Pedestrian Accidents in Kentucky: 1972-1973

Charles V. Zegeer
Kentucky Department of Highways

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF TRANSPORTATION

John C. Roberts
SECRETARY

BUREAU OF HIGHWAYS
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JULIAN M. CARROLL
GOVERNOR

Division of Research
533 South Limestone
Lexington, KY 40508

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MEMO TO: J. R. Harbison
State Highway Engineer
Chairman, Research Committee

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Magnetic tape records of highway accidents have enabled us to do statistical analyses relating road geometrics and pavement characteristics to accident rates. The report submitted herewith presents an analysis of pedestrian accidents sorted from State Police data tapes for 1972 and 1973 and records from several cities and metro areas. Louisville's data tapes were copied and sorted in the same way as State Police tapes were processed. Lexington and Paducah furnished copies of pedestrian accident reports and, in effect, sorted files. In other cases, our staff went to the files and transcribed data or obtained machine copies of reports.

Although this is primarily an informational-type report, it includes state-of-knowledge commentaries concerning safeguards and countermeasures against pedestrian-type accidents.

Respectfully submitted,

Jas. H. Havens
Director of Research

JHH:gd
Attachment
CC's: Research Committee

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16. Abstract

Pedestrian accident data in Kentucky were analyzed for 1972 and 1973 on a rural, urban, and statewide basis. Results showed that about 1500 pedestrian accidents occur in Kentucky each year and cost over $11 million. About 30 percent of pedestrian accidents in rural areas and 4 percent in urban areas are fatal. Although about 78 percent of Kentucky's pedestrian accidents occur in urban areas, over 62 percent of the pedestrian fatalities occur in rural areas.

Specific characteristics of pedestrian accidents were identified and related to human, environmental, and time factors. Highway and street improvements and safety programs generally considered to be effective in minimizing pedestrian accidents are summarized.

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PEDESTRIAN ACCIDENTS IN KENTUCKY: 1972-1973

KYP-72-40, HPR-PL-1(10), Part III

by

Charles V. Zegeer
Research Engineer

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

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EXECUTIVE SUMMARY

Pedestrian accidents which occurred in Kentucky during 1972 and 1973 were analyzed to identify the major causes and to determine possible countermeasures in reducing these accidents. The analysis showed that the pedestrian death rate in Kentucky exceeded the national rate in 1973 and in nine of the last 14 years. There were 167 pedestrian fatalities in 1973 and an estimated 1500 pedestrian accidents, which cost altogether about $11 million. The study consisted of four major parts: (1) an analysis of all pedestrian fatalities, (2) a comparison of rural and urban pedestrian accidents, (3) a detailed study of the pedestrian problem in each of Kentucky's nine most populous cities, and (4) general recommendations for highway improvements and safety programs on the state and local levels to minimize pedestrian accidents.

The analysis showed that dusk is the most likely time for pedestrian fatalities, and they did not vary greatly among the days of the week. Most pedestrian fatalities occurred on two-lane roads. The densely populated counties of Jefferson, Fayette, and Daviess had the higher numbers of pedestrian fatalities, but the deaths per 100,000 population were higher in rural counties (Nicholas, 31; Gallatin, 25; and Livingston, 20). Pedestrian fatalities were highest for ages under 9 and over 64; while the number of drivers involved in pedestrian fatality accidents decreased with increased age. Most pedestrians killed were crossing the street (69 percent). Walking with traffic in rural areas involved three times as many fatalities as walking against traffic (15 to 5 percent). About 69 percent of all pedestrian fatalities were the fault of the pedestrian. About 78 percent of the pedestrian accidents occurred in urban areas. However, over 62 percent of all pedestrian fatalities were in rural areas. Pedestrian accidents were fatal only 4 percent of the time in urban areas, and nearly 30 percent were fatal in rural areas. Nearly half (46 percent) of all rural pedestrian accidents and 25 percent of urban pedestrian accidents occurred at night. Only 9 percent of the rural accidents and 38 percent of urban accidents were at intersections. Drivers were at fault more frequently in rural than in urban areas (32 to 24 percent).

Pedestrian accidents in the nine largest cities totaled 1650 in 1972 and 1973, of which 69 were fatal, and cost over $7 million. The most pedestrian accidents in 1973 occurred in Louisville (476 accidents); Lexington had 133 accidents; and Covington had 98 accidents. The number of pedestrian accidents per 100,000 population was highest in Newport (208) and Covington (168), and lowest in Paducah (35). Intersection-related pedestrian accidents were most common in Owensboro (62 percent) and Paducah (59 percent). Darkness was a factor most often in pedestrian accidents in Ashland (39 percent) and Frankfort (32 percent). Age distributions in pedestrian accidents in each city were also determined to add insight into the predominent pedestrian problem in each city (college campus, school-age children, retirement areas, etc.).

INTRODUCTION

This report presents in-depth information on pedestrian accidents and fatalities which occurred in Kentucky during 1972 and 1973. A comparison of urban and rural pedestrian accidents and an analysis of urban accidents in the nine cities in Kentucky of first and second class status is also presented. Finally, various pedestrian - accident countermeasures, based on past experience by federal, state, and local highway safety agencies, are examined and recommended.

When a pedestrian is hit by a motor vehicle, he is usually injured or killed. There is no protective cushion to absorb the impact. The high concentration of pedestrians in urban areas, coupled with heavy vehicle traffic, often results in large numbers of pedestrian accidents. In rural areas, there are considerably fewer pedestrians but traffic speeds are higher and, therefore, accidents are more often fatal.

Pedestrian fatalities have increased in the United States from about 7,800 in 1960 to approximately 10,500 in 1973 *(1)*. There are 120,000 pedestrian accidents each year. Total traffic accidents in the US number about 17 million annually with about 56,000 fatalities. Thus, pedestrian accidents account for less than 1 percent of the total traffic accidents nationwide but over 18 percent of all traffic fatalities. Total accident costs from pedestrian accidents amount to over $800 million annually (using $2,700 per injury and $45,000 per fatality) *(2)*.

Many highway improvements have been tried, particularly in urban areas, to reduce the number of pedestrian casualties. The improvements should be based on the accident trends of a particular area. For example, Kentucky is largely a rural state and does not have the same pedestrian accident patterns as California or New York. Because the nature of particular urban areas differs, they should be studied individually to ascertain appropriate pedestrian accident reduction actions. For example, a large university located near an urban center will generate a different pedestrian accident pattern than a city of equal size with no such pedestrian generator.

PROCEDURE

To obtain detailed accident information on pedestrian accidents in Kentucky, several sources were utilized. All state-police-reported accident report forms are retrievable from computer tapes. However, nearly all state police records pertain to rural, state-maintained highways. Accidents in urban areas (and cities over 2500 population) are investigated by county or city police, and the accident reports are usually on file with the local police agency. Only fatal accidents are required to be reported to the central office of state police. The 1974 Kentucky state legislature passed a law requiring all police-investigated accident reports to be sent to the central office, effective July 1, 1975. However, much of the pedestrian accident data used in this report was obtained directly from local police departments.

To obtain information on rural pedestrian accidents, a computer program was written to search tapes of state-police-reported rural accidents for 1972 and 1973. A printout of pedestrian accident information was obtained. There were about 340 such accidents each year. The computer printout data was then summarized and analyzed.

To study detailed accident data for urban areas, it was considered adequate to limit the number of urban areas to all first and second class cities in Kentucky. The class of city in Kentucky is determined by the population and local government structure. The nine cities included were Louisville, Lexington, Covington, Owensboro, Bowling Green, Paducah, Ashland, Newport, and Frankfort. The populations of these cities range from about 362,000 (Louisville) to about 22,000 (Frankfort). Thus, a wide range of population was considered. It would have been virtually impossible to obtain copies of accidents reports from the more than 100 cities in Kentucky which are considered urban (2500 population or more).

Accident reports were sorted from accident files at eight of the nine cities (excluding Louisville) and the information summarized. This involved travel to the police departments of each city, and with their cooperation, the necessary information was obtained. For the city of Louisville, computer tapes of all accident reports (about 40,000 annually) in 1972 and 1973 were copied. A computer program was written to extract all pedestrian-related accidents. There were about 460 of these accidents each year.

All of the accident information mentioned was analyzed to determine major causes and patterns of pedestrian accidents. Probable measures or recourses which have been reported by others to be usually effective in reducing pedestrian accidents are summarized and recommended for consideration.

FATAL PEDESTRIAN ACCIDENTS

In 1973, there were an estimated 1500 pedestrian accidents in Kentucky in which 167 pedestrians died. This represents a pedestrian death rate of 5.2 deaths per 100,000 population compared to the national pedestrian death rate of 5.0 in 1973 *(1)*. The pedestrian death rate in Kentucky has exceeded the national rate in nine of the last 14 years since 1960; this is shown in Figure 1. The number of pedestrian deaths in Kentucky has varied between 129 and 167 annually since 1960 (Figure 2) *(3)*. Total accident costs for pedestrian accidents in Kentucky amounted to about $11 million in 1973.

An in-depth study of fatal pedestrian accidents in Kentucky necessitated the inspection of each accident report completed by the investigating police officers. Because of data storage restrictions in the Kentucky State Police Office of Accident Records, only two years of fatal accident report forms were readily available. The number of pedestrian fatalities in Kentucky was 154 in 1972 and 167 in 1973. This sample was assumed to be representative of past pedestrian fatalities in Kentucky

Time Variations in Accidents

The relationship between time of day and the percentage of pedestrian fatalities and all motor vehicle fatalities in Kentucky is shown in Figure 3. The two curves show a reasonable similarity. However, there is a large increase in pedestrian fatalities between 7:00 and 8:00 p.m. This time period corresponds roughly to dusk each day when the pedestrian is particularly hard to discern. Pedestrians often wear dark clothing and have no reflective or lighted surfaces. A minor peak also appears for pedestrian fatalities between 9:00 and 10:00 p.m. This is possibly another indication of the difficulty of drivers in seeing pedestrians at night. Much of the pedestrian activity normally subsides after 10:00 p.m.

The relationship between day of the week and the percentage of pedestrian fatalities and all motor vehicle fatalities is given in Figure 4. Nearly 23 percent of all traffic fatalities occurred on Saturday; 18 percent of pedestrian fatalities occurred on Saturday. Pedestrian fatalities are more evenly distributed through the week, but the larger portion of them occurred on Thursday, Friday, and Saturday. The exposure of school children

Figure 1. Pedestrian Death Rates Since 1960.

