HIGHWAY SAFETY

A Report

of the

JOINT STATE GOVERNMENT COMMISSION

to the

GENERAL ASSEMBLY

of the

COMMONWEALTH OF PENNSYLVANIA

SESSION OF 1955

JOINT STATE GOVERNMENT COMMISSION

JOINT STATE GOVERNMENT COMMISSION
SUBCOMMITTEE ON HIGHWAY SAFETY

Honorable W. MACK GUTHRIE, *Chairman*

Honorable MURRAY PEELOR, *Vice Chairman*

House Members	*Senate Members*
JAMES J. DOUGHERTY	ANTHONY J. DISILVESTRO
W. MACK GUTHRIE	ELMER J. HOLLAND
BLAINE C. HOCKER	A. EVANS KEPHART
JOHN J. MIKULA	MURRAY PEELOR
WILMER W. WATERHOUSE	JOHN G. SNOWDEN
C. O. WILLIAMS	T. NEWELL WOOD

LETTER OF TRANSMITTAL

To the Members of the General Assembly of the
Commonwealth of Pennsylvania:

Pursuant to the directive of the General Assembly contained in House Concurrent Resolution No. 79, Session of 1953, there is presented herewith a report on highway safety and factors responsible for highway accidents in Pennsylvania.

Under authority granted by the Act of 1943, March 8, P. L. 13, Section 1, the Commission created a subcommittee to facilitate the study. On behalf of the Commission, the cooperation of the members of the subcommittee is gratefully acknowledged.

The investigation has developed evidence that legislative concern with safety on Pennsylvania's streets and highways is amply justified. In 1953, motor vehicles traveled more than 31,000,000,000 miles in Pennsylvania, and motor travel by persons was about 59,000,000,000 miles, and in that year, when 1,643 lives were lost and 70,531 persons were injured, traffic accidents reached an all-time high—129,791 accidents, generating a total cost in excess of $89,000,000.

Past and current measures directed toward making driving safer for Pennsylvania's 4,467,177 licensed motor vehicle operators have not established causes of accidents and have not constituted effective programs for accident prevention. The chance of an accident per mile traveled has not changed significantly over the past seven years and, in 1953, was slightly higher than in 1929.

This study, as well as the 1953 study of the Joint Legislative Committee on Turnpike Safety in which the Commission participated, demonstrates that techniques are available to cope effectively with traffic accident problems and to reduce materially the toll in terms of life and property.

BAKER ROYER, *Chairman*

Joint State Government Commission
Capitol Building
Harrisburg, Pennsylvania

CONTENTS

LIST OF CHARTS

RECOMMENDATIONS

The Joint State Government Commission recommends that:

I. The General Assembly authorize a complete and comprehensive survey dealing with safety upon highways in Pennsylvania, to include, but not be limited to:

    A. Driver factors in conjunction with vehicle and highway factors

    B. Driver aptitudes and acquired skills for motor vehicle operation

    C. Re-examination of accident experience with respect to stopped school buses since enactment of Pennsylvania motor vehicle statutes dealing therewith.

II. Funds for this comprehensive highway safety study be appropriated from the Motor License Fund.

III. Provision be made for furnishing to each district and county highway superintendent information concerning accidents occurring in his district.

Part I

FREQUENCY OF TRAFFIC ACCIDENTS

The all-time high in numbers of traffic accidents and numbers of drivers involved in accidents in Pennsylvania was reached in 1953, and preliminary data indicate that 1954 totals will be at even higher levels. Specifically, 129,791 accidents involving 237,448 drivers were recorded in 1953. The estimated cost of these accidents was in excess of $89,600,000.[1]

Of the accidents reported in 1953, 45,916 resulted in injuries to 70,531 persons, and 82,411 resulted in property damage only—in each case the highest annual numbers recorded. During that year, 1,643 persons died in 1,464 fatal traffic accidents.

Accident observations over a twenty-five-year period (1929 to 1953, inclusive) show that in the latest year, 1953, the chance of accident involvement per licensed Pennsylvania operator was more than one and one-half times that for the earliest year, 1929. Like accident involvement of drivers, accident frequencies on a travel mileage basis have *not* tended to decrease—the chance of an accident *per mile traveled* was slightly higher in 1953 than in 1929.

Although total numbers of accidents and chances of accidents per driver and per mile were higher in 1953 than in 1929, both number and likelihood of occurrence of fatal accidents and fatalities resulting therefrom were lower. The likelihood of occurrence of either a fatal accident or a fatality per mile traveled in 1953 was slightly more than one-quarter that of twenty-four years earlier, and the number of persons injured (although at an all-time high) was, on a travel mileage basis, lower than in 1929.

The evidence for the past twenty-five years suggests that measures designed to reduce frequencies of traffic accidents and driver involvement in accidents, compared with measures designed to reduce deaths and injuries resulting from traffic accidents, have been relatively ineffective.

