PROBLEM IDENTIFICATION FOR VIRGINIA'S HIGHWAY SAFETY PLAN

by

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SUMMARY

Problem identification is recognized as an important component of highway safety planning. Under the NHTSA/FHWA concept, problem identification is the first step in program planning and in the development of effective countermeasure programs. The annual highway safety plan (HSP) is the major planning tool used by the Virginia Department of Transportation Safety in meeting its objectives and in responding to the federal reporting requirements.

Over the past 10 years, the HSP production process has become more efficient and responsive to state and local planning needs. However, the methodology applied in analyzing accident data and in evaluating trends has remained virtually unchanged since the process was initiated. Although the results of the problem identification process fulfill the federal reporting requirements, they are not applied as effectively as they could be to comprehensive highway safety program planning.

This report describes Virginia's highway safety problem identification process and provides recommendations for changes in the administrative organization of the process and in the analytical methodology. The current methodology for the identification of systems support and impact problems is described and illustrated using 1980 data.

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INTRODUCTION

Pursuant to the Federal Highway Safety Act of 1966, the Highway Safety Division of Virginia was established in 1968 to implement and evaluate programs designed to reduce the number and severity of motor vehicle accidents occurring in the Commonwealth. By Act of the General Assembly, the Department of Transportation Safety (VDTS) succeeded the Highway Safety Division on July 1, 1978. In addition to retaining responsibility for the state's highway safety program, the VDTS was charged with responsibility for coordinating statewide safety programs in rail, air, water, and mass transit transportation.

While the scope of the VDTS's responsibilities has expanded, Virginia's transportation safety program remains focused on the mitigation of highway safety problems. Specifically, the VDTS is directed to:

1. develop, implement and review, in conjunction with relevant state and federal entities, a comprehensive highway safety program

2. assist cities, counties, and towns of the state in the development, implementation, and review of local highway safety programs

3. recommend through the director to the Governor and to the General Assembly any and all corrective measures, policies, procedures, plans, and programs needed to make the movement of passengers and property on the highways of the state as safe as practicable

4. design, implement, administer, and review special programs or projects as needed to promote highway safety in the Commonwealth

5. integrate highway safety activities into the framework of transportation safety in general.

The main planning tool used by the VDTS in meeting its objectives is the Highway Safety Plan (HSP). Under this program, each state is required to develop a comprehensive, multiyear plan for highway safety program management and to document its goals, planned activities, and funding needs as set out by the requirements of the NHTSA/FHWA Highway Safety Plan Manual, Volume 102. This plan is reviewed and approved by the NHTSA and FHWA as a prerequisite to the allocation of federal highway safety funds. The HSP is also intended to provide a framework for systematic planning and evaluation at the state level.

Under Virginia's HSP process, each state traffic safety agency and local transportation safety commission (TSC) is invited to submit to the VDTS an annual summary of its planned activities and an estimate of the resources needed to support its programs. Until recently, staff members of the Virginia Highway and Transportation Research Council (VHTRC), in conjunction with the VDTS, compiled these summaries to develop an overall annual state HSP.

Problem identification is central to the HSP planning process. Under the NHTSA/FHWA concept, problem identification is the first step in highway safety planning and in the development of effective countermeasure programs. The occurrence and severity of traffic accidents are the product of a complex array of interdependent factors; thus, it is difficult to isolate and evaluate a particular problem. Nonetheless, techniques are available for drawing some general conclusions concerning the characteristics of accidents in a given jurisdiction.

However, in Virginia the methodology applied in acquiring and analyzing accident data and in evaluating trends has remained virtually unchanged since the process was initiated. As a result, there are limitations to the scope of the analysis and to the application of the results achieved. Also, the organization and timing of HSP activities is not in congruence with state and local safety program administration. Although the results of the entire process fulfill the federal reporting requirements, they are not applied as effectively as they could be to comprehensive highway safety program planning.

PURPOSE AND SCOPE

The purpose of this report is to describe and evaluate Virginia's highway safety problem identification process as it has evolved to satisfy federal and state reporting requirements and needs. The report outlines the current methodology for the

identification of systems support and impact problems and illustrates the data analysis process using 1980 highway accident statistics.

The report also comments on the adequacy of the administration of the HSP problem identification process and provides recommendations for improvements to the current process.

The scope of the report is limited to the problem identification analysis performed for the annual HSP. Many of the weaknesses of Virginia's process can be attributed to deficiencies in the statewide traffic records system. Problems associated with the traffic records system which impact problem identification are noted, although they are not examined in detail in this report.

The limitations of the problem identification and HSP planning process are evaluated in the final section of the report, with recommendations for improvement. This evaluation is preceded by a description of the current process and an example of problem identification analysis using 1980 accident data.

OVERVIEW OF THE HSP PROCESS

Guidelines for preparing and submitting the annual HSP are outlined in NHTSA/FHWA Highway Safety Program Manual, Volume 102. Each state has formulated its own approach to meeting the guidelines. Volume 102 emphasizes a comprehensive "top-down" planning process, in which problem analysis is first performed at the statewide level to provide subsequent support to safety programming at the local level. Virginia's approach is, in essence, a reversal of that recommended in Volume 102. The following section describes the problem identification process in Virginia.

Problem Identification Process

The highway safety problem identification process in Virginia revolves around the production of the annual HSP. The HSP problem identification process focuses on two basic categories of highway safety problems as outlined in the Volume 102 manual: "systems support" and "impact" problems. Systems support problems are defined as deficiencies "in a vital traffic safety function, the correction of which may not be directly related to accident, fatality, or injury changes." Ideally, they should be derived each year from an administrative evaluation of Virginia's traffic safety

network and a review of the legislative and regulatory requirements which govern program operations. However, this is a difficult task, due in part to the lack of an adequate technique for evaluating the performance of system support activities. Not enough information on the status of state transportation safety programs is available from the agencies.

Systems support problems identified have remained relatively constant from year to year. In the past three years, systems support problems were identified in the areas of highway safety program planning and administration, highway safety training and education, driver education, periodic motor vehicle inspection, emergency medical services, adjudicative services, and accident data information systems.

Impact problems are defined in Volume 102 as "directly related to factors contributing to accidents, fatalities, and/or injuries, and may be corrected by application of countermeasures designed to minimize the effects of these factors." Impact problem analysis generally focuses on fatal, injury, and property damage accident rates for the entire state as well as the three highway systems (interstate, primary, and secondary).

Impact problem analysis is also conducted in more specific accident problem areas, such as pedestrian involvement, pupil transportation services, type of vehicle involved (bus, truck, motorcycle, bicycle), and alcohol-related accidents. The specific impact problems identified vary from year to year in relation to the results of the problem identification analysis and the changing emphasis of highway safety programs (e.g., 55 mph speed limit enforcement).

In Virginia, problem identification analysis is conducted at both the local and the state level. Since localities generally lack the capability to accumulate the accident and safety program data required to conduct both impact and systems support problem analysis, the VDTS has developed automated systems to provide them with as much information as practically possible. Mini-Crash Facts reports supply localities with accident statistics and problem identification packets (PID's) supply them with systems support data (plus limited crash statistics).

In theory, local TSC's apply these data sources to identify problems and develop local plans and programs. In practice, however, the TSC's lack the capability and manpower to perform in-depth analyses. Thus, the value of local level analysis is limited, and this undermines the effectiveness of Virginia's "bottom-up" system of statewide safety program planning.

The HSP problem identification process is illustrated in Exhibit 1. The VHTRC receives a magnetic tape containing a full year's crash data from the Department of State Police (DSP) in March of each year. This crash file is used to produce a series of reports generated by the VHTRC (the Youth Facts Sheet, the VASAP report), in addition to its use in the HSP local problem identification process.

Specific data related to the 14 highway safety program areas (as specified in Volume 102) are extracted from the DSP crash tape and sorted by locality. Data from the Department of Education's driver education program and the Division of Motor Vehicle's driver conviction information are also available in automated form. Data from these three sources are directly input to a file, known as the master file, which is used to produce locality-specific Mini-Crash Facts and PID's. Other data used, which are available from the Division of Motor Vehicles as well as the Emergency Medical Services, the Pupil Transportation Services, the Bureau of Forensic Sciences, and the Virginia Department of Highways and Transportation, are not in automated form. These data must be manually tabulated from computer printouts or, in some cases, from manual files.

A list of the type of data and their sources used in the impact and systems support problem identification process is included in the Appendix.

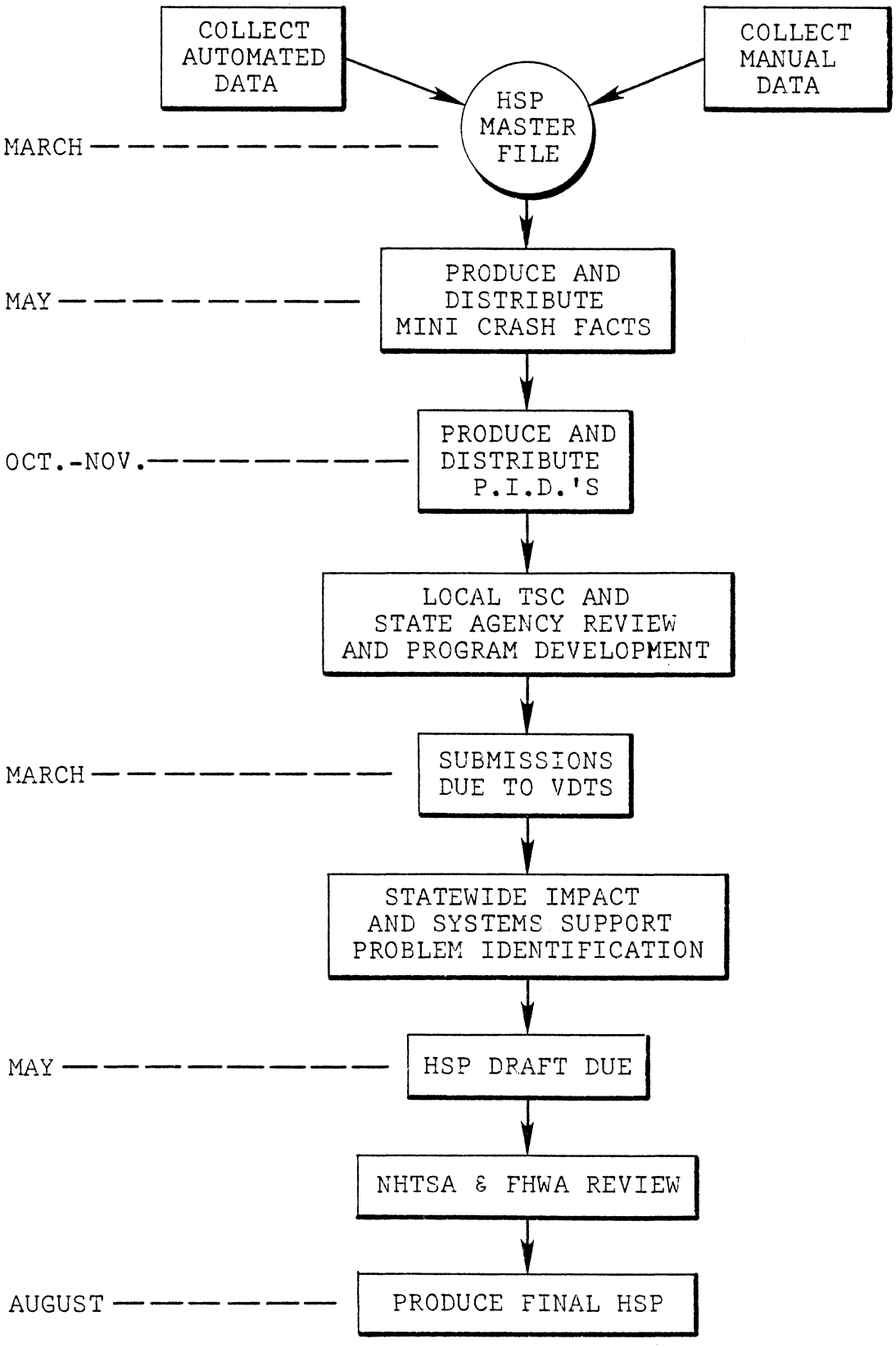
The multiplicity of data sources and formats presents difficulties in the problem identification process. The type of data analysis which can be performed is constrained by the content and format of published sources and discrepancies which sometimes exist between the sources. The process would be improved if all the data could be obtained in raw, automated format.

Local accident data are extracted from the master file to produce the Mini-Crash Facts reports within 2-3 months of the receipt of the DSP crash tape. The reports are distributed to the localities for their use in impact problem identification, generally by the end of May.

The data used in systems support analysis are compiled over the summer months and input into the master file. The PID packets are scheduled for production and distribution in September. The local TSC's are requested to review and analyze the information contained in the PID's and the Mini-Crash Facts reports and to prepare their input to the HSP by March. Input from the commissions is in the form of program descriptions and funding requests for materials, labor, and program management.

EXHIBIT 1

HIGHWAY SAFETY PROBLEM IDENTIFICATION PROCESS



From the submissions, as well as the state problem identification analysis described below, the VDTS attempts to determine changes in accident trends, new problem areas, and significant safety program needs. The VDTS staff relates their findings to the 14 HSP program areas: motorcycle safety, pedestrian safety, pupil transportation services, alcohol-related accidents, traffic courts, identification and surveillance of accident locations, driver education, highway design, construction and maintenance, traffic engineering services, local traffic records systems, debris, hazard control and cleanup, police traffic services, and accident investigation and reporting.

The statewide systems support and impact problem identification analyses are performed following the local analysis. The main sources of data for the impact problem analysis are the Department of State Police Annual Crash Facts and the Virginia Department of Highways and Transportation annual Summary of Accident Data. The statewide system support analysis is based, in part, on the submissions received from the state transportation safety agencies. It is also derived from an intuitive understanding of state safety program problems and needs. A more systematic method for identifying and evaluating the magnitude of systems support problems has not been developed.

The results of the state and local impact and systems support problem identification analyses are compiled by the VDTS, and a draft of the HSP is due in May. Following the NHTSA and FHWA review, the HSP is refined and submitted in final form to the federal agencies in August of each year.

Statewide Impact Problem Analysis

Impact problem analysis is a critical component of the HSP problem identification process. To exemplify the state of the art in Virginia in impact problem identification, an analysis was performed using current data. The results of the analysis are provided in the following section.

The impact analysis is performed by the VHTRC. The data are analyzed by two methods: a regression analysis is employed to project accident trends, and a comparative analysis of the current and the preceding year is conducted to illustrate current changes in accident characteristics. The regression analysis is generally based on ten years of data. For the purpose of this report, 3-year averages of data were calculated and compared. The averaging of the data serves primarily to smooth out the data lines and the results of the analysis are basically the same as those achieved in the analysis of the ten individual years.

The linear regression analysis using the least squares formula (also known in this case as time series analysis) correlates an independent variable (time) to a dependent variable and generates a line which is the best fit to the known data. Trend projections are made by extrapolating from this line.

To evaluate the projections, a correlation coefficient (r) is obtained for each equation. The correlation coefficient assesses the data fit and the validity of the projections. An r of +1.0 represents a perfect fit of the data points to the regression line. An r value approaching zero indicates no relationship between two points and the trend described, and as r approaches +1.0 the data fit to the line improves. In highway safety accident research, the following relationships have been observed for r:

Value of r	Relationship
0 to ± 0.20	None to slight
± 0.21 to ± 0.45	Low, but typical of accident research
± 0.46 to ± 0.85	Moderate to high; correlations over 0.60 are rare
± 0.86 to ± 1.00	Extremely high

Time series analysis is an adequate method of traffic safety problem evaluation, but it is limited in terms of the depth of the results obtained. It does not incorporate measures to cross tabulate safety variables, which are necessary for adequate explanations of causes of accidents and accident trends. There is also little attempt to link exposure data to accident occurrence.

The results of the current impact problem analysis are shown below.

Results of Impact Problem Analysis

Data for various accident categories are depicted in Exhibits 2 through 15. The data are represented as 3-year averages, beginning with 1974 data through 1980 data, the most current information available. In Exhibits 16 through 40, certain data categories have been plotted and projected to 1983 using regression analysis to illustrate historic and projected trends. Exhibit 16 shows the number of vehicle miles travelled. These data were used to calculate

the accident, injury, and death rates shown in Exhibits 17, 18, and 19. The rates are broken out by four classifications of highway systems: (1) all Virginia; (2) interstate; (3) primary; and (4) secondary. Projections for three categories of accident severity (total, injury, and fatal accidents) are shown in Exhibits 20, 21, and 22. The numbers of bicyclists and pedestrians injured and killed are shown in Exhibits 23 through 26. Exhibits 27 through 34 depict the numbers of vehicles involved in all accidents and in fatal accidents, and the type of vehicles involved in both accident categories. Finally, Exhibits 35 through 40 project trends in both total and fatal accident categories involving drinking and nondrinking drivers.