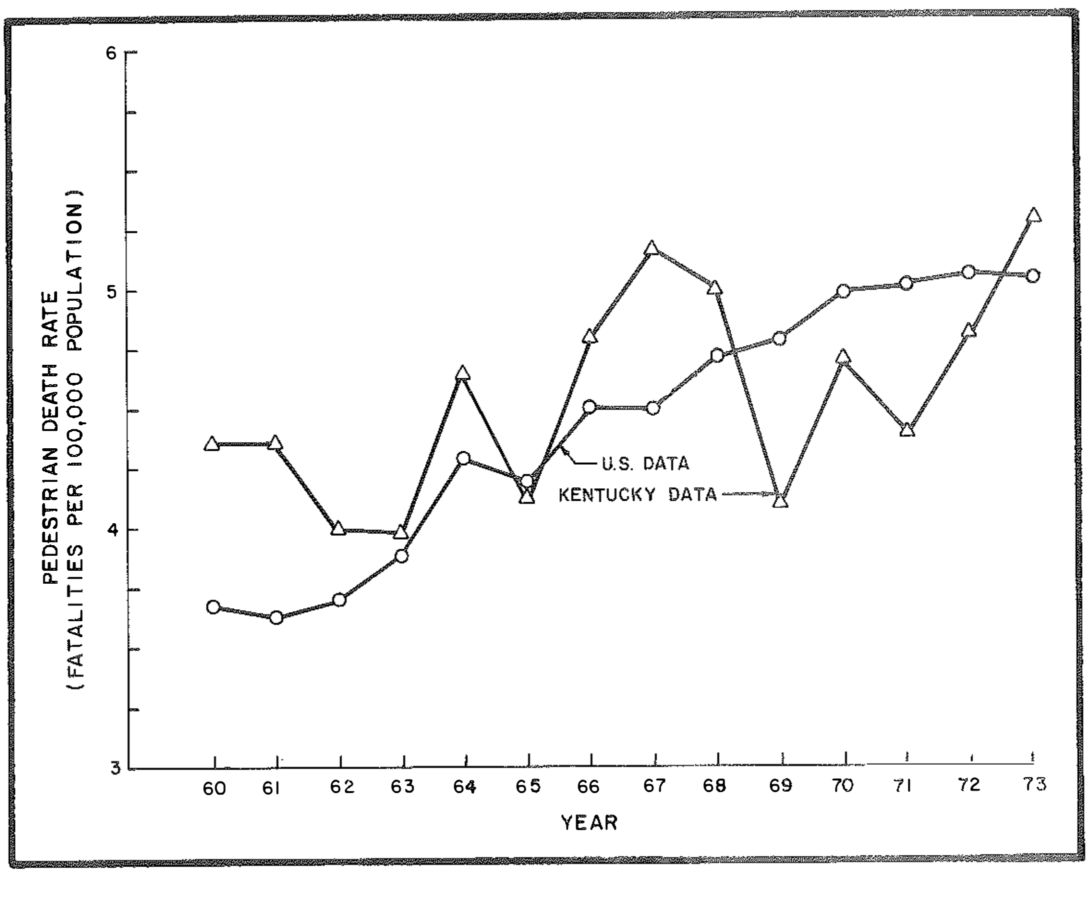
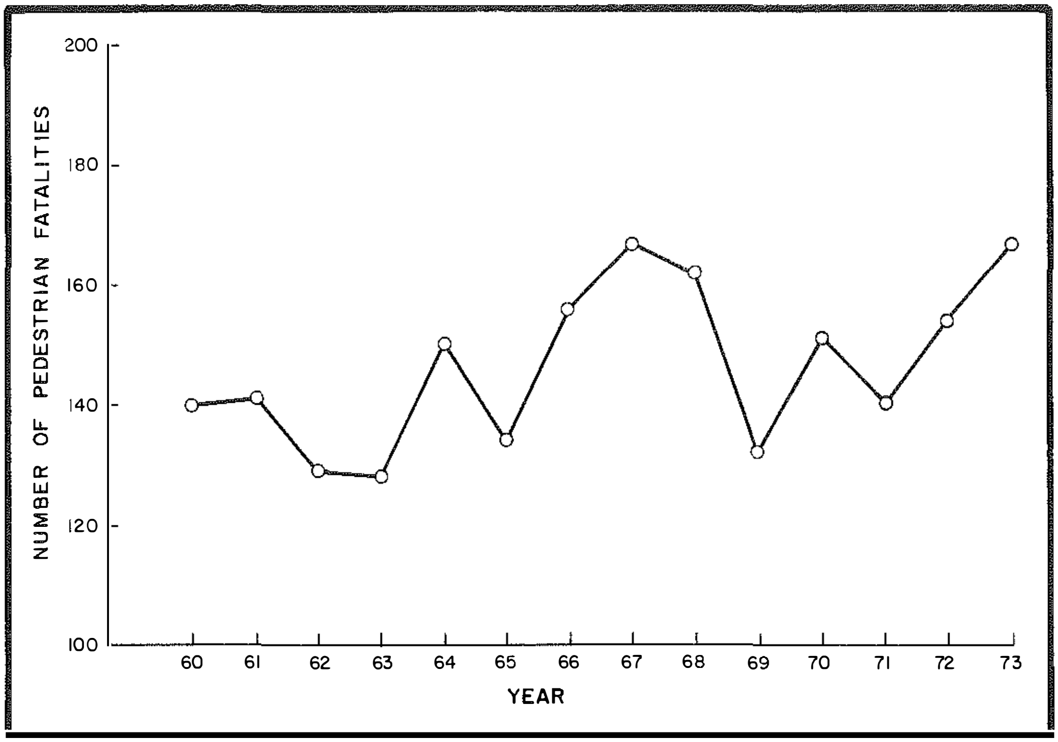


Figure 2. Number of Pedestrian Fatalities in Kentucky.



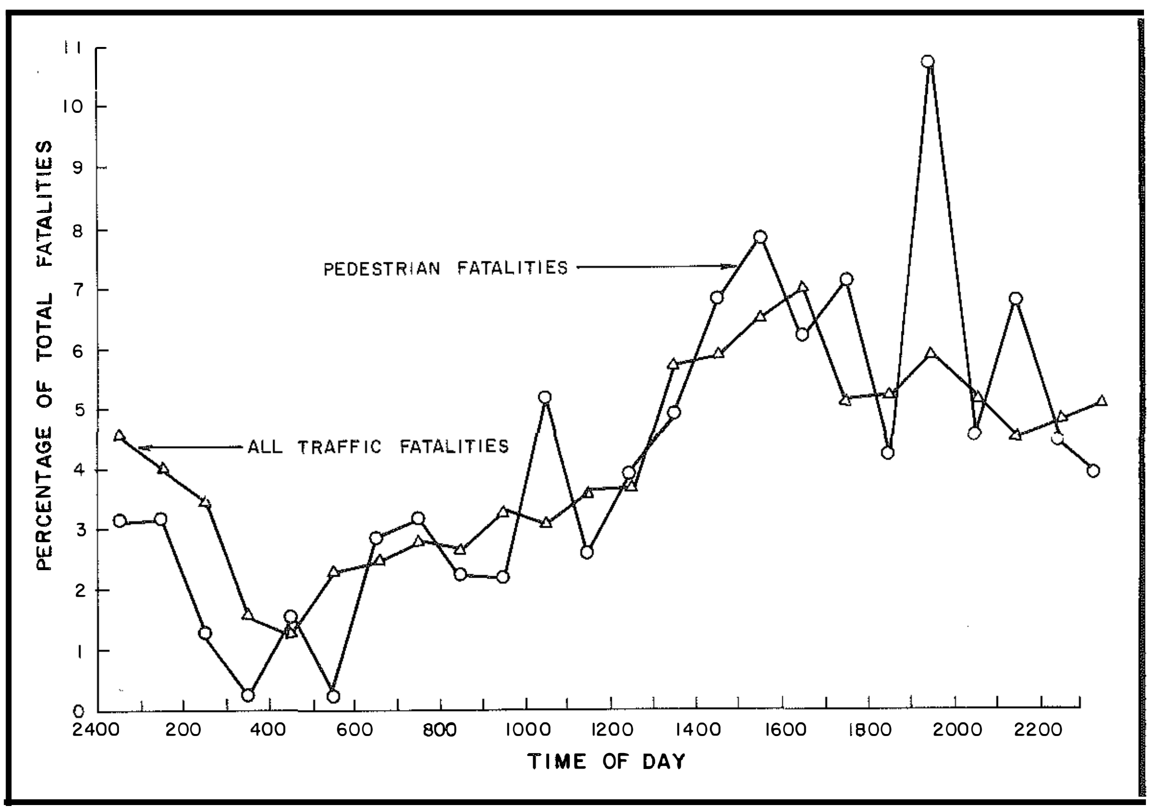
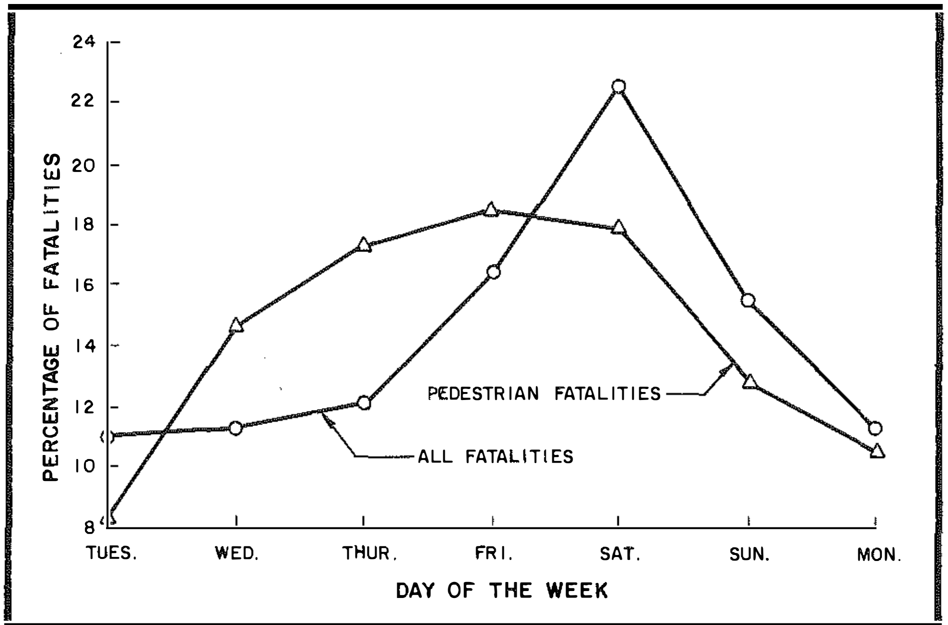


Figure 3. Fatalities versus Time of Day.

Figure 4. Fatalities versus Day of Week.



to motor vehicles before and after school on weekdays, combined with weekday pedestrian shopping trips, tend to smooth the curve of pedestrian fatalities over the week. Sundays and Mondays have the lowest percentage of pedestrian and total traffic fatalities.

Time variations of fatalities by months of the year are shown in Figure 5. The curves for pedestrian and total traffic fatalities agree closely from January to June. There is considerable variation between the curves from July to December; in September, total traffic fatalities exceeded pedestrian fatalities by about 3 percent. This difference could possibly be a result of nationwide campaigning every September by local school officials (and the American Automobile Association) to watch for school children. However, more detailed evaluations should be made to verify the effectiveness of such campaign activity.

Environmental Conditions

The environmental conditions associated with fatal pedestrian accidents are of particular importance because they give the safety engineer information that may be helpful in deciding what physical characteristics of the roadway may contribute to pedestrian fatalities. Particular environmental conditions considered here are road defects, road character, weather and light conditions, type and class of road, and area or county where pedestrian fatalities are most prevelant.

Each state-police accident report has a box to check if any road defect exists at an accident location. Officers were quite thorough in completing details of each accident. Of the 321 pedestrian fatal reports examined, only 12 reports indicated any road defect which could have contributed to the accident. A summary of the road defects is given in Table 1. Of the 12 road defects, five of them were defective shoulders and two were road construction zones.

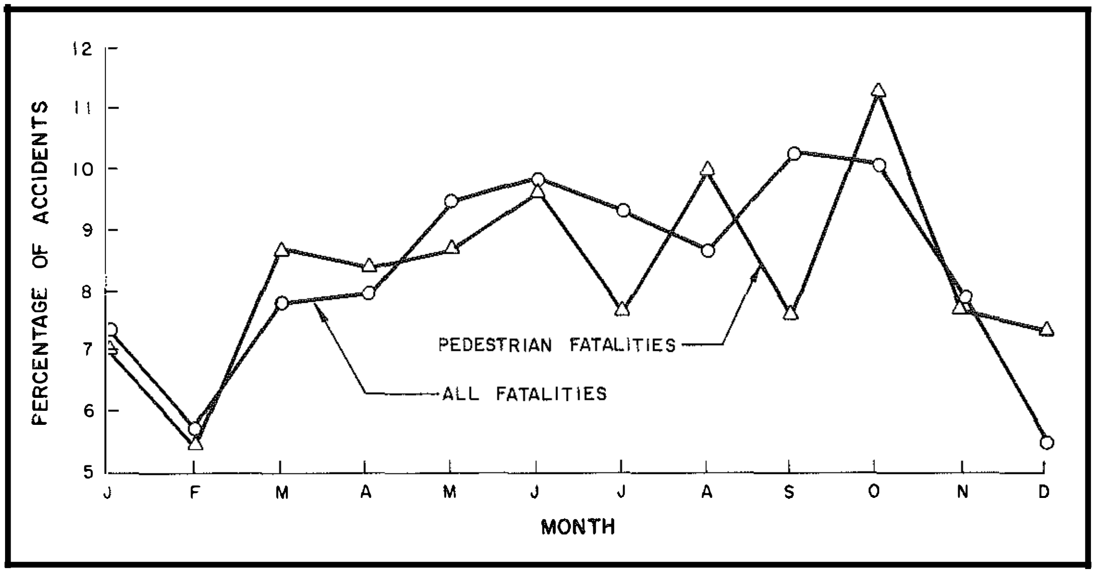


Figure 5. Fatalities versus Month of Year.