Traffic Accidents, Licensed Operators, Registered Vehicles, and Travel Mileages

Increases over the period 1929 to 1953 in numbers of traffic accidents, licensed operators, registered motor vehicles, and estimated annual miles of vehicle travel in Pennsylvania are shown in Chart I.[2]

In 1929, there were 43,776 traffic accidents, 2,057,085 licensed operators, and 1,788,593 registered vehicles, and vehicle travel is estimated to have been 10,660 million miles. General increases are shown from year to year, except for the years 1942 to 1946. In 1953, there were 129,791 traffic accidents, 4,316,654 licensed operators, and 3,477,331 registered vehicles, and vehicle travel is estimated to have been 31,412 million miles.

---

[1] Estimated from National Safety Council data; includes damage to vehicles and property, medical expenses, wage losses, and insurance overhead cost (but not claims paid).

[2] Data in Chart I are shown in tabular form in Table A-1 of Appendix A.

In Chart I, the line showing number of accidents is not connected between the years 1948 and 1949, since, due to a change in accident reporting requirements, data for 1948 and preceding years are not comparable with data for the years 1949 through 1953.

Reporting requirements are statutorily defined. Act No. 403, Session of 1929 (1929, May 1, P. L. 905), provided for the filing of reports of accidents resulting in injuries or death or *total property damage* to an apparent extent of *$50.00 or more*. Act No. 386, Session of 1949 (1949, May 12, P. L. 1297) provides for reporting of accidents resulting in bodily injury or death or *damage to the property of any one person in excess of $100.00.*

Property-damage accident reporting is affected not only by changes in statutory requirements but also by changes in prices. Generally, in times of rising prices, increasing proportions of accidents will exceed the statutory dollar minimums above which reporting is required, while in times of falling prices the reverse is true. (The effects of price on reporting are but infrequently taken into account in conventional compilations of accident statistics.)

Ratios of accidents to drivers, vehicles, and mileages may be computed from the individual series shown in Chart I. Ratios for 1929 were 2,128 accidents per hundred thousand licensed operators and 2,448 accidents per hundred thousand registered motor vehicles. In 1953, they were 3,007 accidents per hundred thousand licensed operators and 3,732 accidents per hundred thousand regis-

tered motor vehicles. The lowest and the highest of these ratios (excluding the years 1942 through 1946) were 1,952 accidents per hundred thousand licensed operators in 1932 and 3,083 in 1951, and 2,395 accidents per hundred thousand registered motor vehicles in 1932 and 3,895 in 1948. The mileage ratios were 411 accidents *per hundred million vehicle miles* in 1929 and 413 accidents *per hundred million vehicle miles* in 1953. The lowest and highest accident-mileage ratios (excluding the years 1942 through 1946) were 322 accidents *per hundred million vehicle miles* in 1936 and 432 in 1948.

Over the past twenty-five years, driver and vehicle *involvement* in motor vehicle accidents increased more rapidly than number of accidents, because of increasing frequencies of two-vehicle and multi-vehicle accidents. The reported number of drivers (or vehicles) per accident increased from 1.63 in 1929 to 1.83 in 1953.

The 237,448 drivers (or vehicles) involved in accidents in 1953 represented more than a threefold increase over the number recorded twenty-four years earlier—71,529 drivers (or vehicles) in 1929. Over the same twenty-five years, the number of licensed operators and the number of registered motor vehicles in Pennsylvania approximately doubled. In 1953, the chance of driver involvement in a traffic accident and the chance of motor vehicle involvement in a traffic accident were each more than one and one-half times as great as in 1929.[3]

---

[3] Data for the years 1929 through 1953 are shown in Table A-2 of Appendix A.