Statewide Fatal, Injury, and Property Damage Accident Rates

An analysis of the data reveals a general trend toward reduction or stabilization in the number of accidents experienced statewide despite the steady increase in the number of vehicle miles travelled (Exhibit 16). The 1978-80 accident statistics for all Virginia roadways indicate no change in the occurrence of personal injury accidents, and average decreases of 2.0% and 9.0% in fatal and property damage crashes, respectively (Exhibit 2). The accident rate (number of accidents/100 million vehicle miles of travel) shows an average decrease of 6.0% over 1977-79 (Exhibits 6 and 17). An average decrease of 2.0% in the death rate was observed in 1978-80 over the previous period (Exhibits 6 and 19). A slight increase (1.0%) in the average injury accident rate was noted, which is in keeping with the trend of a slight increase and stabilization over the past 6 years (Exhibit 18). It is interesting to note, however, that the injury rate was decreasing prior to the 1974-76 period.

Accidents Occurring on the State Highway Systems

The interstate, arterial and primary, and secondary highway systems comprise the total mileage under the jurisdiction of the Virginia Department of Highways and Transportation (VDH&T). The Department is also responsible for road mileage in incorporated municipalities with a population less than 3,500.

The Interstate System

Exhibit 3 provides a summary of accident statistics for the interstate system, which remains the safest of Virginia's roadways. In recent years the injury rate has increased slightly and stabilized, whereas the accident and death rates have continued

to decline (Exhibits 6 and 17 through 19). During the 1978-80 period, the average frequency rates for accidents, injuries, and deaths were 78, 41 and 1.03, respectively. These represent an average increase of 3.0% in the injury rate over the previous years, and significant decreases of 6.0% in the accident rate and 12.0% in the death rate.

The safety advantages of the interstate system continue to be evident in the accident experience of the total mileage under the VDH&T. The interstate system experienced 30% of the travel, but only 10% of the accidents,, 10% of the persons injured, 11% of the persons killed, and 10% of the property damage that occured on the highway system under the supervision of the VDH&T in 1978-80.

The Primary System

The accident experience of the primary system is shown in Exhibit 4. The average accident, injury, and death rates for 1978-80 were 244, 130, and 3.77, respectively (Exhibit 6). The accident rate for this system showed a 7.0% average decrease in 1978-80, which is in keeping with the decreasing trend shown in Exhibit 17. The average death rate decreased 5.0% from 1977-79 to 1978-80. The 1978-80 average injury rate decreased slightly (1.0%), contrary to the gradually increasing trend projected in Exhibit 18. The primary system comprises about 12% of the mileage under the supervision of the VDH&T. This system experienced 48% of the travel, 49% of the accidents, 52% of the persons injured, 60% of the persons killed, and 49% of the property damage occurring on the highway systems under the jurisdiction of the VDH&T.

The Secondary System

The secondary system is inherently the most hazardous of the highway systems under the supervision of the VDH&T. The accident experience for the secondary system is shown in Exhibit 5. This system has the highest average accident, injury, and death frequency rates of all the systems at 446, 210, and 3.90, respectively (Exhibit 6). In 1978-80, the average accident rate decreased by 9.0% over the previous 3-year average, which is in keeping with the declining trend shown in Exhibit 17. The secondary system death rate alsc exhibits a declining trend, and in 1978-80 decreased an average of 2.0% (Exhibit 19). The injury rate experienced an average 2.0% decrease which is, however, contrary to the trend of slight increase shown in Exhibit 18.

Although the secondary system experienced only 22% of the total travel, 41% of the reported accidents, 38% of the persons injured, 29% of the fatalities, and 41% of the property damage accidents during 1978-80 occurred on secondary roads.

Injury Accidents

During the 1978-80 period, total motor vehicle accidents decreased by an average 6.0%, and are projected to continue to decrease (Exhibit 20). Although total personal injury accidents decreased by an average of less than 1.0% from 1977-79 to 1978-80, the occurrence of injury accidents has been gradually increasing in recent years and this trend is projected to continue (Exhibit 21). This evidence may indicate that past emphasis on reducing the severity of accidents has been effective, and that those accidents which formerly were fatal accidents are now classified as injury accidents because advanced life-saving techniques and the installation of safety hardware (impact attenuators, safety barriers, breakaway sign supports, etc.) have combined to reduce accident severity.

Data on the average numbers of total persons, pedestrians, and bicyclists injured for the 3-year periods are shown in Exhibit 7. The average increase in the total number of persons injured was less than 1.0% from 1977-79 to 1978-80, yet the results of the regression analysis project a sharp increase in the number of persons injured in upcoming years (Exhibit 23). During the 1978-80 period, the number of pedestrians injured decreased by an average 2.0%, and the number of bicyclists injured increased by an average 6.0% (Exhibit 7). These changes are in keeping with the general projected trends of decrease and increase for numbers of pedestrians and bicyclists injured, respectively, as shown in Exhibit 24.

Fatal Accidents

In 1978-80, the total number of fatal accidents decreased by an average 2.0% over the previous period. Since 1974, fatal accident incidence has been increasing slightly on the 3-year average basis, and this trend is projected to continue (Exhibit 22).

The total average number of persons, pedestrians, and bicyclists killed are shown in Exhibit 8. In the 1978-80 period, the average number of persons killed decreased by 2.0% over the 1977-79 period. This is contrary to the results of the regression analysis, which projects a slight increase and stabilization over the next few years (Exhibit 25).

In 1978-80 Virginia experienced a slight increase (1.0%) in the number of pedestrians killed over the 1977-79 average. The number of pedestrian deaths, however, is projected to show a decreasing trend (Exhibit 26). The number of bicyclists killed as a result of traffic accidents increased by an average 15% in 1978-80 over 1977-79. The apparent significance of this value is misleading, since the absolute average increase during that time period was from 20 to 23 bicyclists. Nonetheless, this increase is in keeping with the projected moderate increase as shown in Exhibit 26.

Types of Vehicles Involved in All Accidents

Exhibit 9 depicts the total number of vehicles involved in all accidents by vehicle type. During the 1978-80 period, the total number of vehicles involved in all accidents decreased by an average of 8% over 1977-79. Exhibit 27 shows this decrease is in keeping with the projected trend of decline, although the absolute average value will be higher than that of 1978-80.

In 1978-80, automobiles represented 77% of the total vehicles involved in all accidents, followed in magnitude of incidence by trucks (18%), motorcycles (1.0%), and buses (less than 1.0%). The absolute number of autos involved in all accidents, however, decreased by an average 10% from 1977-79 to 1978-80, and is expected to continue to decrease (Exhibit 28). Although the number of trucks involved in all accidents in 1978-80 decreased by an average 2.0% over the 1977-79 period, the involvement of trucks in traffic accidents has been increasing in recent years and this trend is projected to continue (Exhibit 29).

The number of motorcycles and buses involved in all accidents decreased by an average 4.0% and 9.0%, respectively, from 1977-79 to 1978-80. This is in keeping with a projected decline of involvement of both motorcycles and buses in all accidents (Exhibit 30).

Types of Vehicles Involved in Fatal Accidents

The total number of vehicles involved in fatal accidents decreased by an average 4.0% from 1977-79 to 1978-80 (Exhibit 10). This is contrary to the projected increasing trend of number of vehicles in fatal accidents (Exhibit 31). The order of magnitude of types of vehicles in fatal accidents is the same as that for all accidents, except that trucks and motorcycles account for a larger percentage of all vehicles involved (26% and 6.0%, respectively).

In 1978-80, the number of autos involved in fatal accidents decreased by an average 7.0%, which is in accord with the projected trend of gradual decline (Exhibit 32). During this same period, the number of trucks involved in fatal accidents stayed the same, although historically truck involvement has been increasing steadily and is projected to continue to increase (Exhibit 33).

The involvement of buses in fatal accidents has remained virtually the same for the past 6 years, and no change is projected in this trend (Exhibit 34).

Although the incidence of motorcycles in all accidents is projected to decrease, motorcycle involvement in fatal accidents has increased in recent years and is projected to continue to increase (Exhibit 34). The average number of motorcycles involved in fatal accidents increased by 7% from 1977-79 to 1978-80.

Types of Accidents

Exhibit 11 depicts the average number of types of accidents. Sixty-two percent of the total number of accidents which occurred in the 1978-80 period involved collisions of motor vehicles with other motor vehicles. Non-collision accidents accounted for 25% of the total accidents in 1978-80. Motor vehicle collisions with fixed objects, pedestrians, and bicycles accounted for 7.0%, 2.0%, and 1.0%, respectively, of the total types of accidents which occurred in 1978-80. It may be significant to note that accidents involving motor vehicles with fixed objects increased by an average 20% in 1978-80 over 1977-79, and have been steadily increasing over the past 6 years.

Location of All Accidents and Fatal Accidents

Exhibits 12 and 13 depict the location of accidents in a general sense. In 1978-80, 34% and 33% of the total average number of accidents occurred in business-industrial and open country locations, respectively. Accidents occurring in residential locations accounted for an average 29% of the total accidents, and school zone or playground accidents accounted for only 3.0% of the total accidents.

When examining the location of fatal accident occurrence, the percentage of fatal accidents that occurred in open country (67%) was double the percentage of all accidents in all locations in 1978-80. Sixteen percent of fatal accidents in 1978-80 occurred in a residential district, and 14% occurred in a business or industrial area. Only 1.0% occurred in a school zone or playground. The proportion of total and fatal accidents in each location has remained virtually the same in recent years.

Alcohol-Related Accidents

Exhibits 14 and 15 show alcohol-related crash data for total and fatal accidents by these categories: obviously drunk, ability not impaired, and had not been drinking. The total number of drivers in all accidents decreased by an average 7.0% in 1978-80 over 1977-79. The number of drivers involved in all accidents who were under the influence of alcohol, to varying degrees, increased by an average of 3% to 4% during the same period. Correspondingly, the number of drivers who had not been drinking showed an average 6.0% decrease from 1977-79 to 1978-80. All in all, an average 7.0% of the total number of drivers in all accidents had been drinking. The results of the regression analysis predict these trends will continue (Exhibits 35-37).

Although the total number of drivers in all accidents has been decreasing in recent years, the total number of drivers in fatal accidents has been increasing, and this trend is projected to continue (Exhibit 38). In the 1978-80 period, a total of 10% of all drivers in all accidents had been drinking (Exhibit 15). Decreases of 10% and 12% in the average numbers of drivers who were obviously drunk or whose ability was impaired occurred in 1978-80 over 1977-79. However, these declines are contrary to historic and projected trends, as shown in Exhibit 39. The increase in the percentage of drivers (17%) whose ability was not impaired is also contrary to the decreasing trend in this category, as shown in Exhibit 39.

From 1977-79 to 1978-80, the average number of drivers involved in fatal accidents decreased significantly (26%), which is consistent with the declining trend depicted in Exhibit 40. In total, 10% of all drivers involved in fatal accidents in 1978-80 had been drinking.

EXHIBIT 2

ALL VIRGINIA HIGHWAYS, STREETS, AND ROADS

Years	Length In Miles	Annual VMT*	Fatal Accidents	Persons Killed	Injury Accidents	Persons Injured	Property Damage Accidents	Total Accidents
1974-76	62,849	34,995,000	904	1,033	35,316	50,580	97,514	133,734
1975-77	63,573	36,484,000	931	1,065	37,345	53,662	94,702	132,979
1976-78	64,250	38,213,000	955	1,082	39,401	57,322	95,524	135,879
1977-79	64,828	38,802,000	964	1,082	40,519	59,383	94,172	135,655
1978-80	65,156	38,685,000	949	1,055	40,398	59,594	85,678	127,025
Percent Change 1978-80 Over 1977-79			2.0%	2.0%	0.0%	0.0%	9.0%	6.0%

* Annual Vehicle Miles of Travel (In Thousands)

EXHIBIT 3

INTERSTATE SYSTEM

Years	Length In Miles	Annual VMT*	Fatal Accidents	Persons Killed	Injury Accidents	Persons Injured	Property Damage Accidents	Total Accidents
1974-76	878	6,808,232	67	84	1,778	2,613	4,771	6,617
1975-77	885	7,321,558	79	95	1,932	2,851	4,680	6,691
1976-78	898	7,899,642	85	102	2,121	3,192	4,838	7,044
1977-79	925	8,335,186	84	97	2,230	3,368	4,635	6,949
1978-80	958	8,503,577	74	88	2,301	3,496	4,311	6,686
Percent Change 1978-80 Over 1977-79			12%	9.0%	3.0%	4.0%	7.0%	4.0%

* Annual Vehicle Miles of Travel (In Thousands)

EXHIBIT 4

PRIMARY SYSTEM

Years	Length In Miles	Annual VMT*	Fatal Accidents	Persons Killed	Injury Accidents	Persons Injured	Property Damage Accidents	Total Accidents
1974-76	7,733	11,875,100	397	464	9,496	14,516	22,594	32,577
1975-77	7,733	12,402,720	419	494	10,196	15,472	21,883	32,496
1976-78	7,735	12,985,153	436	514	11,028	16,930	23,296	34,760
1977-79	7,743	13,402,215	447	520	11,374	17,573	23,109	34,929
1978-80	7,758	13,569,425	439	498	11,334	17,583	21,292	33,067
Percent Change 1978-80 Over 1977-79			2.0%	4.0%	0.0%	0.0%	8.0%	5.0%

* Annual Vehicle Miles of Travel (In Thousands)

EXHIBIT 5

SECONDARY SYSTEM

Years	Length In Miles	Annual VMT*	Fatal Accidents	Persons Killed	Injury Accidents	Persons Injured	Property Damage Accidents	Total Accidents
1974-76	42,726	5,038,079	204	229	7,390	10,390	18,238	25,832
1975-77	42,874	5,278,435	208	232	7,854	11,069	18,430	26,493
1976-78	43,007	5,539,012	212	234	8.368	11,923	19,857	28,437
1977-79	43,183	5,835,005	212	231	8,673	12,439	19,526	28,412
1978-80	43,358	6,099,706	220	238	8,883	12,808	17,960	27,063
Percent Change 1978-80 Over 1977-79			4.0%	3.0%	2.0%	3.0%	8.0%	5.0%

* Annual Vehicle Miles of Travel (In Thousands)

EXHIBIT 6

ACCIDENT, INJURY, AND DEATH RATES

All Virginia	Accident Rate	Injury Rate	Death Rate
1974-76	383	145	2.96
1975-77	364	147	2.92
1976-78	356	150	2.83
1977-79	350	153	2.79
1978-80	328	154	2.73
Percent Change 1978-80 Over 1977-79	6.0%	1.0%	2.0%
Interstate System			
1974-76	97	38	1.23
1975-77	92	39	1.30
1976-78	89	40	1.30
1977-79	83	40	1.17
1978-80	78	41	1.03
Percent Change 1978-80 Over 1977-79	6.0%	3.0%	12%
Primary System			
1974-76	275	122	3.90
1975-77	262	125	3.97
1976-78	267	130	3.97
1977-79	261	131	3.87
1978-80	244	130	3.67
Percent Change 1978-80 Over 1977-79	7.0%	1.0%	5.0%
Secondary System			
1974-76	514	206	4.57
1975-77	502	209	4.40
1976-78	513	215	4.23
1977-79	489	214	3.97
1978-80	446	210	3.90
Percent Change 1978-80 Over 1977-79	9.0%	2.0%	2.0%

EXHIBIT 7

PERSONS INJURED

Year	All Persons Injured	Pedestrians Injured	Bicyclists Injured
1974-76	50,580	2,215	1,156
1975-77	53,662	2,209	1,130
1976-78	57,322	2,223	1,120
1977-79	59,383	2,232	1,169
1978-80	59,594	2,187	1,240
Percent Change 1978-80 Over 1977-79	0.0%	2.0%	6.0%

EXHIBIT 8

PERSONS KILLED

Year	All Persons Killed	Pedestrians Killed	Bicyclists Killed
1974-76	1,033	184	14
1975-77	1,065	175	16
1976-78	1,082	171	19
1977-79	1,082	168	20
1978-80	1,055	170	23
Percent Change 1978-80 Over 1977-79	2.0%	1.0%	15%

EXHIBIT 9

TYPES OF VEHICLES INVOLVED IN ALL ACCIDENTS

Years	Autos	Motorcycles	Vehicle Type Trucks	Buses	Other Vehicles	Total Vehicles
1974-76	196,656	3,120	30,740	1,792	5,510	237,819
1975-77	193,633	2,979	32,227	1,626	5,362	236,157
1976-78	191,852	2,967	35,612	1,574	5,972	238,307
1977-79	184,466	2,887	38,501	1,530	6,689	234,396
1978-80	165,954	2,777	37,803	1,387	6,814	214,735
Percent Change 1978-80 Over 1977-79	10%	4.0%	2.0%	9.0%	2.0%	8.0%

EXHIBIT 10

TYPES OF VEHICLES INVOLVED IN FATAL ACCIDENTS

Years	Cars	Motorcycles	Vehicle Type Trucks	Buses	Other	Total
1974-76	910	61	268	11	23	1,273
1975-77	949	63	293	11	19	1,335
1976078	959	72	316	11	26	1,383
1977-79	939	70	344	11	30	1,393
1978-80	871	75	345	10	38	1,338
Percent Change 1978-80 Over 1977-79	7.0%	7.0%	0.0%	9.0%	27%	4.0%

