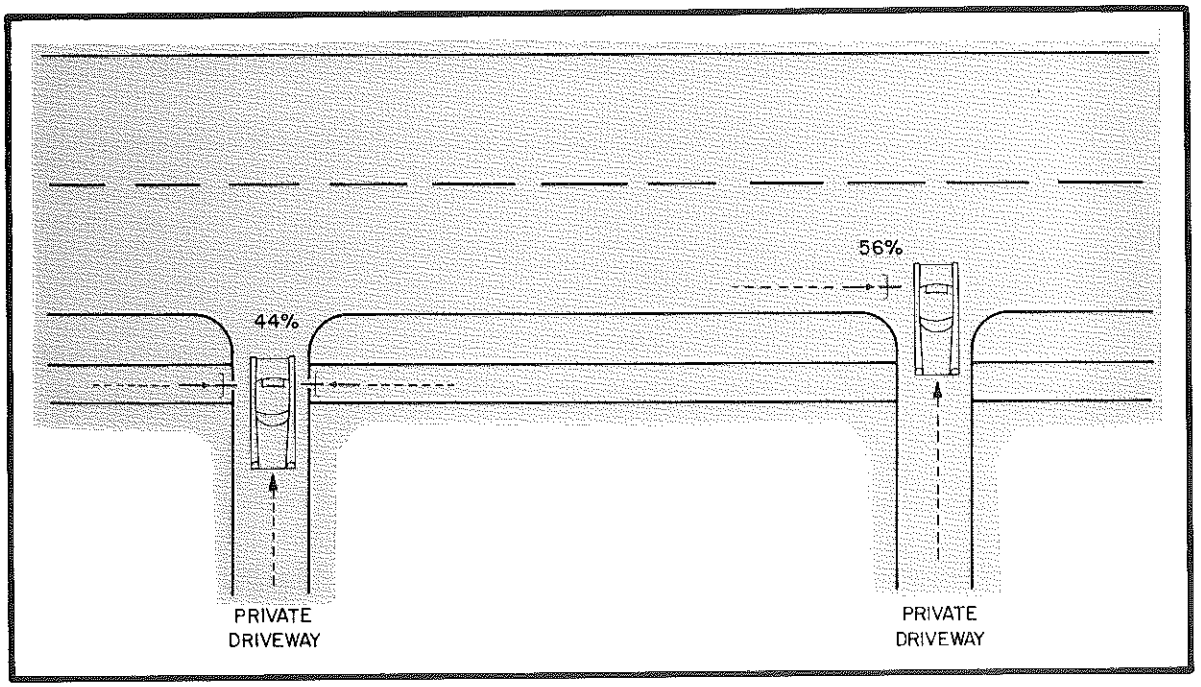


Figure C9. Motorist Exited Driveway into Cyclists Path (3.7 Percent of All Accidents).

APPENDIX D

MISCELLANEOUS TABLES

TABLE D1. DISTRIBUTION OF CONTRIBUTING CIRCUMSTANCES FOR CYCLIST AND DRIVER

CONTRIBUTING CIRCUMSTANCES	CYCLIST		DRIVER	
	NUMBER OF CASES	PERCENT OF TOTAL	NUMBER OF CASES	PERCENT OF TOTAL
UNSAFE SPEED	9	1.0	12	1.6
FAILED TO YIELD RIGHT OF WAY	188	29.0	39	5.3
FOLLOWING TOO CLOSELY	5	0.8	3	0.4
IMPROPER PASSING	3	0.5	4	0.5
DISREGARD TRAFFIC CONTROLS	43	6.5	6	0.8
TURNING IMPROPERLY	26	4.0	6	0.8
ALCOHOL MOVEMENT	0	0.0	8	1.1
DRUG INVOLVEMENT	0	0.0	1	0.1
DRIVER INATTENTION	93	14.0	46	6.3
DISTRACTION	6	0.9	3	0.4
OTHER	69	10.6	42	6.0
NONE DETECTED	212	32.7	561	76.7

TABLE D2. DISTRIBUTION OF PRE-ACCIDENT ACTION FOR CYCLIST AND DRIVER

PRE-ACCIDENT ACTION	CYCLIST		DRIVER	
	NUMBER OF CASES	PERCENT OF DATA	NUMBER OF CASES	PERCENT OF TOTAL
GOING STRAIGHT AHEAD	514	69.8	567	75.0
MAKING RIGHT TURN	46	6.3	49	6.5
MAKING LEFT TURN	65	8.8	48	6.0
MAKING U-TURN	1	0.1	0	0.0
STARTING FROM PARKING	0	0.0	4	0.5
STARTING IN TRAFFIC	6	0.8	4	0.5
SLOWING OR STOPPING	4	0.5	9	1.2
STOPPED IN TRAFFIC	1	0.1	15	2.0
ENTERING PARKED POSITION	0	0.0	1	0.1
PARKED	5	0.7	16	2.1
AVOIDING OBJECT IN ROADWAY	0	0.0	1	0.1
CHANGING LANES	21	3.0	5	0.7
OVERTAKING	2	0.3	14	1.8
MERGING	6	0.8	0	0.0
BACKING	1	0.1	11	1.5
OTHER	64	8.7	14	2.0