4

Chart I

TRAFFIC ACCIDENTS, MOTOR VEHICLE TRAVEL MILEAGES, LICENSED OPERATORS, AND REGISTERED MOTOR VEHICLES
PENNSYLVANIA: 1929-1953
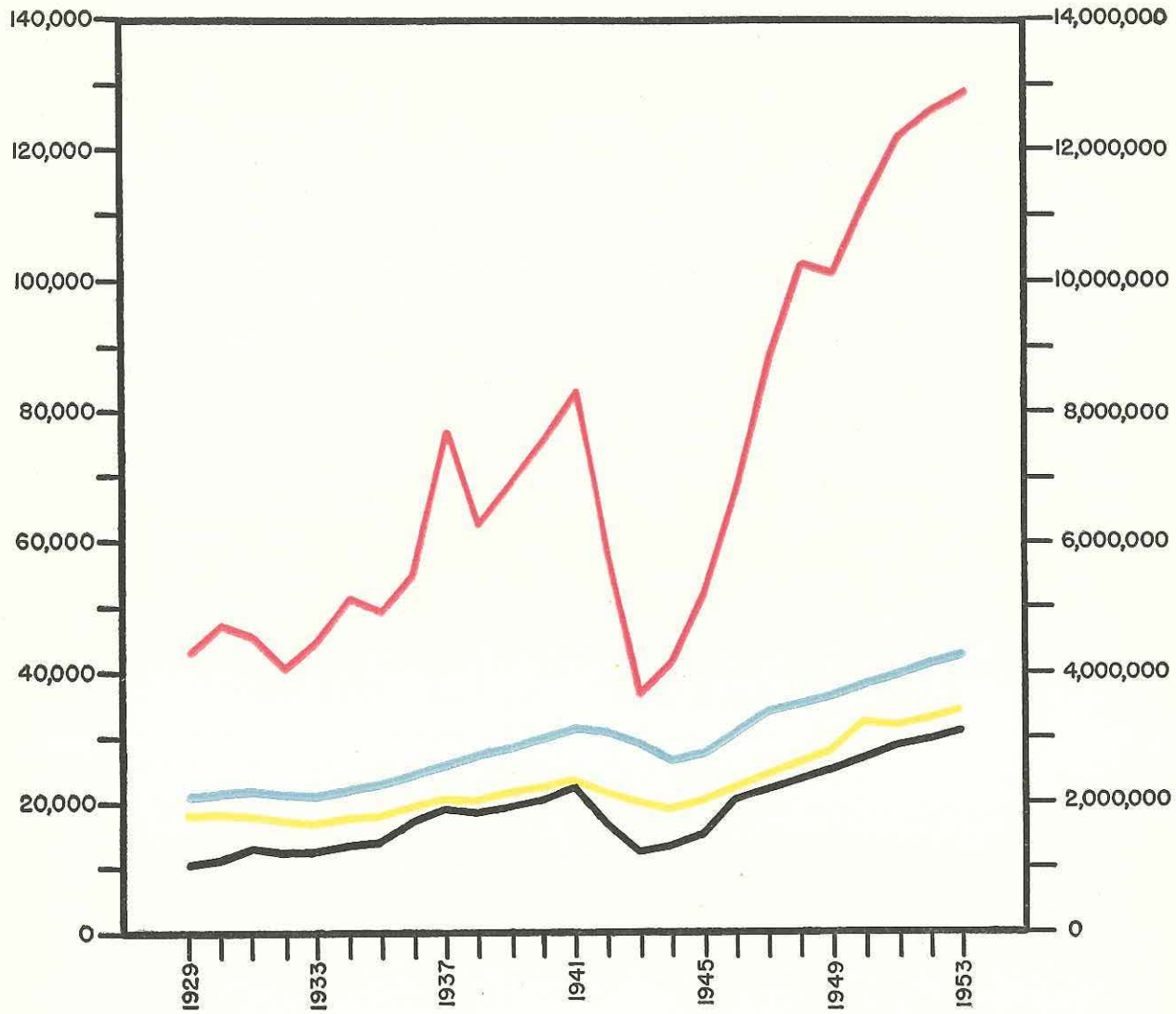
Read on left scale:

— Traffic Accidents

— Motor Vehicle Travel (millions of miles)

Read on right scale:

— Licensed Operators

— Registered Motor Vehicles

NUMBERS OF TRAFFIC ACCIDENTS, BY TYPE, AND NUMBERS OF PERSONS KILLED AND INJURED

Total numbers of traffic accidents, property-damage accidents, injury accidents and persons injured in such accidents, and fatal accidents and traffic fatalities, for the years 1932 (the first year for which separate data are available for each of the types of traffic accidents) to 1953, are shown in Chart II.[4] The greatest total number of accidents and the greatest number of property-damage accidents appear for the latest year shown, 1953, and it is virtually certain that an even greater number of property-damage accidents would have been reported for each of the years from 1949 through 1953 had it not been for the 1949 change in reporting requirements.

A total of 129,791 traffic accidents was reported in Pennsylvania in 1953; 45,916 resulted in bodily injuries to 70,531 persons, and 82,411 resulted in property damage only—in each case, the greatest annual numbers recorded (upper part of Chart II). During the year 1932, a total of 41,004 traffic accidents was recorded. Of these, 26,623 accidents resulted in injuries to 41,836 persons, and 12,603 resulted in property damage only.

Both number of fatal traffic accidents and number of fatalities (lower part of Chart II) were lower in 1953 than in 1932. In 1953, 1,464 fatal accidents resulting in death to 1,643 persons were recorded, while in 1932, 1,778 fatal accidents resulted in death to 1,926 persons.

TRAFFIC ACCIDENT RATES

Meaningful traffic accident rates are computed by dividing the number of accident observations by a measure which accurately represents the total of all situations in which accidents could possibly take place (the exposure base). Commonly, accident rates are computed by dividing numbers of traffic accidents (or numbers of persons injured or numbers of persons killed) by travel mileage of motor vehicles or by population.[5] Since it more nearly reflects exposure to accident hazards, travel mileage of motor vehicles appears to be a more adequate base than population.

Accident rates are used as indicators of change in the operation of factors which generate accidents. However, to evaluate current safety programs or select new safety measures, the components of accident observations and accident bases must be investigated. For use in facilitating selection among highway safety measures, accident rates must be computed for groups (drivers by sex and age, for example) for which definable and quantifiable characteristics associated with exposure to traffic accident hazards are known or can be ascertained.

Rates *per hundred million miles of vehicle travel* for all accidents, property-damage accidents, injury accidents, fatal accidents, and for persons injured and persons killed in traffic accidents are shown for the years 1932-1953 in Chart III.[6]

---

[4] Data in Chart II are shown in tabular form in Appendix A, Table A-3.

[5] Traffic fatality and injury rates based on population are shown for the years 1930, 1940, 1950, and 1953 in Appendix A, Table A-5.