EXHIBIT 11

TYPES OF ACCIDENTS - ALL ACCIDENTS

Year	Other Motor Vehicles	Pedestrian	Bicycle	Motor Vehicle With Fixed Object	Other	Non-Collision	Total
1974-76	94,400	2,079	1,201	4,014	2,135	29,906	133,734
1975-77	93,189	2,058	1,153	3,870	2,056	30,653	132,979
1976-78	92,887	2,076	1,100	5,100	2,956	31,657	135,877
1977-79	89,323	2,097	1,155	7,045	3,532	32,437	135,654
1978-80	79,191	2,061	1,213	8,400	4,223	31,839	127,025
Percent Change 1978-80 Over 1977-79	11%	2.0%	5.0%	19%	20%	2.0%	6.0%

EXHIBIT 12

KIND OF LOCALITY - ALL ACCIDENTS

Years	Total Accidents	Business or Industrial	Residential	School Zone or Playground	Open Country	Not Stated
1974-76	133,734	45,567	40,872	1,884	42,442	2,637
1975-77	132,979	44,946	39,938	1,919	43,302	2,540
1976-78	135,879	45,979	40,238	2,622	44,935	2,108
1977-79	135,655	46,088	39,712	3,085	44,920	1,849
1978-80	127,025	42,873	36,947	3,310	42,433	1,462
Percent Change 1978-80 Over 1977-79	6.0%	7.0%	7.0%	7.0%	6.0%	21%

EXHIBIT 13

KIND OF LOCALITY - FATAL ACCIDENTS

1974-76	904	132	171	9	583	9
1975-77	931	136	163	7	617	8
1976-78	955	137	159	10	634	11
1977-79	962	143	149	10	646	13
1978-80	942	133	149	12	631	17
Percent Change 1978-80 Over 1977-79	2.0%	7.0%	0.0%	20%	2.0%	31%

EXHIBIT 14

ALCOHOL-RELATED ACCIDENTS - ALL ACCIDENTS

Year	Total Drivers In All Accidents	Driver's Condition: Obviously Drunk	Ability Impaired	Ability Not Impaired	Had Not Been Drinking	Not Available
1974-76	226,994	4,859	3,638	3,959	186,359	28,178
1975-77	226,087	4,972	3,726	4,094	185,044	28,251
1976-78	231,548	5,385	3,929	4,406	192,089	25,739
1977-79	230,740	5,802	4,206	4,781	192,634	23,442
1978-80	214,735	6,035	4,338	4,904	180,210	19,248
Percent Change 1978-80 Over 1977-79	7.0%	4.0%	3.0%	3.0%	6.0%	18%

EXHIBIT 15

ALCOHOL-RELATED ACCIDENTS - FATAL ACCIDENTS

Year	Total Drivers In All Fatal Accidents	Obviously Drunk	Ability Impaired	Ability Not Impaired	Had Not Been Drinking	Not Available
1974-76	1,266	59	46	22	736	403
1975-77	1,328	65	48	22	766	427
1976-78	1,376	70	52	22	800	433
1977-79	1,390	71	51	18	790	458
1978-80	1,338	64	45	21	581	474
Percent Change 1978-80 Over 1977-79	4.0%	10%	12%	17%	26%	3.0%