TABLE D3. BICYCLE DEFECTS CONTRIBUTING TO BICYCLE ACCIDENT

DEFECT	NUMBER OF CASES	PERCENT OF ALL DEFECTS
BRAKES	18	45.0
LIGHTING	12	30.0
STEERING	1	2.5
TIRE	1	2.5
EXCESSIVE LOAD	1	2.5
OTHER	7	17.5

TABLE D4. ROAD DEFECTS CONTRIBUTING TO BICYCLE ACCIDENTS

ROAD DEFECT	NUMBER OF CASES	PERCENT OF TOTAL
VIEW OBSTRUCTED	24	57.1
SLIPPERY SURFACE	4	9.4
ANIMAL ACTION	3	7.1
GLARE	2	4.8
IMPROPERLY PARKED VEHICLE(S)	2	4.8
FIXED OBJECTS	2	4.8
DEBRIS IN ROADWAY	1	2.4
DEFECTIVE SHOULDERS	1	2.4
HOLES, RUTS, OR BUMPS	1	2.4
OTHER	2	4.8

TABLE D5. ROAD SURFACE CONDITIONS AND BICYCLE ACCIDENTS

ROAD SURFACE CONDITIONS	NUMBER OF ACCIDENTS	PERCENT OF TOTAL
DRY	712	94.3
WET	41	5.4
SNOW/ICE	2	0.3

TABLE D6. ROADWAY GEOMETRICS AND BICYCLE ACCIDENTS

ROAD GEOMETRICS	NUMBER OF ACCIDENTS	PERCENT OF TOTAL
STRAIGHT AND LEVEL	546	72.6
STRAIGHT AND GRADE	121	16.1
STRAIGHT AND HILLCREST	24	3.2
CURVE AND LEVEL	30	4.0
CURVE AND GRADE	24	3.2
CURVE AND HILLCREST	7	0.9

TABLE D7. RESIDENCE OF CYCLISTS INVOLVED IN ACCIDENTS

	BICYCLE ACCIDENTS ONLY		ALL ACCIDENTS
RESIDENCE	CYCLIST	MOTORIST	MOTORIST
LOCAL RESIDENT	96.0	84.6	87.8
RESIDING ELSEWHERE IN THE STATE	3.4	11.2	3.9
OUT-OF-STATE	0.6	4.2	8.3

TABLE D8. VEHICLE TYPES INVOLVED IN ACCIDENTS WITH BICYCLES

VEHICLE TYPE	PERCENT OF ALL MOTOR-VEHICLE ACCIDENTS	PERCENT OF ALL BICYCLE-VEHICLE ACCIDENTS
CAR	88.7	87.0
TRUCK	6.3	11.3
MOTORCYCLE	0.7	1.7
OTHER	4.3	0

TABLE D9. COMPARISON OF TYPE OF ACCIDENT BY MANEUVER TO CITY POPULATION

TYPE OF ACCIDENT BY MANEUVER	POPULATION CATEGORIES			
	RURAL	2,500 TO 25,000	25,000 TO 100,000	100,000 AND LARGER
CYCLIST EXITED DRIVEWAY INTO MOTORIST'S PATH	22.5	14.1	14.3	16.8
MOTORIST EXITED DRIVEWAY INTO CYCLIST'S PATH	2.2	5.2	3.8	3.1
CYCLIST FAILED TO STOP OR YIELD AT INTERSECTION	10.1	23.4	33.6	18.8
CYCLIST MADE IMPROPER LEFT TURN	29.3	14.1	6.8	9.0
CYCLIST RODE ON WRONG SIDE OF STREET	16.9	6.3	7.4	9.3
MOTORIST COLLIDED WITH REAR OF CYCLIST	9.0	4.7	4.5	11.2
MOTORIST FAILED TO STOP OR YIELD AT INTERSECTION	0	5.2	6.8	5.6
MOTORIST MADE IMPROPER LEFT TURN	2.2	5.2	3.8	5.3
MOTORIST MADE IMPROPER RIGHT TURN	1.1	5.2	4.5	5.3
MOTORIST OPENED CAR DOOR	0	2.6	0.8	0.9
OTHER	6.7	5.7	3.8	7.5
PARKING LOT	0	3.6	3.8	4.7
CYCLIST COLLIDED WITH REAR OF MOTOR VEHICLE	0	3.1	2.3	0.9
CYCLIST MADE IMPROPER RIGHT TURN	0	1.6	3.8	1.6