[6] Data are available for computation of each of these rates on a *vehicle travel mileage* basis for the years 1932 to 1953, inclusive. Although all rates, other than fatality rates and fatal accident rates, are usually expressed in numbers per hundred *thousand* miles of vehicle travel, they are expressed in Chart III in numbers per hundred *million* miles of vehicle travel to facilitate comparisons among all rates. Data in Chart III are shown in tabular form in Appendix A, Table A-4.

Chart II

Numbers of Traffic Accidents, by Type, and Numbers of Persons Killed and Injured in Traffic Accidents
Pennsylvania: 1932-1953

All Accidents   Persons Injured   Injury Accidents   Property-damage Accidents

Fatalities   Fatal Accidents

Note: Breaks in all-accident and property-damage accident lines indicate that, due to statutory change in reporting requirements, data for 1949-53 are not comparable with data for earlier years.

7
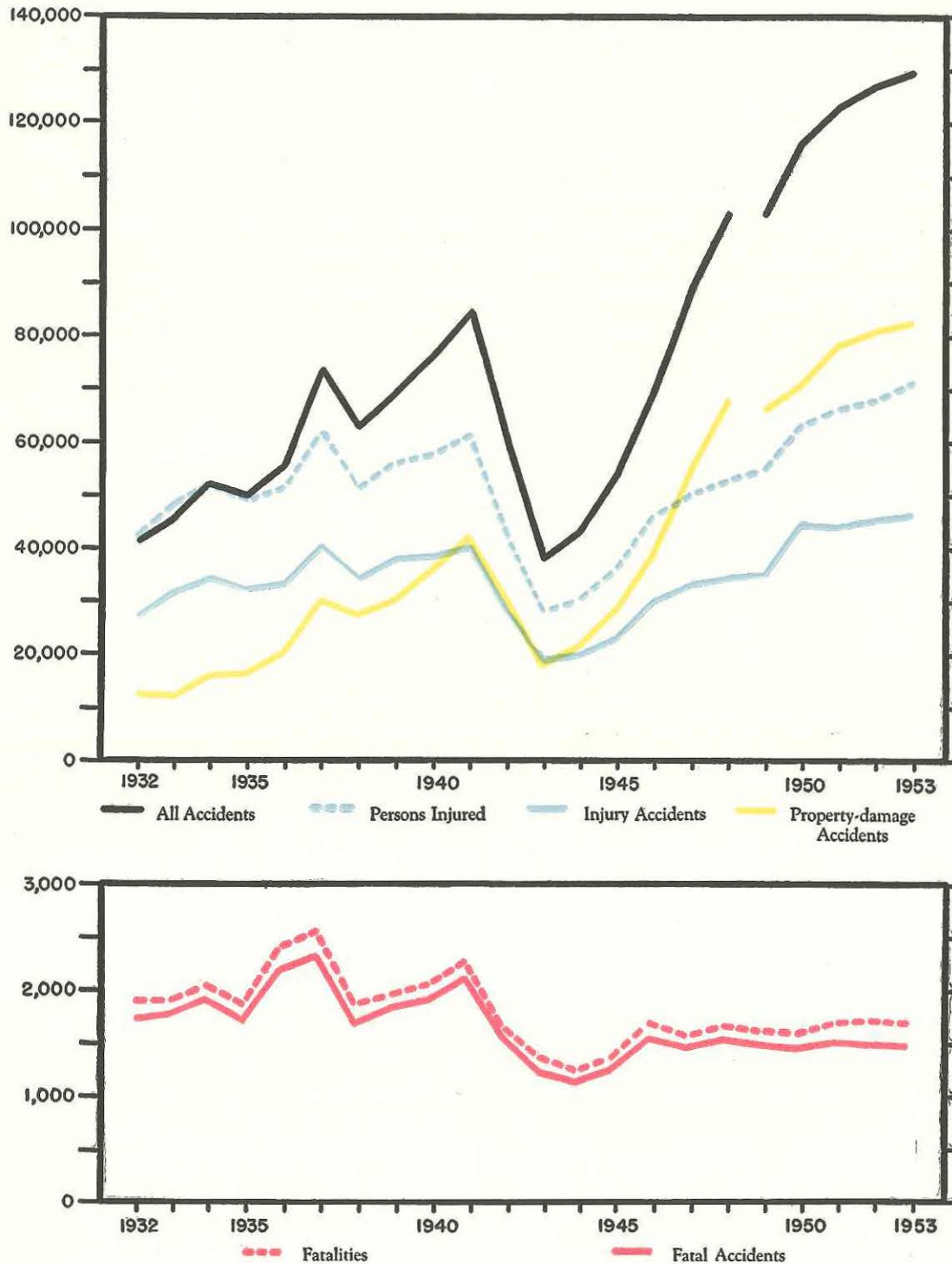
Inspection of the chart shows that in recent years each of the six rates has been relatively stable, and rates for the total of all accidents and for property-damage accidents have remained at comparatively high levels.