EXHIBIT 16

Billions of Miles of Vehicle Travel

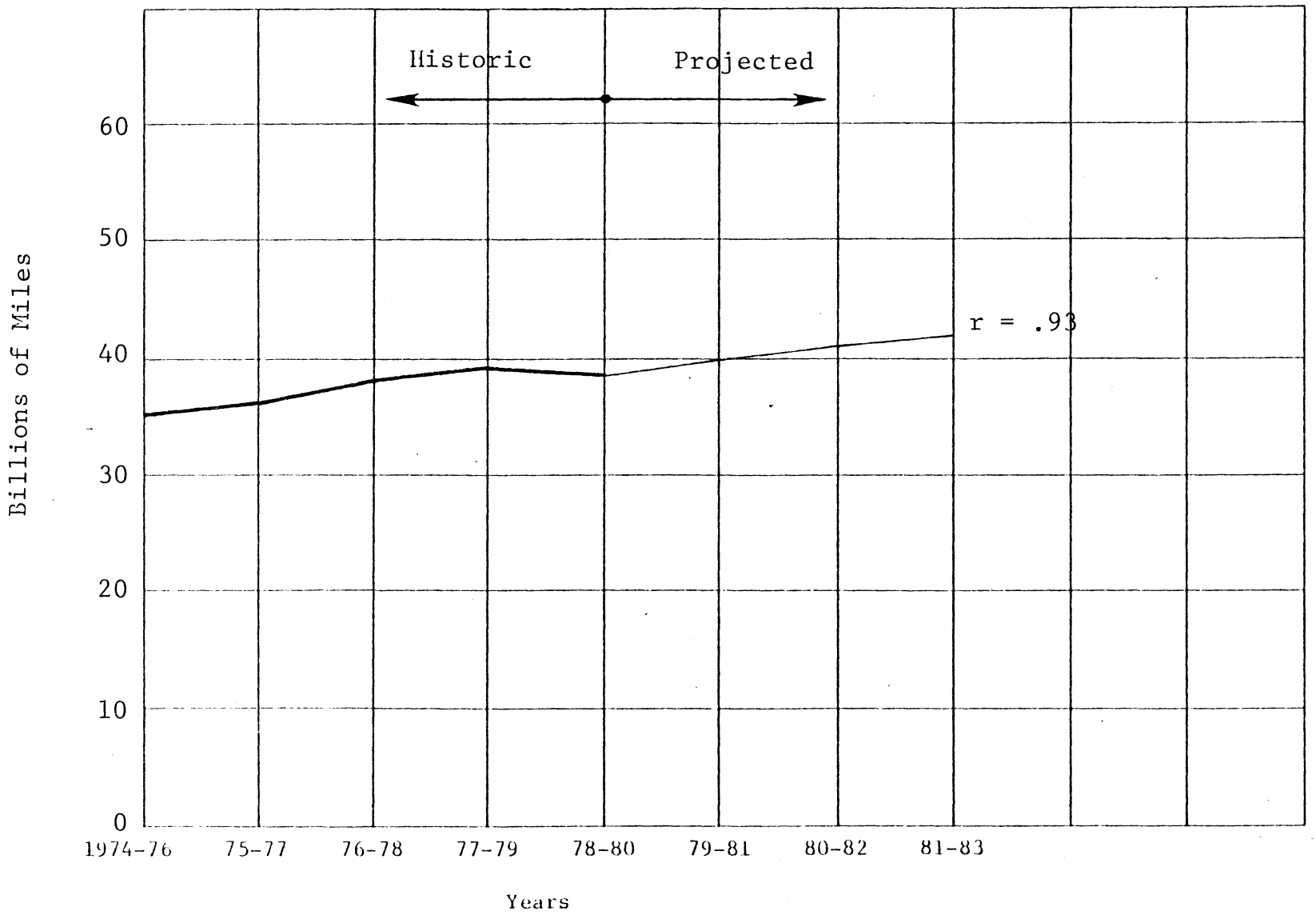


EXHIBIT 17

Highway Accident Rate Trends

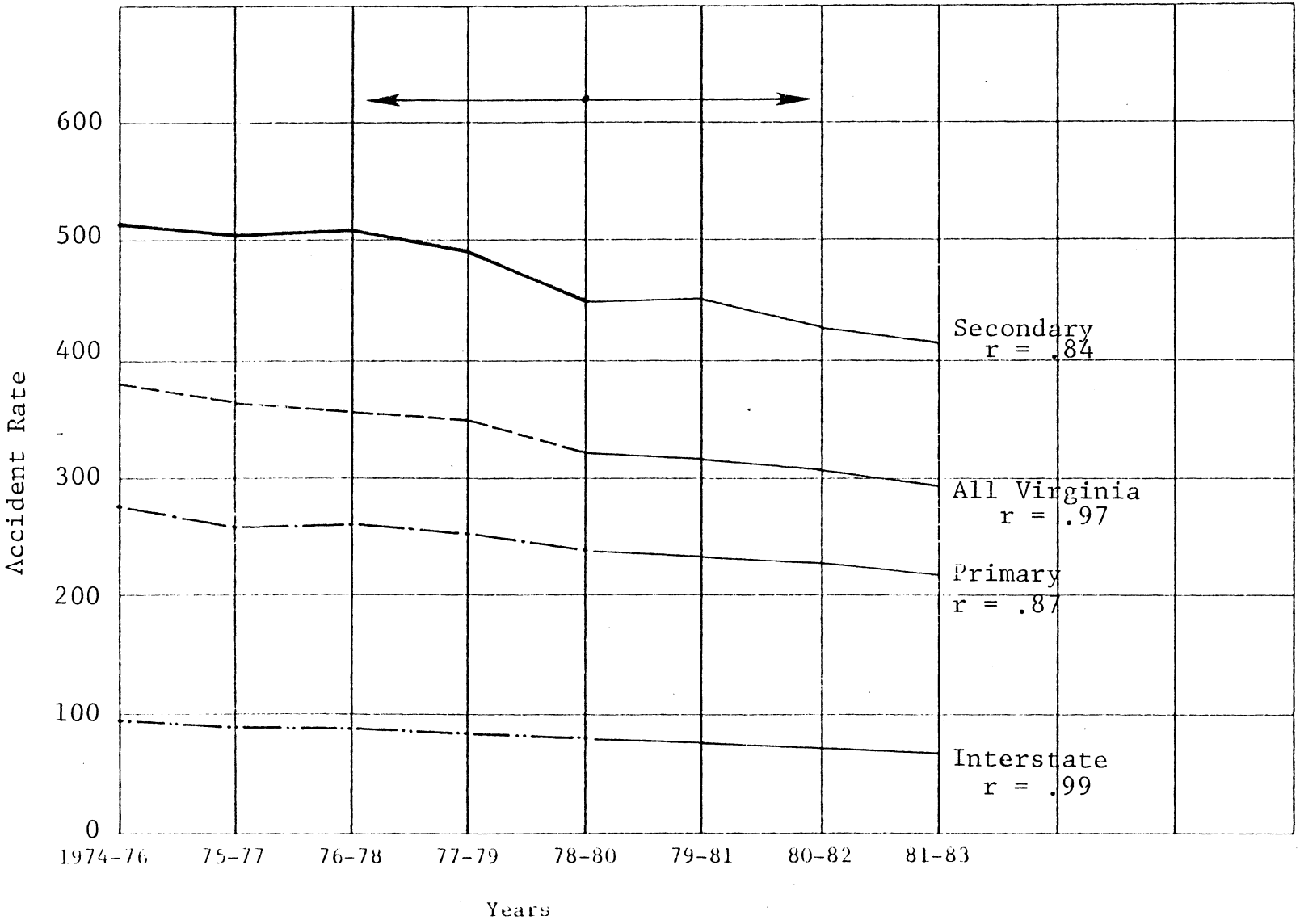


Exhibit 18

Highway Injury Rate Trends

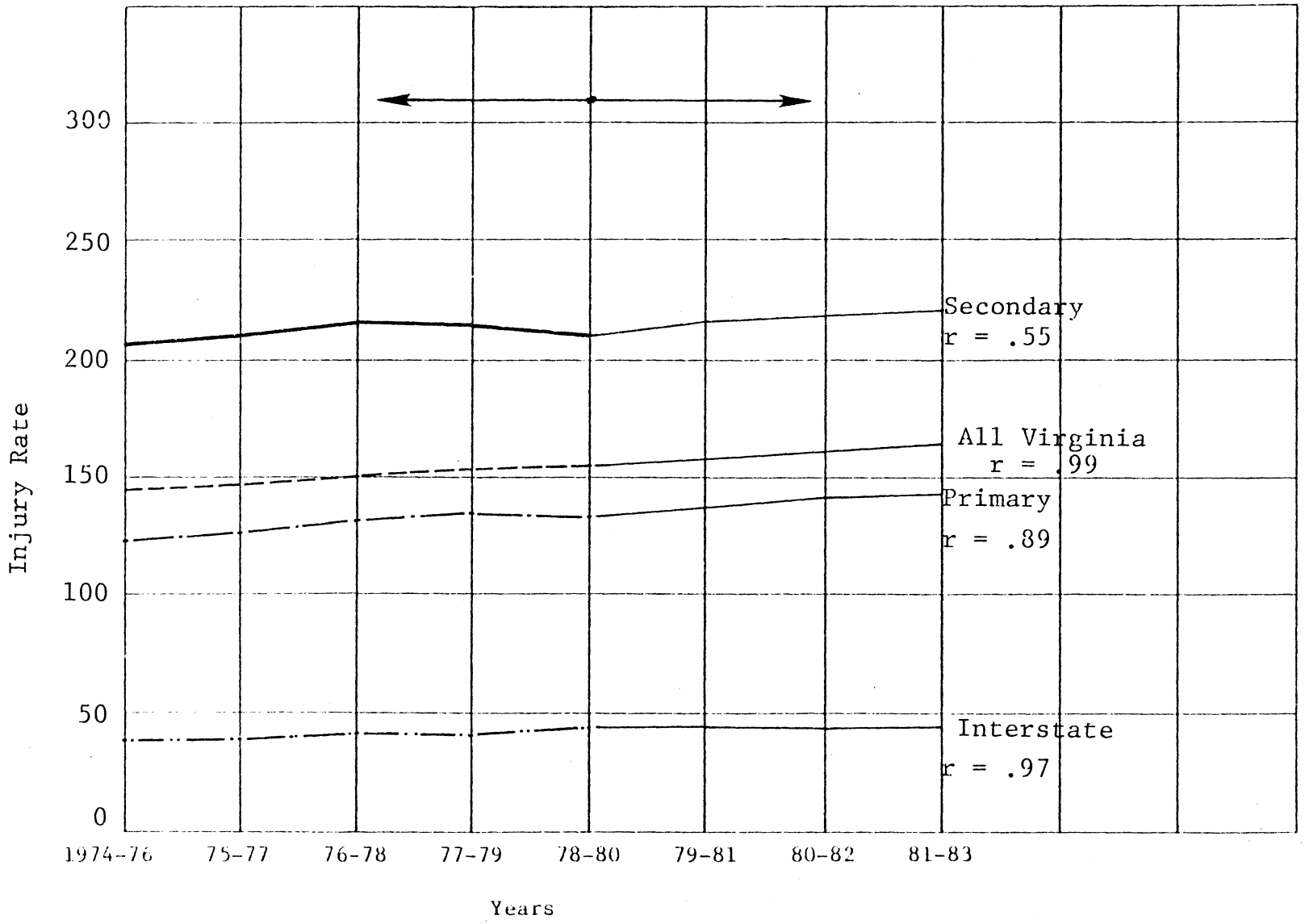


EXHIBIT 19

Highway Death Rate Trends

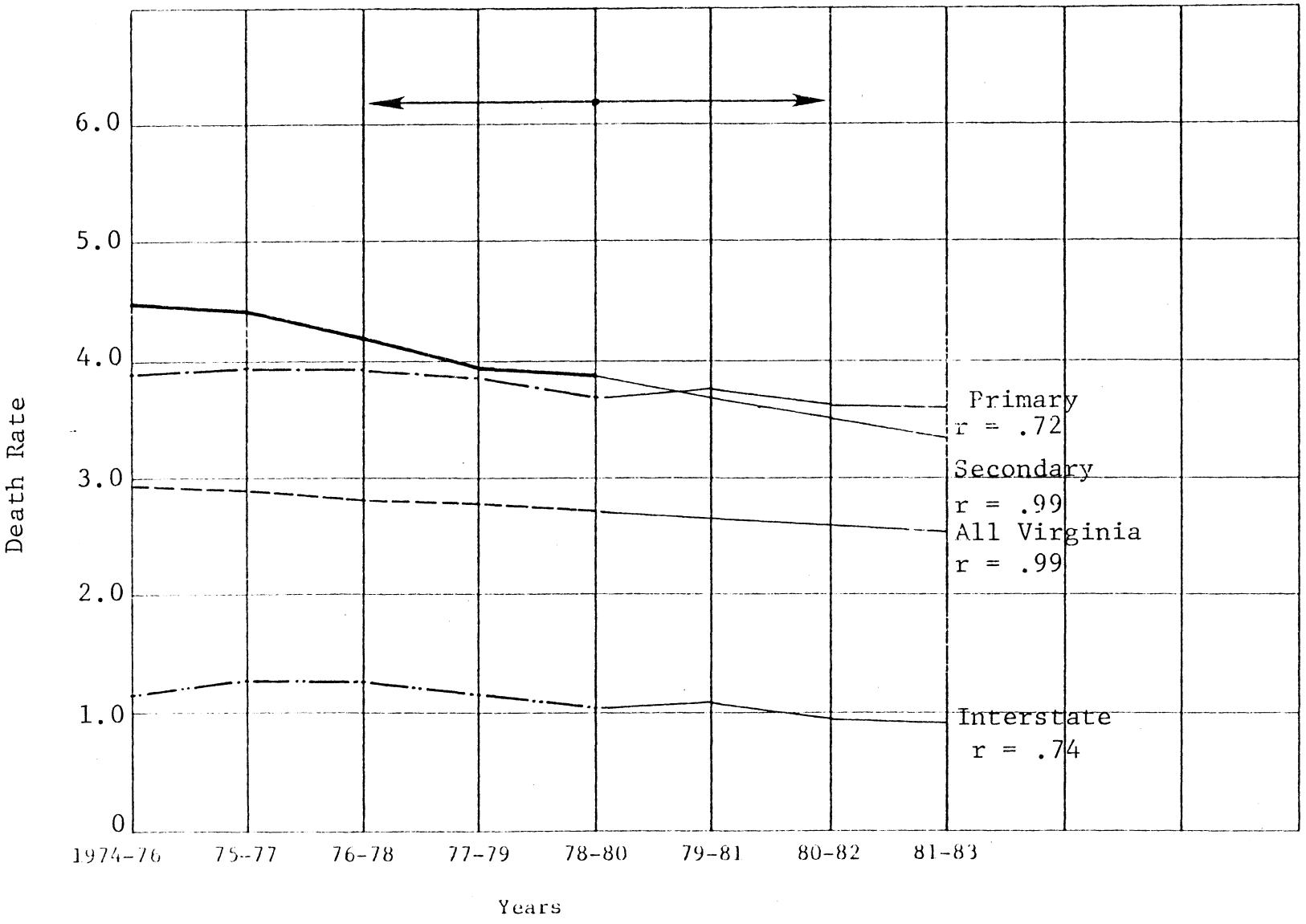


EXHIBIT 20

Total Motor Vehicle Accidents

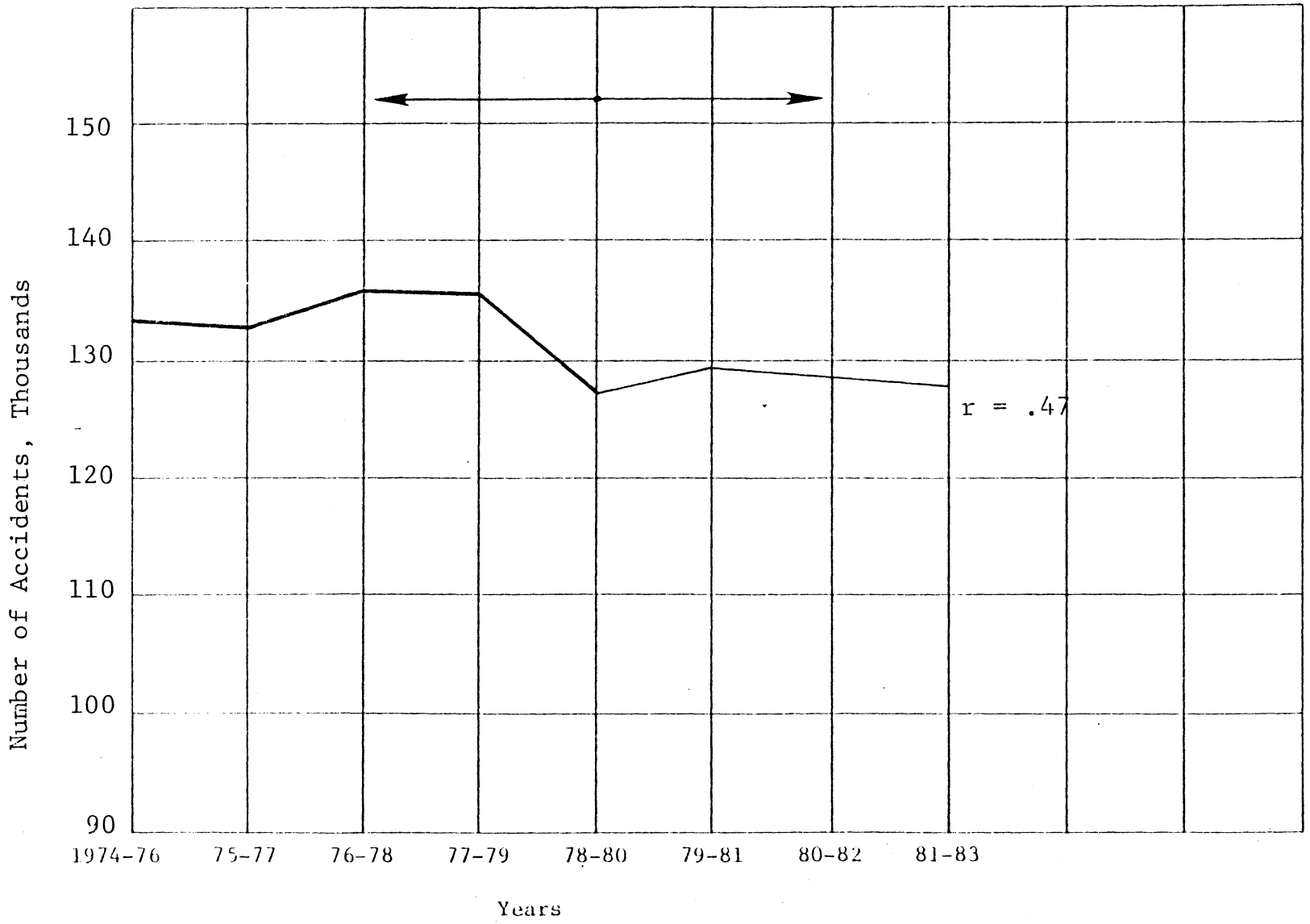


EXHIBIT 21

Total Personal Injury Accidents

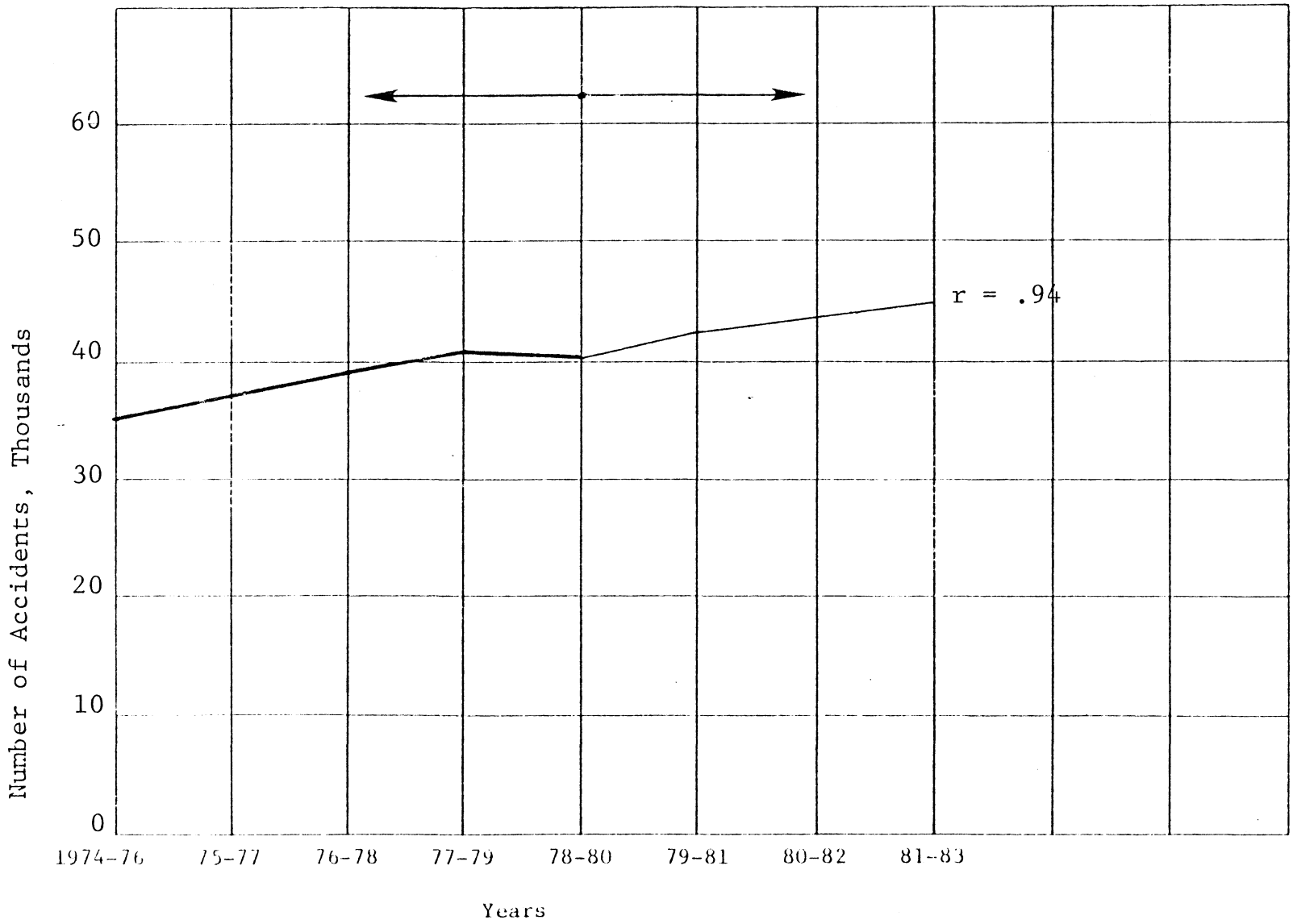


EXHIBIT 22

Total Fatal Accidents

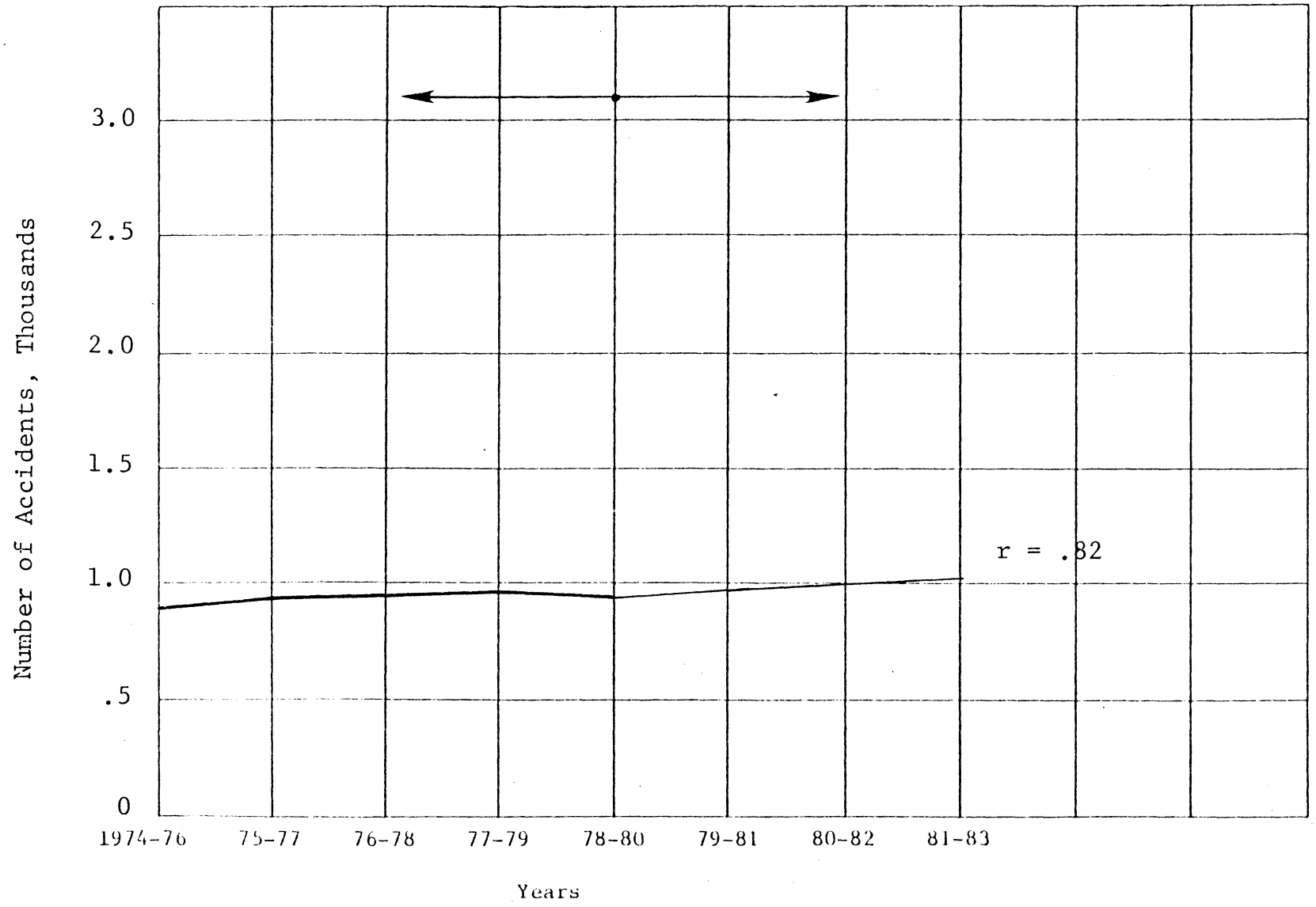


EXHIBIT 23

All Persons Injured

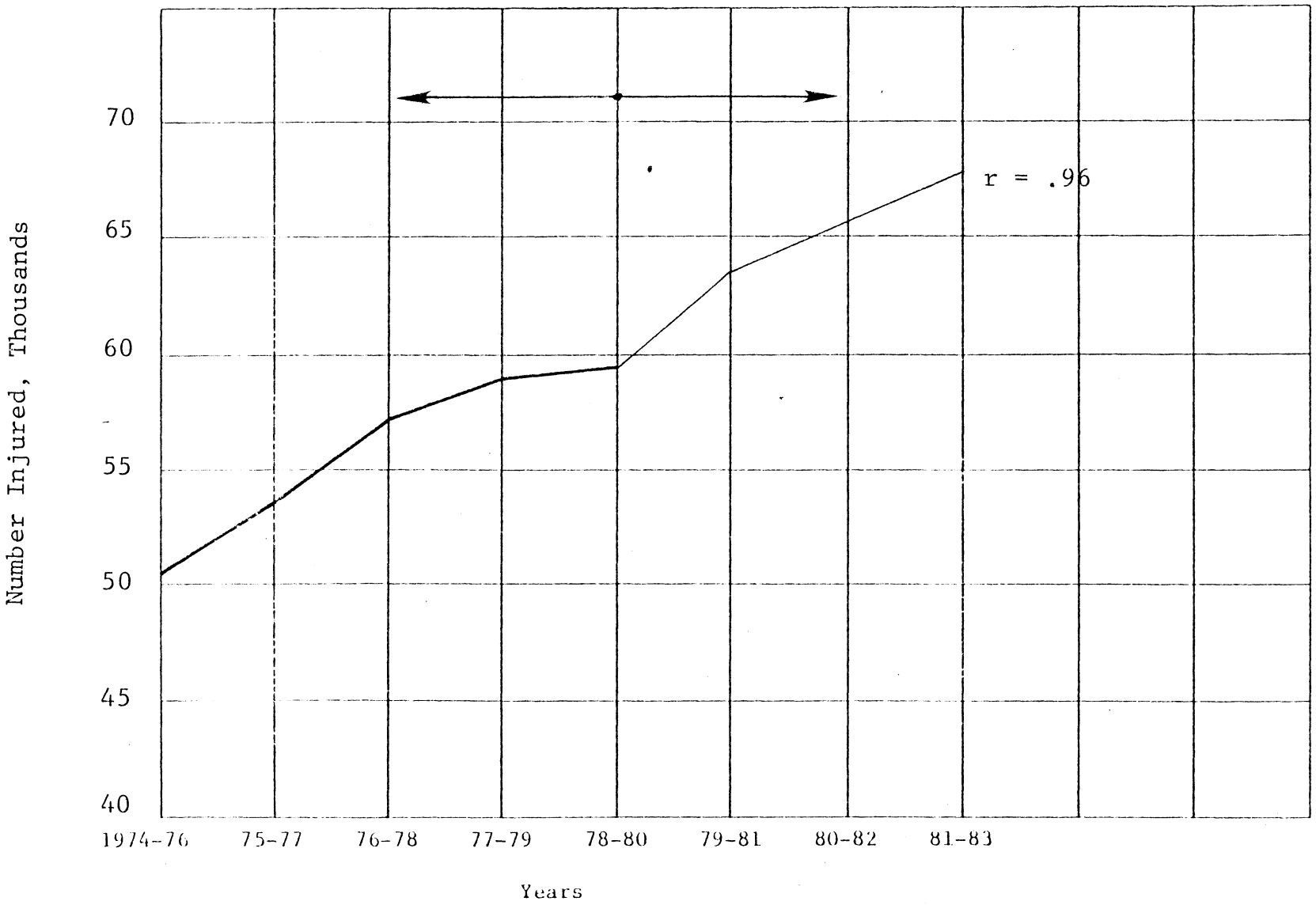


EXHIBIT 24

Bicyclists and Pedestrians Injured

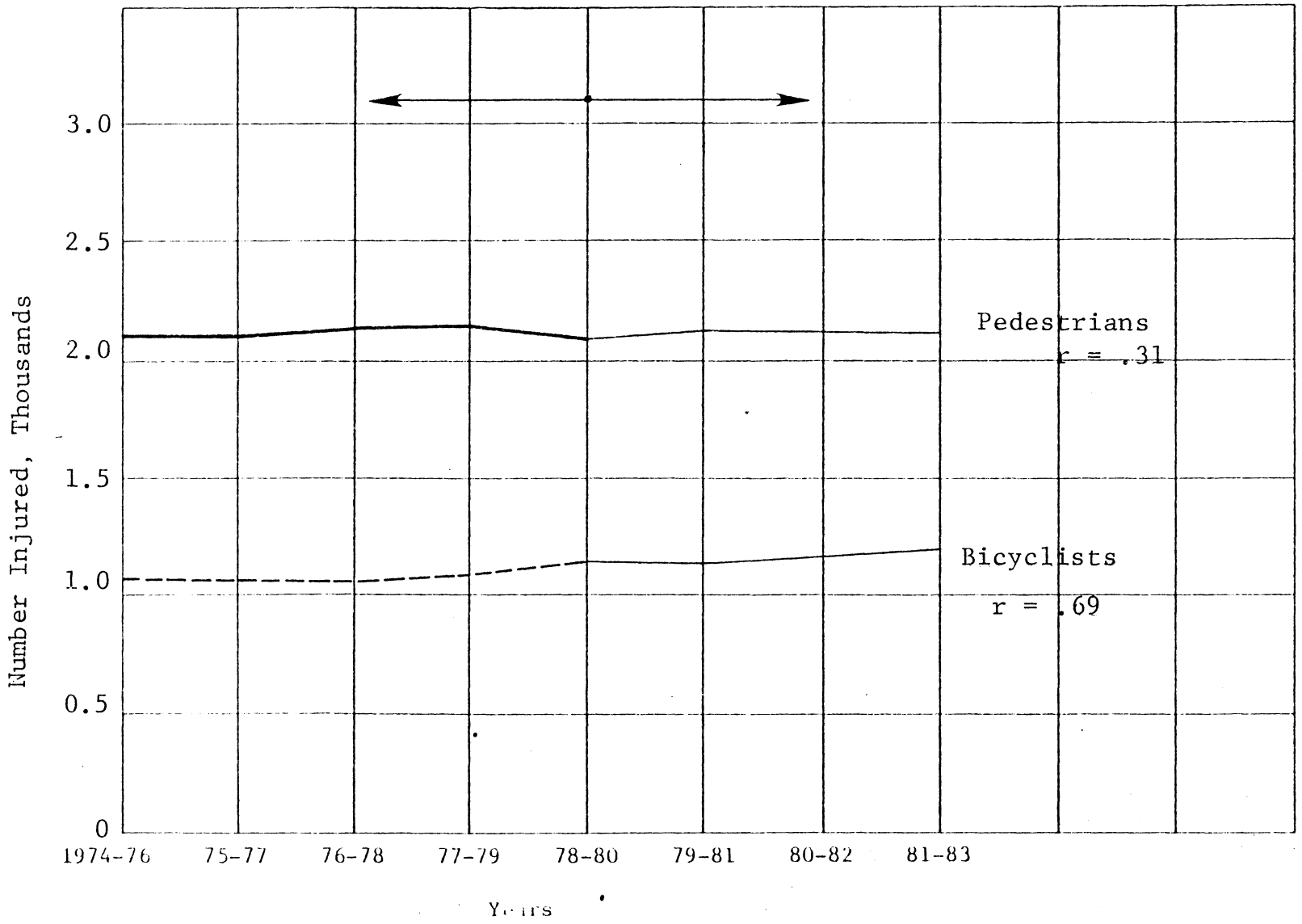


EXHIBIT 25

All Persons Killed

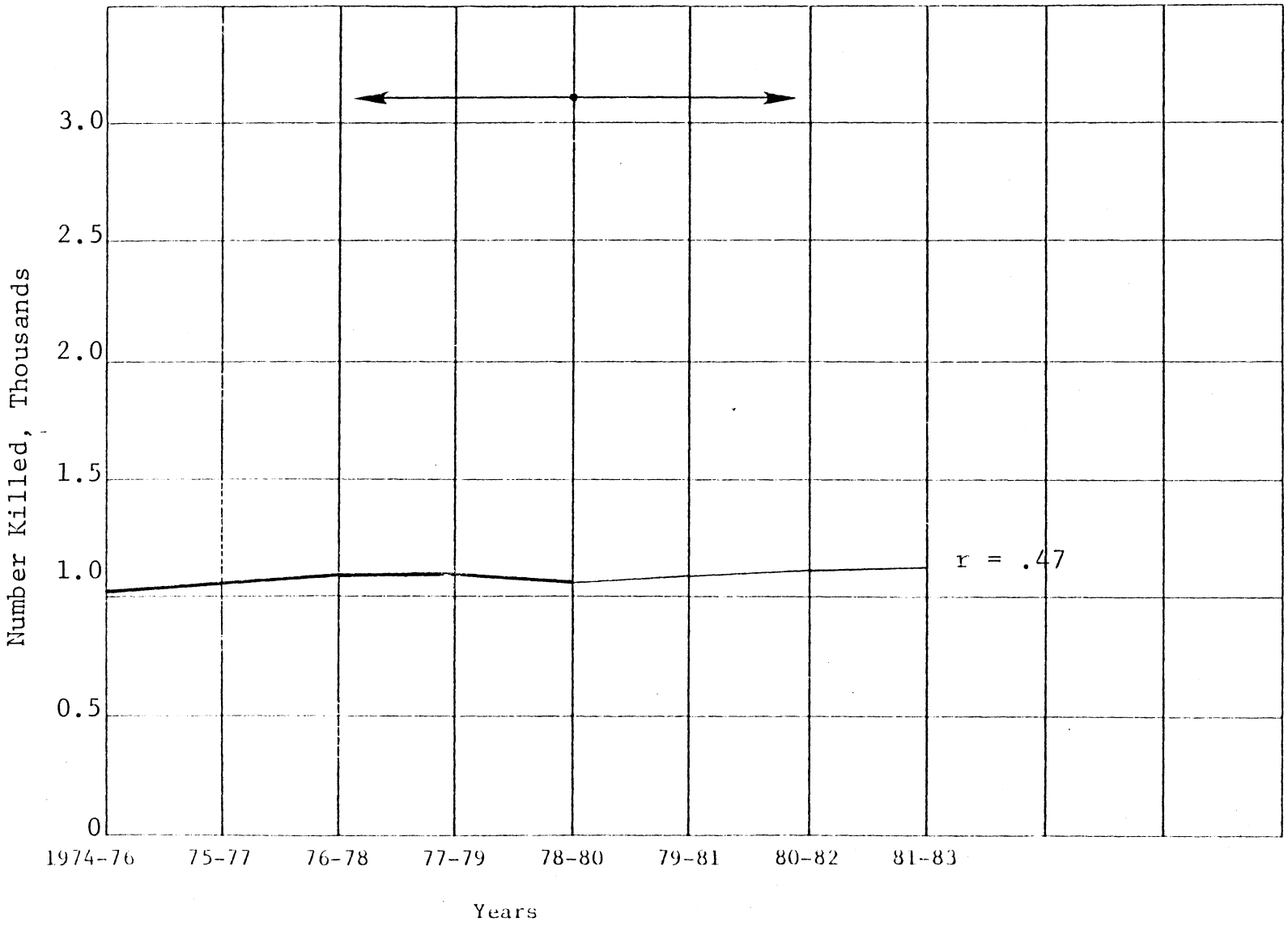


EXHIBIT 26

Bicyclists and Pedestrians Killed

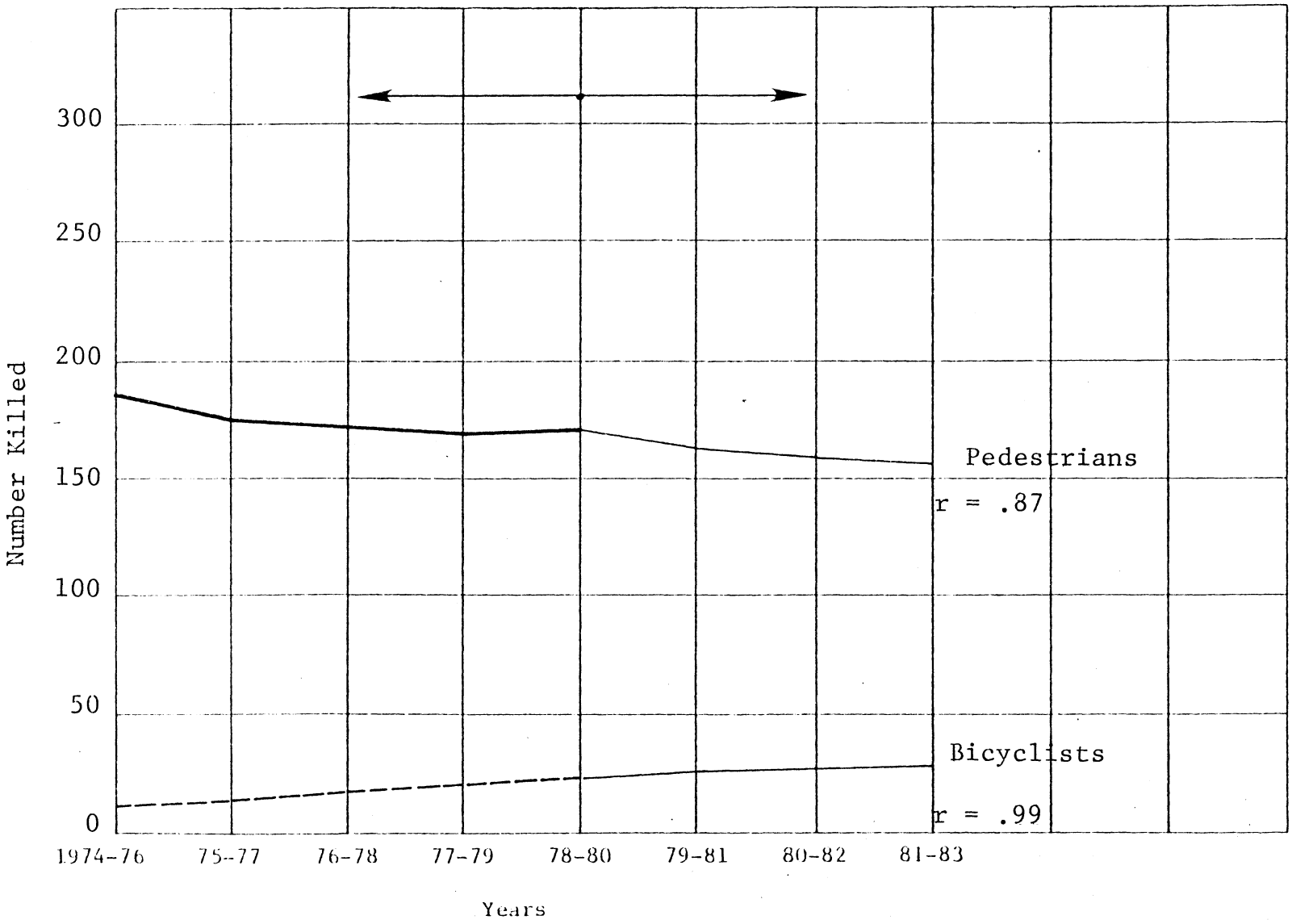


EXHIBIT 27

Number of Vehicles Involved in All Accidents

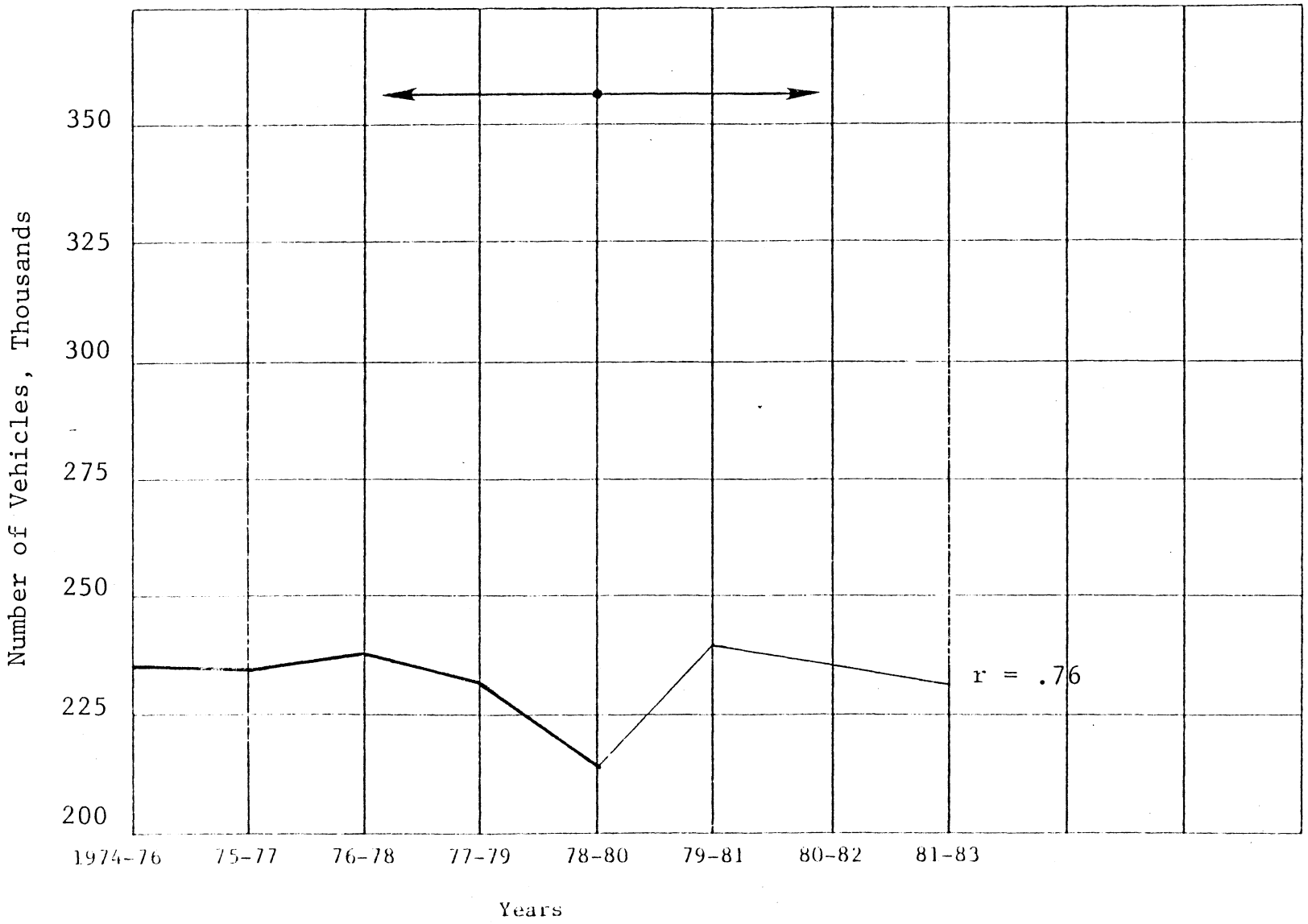


EXHIBIT 28

Number of Autos Involved in All Accidents

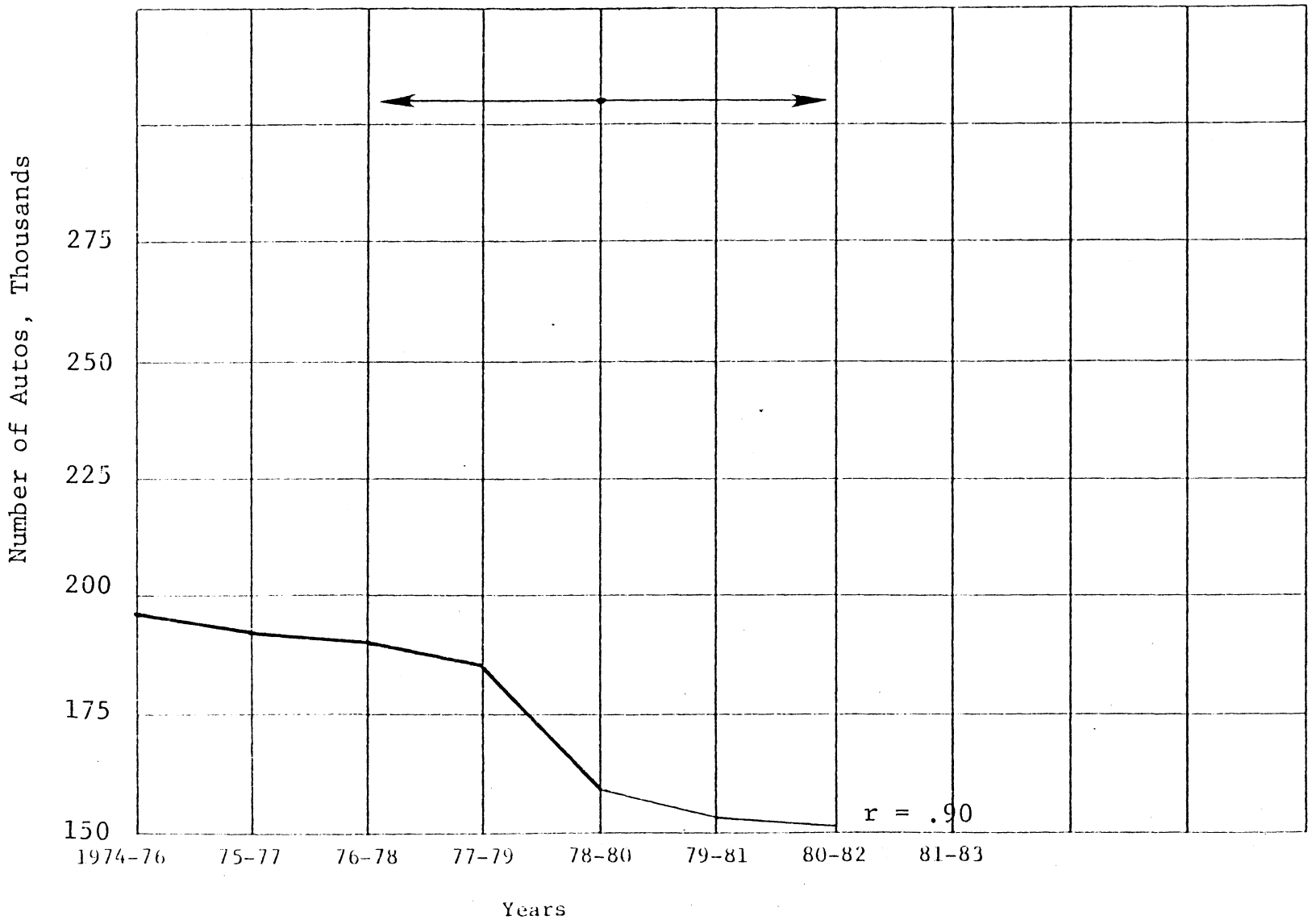


EXHIBIT 29

Number of Trucks Involved in All Accidents

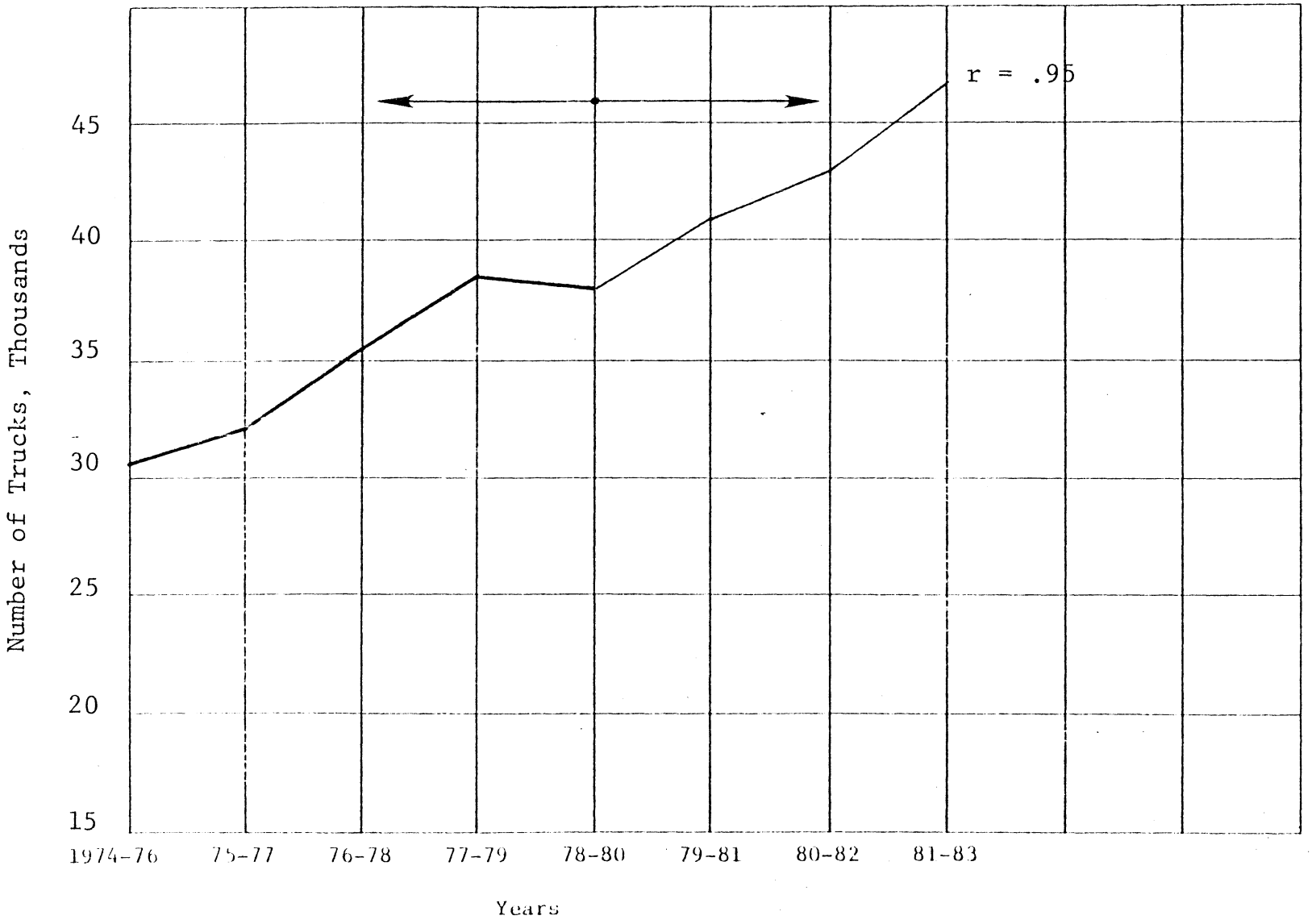


EXHIBIT 30

Number of Motorcycles and Buses Involved in All Accidents

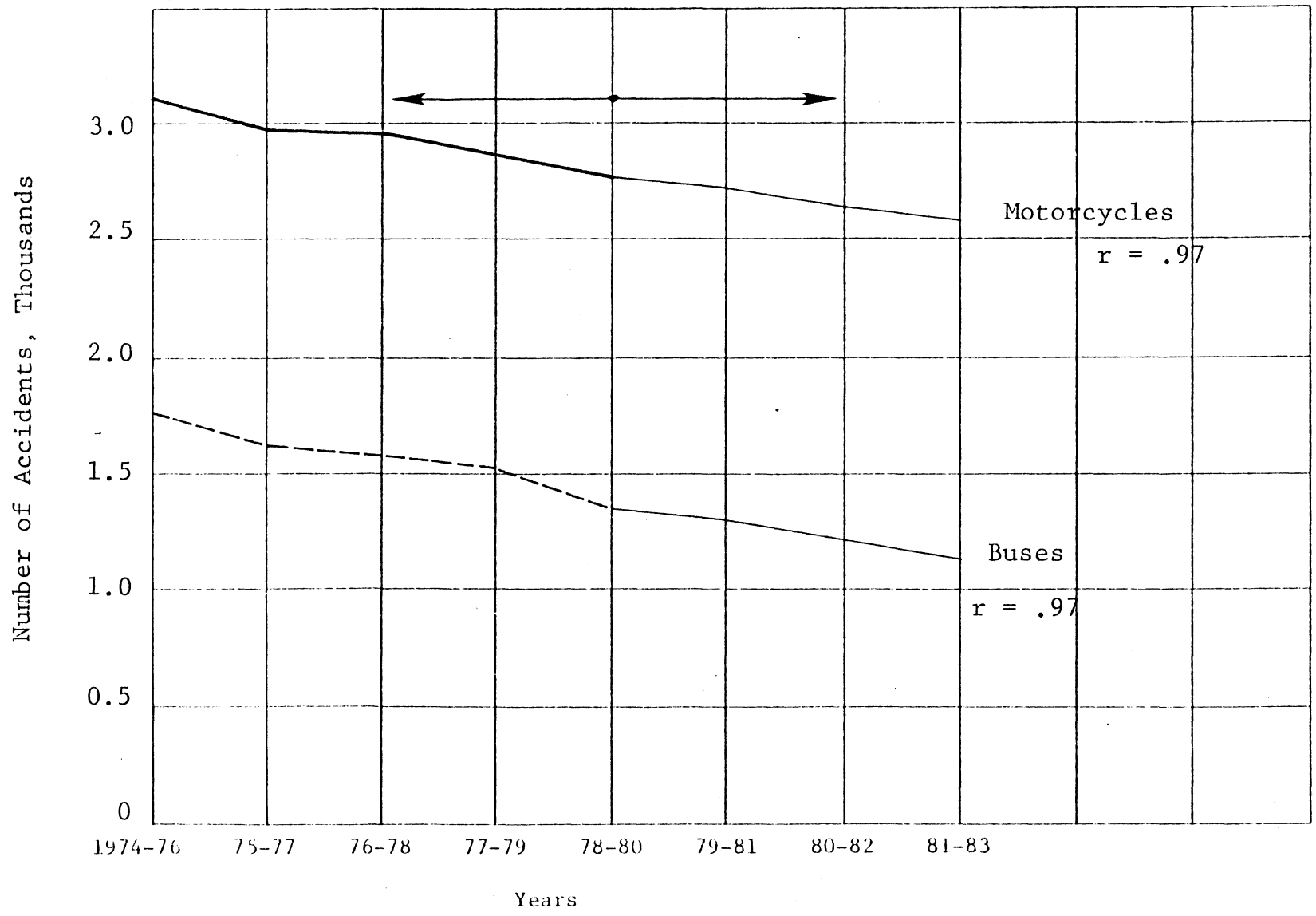


EXHIBIT 31

Total Motor Vehicles Involved in Fatal Accidents

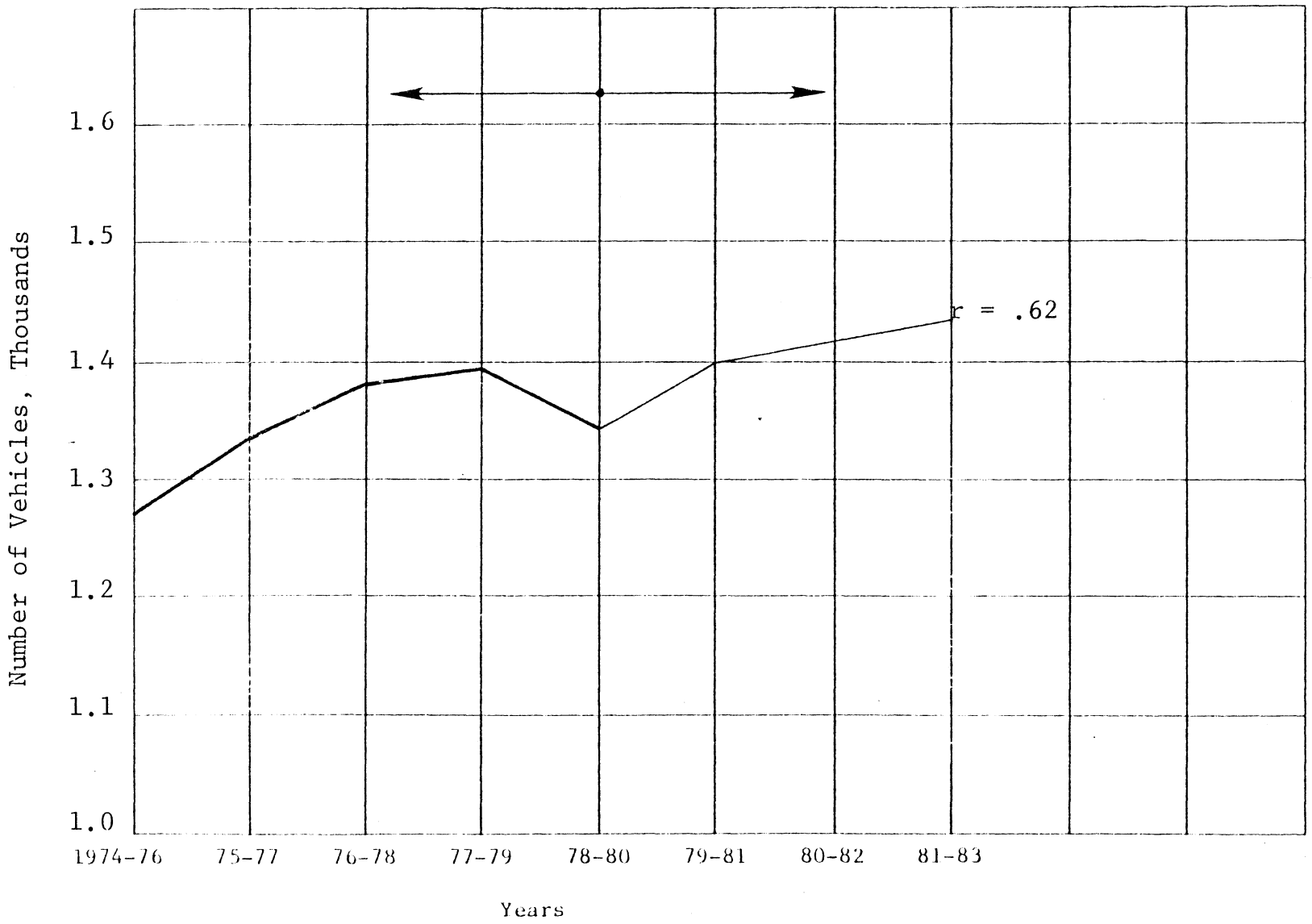


EXHIBIT 32

Number of Autos Involved in Fatal Accidents

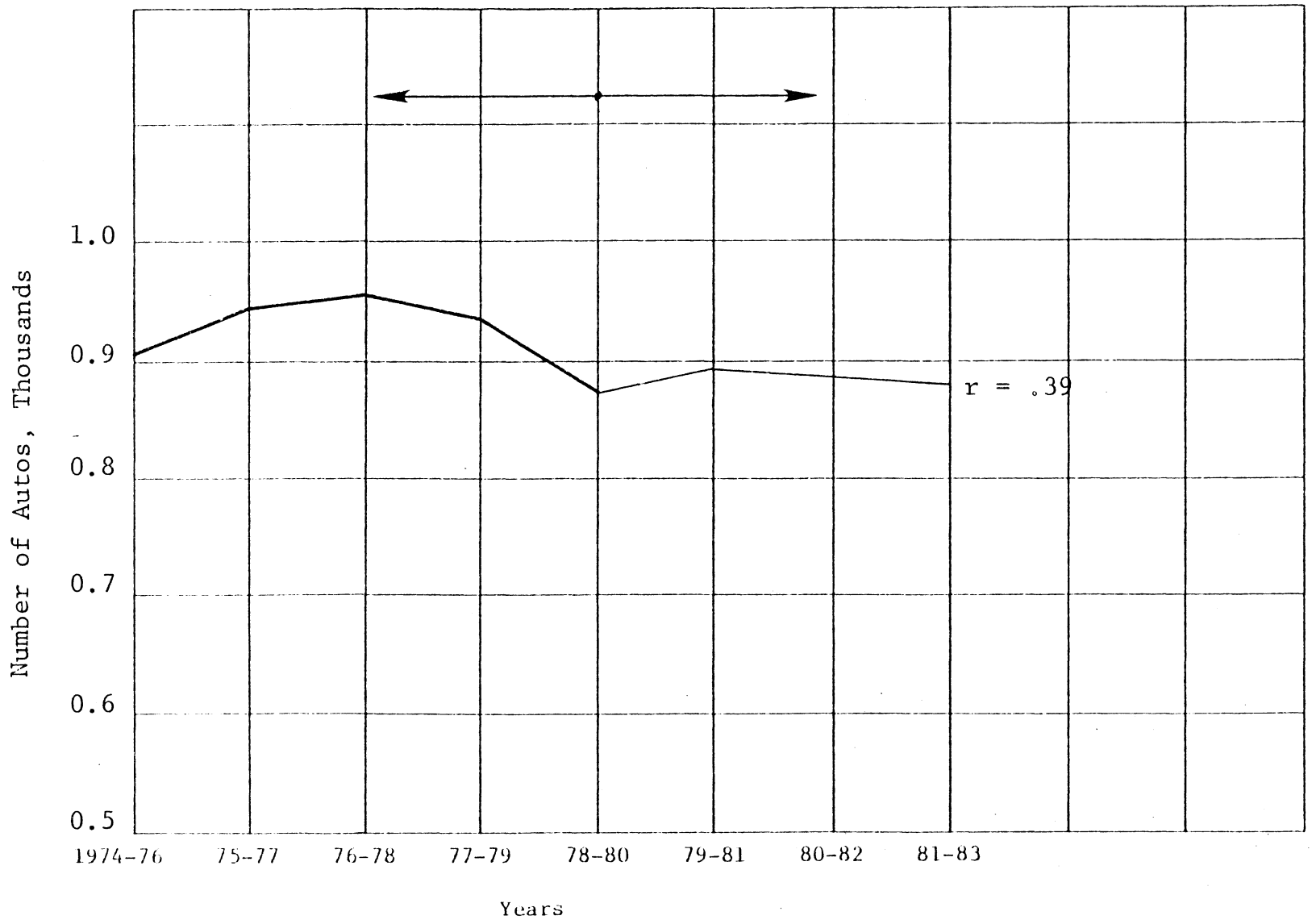


EXHIBIT 33

Number of Trucks Involved in Fatal Accidents

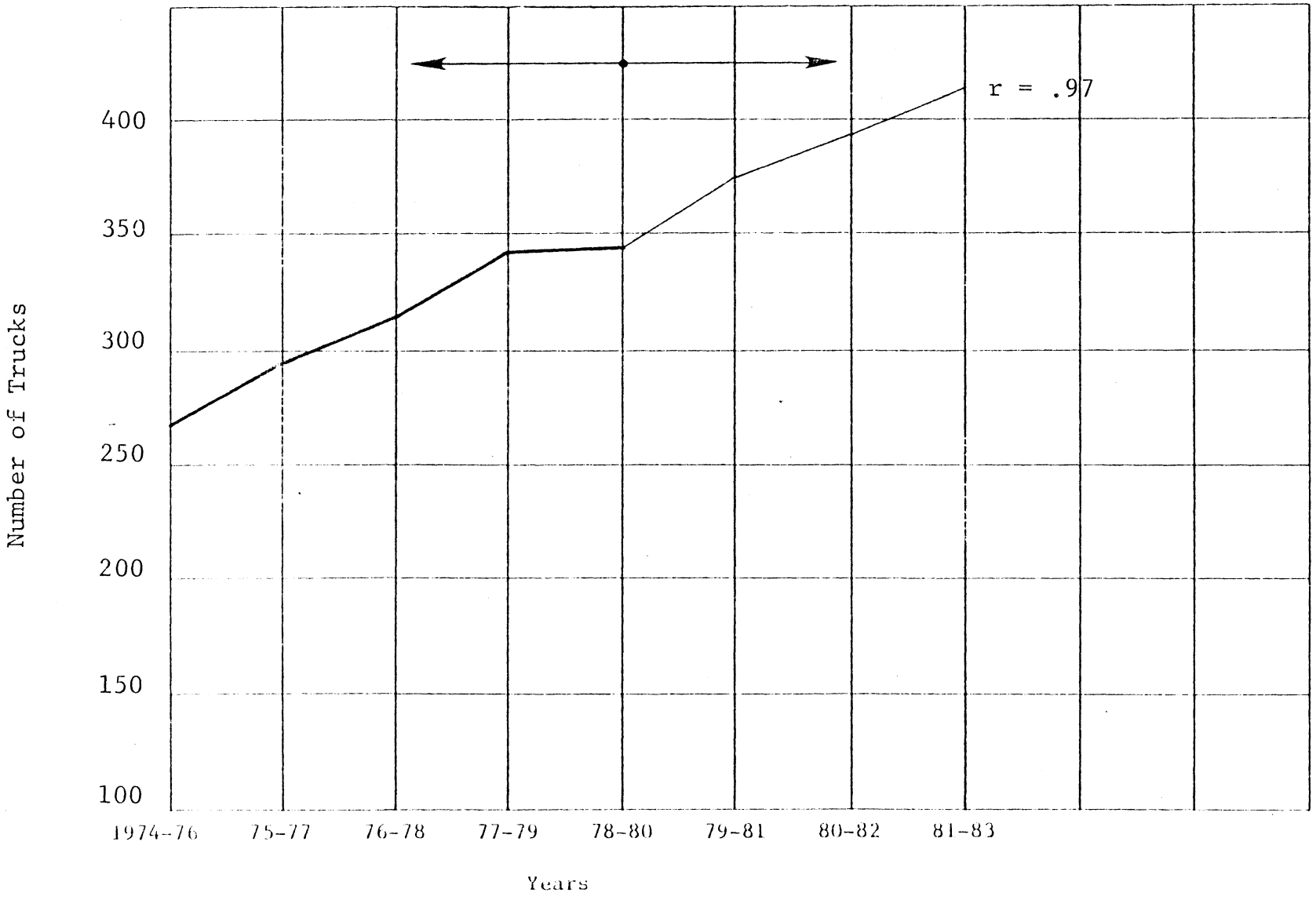


EXHIBIT 34