TABLE 1. SUMMARY OF ROAD DEFECTS FOR PEDESTRIAN FATALITIES

ROAD DEFECT	NUMBER OF FATALITIES
Dirt Road	1
Defective Shoulder	5
Road Under Construction	2
Holes, Ruts, or Bumps in Road	1
Mud on Road	1
Sand on Road	1
Loose Materials on Surface	1
Total Defects	12

The road characters of pedestrian fatality locations are summarized in Table 2. The most common location character was a straight, level roadway (41 percent). Other types with appreciable fatalities were intersections (20 percent), straight roads on a grade (14 percent), and alleys and driveways (13 percent).

A summary of weather and light conditions (Table 3) shows that most pedestrian fatalities (52 percent) occurred during daylight hours. Dry highway surfaces were reported in 81 percent of these accidents. Lighted streets accounted for only 12 percent, and dark street conditions existed during 36 percent of the pedestrian fatalities.

The description of each highway location was noted during the analysis of pedestrian fatalities. The percentage of fatalities by location type (rural, small urban, and large urban) and number of lanes is shown in Table 4. Nearly half of all pedestrian fatalities (49 percent) occurred on rural, two-lane highways. Two-lane roads accounted for 75 percent of these fatalities, and about 61 percent of them were in rural areas. Interstates and parkways accounted for 9 percent even though pedestrians are prohibited on these facilities.

The number of pedestrian fatalities for each of the 120 Kentucky counties was listed for 1972 and 1973 along with corresponding county populations *(4)*. As expected, Jefferson County had by far the highest number of pedestrian fatalities with 40 annually. Other counties averaging over three pedestrian fatalities per year were 5 in Fayette, 4.5 in Daviess, 3.5 in Campbell, 3.5 in Calloway, and 3.5 in Harlan. Thirty counties had no pedestrian fatalities during the two years. Death rates in each county ranged from 0 to 31 pedestrian fatalities per 100,000 population. Counties having the highest death rates were Nicholas with 31, Gallatin with 25, Livingston with 20, Russell with 19, Larue with 19, and Wolfe with 18. All of these are rural counties. Relatively low pedestrian fatality rates were found in the urban counties of Jefferson, Fayette, Daviess, and Campbell. Details of pedestrian fatalities and fatality rates are given in APPENDIX A.

The 120 counties were grouped by population. Nine population groups as shown in Table 5 were used. The number of fatalities per county was computed for each group along with the average population of the counties in each group. The data are shown plotted in Figure 6. Fatality rates for each of the nine county groupings are shown in Figure 7. The pedestrian fatality rate decreases with increasing population because of the high percentage of deaths in predominately rural counties. The higher vehicle speeds in pedestrian-related accidents on rural roads present a greater likelihood of a fatality. About 30 percent of all rural pedestrian accidents in Kentucky result in fatalities.

In cities like Louisville, Lexington, and Covington, there are large numbers of accidents due to congestion. There were over 40,000 traffic accidents within the city limits of Louisville in 1973 compared to about 39,000 accidents reported over the entire rural highway system in Kentucky by state police in 1973. There were 476 pedestrian accidents in Louisville in 1973 compared to 342 over the statewide rural highway system. Because of the large number of pedestrian accidents in urban areas, combined with a high risk of any pedestrian accident resulting in a fatality, the pedestrian death rate was nearly 6 (Figure 7) in the most highly populated Jefferson County.

TABLE 2. ROAD CHARACTER FOR PEDESTRIAN FATALITIES

ROAD CHARACTER	PERCENT OF FATALITIES
Straight, Level	41
Intersections	20
Straight, Grade	14
Alleys and Driveways	13
Curves	8
Parking Lots	2
Interchanges	1
Bridges	1

TABLE 3. LIGHTING CONDITIONS FOR FATAL PEDESTRIAN ACCIDENTS

LIGHTING CONDITIONS	PEDESTRIAN ACCIDENTS (PERCENT)	
	DRY	WET
Daylight	46.0	6.0
Dark -- No Lights	28.0	8.0
Dark -- Lights	7.0	5.0

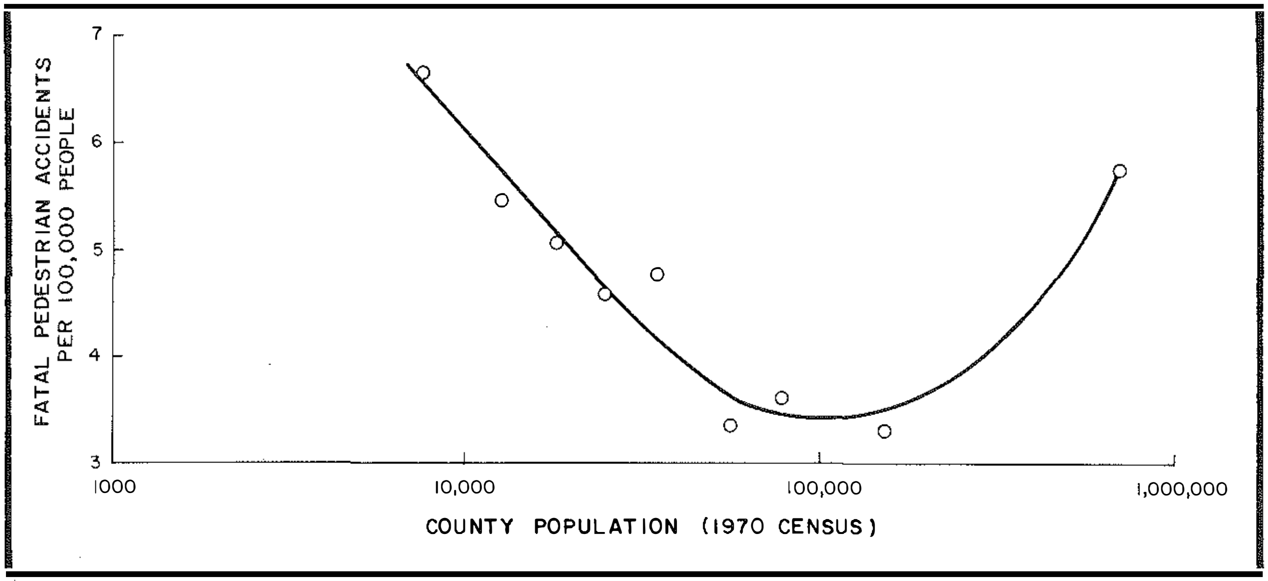
TABLE 4. PEDESTRIAN FATALITIES BY LOCATION TYPE

HIGHWAY TYPE	RURAL AREAS UNDER 2,500 PEOPLE (PERCENT)	SMALL CITIES 2,500-22,000 PEOPLE (PERCENT)	LARGE CITIES OVER 22,000 PEOPLE (PERCENT)
Two-lane	49	11	15
Three-lane	1	0	0
Four-lane Undivided	3	2	5
Four-lane Divided	2	1	2
Interstate and Parkway	6	0	3

TABLE 5. FATALITIES GROUPED BY COUNTY SIZE

GROUP NUMBER	COUNTY SIZE	NUMBER OF COUNTIES	AVERAGE ANNUAL NUMBER OF PEDESTRIAN FATALITIES PER COUNTY	AVERAGE POPULATION OF EACH GROUP
1	0-10,000	34	0.49	7,500
2	10,001-15,000	32	0.67	12,500
3	15,001-20,000	18	0.89	17,500
4	20,001-30,000	14	1.14	25,000
5	30,001-40,000	10	1.65	34,000
6	40,001-60,000	5	1.80	55,000
7	60,001-100,000	4	2.89	80,000
8	100,001-200,000	2	5	150,000
9	200,001-700,000	1	40	700,000

Figure 6. Relationship between County Population and Average Annual Pedestrian Fatalities.



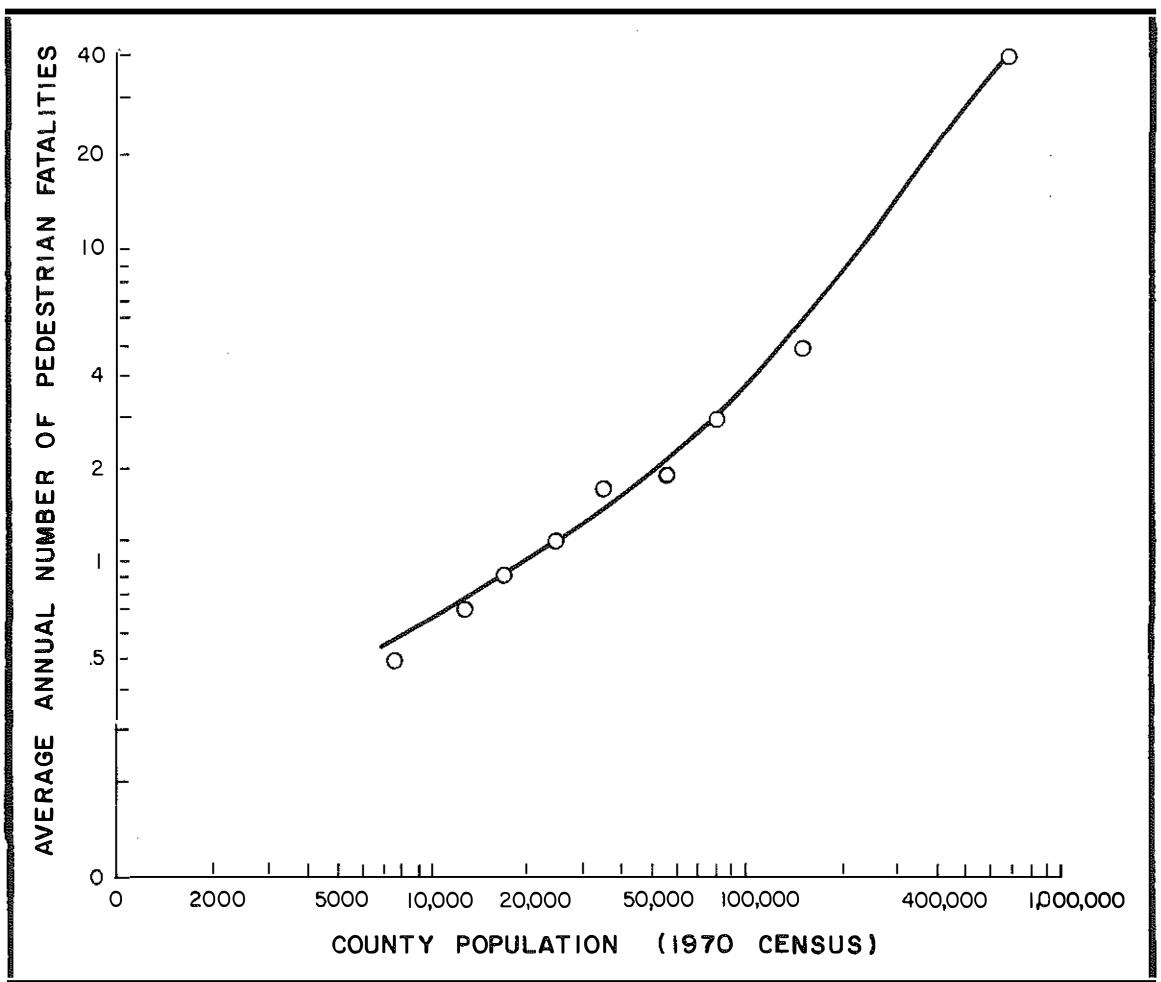


Figure 7. Relationship between County Population and Pedestrian Fatality Rates.