For the total of all types of traffic accidents in Pennsylvania, the rate in 1953 was 413 accidents per hundred million miles of vehicle travel—less than the highest rate (432 for the year 1948), but greater than the lowest nonwartime rate (322 for the year 1936). It is estimated that the comparable rate for the year 1929 (not shown on the chart) was 411 accidents per hundred million miles of motor vehicle travel, indicating that the chances of occurrence of traffic accidents (per mile traveled) were slightly less in 1929 than in 1953. Although rates shown for 1949 and succeeding years are, because of reporting changes, somewhat understated for comparison with rates shown for the years 1932 through 1948, inspection of the chart for the twenty-two year period shows that annual rates for these latter years are comparatively high.

The property-damage accident rate in Pennsylvania in 1953 was 262 accidents per hundred million miles of vehicle travel—more than two and one-half times greater than the 1932 rate of 103. The lowest rate and highest rate over these twenty-two years were 99 and 284 accidents per hundred million miles of motor vehicle travel, for 1933 and 1948, respectively.

The 1953 *injury accident rate* in Pennsylvania was 146 accidents per hundred million miles of motor vehicle travel, approximately two-thirds as great as the rate, 218, for the year 1932. For the years shown on Chart III, the highest rate, 252, appears for the year 1933, and the lowest rate, 135 injury accidents per hundred million miles of vehicle travel, for the year 1949. Rates showing *persons injured* generally parallel those showing in-jury accidents. The highest of these rates is shown for the year 1933, the lowest for the year 1949, and the 1953 rate of 225 persons injured per hundred million miles of vehicle travel was about two-thirds of the 1932 rate of 343.

Taking into account all deaths attributable to 1953 motor vehicle accidents (whether death occurred during or subsequent to 1953), the motor vehicle accident *fatality rate* in Pennsylvania was 5.2 deaths per hundred million miles of vehicle travel—the lowest annual Pennsylvania traffic accident fatality rate.[7]

The 1953 *fatal accident rate* in Pennsylvania was 4.7 fatal accidents per hundred million miles of vehicle travel—also the lowest annual rate during the twenty-two year time period. The highest *fatality rate,* 15.8 deaths per hundred million miles of vehicle travel, is shown in Chart III for the year 1932, while the highest *fatal accident rate,* 14.6, is shown for the years 1932 and 1933. Data for fatal traffic accidents and traffic fatalities for the year 1929 (not shown in Chart III) indicate higher rates than those noted above. It is estimated that in 1929 the *fatality rate* and the *fatal accident rate* in Pennsylvania were 18.7 fatalities and 17.7 fatal accidents per hundred million miles of vehicle travel. Comparison of these data with the 1953 rates of 5.2 and 4.6, respectively, shows that the likelihood of occurrence of a fatal traffic accident or a traffic fatality was slightly more than one quarter as great in 1953 as in 1929.

Increases in rates for all traffic accidents and property-damage accidents, in conjunction with decreases in rates for traffic deaths and injuries, suggest that the relative importance of factors responsible for motor vehicle accidents has changed over the years.

---

[7] Motor vehicle accident fatality rates in the United States by states, for the years 1951, 1952, and 1953, are shown in Appendix A, Table A-6.