Number of Motorcycles and Buses Involved in Fatal Accidents

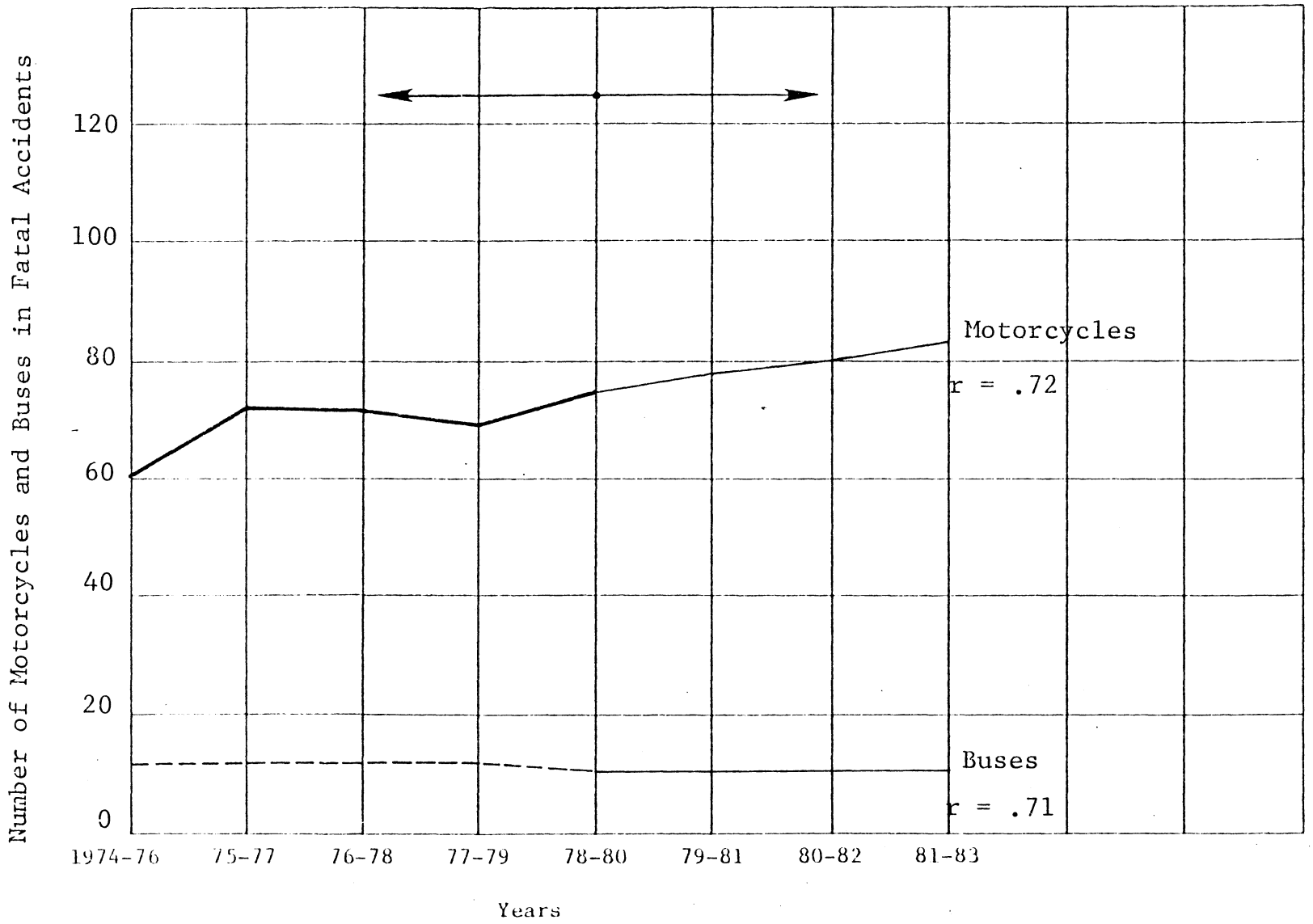


EXHIBIT 35

Total Drivers Involved in All Accidents

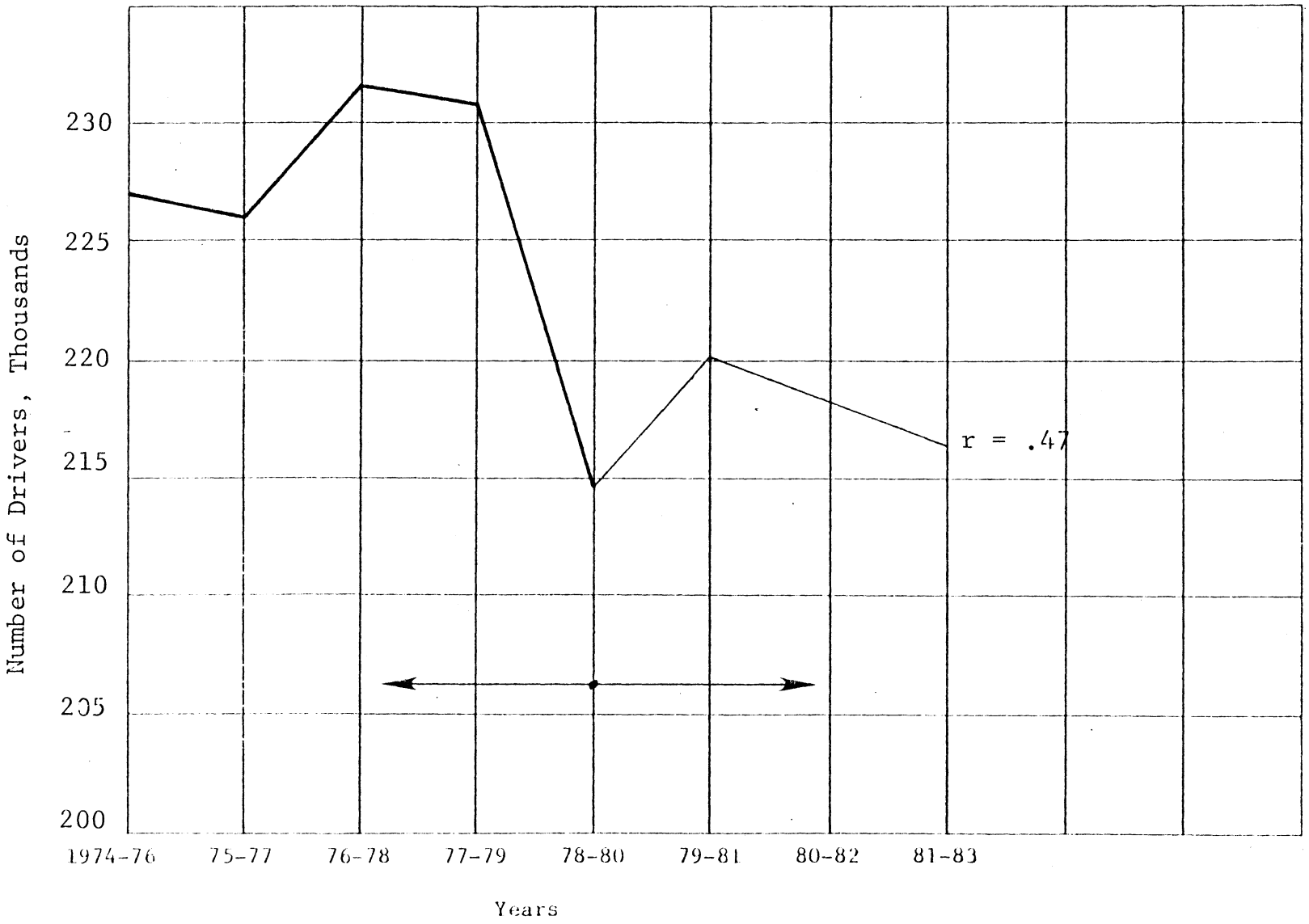


EXHIBIT 36

Drinking Drivers Involved in All Accidents

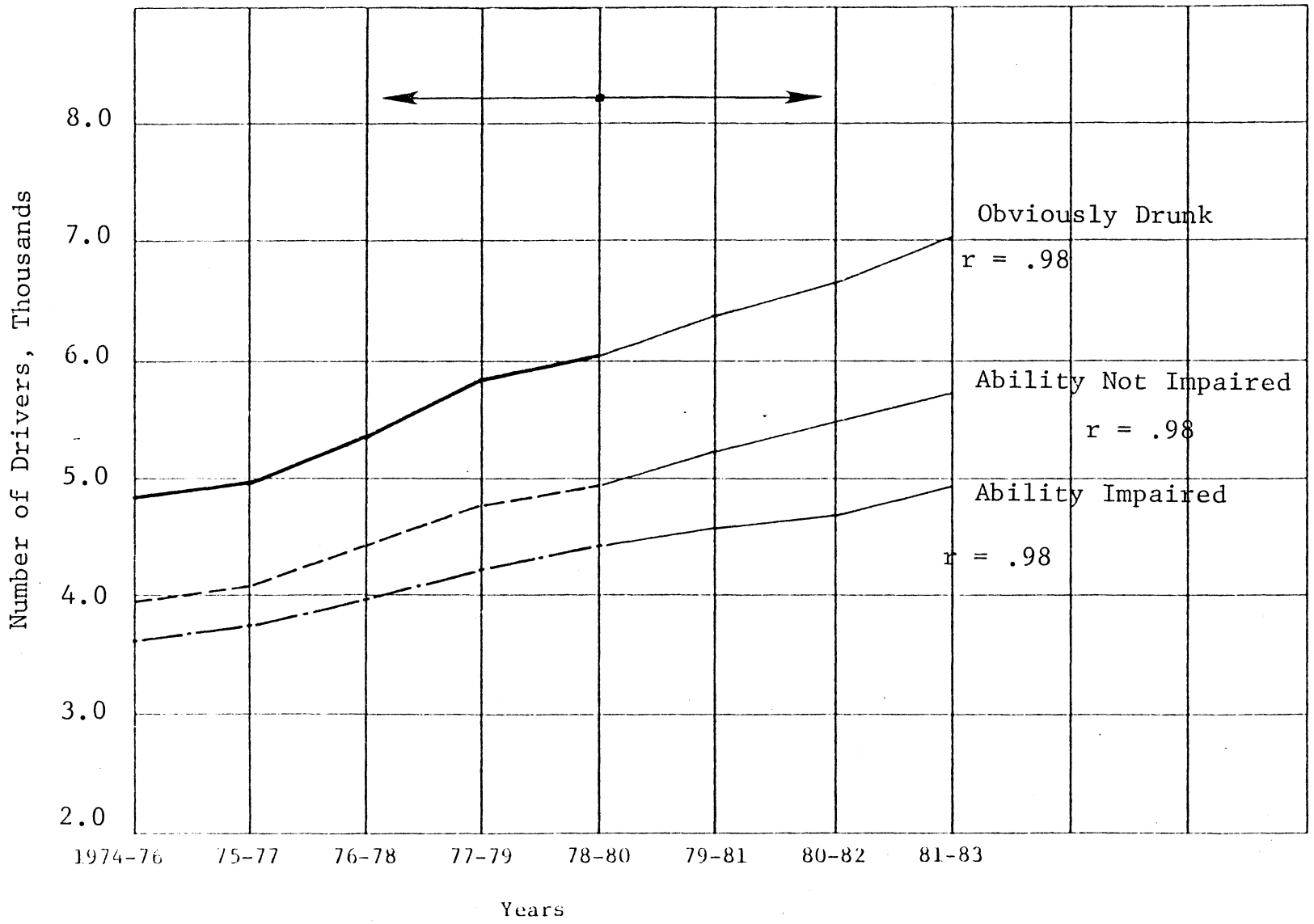


EXHIBIT 37

Nondrinking Drivers in all Accidents

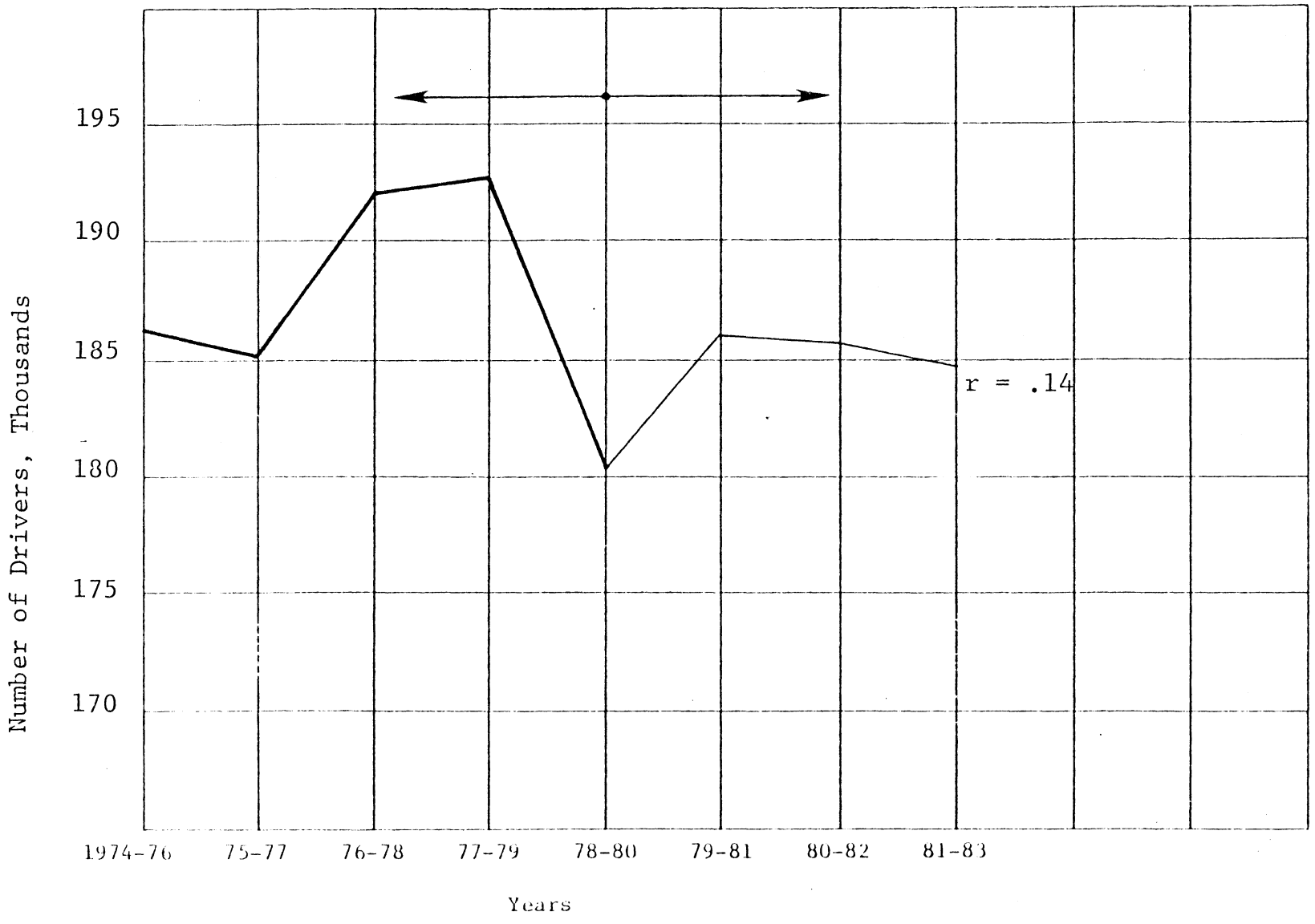


EXHIBIT 38

Total Drivers Involved in Fatal Accidents

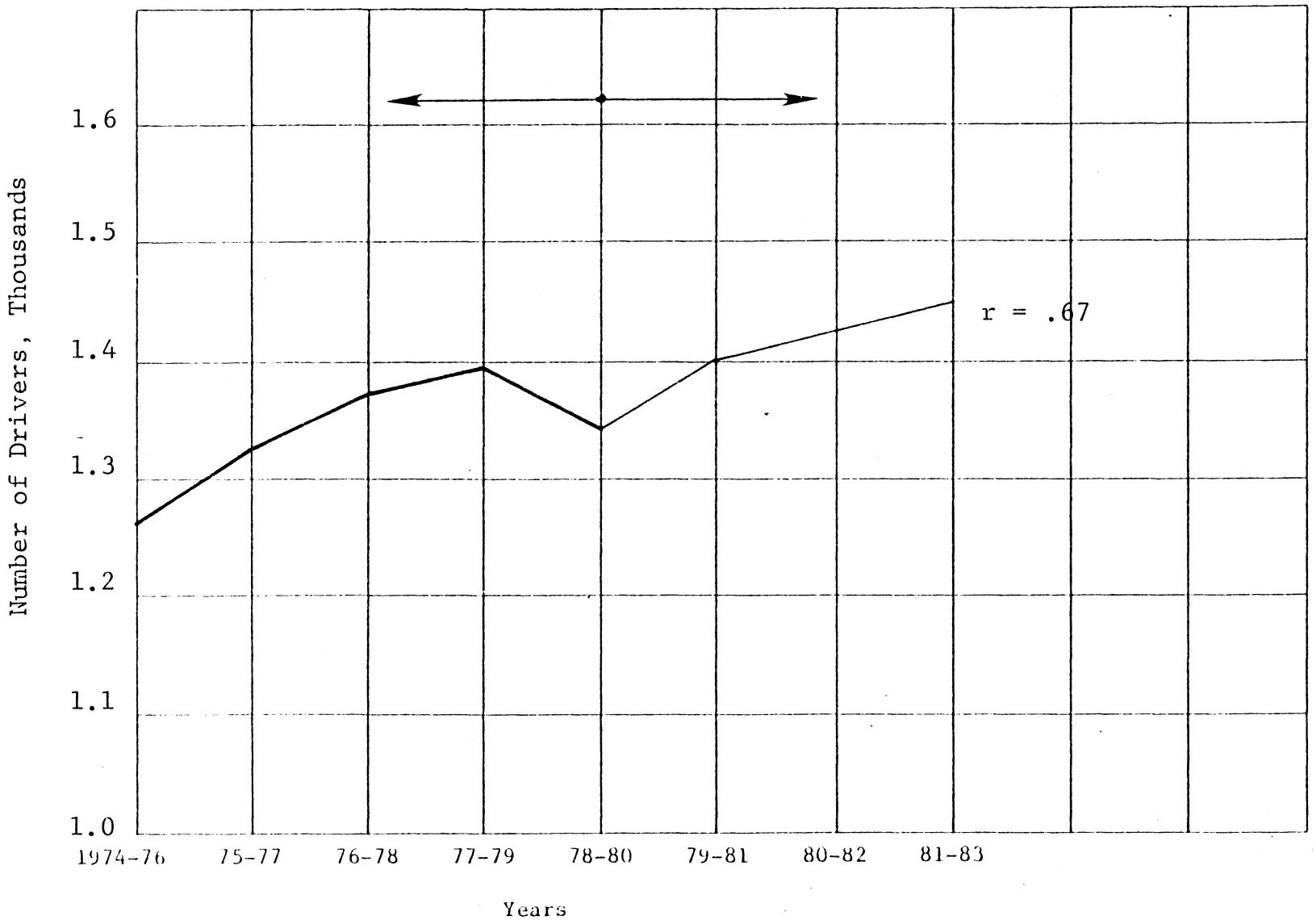


EXHIBIT 39

Drinking Drivers Involved in Fatal Accidents

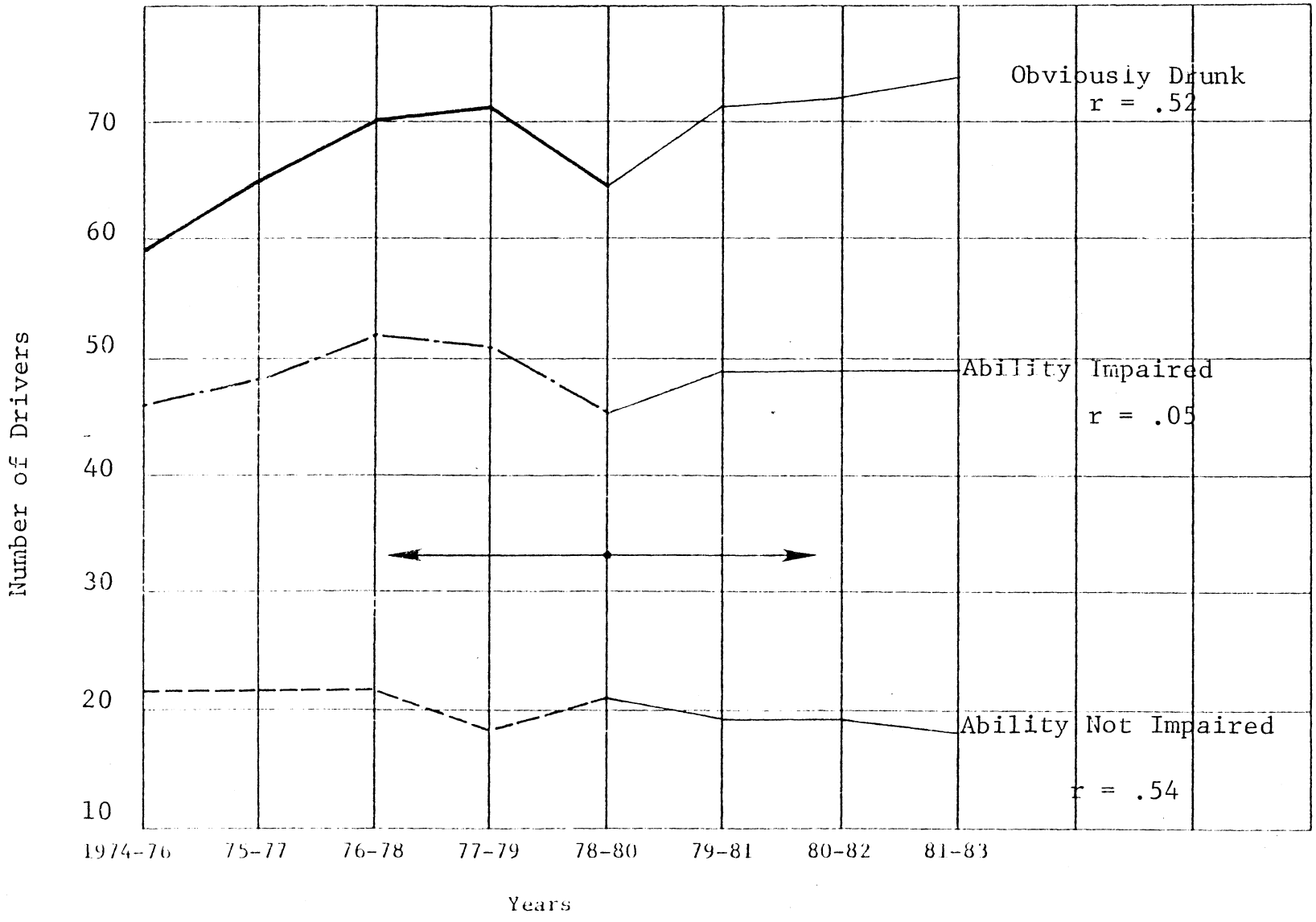
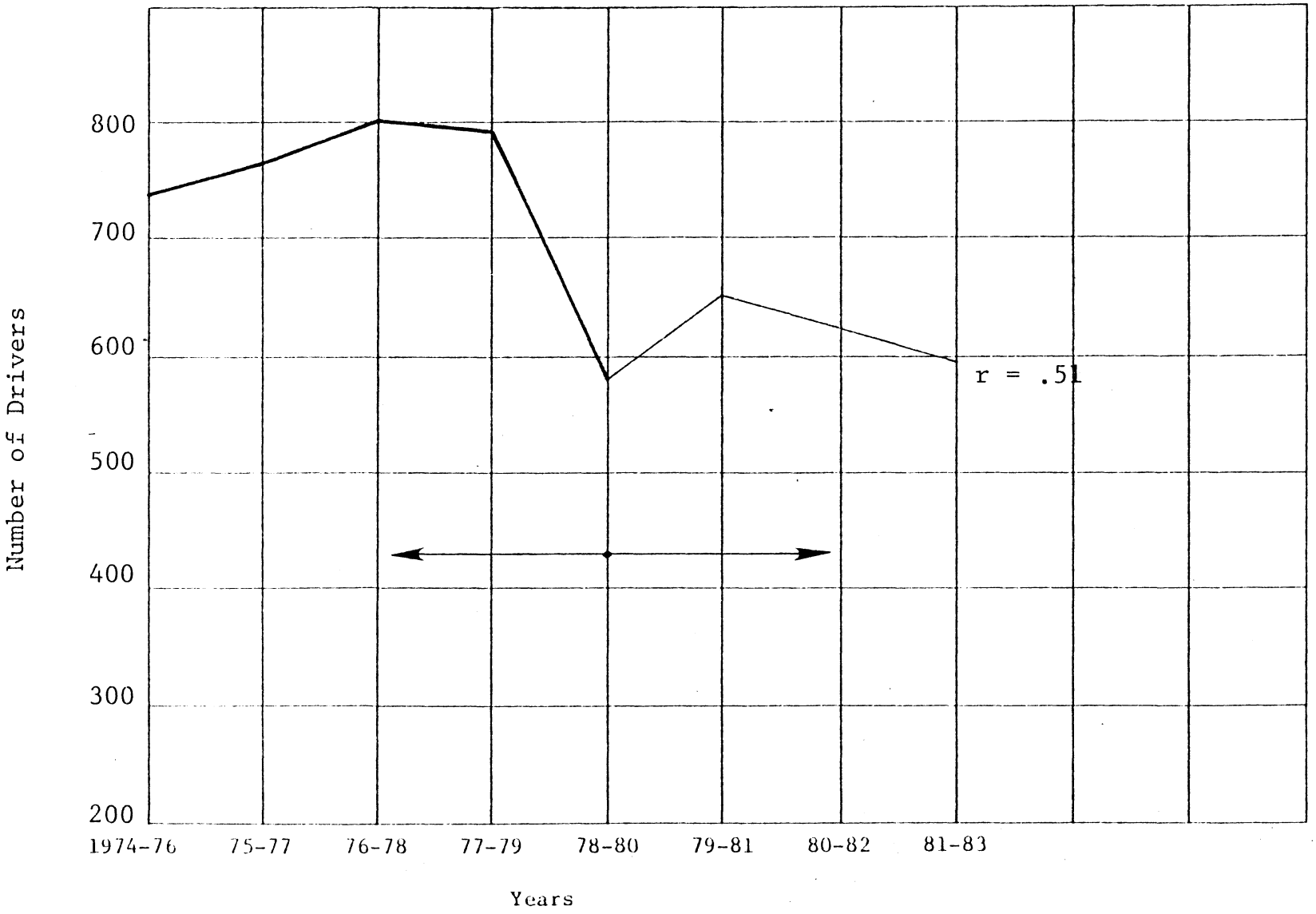


EXHIBIT 40

Non-Drinking Drivers Involved in Fatal Accidents



EVALUATION OF THE PROBLEM IDENTIFICATION PROCESS

The effectiveness of the problem identification process in Virginia is impeded by (1) the administrative organization of the process, and (2) limitations of the data analysis methodology.

Currently, problem identification and data analysis are performed following distribution of the PID's and receipt of the TSCs' and state agencies' submissions. Although this method is successful in incorporating participation at the local level, it is not as effective as a "top-down" planning process, as emphasized in the Volume 102 HSP guidelines. In other words, according to Volume 102, comprehensive planning should be first performed at the state level prior to distribution of the PID's. The results of the analysis would then be translated into goals and areas of emphasis which are communicated to the TSC's and state agencies to provide support for problem identification at the local level.