Human Factors

Most traffic accidents result from errors in human judgment. Past research indicates that about two out of every three pedestrians killed in traffic accidents violated a traffic law or committed an unsafe act *(5)*. Thus, a reasonable approach to reducing traffic accidents of any kind is to analyze the nature and possible causes of human error and seek to remedy them. The human factors considered were (1) the effect of the ages of the pedestrian and driver, (2) pedestrian action preceding the accident, and (3) the cause of the accident.

Age of the driver was plotted against the number of pedestrian fatalities in Figure 8. As expected, the number of accidents sharply decreases with an increase in driver age. This may indicate that driving experience is important in avoiding accidents. The age of pedestrians killed in traffic accidents was plotted against percentage of occurrence. This curve was compared to the ages of people killed in all Kentucky motor vehicle fatalities in 1972 and 1973 (Figure 9). Pedestrian fatalities were highest for ages under 9 and over 64. The predominent number of people killed in all statewide traffic accidents are between the ages of 15 and 44, which corresponds to the vast majority of drivers in this age range *(6)*. The large percentage of very young pedestrians killed results from their lack of understanding of traffic dangers. The high percentage of fatalities within the elderly pedestrian group results from reduced mobility and failing eyesight or hearing. Also, elderly people often are not in the best of health or are usually more fragile. A plot of annual fatality rate for various ages of pedestrians in Figure 10 illustrates this quite clearly.

Pedestrian action preceeding the fatal accidents is given in Table 6. The major actions involved crossing the street (69 percent). As expected, walking with traffic causes three times as many pedestrian fatalities as walking against traffic (15 to 5 percent).

The cause of most pedestrian fatalities (Table 7) was the fault of the pedestrian (69 percent). A large percentage of fatalities (25 percent) involved children under 10 playing in or running across the street. Although a national study indicated about 23 percent of all pedestrians killed in accidents had been drinking, only 5 percent were identified as such in Kentucky *(5)*. It may be important to also note that, although 20 percent of all pedestrian fatalities occur at intersections, only 3 percent of them resulted from an illegal intersection crossing. The major driver fault was speeding or reckless driving (12 percent). Inattentiveness was a factor in 9 percent of the cases, and drinking caused 4 percent of the fatalities. Alcoholic affectation, therefore, was responsible for about 9 percent of the pedestrian fatalities compared to about 17 percent of all traffic fatalities.

URBAN VERSUS RURAL PEDESTRIAN ACCIDENTS

Kentucky is predominantly a rural state. Since 1960, most pedestrian fatalities have been in rural areas (Figure 11). However, only 342 occurred on the rural state-maintained highway system out of an estimated 1500 annual pedestrian accidents in Kentucky in 1973. Nearly 30 percent of all rural pedestrian accidents are fatalities whereas only 4.2 percent were fatalities in urban areas (Table 8). (There were virtually no property-damage-only pedestrian accidents reported.)

A comparison of several factors was made for rural and urban accidents to determine major pedestrian accident causes. The rural pedestrian accidents used were the 682 reported by the state police in 1972 and 1973. The urban pedestrian accidents included 1650 which occurred in the nine first and second class Kentucky cities in 1972 and 1973. Therefore, about 2300 pedestrian accidents were used for this analysis. Again, the major factors considered were time factors, environmental factors, and human factors.

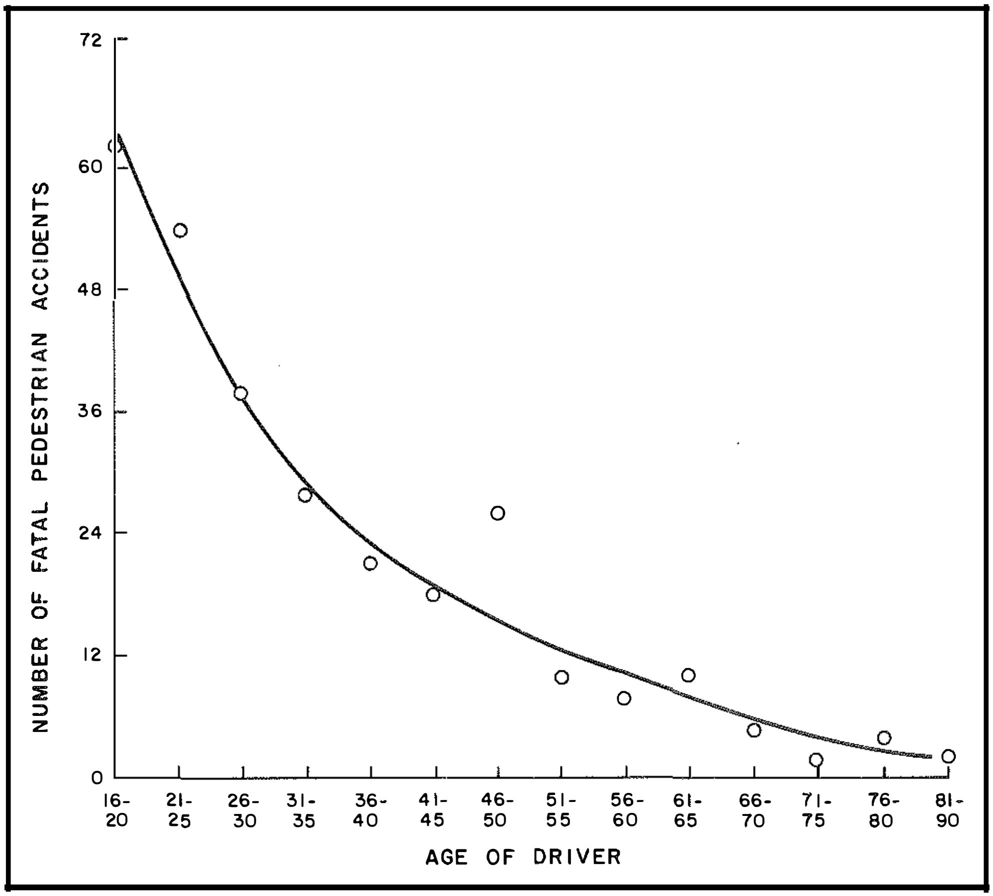
Time Factors

The pedestrian accident trends throughout the average day were fairly similar for urban and rural locations. The urban accidents were about 4 percent higher between 4:00 and 5:00 p.m. due to the afternoon rush hour in the cities (Figure 12). This could be due, in part, to the increase in accidents involving intoxication of the driver or pedestrian during late afternoon, evening, and nighttime hours. Of 76 rural pedestrian accidents in Kentucky in which drunk driving or public drunkenness (of the pedestrian) was a contributing cause, over two-thirds of these accidents occurred between 4:00 p.m. and 1:00 a.m. (about one-third of the day). Most of these accidents (about 60 percent) involved pedestrian rather than driver intoxication.

The percent of daily pedestrian accidents peaks on Saturday in rural areas (19 percent) (Figure 13). Fridays claimed the highest percentage of urban pedestrian accidents (18.5 percent) with the lowest percentage (8.5 percent) on Sundays. Mondays had a high percentage of urban pedestrian accidents (16.5 percent). Store closings on Sundays probably account for most of that day's urban pedestrian accident decline.

When the urban and rural pedestrian accident trends were compared by month of year, no conclusions could be made. There were slight variations from month to month, but no definite trends were discernable.

Figure 8. Relationship between Fatal Pedestrian Accidents and Age of Drivers.



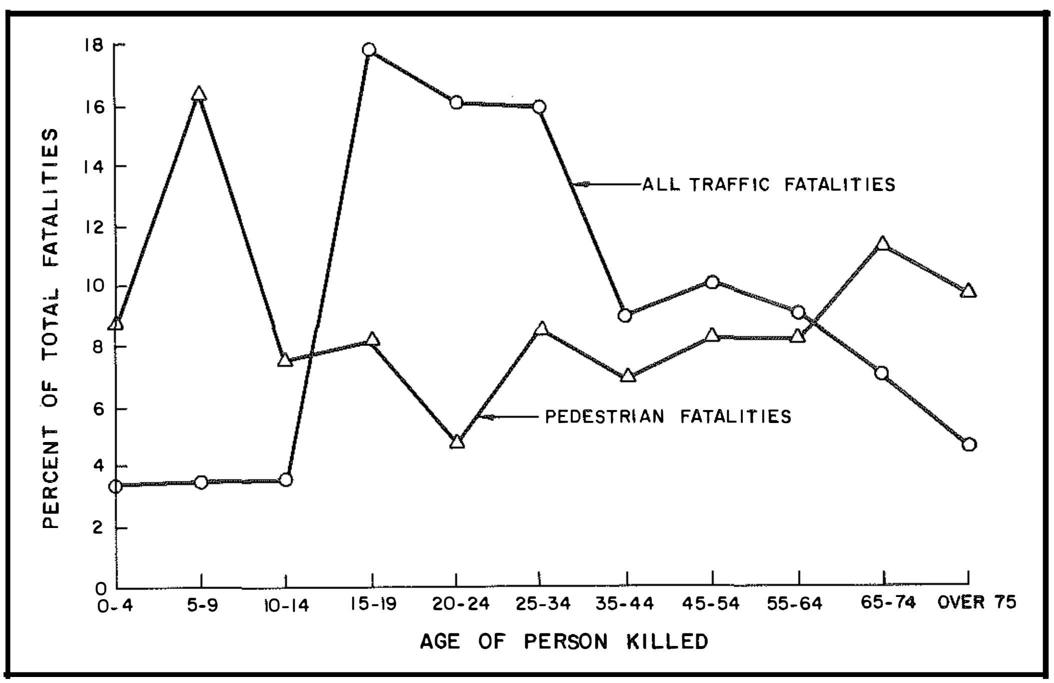


Figure 9. Distribution of All Traffic and Pedestrian Fatalities by Age.

Figure 10. Annual Fatality Rates for Various Pedestrian Ages.

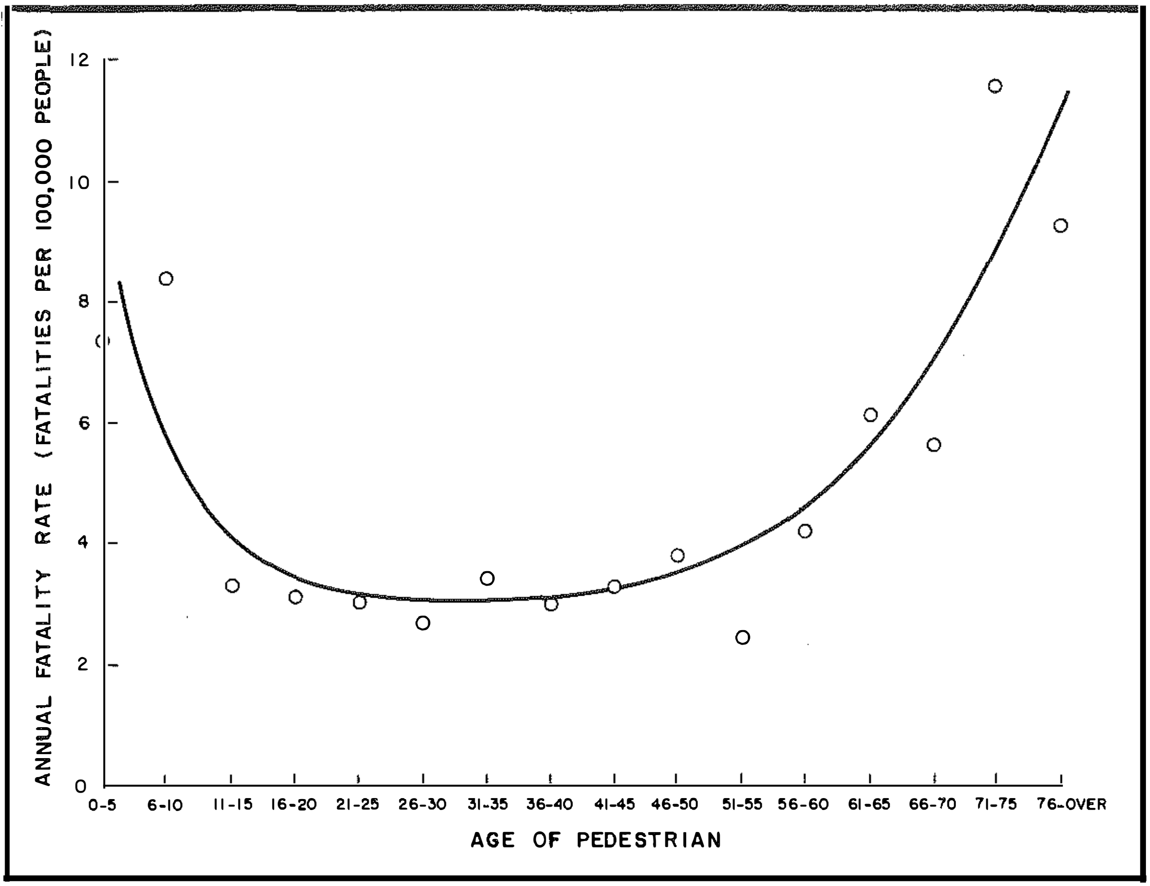


TABLE 6. PEDESTRIAN ACTION PRECEDING FATALITIES

PEDESTRIAN ACTION	PERCENT OF FATALITIES
Crossing Street	69
Walking with Traffic	15
Standing, Lying, or Playing in Road	11
Walking against Traffic	5