Chart III

TRAFFIC ACCIDENT RATES, BY TYPE, AND TRAFFIC INJURY AND FATALITY RATES
PENNSYLVANIA: 1932-1953

[All rates per *hundred million* miles of vehicle travel]
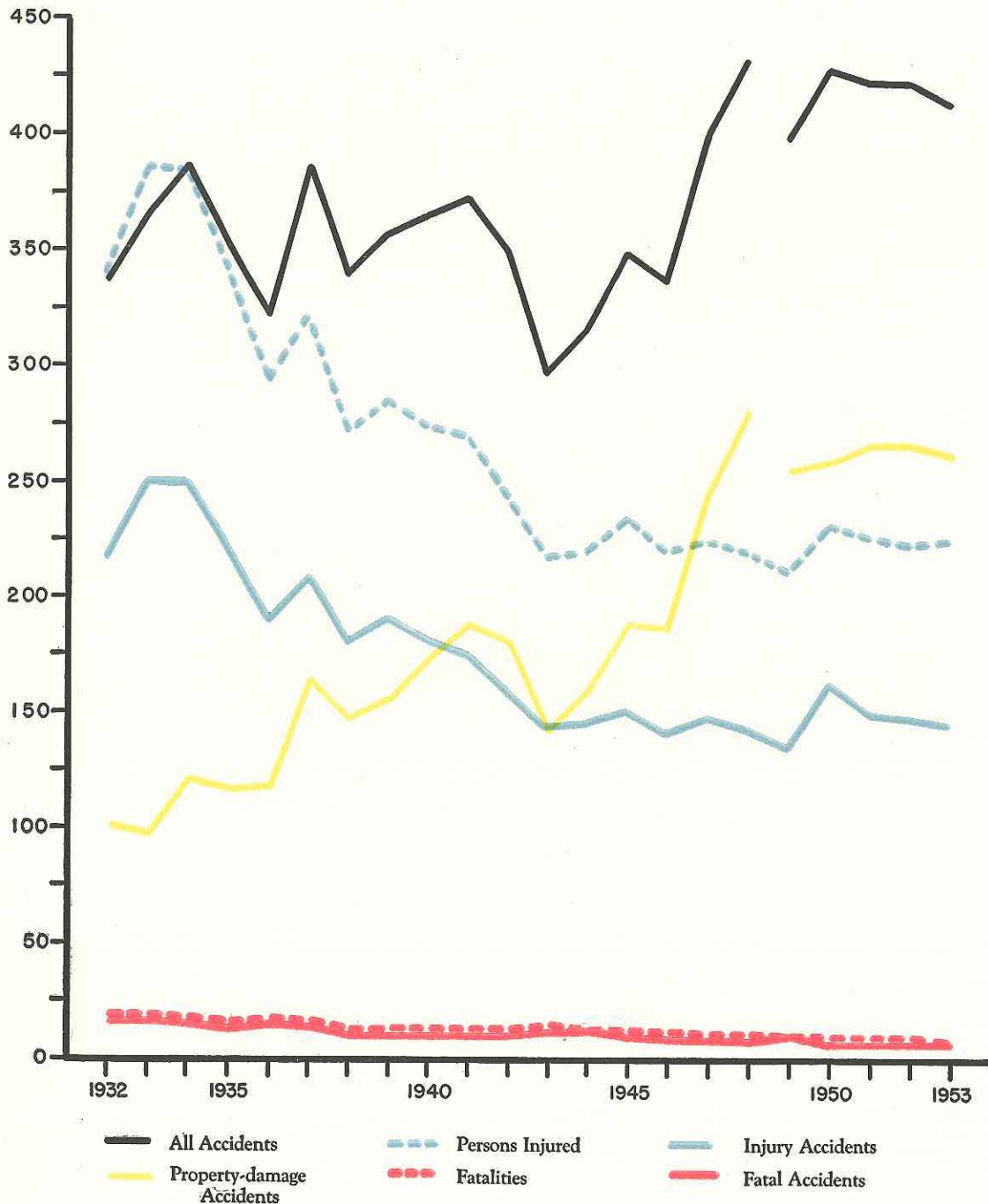
Legend:
- **All Accidents** (black solid)
- **Persons Injured** (blue dashed)
- **Injury Accidents** (blue solid)
- **Property-damage Accidents** (yellow)
- **Fatalities** (red dashed)
- **Fatal Accidents** (red solid)

NOTE: Breaks in all-accident and property-damage accident lines indicate that, due to statutory change in reporting requirements, data for 1949-53 are not comparable with data for earlier years.

9

Part II

CURRENT ACCIDENT-PREVENTION PRACTICE AND FACTORS RESPONSIBLE FOR TRAFFIC ACCIDENTS

Traffic accidents are caused by driver, vehicle, and road factors, singly or in combination. Driver factors are critical in the vast majority of highway accidents.

In hazardous situations, accidents may be averted if drivers are able, within available time, to recognize potential dangers and to select and effect safe courses of action. Even drivers who ordinarily react adequately may operate a vehicle dangerously when under stress.

Recognizing dangerous situations and selecting safe courses of action depend upon aptitudes for, and experience or training in, vehicle operation. For example, a driver proceeding upon an icy highway may precipitate an accident because of lack of aptitude—poor visual acuity, comparatively long reaction time, or insufficient mental alertness to interpret actions of other drivers and road and weather conditions. Similarly, the driver may precipitate an accident because of lack of relevant experience or training—a sudden skid may confront him with a situation which he has never before experienced or which he has never been trained to meet successfully.

Some accidents are ordinarily unavoidable—loss of a wheel while a car is in motion (vehicle factor) or passage on to a soft spot of a rain-soaked, but otherwise firm, highway shoulder (road factor) may generate situations so hazardous that accidents cannot be prevented. Further, *involvement* in certain types of collision accidents resulting from the action of other motor vehicle operators may also be unavoidable.

Traffic safety programs dealing with road, vehicle, and driver factors may affect the number or the severity of highway accidents, or both. For example, improving the alignment of highways may tend to reduce the number of accidents occurring thereon; the use of safety glass in automobiles may decrease the severity of injuries; and the proper training of drivers to meet potentially dangerous situations may tend to reduce both the number and severity of accidents.

Current Commonwealth accident-prevention practice includes measures which deal with each of the three accident factors—driver, vehicle, and road. Among such measures are the following:

The Road.—In its accident-prevention program the Pennsylvania Department of Highways utilizes safety warning devices and highway markers on both new and existing highways. Field forces in each of the highway districts, in conjunction with central office forces, provide for regular attention to traffic-control improvements to enhance traffic safety.

New highways are engineered for safe traffic flows through improved gradients, alignments, lane separators, and lane and berm designs, taking into account contemporary characteristics of vehicle design and operation. Integrated with the foregoing programs for the provision of safe highways within the Commonwealth are other programs applicable to special situations, such as the program for elimination of railway grade crossings.

Current administrative practice in Pennsylvania does not provide for regular reporting by the Bureau of Highway Safety of the Department of Revenue to the Department of Highways of road defect statements contained in operators' accident reports.