The need for reversing the chronology of the HSP process is evidenced by the fact that the submissions received from the TSC's and agencies generally indicate a lack of data analysis or an attempt to relate 402 funding requirements to the data. The submissions are also deficient in respect to the program evaluation component. Evaluation is important to measure past results and to predict future goals and program emphases. Both impediments indicate a lack of planning capability at the local level.

Revising the problem identification process so that the locality-specific analysis is performed at the state level will not only relieve the localities of this burden, but will also improve the VDTS's ability to evaluate and compare local programs and prioritize problem areas and funding needs.

The second major problem in the HSP and problem identification process is related to limitations of the statistical analysis methodology, as previously mentioned. Although the linear regression technique currently employed is a valid approach to problem analysis, the results do not provide explanations for the observed trends and changes; they merely give comparisons of absolute numbers of accidents. Also, the analysis is based on historical data and cannot account for fluctuations in trends due to external variables such as energy consumption, climate, etc.

The shortcomings of the statistical analysis are related more directly to the format of the data than to the methodology itself. The accident data available for analysis is in an aggregated format that prevents more specific, in-depth problem analysis. The process would be improved if the crash data were received in raw format and then compiled into the 14 program areas specified in Volume 102.

Thus, specific characteristics of a safety problem, rather than simply a comparison of numbers, could be used to achieve a detailed and effective analysis. This would, in turn, improve the validity and usefulness of the problem identification process in highway safety planning at the state level.

There are other factors related to the accuracy and timeliness of the data that adversely affect the problem identification process. The validity of data analysis depends on the validity of the data input to the system. Discrepancies between data received from different sources indicate a need for quality control at the time the data are initially reported and collected.

The application of the results of the data analysis is also affected by the timeliness of the data. Current safety program planning is generally based on accident data that are two years old; i.e., the FY 1981 HSP is based on FY 1978 data. This problem stems from inefficiencies in the management of the statewide traffic records system. It is beyond the scope of this report to comment further on these problems.

SUMMARY AND RECOMMENDATIONS

Over the past ten years, much progress has been made in improving the efficiency of the problem identification process in Virginia. However, the "bottom-up" planning process that has evolved in response to the federal HSP and 402 funding programs has impeded highway safety planning at the state level. The changes imposed on such planning by the new federal administration make it difficult to predict the future of the HSP. Regardless of policy changes, the problem identification process remains an integral component of highway safety planning. The effectiveness of this process can be improved by implementing the following recommendations.

1. The VDTS administrators should consider revising the HSP planning process so that locality-specific and statewide systems support and impact problem identification analysis are performed at the state level prior to the issuance of PID packets, so the results of the analysis can be used to assist planning at the local level.

2. The VDTS should acquire disaggregated data for use in statistical problem analysis and should focus its analysis efforts on detailed accident characteristics specific to each program area.

3. The VDTS should explore the possibility of employing sophisticated and in-depth data analysis techniques to increase the effectiveness and validity of the problem identification process.

APPENDIX

DATA SOURCES USED IN THE HSP PROBLEM IDENTIFICATION PROCESS

Department of State Police	State Police Crash Tape Virginia Crash Facts
Division of Motor Vehicles	Conviction Data Tape Licensed Drivers Report Registered Vehicles Printout
Virginia Department of Highways and Transportation	Summary of Accident Data Road Mileage Tables Division Program Reports
Department of Education	Pupil Transportation Reports Driver Education Program Data
Bureau of Emergency Medical Services	Training Data
Bureau of Forensic Sciences	Alcohol Breath Test Data
Virginia Department of Transportation Safety	VASAP Program Data
Virginia Commonwealth University	Training Reports
U. Va. Tayloe Murphy Institute	Annual Census Index