TABLE 7. PEDESTRIAN FATAL ACCIDENTS BY CAUSE

CAUSE	PERCENT OF FATALITIES
Playing, Running, or Walking in Front of Car	
Age 0-5	11
Age 6-10	14
Older than 10	26
Intoxicated or Had Been Drinking	5
Crossed Illegally at Intersection	3
Lying in Roadway (Hurt, Drugged, Unconscious)	3
Standing in Roadway	2
Walking in Road	2
Getting into or out of Vehicle	1
School Just Out -- Crossing Illegally	1
Pedestrian Sick or Handicapped	1
Subtotal	69
Drinking or Drunk Driving	4
Speeding or Reckless Driving	12
Inattentive	9
Other Driving Error	4
Vehicle Brake Failure	1
Passed Stopped School Bus	1
Subtotal	31

Figure 11. Urban and Rural Pedestrian Fatalities in Kentucky Since 1960.

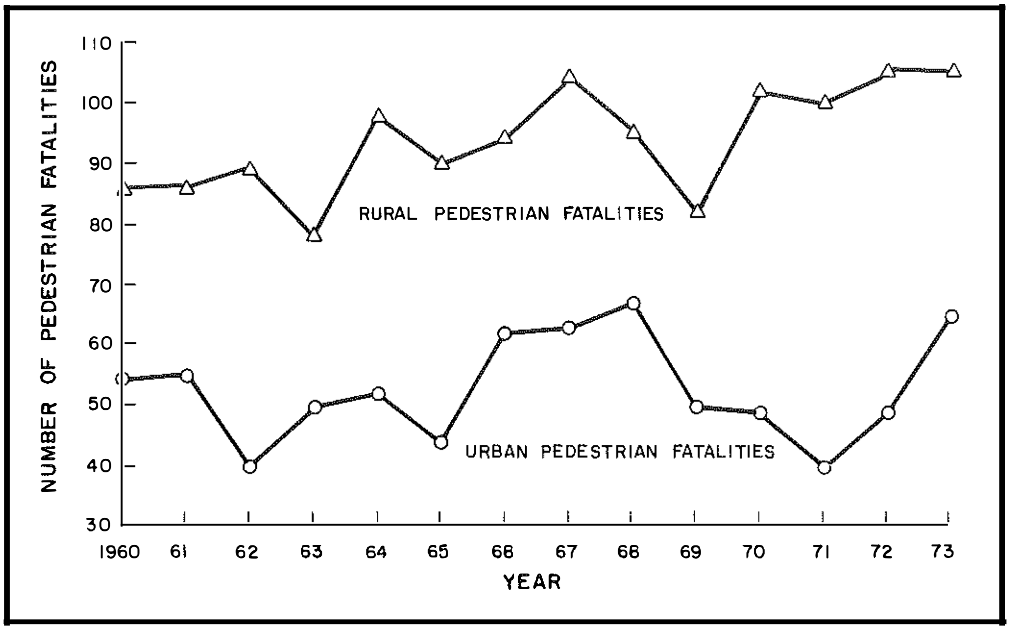


TABLE 8. FATAL PEDESTRIAN ACCIDENTS IN RURAL AND URBAN AREAS

AREA	FATAL ACCIDENTS (PERCENT)	INJURY ACCIDENTS (PERCENT)
Rural	29.7	70.3
Urban	4.2	95.8

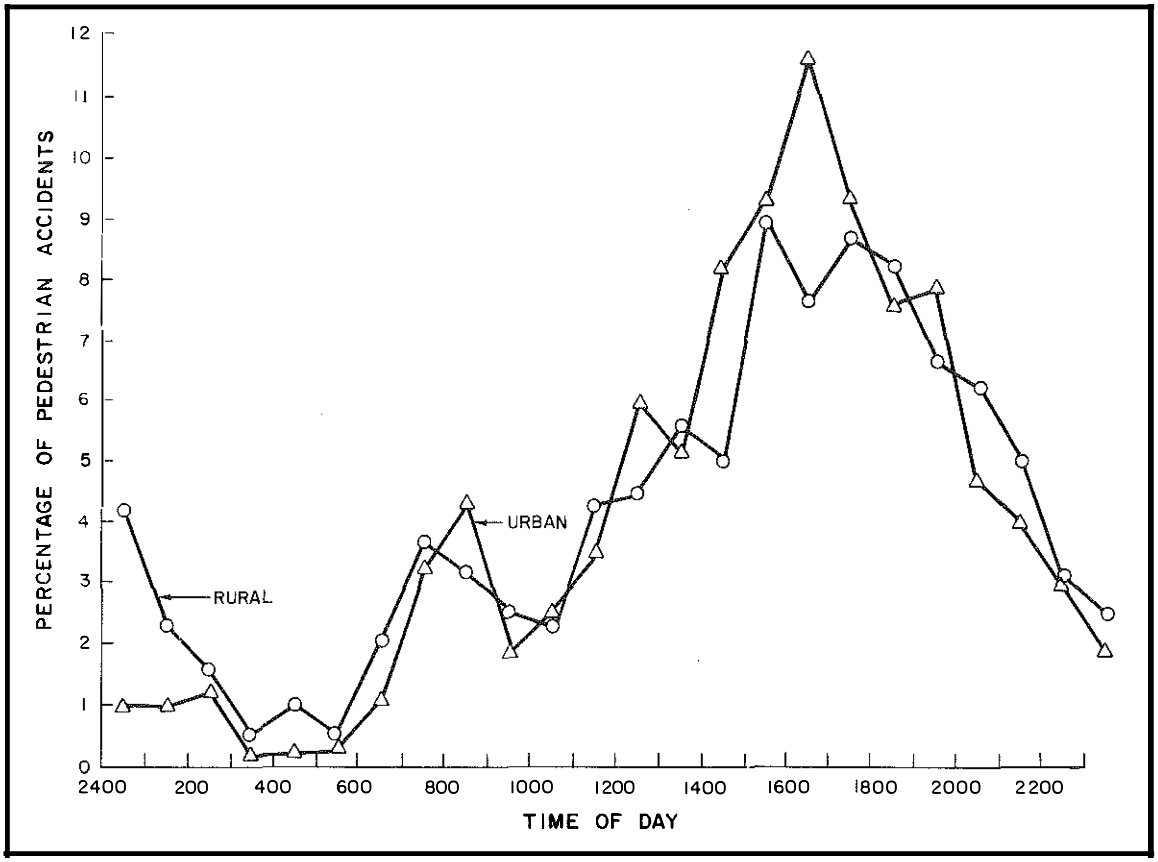


Figure 12. Urban and Rural Pedestrian Accidents by Time of Day.

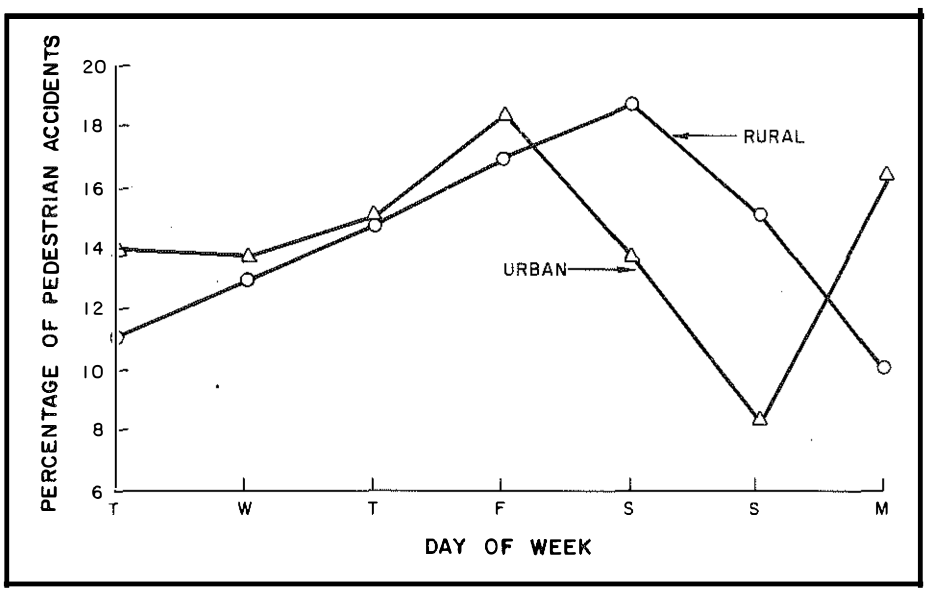


Figure 13. Urban and Rural Pedestrian Accidents by Day of Week.

Environmental Factors

One important environmental factor is the light condition during the accident. All of the nine urban areas have overhead lighting which may be a factor in reducing nighttime accidents. There is virtually no lighting of rural highways in Kentucky, except at some interstate interchanges. By comparing day and night accidents in urban and rural areas, about 25 percent of all urban pedestrian accidents occurred at dawn, dusk, or night. About 46 percent of all rural accidents occurred during these times (Table 9). This indicates that nighttime lighting may be important in reducing pedestrian accidents.

The percentage of pedestrian accidents occurring on wet, dry, and icy roads was determined for urban and rural conditions. There was a great deal of similarity between urban and rural areas. About 13 percent of the accidents occurred on wet rural roads compared to 16.5 percent on wet urban roads (Table 10). Snowy and icy roads accounted for only 2.2 percent on rural roads and 1.2 percent on urban roads.

The comparison between the number of pedestrian accidents at intersections and midblock locations is shown in Table 11. About 9 percent of the rural pedestrian accidents occurred at intersections, whereas nearly 38 percent of all urban pedestrian accidents were at intersections. The difference results from the low number of rural intersections per square mile (square kilometer) in contrast to the urban areas. The remaining large percentage of urban midblock pedestrian accidents (62 percent) indicated the danger in crossing at non-intersection locations.

Human Factors

The human factors considered for urban and rural areas were driver violation and pedestrian action. Drivers were at fault in only 24 percent of all urban pedestrian accidents compared to 32.8 percent in rural pedestrian accidents (Table 12). This probably results from pedestrian impatience in urban areas due to crowded conditions. Drivers do not necessarily drive better in urban areas than rural areas, but pedestrians probably make more impulsive and unsafe movements in urban areas than rural areas. Inattentiveness leads the driver violations in rural areas (11 percent), and failure to yield to pedestrians causes 8.4 percent of all urban pedestrian mishaps.