The Vehicle.—The periodic examination of all vehicles registered within the Commonwealth is required under the provisions of Act No. 263, Session of 1931 (1931, June 22, P. L. 751), as amended. This inspection program tends to keep from the roads of the Commonwealth potentially dangerous vehicles. Further, Pennsylvania statutes deal with many automotive safety devices— for example, safety glass is the subject of Act No. 264, Session of 1933 (1933, May 31, P. L. 1088), and four-wheel brakes are the subject of Act No. 355, Session of 1935 (1935, July 16, P. L. 1056). Pennsylvania law requires that minimum standards for certain automotive equipment be established by the Department of Revenue and that, for use in the Commonwealth, such items of equipment be approved as safe by the department.

Engineering improvements in automobiles and commercial vehicles tend to reduce numbers and severity of highway accidents. Among these improvements are all-steel roofs, lowered centers of gravity, and hydraulic and air brakes.

The Driver.—An applicant for a Pennsylvania driver's license must have his vision tested, undergo a driving examination, and give evidence that he is familiar with the rules of the road before he may be granted the privilege of operating a motor vehicle in the Commonwealth. Although semiannual inspections of vehicles are required in Pennsylvania, periodic examinations of motor vehicle operators are *not* required. Further, operators of varying driving skills are not accorded differential privileges. The driver whose abilities are such that it would be dangerous for him to exceed 30 miles per hour may be permitted to drive as rapidly as the driver of greater ability.

Operators' permits may be revoked or suspended for cause by the Secretary of Revenue. And, at the discretion of the secretary, operators may be subject to re-examination.

In certain of the public schools within the Commonwealth, driver training courses are offered.[1] In 1953, this program, together with the re-examination program, affected but 0.8 percent of the 4,316,654 licensed Pennsylvania operators. In addition to these specific accident-prevention activities, general highway safety publicity programs are conducted by the Commonwealth.

Suspensions and revocations of operators' permits, primarily a law-enforcement activity rather than a highway safety program, have not pre-vented increases in numbers of motor vehicle accidents. Numbers of motor vehicle accidents and suspensions and revocations of operators' permits for the years 1950 to 1953, inclusive, were as follows:

Year	Number of Motor Vehicle Accidents	Number of Suspensions and Revocations of Operators' Permits
(1)	(2)	(3)
1950	116,139	32,950
1951	123,088	43,268
1952	126,820	51,652
1953	129,791	57,136

FREQUENCIES OF ROAD, VEHICLE, AND DRIVER FACTORS IN HIGHWAY ACCIDENTS

The relative importance of road factors in highway accidents is, in some measure, indicated by numbers of road defects at places of accidents. It should be noted that the existence of a road defect at the place of an accident does not necessarily mean that the road defect was the sole cause of, or a significant contributing factor in, the accident. Road defect data are available for the years 1950 through 1953 only. The reported numbers of road defects at places of accidents as percents of total numbers of accidents during these years were as follows:

1950	7.2 percent
1951	6.6 percent
1952	7.3 percent
1953	7.4 percent

Although many driver failures at times of accidents are not violations of Pennsylvania law, reported numbers of driver violations of the provi-

---

[1] See Appendix B, "Driver Training in Pennsylvania Public Schools."

sions of the Vehicle Code at times of accidents may be used as an approximate measure in estimating driver factors in traffic accidents. Similarly, a rough measure of the importance of vehicle factors is the reported number of identifiable vehicle defects at times of accidents.

The effectiveness of accident-prevention programs directed to drivers compared with the effectiveness of programs dealing with vehicles is indicated in Chart IV.[2] Reported vehicle defects as percents of total numbers of accidents declined from 22.63 percent to 3.92 percent over the years 1932 to 1953. For the comparable time period, reported driver violations as percents of total numbers of accidents increased from 58.18 percent in 1932 to 92.50 percent in 1953.

---

[2] Data in Chart IV are shown in tabular form in Appendix A, Table A-7.

Chart IV

Driver Violations of the Vehicle Code at Times of Accidents and Identifiable Vehicle Defects at Times of Accidents, as Percents of Total Numbers of Traffic Accidents
Pennsylvania: 1932-1953

Driver Violations of the Vehicle Code at Times of Accidents as Percent of Total Number of Traffic Accidents

Identifiable Vehicle Defects at Times of Accidents as Percent of Total Number of Traffic Accidents