Crossing the street at midblock was the most common pedestrian action in rural (46.8 percent) and urban (55.6 percent) areas (Table 13). Crossing at an intersection was responsible for 27.1 percent of urban accidents and only 4 percent of rural accidents. Walking with traffic (8 percent) and against traffic (4.4 percent) involved over 12 percent of pedestrian accidents in rural areas. Vehicle defects were responsible for about 5 percent of the rural pedestrian accidents. Crossing the street accounted for about 83 percent of all urban pedestrian accidents.

ANALYSIS OF PEDESTRIAN ACCIDENTS IN SELECTED URBAN AREAS

As stated previously, the pedestrian accident patterns in two different urban areas will differ depending on many social, educational, recreational, and traffic characteristics of the cities. Therefore, a thorough study of pedestrian accident patterns in each city is necessary before specific accident preventive measures can be derived.

The number of pedestrian accidents in the nine first and second class cities was determined for 1972 and 1973 (Table 14). The number of fatalities and total accident costs using National Safety Council values *(2)* were also calculated. Louisville had the most pedestrian accidents (476) and the most fatalities (28) in 1973. Frankfort had 7 during 1972; Bowling Green recorded no fatalities in 1972 or 1973. Total pedestrian accident costs were the highest in Louisville in 1973, reaching nearly $2.5 million. Lexington was second with slightly over $600,000 in 1973.

The annual number of pedestrian accidents is shown in Figure 14 for the various city populations. The plot shows a uniform increase in pedestrian accidents as population rises from 22,000 to 360,000. As can be seen, a straight line closely represents six of the nine cities. Covington and Newport lie considerably above this line, and Paducah lies below the line. Covington and Newport, therefore, have a more serious pedestrian accident problem than the other cities. Paducah, on the other hand, has less of a pedestrian accident problem.

Newport had the highest fatality rate for 1972 and 1973 (7.7 pedestrian deaths per 100,000 population, Table 15). The combined fatality rate of the nine cities in 1972 and 1973 was about 4.8, which was slightly below the statewide pedestrian death rate of 5.2. However, the fatality rate for the nine cities in 1973 was 5.8 per 100,000 population due mainly to the 28 fatalities in Louisville in that year.

TABLE 9. LIGHT CONDITIONS IN PEDESTRIAN ACCIDENTS

LIGHT CONDITION	RURAL ACCIDENTS (PERCENT)	URBAN ACCIDENTS (PERCENT)
Day	54.2	75.4
Dawn or Dusk	6.4	3.2
Night	39.4	21.4

TABLE 10. ROAD SURFACE CONDITIONS IN PEDESTRIAN ACCIDENTS

ROAD SURFACE CONDITION	RURAL ACCIDENTS (PERCENT)	URBAN ACCIDENTS (PERCENT)
Dry	84.5	82.3
Wet	13.3	16.5
Snow or Ice	2.2	1.2

TABLE 11. ROAD CHARACTERISTICS IN PEDESTRIAN ACCIDENTS

ROAD CHARACTERISTIC	RURAL ACCIDENTS (PERCENT)	URBAN ACCIDENTS (PERCENT)
Intersections	9.2	37.8
Midblocks	90.8	62.2

TABLE 12. DRIVER VIOLATIONS IN PEDESTRIAN ACCIDENTS

DRIVER VIOLATION	RURAL ACCIDENTS (PERCENT)	URBAN ACCIDENTS (PERCENT)
Speeding or Reckless Driving	9.4	3.2
Inattentive	11.0	3.1
Hit-and-Run	5.3	8.1
Driving while Intoxicated	1.8	0.6
Failure to Yield to Pedestrian	2.2	8.4
Other Driver Violation	3.1	0.9
No Driver Violation	67.2	75.7

TABLE 13. PEDESTRIAN ACTION

PEDESTRIAN ACTION	RURAL ACCIDENTS (PERCENT)	URBAN ACCIDENTS (PERCENT)
Crossing or Entering at an Intersection	4.0	27.1
Crossing or Entering Not at an Intersection	46.8	55.6
Getting into or out of Vehicle	2.2	1.1
Walking with Traffic	8.0	0.9
Walking against Traffic	4.4	1.1
Standing	8.0	2.5
Pushing or Working on Vehicle	5.3	0.5
Other Working (Construction)	1.9	0.9
Playing	3.4	2.1
Other	5.3	1.4
Not in Roadway	10.8	2.1

TABLE 14. PEDESTRIAN ACCIDENT COSTS IN MAJOR KENTUCKY CITIES

CITY	POPULATION (1970 CENSUS)	NUMBER OF ACCIDENTS		NUMBER OF FATALITIES		TOTAL ACCIDENT COSTS	
		1972	1973	1972	1973	1972	1973
Louisville	361,958	470	476	12	28	$1,776,600	$2,469,600
Lexington	108,137	102	133	4	6	$444,600	$612,900
Covington	52,535	79	98	3	2	$340,200	$349,200
Owensboro	50,329	25	40	3	2	$194,400	$192,600
Bowling Green	36,253	18	27	0	0	$48,600	$72,900
Paducah	31,627	12	10	1	1	$74,700	$69,300
Ashland	29,245	20	13	2	0	$138,600	$35,100
Newport	25,998	52	56	2	2	$225,000	$235,800
Frankfort	21,902	7	12	0	1	$18,900	$74,700
Totals	717,984	785	865	27	42	$3,261,000	$4,112,100

TABLE 15. PEDESTRIAN DEATHS AND ACCIDENT OCCURRENCE IN MAJOR KENTUCKY CITIES

CITY	POPULATION (1970 CENSUS)	FATALITY RATE		PERCENT FATALITIES	ANNUAL PEDESTRIAN ACCIDENT RATE (ACCIDENTS PER 100,000 POPULATION)
		1972	1973		
Louisville	361,958	3.3	7.7	4.2	130.7
Lexington	108,137	3.7	5.6	4.3	108.7
Covington	52,535	5.7	3.8	2.8	168.5
Owensboro	50,329	6.0	4.0	7.7	64.6
Bowling Green	36,253	0.0	0.0	0.0	62.1
Paducah	31,627	3.2	3.2	9.1	34.8
Ashland	29,245	6.9	0.0	6.1	56.4
Newport	25,998	7.7	7.7	3.7	207.7
Frankfort	21,902	0.0	4.6	5.3	43.4
Totals	717,984	3.8	5.8	4.2	114.9

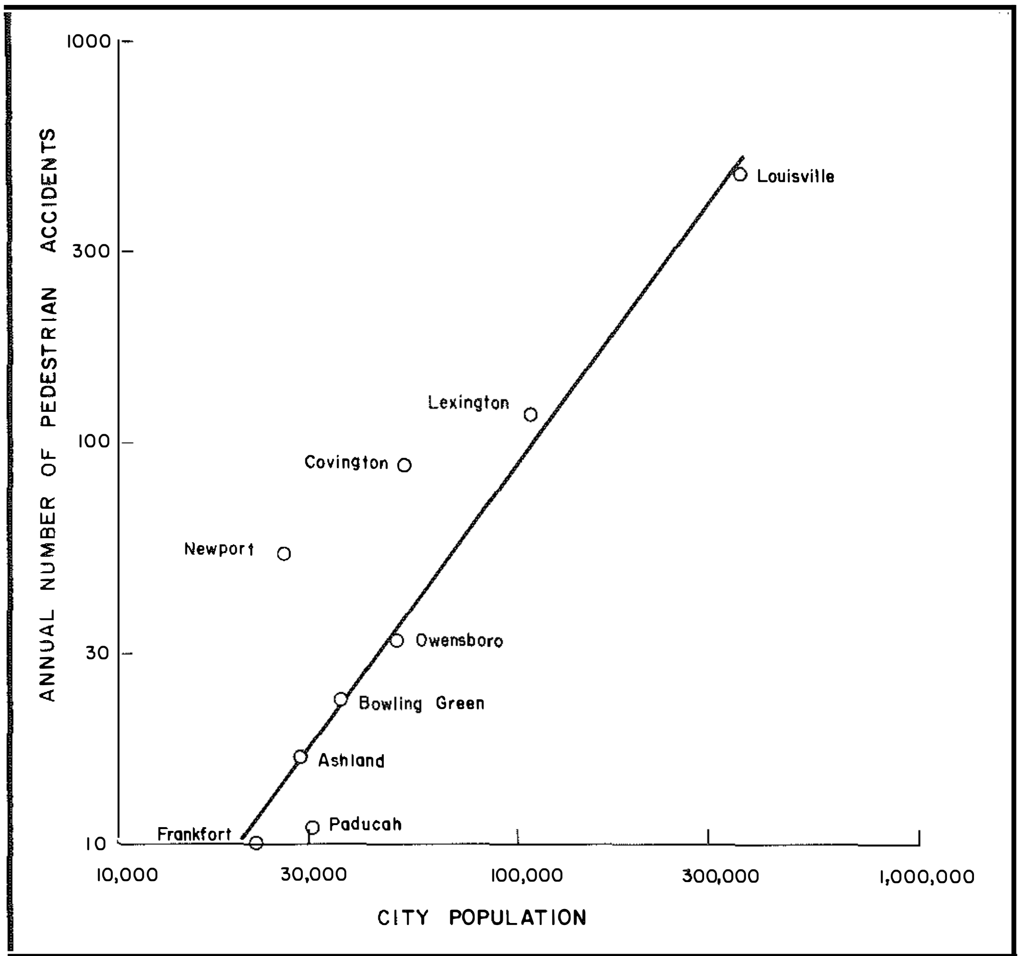


Figure 14. Relationship between Annual Number of Pedestrian Accidents and Population in Major Kentucky Cities.

The percent of fatalities in pedestrian accidents varied from 0 to 9.1. This indicator should not be given too much importance since it may be strongly affected by vehicle speeds (which are inversely related to urban population). However, the overall percent fatalities for the nine cities may be of some comparative interest. The 4.2 percent fatalities in 1972 and 1973 in Kentucky's major cities agrees closely with 4.0 percent fatalities found in 16 major cities in a 1968 nationwide study by AAA *(7)*. In that study, cities ranged from 180,000 population (St. Petersburg, Florida) to nearly 2.5 million population (Los Angeles, California).

The annual pedestrian-accident occurrence rate (per 100,000 population) was also computed for each city (Table 15). These were plotted versus city populations in Figure 15. The relatively high rates of 207.7 in Newport and 168.5 in Covington are shown relative to the other cities. Again, Paducah shows a slightly lower pedestrian accident rate for its population.

Pedestrian accidents in each city were classified as intersection, midblock, parking lot, or alleys and driveways in Table 16. Louisville accidents were classified only as midblocks or intersections. Approximately 60 percent of the pedestrian accidents in Owensboro and Paducah occurred at intersections. In most of the other cities, the percent of pedestrian accidents at intersections was less than 4.5. Parking-lot accidents accounted for about 9 percent of all pedestrian accidents in Bowling Green and Ashland. Most other cities had 4.5 percent or less parking-lot pedestrian accidents. Therefore, the percentages of parking-lot accidents in Bowling Green and Ashland are unusually high.

The light conditions during pedestrian accidents are given in Table 17. The higher percentages of "dark" accidents occurred in Ashland (38.7 percent), Frankfort (31.6 percent), and Paducah (28.6 percent); these percentages may be compared with an average of 21.1 percent "dark" pedestrian accidents in all nine cities.

The percentage of pedestrian accidents for various age groups is presented in Table 18. The percentage of college-age pedestrian accidents was highest in Frankfort (Kentucky State University), Lexington (University of Kentucky), Ashland (Ashland Community College), and Bowling Green (Western Kentucky University).

A high percentage of accidents involving pedestrians over 61 years old was found in Paducah (19 percent) and Owensboro (14.8 percent). The higher percentages of grade-school children involved in pedestrian accidents were in Newport (48.6 percent), Covington (46.6 percent), Louisville (44.4 percent), and Frankfort (43.8 percent).

PEDESTRIAN ACCIDENT REDUCTION

Some of the measures which have been used effectively in reducing pedestrian accidents in urban and rural areas include:

1. vehicle parking prohibition,
2. designation of one-way streets,
3. improvements in overhead street lighting,
4. crosswalk usage,
5. installation of pedestrian signals,
6. use of pedestrian barriers,
7. pedestrian prohibition (on interstates),
8. driver regulations,
9. installation of pedestrian refuge islands,
10. reflectorized apparel for pedestrians,
11. special pedestrian signing and markings,
12. shoulder widening (rural areas),
13. sidewalk installation,
14. grade-separated crossings,
15. construction of pedestrian malls,
16. playgrounds built in urban areas,
17. pedestrian education programs, and
18. increased enforcement of pedestrian and driver regulations.

Statewide Pedestrian Accident Countermeasures

The high percentage of pedestrian accidents which occurred near dusk (7:00 to 8:00 p.m.) and dark hours (particularly until 2:00 a.m.) suggested a need for improved pedestrian visibility. Unlike motor vehicles which are equipped with lights and reflectors, pedestrians become almost invisible for a driver at night. Also, pedestrians often do not realize how invisible they are, particularly in bad weather or when an oncoming driver's sight and reflexes have been hindered by alcohol, drugs, fatigue, or the headlights of another car *(8, 9)*. One practical solution to this problem is the use of retro-reflective materials by pedestrians at night. These materials return headlight beams directly back to the driver and may be worn in several forms. Reflective clothing, shoes, and jackets may be easily and cheaply made. Reflective tape can easily be applied to outer clothing and is very effective. Special reflectorized patches and emblems for children are inexpensive and may be desirable since a high percentage of pedestrian accidents involve children *(9)*. Mandatory use of reflectorization materials on jackets or other clothing (especially for children) would be very helpful in reducing nighttime pedestrian accidents.

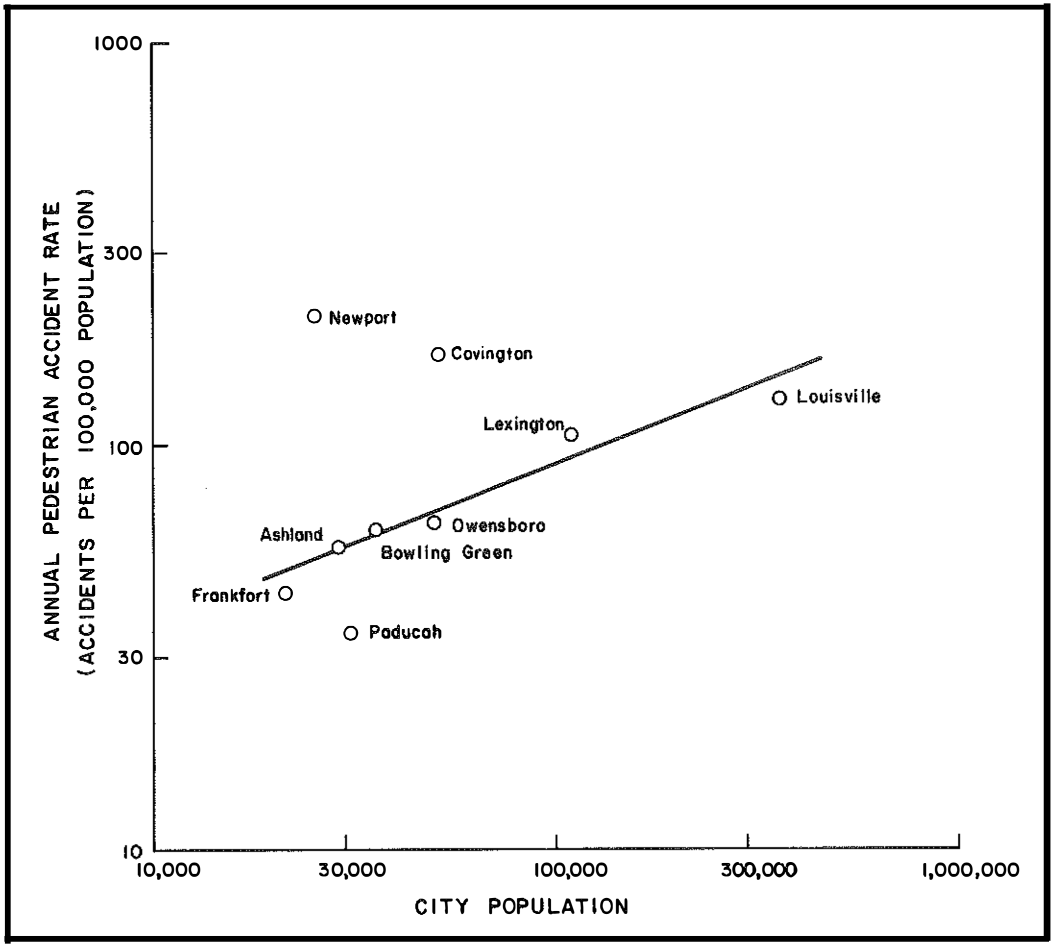


Figure 15. **Relationship between Annual Pedestrian Accident Rate and Population in Major Kentucky Cities.**

TABLE 16. PEDESTRIAN ACCIDENT LOCATIONS IN MAJOR KENTUCKY CITIES

CITY	PEDESTRIAN ACCIDENTS (PERCENT)			
	INTERSECTIONS	MIDBLOCKS	PARKING LOTS	ALLEYS AND DRIVEWAYS
Louisville	31.4	68.6		
Lexington	43.0	52.8	3.0	1.3
Covington	40.7	51.4	4.0	4.0
Owensboro	61.5	35.4	0.0	3.1
Bowling Green	22.2	66.7	8.9	2.2
Paducah	59.2	31.8	4.5	4.5
Ashland	33.3	54.5	9.1	3.0
Newport	50.9	41.7	1.9	5.6
Frankfort	42.1	47.4	5.3	5.3

TABLE 17. LIGHT CONDITIONS FOR PEDESTRIAN ACCIDENTS IN MAJOR KENTUCKY CITIES

CITY	PEDESTRIAN ACCIDENTS (PERCENT)		
	LIGHT	DARK	DAWN OR DUSK
Louisville	79.0	19.3	1.7
Lexington	73.0	21.2	5.8
Covington	72.3	23.7	4.0
Owensboro	79.0	9.7	11.3
Bowling Green	67.5	27.5	5.0
Paducah	61.9	28.6	9.5
Ashland	51.6	38.7	9.7
Newport	73.1	26.9	0.0
Frankfort	63.2	31.6	5.3
Average	75.8	21.1	3.1

TABLE 18. AGE DISTRIBUTIONS OF PEDESTRIANS HIT BY VEHICLES IN MAJOR KENTUCKY CITIES

CITY	PEDESTRIAN ACCIDENTS (PERCENT)						
	0-5 (PRESCHOOL)	6-15 (GRADE SCHOOL)	16-18 (HIGH SCHOOL)	19-23 (COLLEGE)	24-40	41-60	61-UP
Louisville	13.3	44.4	7.5	4.7	9.8	11.4	8.3
Lexington	21.2	33.2	5.1	10.6	11.1	14.3	4.6
Covington	18.6	46.6	7.4	5.6	8.1	8.7	6.8
Owensboro	32.8	34.4	3.3	4.9	3.3	6.6	14.8
Bowling Green	19.0	35.7	4.8	9.5	7.1	14.2	9.5
Paducah	33.3	23.8	0.0	4.8	0.0	19.0	19.0
Ashland	10.3	34.5	13.8	10.3	6.9	17.2	6.9
Newport	23.4	48.6	3.7	3.7	7.5	5.6	7.5
Frankfort	12.5	43.8	0.0	12.5	12.5	12.5	6.3

Environmental conditions include road defects, road character, weather and light conditions, type and class of road, and county considerations. Road defects contributed to 12 or 321 pedestrian accidents. The percentage of pedestrian fatalities on interstates (9 percent) is surprising inasmuch as pedestrians are not allowed those roads. In many cases, vehicle breakdowns cause drivers to become pedestrians or roadside mechanics. At night, traffic volumes reduce and driver apprehensiveness minimizes the likelihood of a stranded motorist receiving help. Therefore, darkness, high vehicle speeds, and long distances to service areas increase the likelihood of a pedestrian fatality. One possible solution to this dilemma is increased police surveillance on interstates, especially during night hours. Also, strict enforcement of hitch-hiker prohibition laws on interstates might be helpful.

Human factors include driver and pedestrian ages, pedestrian action, and accident cause. The high occurrence of pedestrian fatalities among children under 9 years old plus the fact that 85 percent of these fatal accidents are the pedestrian's fault are significant. These accidents occur because young children have not fully developed the skills of localizing sounds, seeing out of the corners of their eyes, or understanding road signs *(10)*. Also, young children are unable to accurately estimate the speed of oncoming cars *(11)*. There are a number of elementary school teaching programs currently in use to improve the skills of crossing the street safely. The American Automobile Association has programs aimed at all elementary schools to help educate children in pedestrian safety habits *(10)*. Pedestrian safety teaching aids are distributed by the North Carolina Department of Motor Vehicles to school superintendents throughout the state. This consists of a two-week classroom safety education program *(12)*. Some form of effective classroom safety education program should be stressed in all elementary schools and supported by state and local safety agencies.

Pedestrians over 64 years old are also involved in a relatively large percentage of fatalities (Figure 9). Injuries to older pedestrians are usually more serious than to younger pedestrians; older people cannot recover as readily from injuries and are more fragile. Death results in one out of every five older adults struck in traffic compared to one death per 37 school-age children. Therefore, the chance of a fatality is seven times greater for a person over 64 than for a school-age child *(13)*. Several engineering improvements may assist in reducing pedestrian accidents involving older people. At intersections, feasible improvements include installation or retiming of pedestrian signals, the installation of refuge islands on multilane streets, lowering curbs, and the prohibition of vehicle turning movements. Non-engineering alternatives include increased enforcement of driver and pedestrian regulations and safety courses or lectures to various civic organizations.

Driver involvement in pedestrian fatalities is inversely related to driver age, as shown in Figure 8. Although travel mileage differs by age group, this figure is significant in showing how the greatest number of pedestrian fatalities relates to driver age. Driver experience is important in avoiding traffic accidents. Mandatory driver training for all would be a desirable prerequisite for driver licensing. Driver training programs are already taught in many high schools in Kentucky as an elective course. The improvement of facilities and the increased hiring of qualified driver training instructors could result if additional funds were available. Mandatory driver training could have a favorable long-term effect in reducing traffic accidents.

Rural Pedestrian Accident Countermeasures

Although most pedestrian accidents in Kentucky occur in urban areas, most pedestrian fatalities are in rural locations (Figure 11). About 80 percent of all rural pedestrian fatalities occur on two-lane roads, most of which have very narrow shoulders. Over 20 percent of these accidents are caused by the pedestrian walking or standing in the roadway. Inadequate or non-existent roadway shoulders along two-lane roads often force the pedestrian to walk in the road, and occassionally he is not noticed by the oncoming driver. The simplest solution to this problem would be to widen narrow shoulders along roads where considerable pedestrian activity exists. A better but more expensive alternative is to construct sidewalks along such roads. Rural locations where sidewalk construction is most desirable includes areas of community activity such as schools, meeting halls, churches, local businesses, and industrial plants. Criteria for the justification of sidewalks on one or both sides of a roadway in rural areas was established by AASHO in 1954 *(14)*. These warrants are given in APPENDIX B.

The installation of overhead lighting at some built-up rural locations may be of benefit for increased nighttime safety. School-zone flashing beacons are helpful in protecting children during morning and afternoon hours. The flashing beacons should be maintained to function properly throughout the year but installed only where warranted *(15)*.

Urban Pedestrian Accident Countermeasures

Possible accident countermeasures at intersections include modification and use of pedestrian signals, prohibition of turning movements, parking prohibition near intersections, and installation of crosswalks. Pedestrian signals are used by over 90 percent of the cities with over 25,000 population *(16)* and have been shown to reduce pedestrian-vehicle conflicts and hazards *(17)* as well as pedestrian accidents in many cases *(18)*. Vehicle turning prohibitions may be desirable in areas where pedestrian signals exist and pedestrians ignore turning vehicles. Parking prohibition within 100 to 200 feet (30 to 60 meters) of an intersection increases pedestrian visibility to motorists. The use of painted crosswalks at pedestrian-signalized intersections is often preferred, but studies have shown that indiscriminantly painting crosswalks at intersections will sometimes increase pedestrian accidents *(19, 20)*. This is due largely to the pedestrian's lack of caution when using the marked crosswalk *(20)*.

Midblock-crossing pedestrian accidents are generally more of a problem and harder to prevent than intersection pedestrian accidents. The offending pedestrian or jaywalker is nearly always at fault. Some of the measures used for reducing such accidents are one-way street designations, installation of pedestrian refuge islands, use of sidewalk railings, midblock-crossing designations, and grade-separated crossings.

Although two-way streets are converted to one-way primarily for improved traffic flow, pedestrian accidents often decrease as a result of the conversion. Studies in Sacramento, California, and Hamilton, Ontario, have shown decreases in pedestrian accidents of 62 percent and 66 percent, respectively, after conversion from two-way to one-way streets *(19)*. The total effect of one-way conversion should be studied, however, before such a change is made. Other traffic accident problems may be created if the situation is not carefully studied.

Pedestrian refuge islands are used for pedestrians who cannot safely cross the entire street at one time because of a wide street and high traffic volumes. Refuge islands may include nonmountable curbs, posts or guardrails, or warning signs at the approach end of the island. The island width should be at least 4 feet (1.2 meters) *(21)*. More detailed design applications and legal authority for refuge islands is available *(22)*.

Sidewalk railings and other pedestrian barriers are often effective on major streets at points where pedestrian crossing would result in exceptional hazard or vehicle delay. Barriers are generally used to channelize pedestrians into midblock crosswalks or intersection crossings. Barriers should be installed only after careful analysis of pedestrian movements and traffic; on-street parking must be prohibited where these barriers are installed. Various types of pedestrian barriers are also used at and on pedestrian overpasses and underpasses *(23)*.

Midblock crossings are often very dangerous at locations where only painted crosswalks and overhead **YIELD TO PEDESTRIAN** signing is installed. Midblock crossings are most effective on unusually long blocks where vehicle speeds are low (10-25 mph (4.5-11.2 m/s)) and pedestrian actuated traffic signals are used.

Pedestrian tunnels and overpasses may be warranted for high pedestrian and vehicular volumes at locations such as factories, schools, and sports arenas where multilane or freeway crossing is necessary. Overpasses are usually less expensive and safer (from criminal attack) than tunnels and require no forced ventilation or special drainage facilities. Tunnels, however, require less vertical space and provide protection from outdoor elements. The high cost of pedestrian tunnels and overpasses limits their use, but both provide excellent pedestrian protection *(23)*.

Substandard nighttime lighting is a possible contributing factor to pedestrian accidents. Whereas the intensity of highway lighting should depend partially on the pedestrian and vehicular volumes of a particular location, all urban streets should be lighted to uniform standards *(23)*. Past research has shown that improved street lighting can be effective in reducing nighttime pedestrian accidents, although the degree of accident reduction varies *(23)*.

Several improvements can be made to reduce pedestrian accidents for different age groups as stated previously. For pre-school children (ages 0-5), home training concerning the dangers of urban streets is of major importance. Careful implementation of a school crossing protection program is effective in providing safety to school children going to and from school. Such a program was established by the Institute of Traffic Engineers *(15)*. For college students in urban areas, such measures as pedestrian crossings, overpasses or tunnels, refuge islands, and special signing may all be helpful in reducing pedestrian accidents. Special pedestrian controls are required in cities with an unusually high percentage of elderly people. Streets adjacent to retirement homes deserve particular attention when attempting to reduce pedestrian accidents involving the elderly.

The availability of playgrounds throughout an urban area has been shown to result in considerably fewer accidents to children 5 to 9 years old than locations where no playgrounds exist *(7)*. Special pedestrian signing and markings may be helpful at many high-pedestrian urban areas. Local traffic laws and ordinances should recognize pedestrian needs and responsibilities but adequately and practically regulate pedestrian movement *(24)*. Model pedestrian regulations are given by the National Committee on Uniform Traffic Laws and Ordinances for states (Uniform Vehicle Code) and cities (Model Traffic Ordinance) *(25)*.

Pedestrian malls are now being used increasingly in cities across the United States to revitalize central business districts and reduce vehicle-pedestrian conflicts and accidents. Variations of pedestrian malls include modified sidewalks, transitways, plazas (interrupted malls), continuous malls, concourses, and multilevel traffic separation *(26)*. Louisville's River City Mall is the third largest full pedestrian mall in the United States, and Louisville is the nation's largest city that has built a true pedestrian mall. The half-mile (0.8-kilometer) three-block mall was built in 1972 in a previous four-lane traffic corridor *(27)*. Frankfort has recently completed construction of a pedestrian mall, transforming St. Clair Street into a pedestrian walkway. Studies should be made to determine the effectiveness of these two malls in reducing pedestrian accidents in the area and improving business revenue along the mall.

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APPENDIX A. PEDESTRIAN FATALITIES BY COUNTY

COUNTY	GROUP NUMBER	POPULATION (1970 CENSUS)	PEDESTRIAN FATALITIES 1972	PEDESTRIAN FATALITIES 1973	PEDESTRIAN FATALITIES AVG.	PEDESTRIAN FATALITY RATE (DEATHS PER 100,000 POPULATION)
Adair	2	13,037	2	1	1.5	12
Allen	2	12,598	1	0	.5	4
Anderson	1	9,358	1	0	.5	5
Ballard	1	8,276	0	0	0	0
Barren	4	28,677	2	1	1.5	5
Bath	1	9,235	0	2	1	11
Bell	5	31,121	3	1	2	6
Boone	5	32,812	0	2	1	3
Bourbon	3	18,476	1	0	.5	3
Boyd	6	52,376	2	0	1	2
Boyle	4	21,090	0	1	.5	2
Bracken	1	7,227	0	0	0	0
Breathitt	2	14,221	2	1	1.5	11
Breckinridge	2	14,789	0	0	0	0
Bullitt	4	26,090	3	0	1.5	6
Butler	1	9,723	0	1	.5	5
Caldwell	2	13,179	0	0	0	0
Calloway	4	27,692	3	4	3.5	13
Campbell	7	88,561	3	4	3.5	4
Carlisle	1	5,354	0	0	0	0
Carroll	1	8,523	1	1	1	12
Carter	3	19,850	0	3	1.5	8
Casey	2	12,930	0	0	0	0
Christian	6	56,224	2	2	2	4
Clark	4	24,090	1	1	1	4
Clay	3	18,481	0	0	0	0
Clinton	1	8,174	0	1	.5	6
Crittenden	1	8,493	1	0	.5	6
Cumberland	1	6,850	0	1	.5	7
Daviess	7	79,486	5	4	4.5	6
Edmonson	1	8,751	1	0	.5	6
Elliott	1	5,933	0	1	.5	8
Estill	2	12,752	0	0	0	0
Fayette	8	174,323	4	6	5	3
Fleming	2	11,366	0	2	1	9
Floyd	5	35,889	0	0	0	0
Franklin	5	34,481	1	3	2	6
Fulton	2	10,183	1	1	1	10
Gallatin	1	4,134	1	1	1	25
Garrard	1	9,457	0	0	0	0
Grant	1	9,999	1	2	1.5	15
Graves	5	30,939	2	2	2	6
Grayson	3	16,445	0	1	.5	3
Green	2	10,350	0	0	0	0
Greenup	5	33,192	0	1	.5	2

COUNTY	GROUP NUMBER	POPULATION (1970 CENSUS)	PEDESTRIAN FATALITIES 1972	1973	AVG.	PEDESTRIAN FATALITY RATE (DEATHS PER 100,000 POPULATION)
Hancock	1	7,080	1	0	.5	7
Hardin	7	78,421	0	2	1	1
Harlan	5	37,370	3	4	3.5	9
Harrison	2	14,158	1	2	1.5	11
Hart	2	13,980	3	0	1.5	11
Henderson	5	36,031	3	3	3	8
Henry	2	10,910	0	0	0	0
Hickman	1	6,264	0	0	0	0
Hopkins	5	38,167	2	1	1.5	4
Jackson	2	10,005	0	1	.5	5
Jefferson	9	695,055	35	45	40	6
Jessamine	3	17,430	0	1	.5	3
Johnson	3	17,539	2	2	2	11
Kenton	8	129,440	4	6	5	4
Knott	2	14,698	0	0	0	0
Knox	4	23,689	0	4	2	8
Larue	2	10,672	2	2	2	19
Laurel	4	27,386	0	0	0	0
Lawrence	2	10,726	0	1	.5	5
Lee	1	6,587	0	0	0	0
Leslie	2	11,623	1	0	.5	4
Letcher	4	23,165	0	0	0	0
Lewis	2	12,355	0	2	1	8
Lincoln	3	16,663	0	1	.5	3
Livingston	1	7,596	2	1	1.5	20
Logan	4	21,793	2	1	1.5	7
Lyon	1	5,562	0	0	0	0
McCracken	6	58,281	2	3	2.5	4
McCreary	2	12,548	0	0	0	0
McLean	1	9,062	1	1	1	11
Madison	6	42,730	1	4	2.5	6
Magoffin	2	10,443	0	0	0	0
Marion	3	16,714	1	1	1	6
Marshall	4	20,381	2	1	1.5	7
Martin	1	9,377	0	1	.5	5
Mason	3	17,273	1	0	.5	3
Meade	3	18,796	1	1	1	5
Menifee	1	4,050	0	0	0	0
Mercer	3	15,960	0	0	0	0
Metcalfe	1	8,177	1	0	.5	6
Monroe	2	11,642	1	1	1	9
Montgomery	3	15,364	3	2	2.5	16
Morgan	2	10,019	1	0	.5	5
Muhlenberg	4	27,537	1	1	1	4
Nelson	4	23,477	1	0	.5	2
Nicholas	1	6,508	2	2	2	31
Ohio	3	18,790	2	0	1	5
Oldham	2	14,687	1	1	1	7
Owen	1	7,470	0	1	.5	7
Owsley	1	5,023	0	0	0	0

COUNTY	GROUP NUMBER	POPULATION (1970 CENSUS)	PEDESTRIAN FATALITIES			PEDESTRIAN FATALITY RATE (DEATHS PER 100,000 POPULATION)
			1972	1973	AVG.	
Pendleton	1	9,949	0	0	0	0
Perry	4	26,259	0	2	1	4
Pike	7	61,059	2	3	2.5	4
Powell	1	7,704	0	1	.5	6
Pulaski	5	35,234	2	0	1	3
Robertson	1	2,163	0	0	0	0
Rockcastle	2	12,305	1	1	1	8
Rowan	3	17,010	0	1	.5	3
Russell	2	10,542	0	4	2	19
Scott	3	17,948	0	0	0	0
Shelby	3	18,999	3	2	2.5	13
Simpson	2	13,054	1	0	.5	4
Spencer	1	5,488	0	0	0	0
Taylor	3	17,138	0	2	1	6
Todd	2	10,823	1	0	.5	5
Trigg	1	8,620	1	0	.5	6
Trimble	1	5,349	0	0	0	0
Union	3	15,882	1	0	.5	3
Warren	6	57,432	1	1	1	2
Washington	2	10,728	0	0	0	0
Wayne	2	14,268	1	1	1	7
Webster	2	13,282	0	0	0	0
Whitley	4	24,145	0	1	.5	2
Wolfe	1	5,669	0	2	1	18
Woodford	2	14,434	2	0	1	7

APPENDIX B. AASHTO SIDEWALK CONSTRUCTION WARRANTS *(14)*

VEHICULAR TRAFFIC (VEHICLES PER HOUR)	PEDESTRIANS PER DAY WHEN DESIGN SPEED IS:	
	30 TO 50 MPH (13 TO 22 M/S)	60 AND 70 MPH (27 AND 31 M/S)
Sidewalk, one side		
30 to 100	150	100
More than 100	100	50
Sidewalk, both sides		
50 to 100	500	300
More than 100	300	200