15
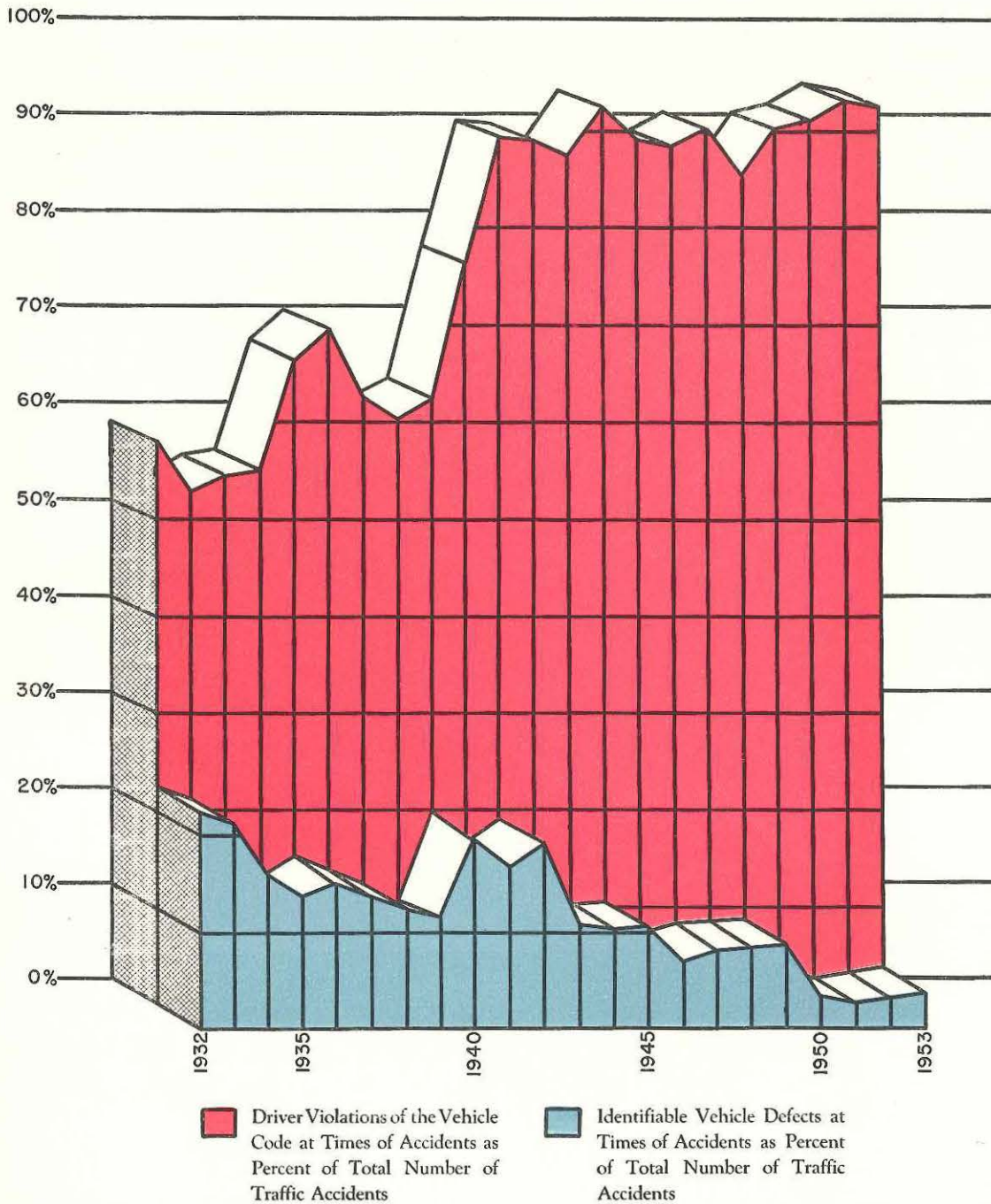
Part III

EFFECTIVE TRAFFIC SAFETY PROGRAMS

Effective approaches to problems of accident reduction require controlled observations of accidents and analyses of the operation of driver, vehicle, and road factors in all significant traffic situations. Only in the light of information developed from such observations and analyses can valid comparisons of the efficiency of alternate highway safety programs be made.

Adequate observation and analysis procedures are more frequently employed with respect to vehicle and road factors than with respect to driver factors, although, in the vast majority of traffic accidents, driver factors are critical.

Examples of effective approaches relating to roads and vehicles are provided by highway design standards and by motor vehicle inspection systems. The geometric design standards for Pennsylvania highways (including maximum gradients and curvatures and required widths and numbers of traffic lanes) reflect size and power characteristics of vehicles and driving habits of operators and are calculated to provide for the safe and unimpeded flow of traffic. Pennsylvania's motor vehicle inspection system is designed to prevent acci-

dents caused by faulty vehicle equipment. Before 1932, inspections were limited to light and brake equipment of vehicles and were not made at regular intervals. Observations of the frequency of faulty vehicle equipment in traffic accidents led, in 1932, to the regular inspection of all significant safety equipment of all Pennsylvania vehicles. In this connection, it may be observed that 9,281 vehicle defects at times of accidents were reported in 1932, and 5,092 in 1953. During these same two years, the numbers of traffic accidents were 41,004 and 129,791, respectively.

A similar observation and analysis approach to driver factor problems, although used in safety studies of commercial transportation companies,[1] is not currently used by the Commonwealth.

Driver factors are the physical and mental traits associated with aptitudes for, and skill in, vehicle operation. Deficiencies in aptitudes or skills frequently lead to traffic accidents.

---

[1] For example, see Moffie, Alexander, and Parker, *The Influence of Personal and Psychological Characteristics on the Accident Experiences of Tractor-Trailer Drivers* (Raleigh, N. C.: North Carolina State College School of Education, 1952).

Precision in accident observations is necessary for effective approaches to accident-reduction problems. Accurate information on a sample basis could be provided by trained personnel through prompt and uniform accident investigations and uniform driver testing. Current accident report information is frequently inaccurate.[2]

Information gathered by Commonwealth highway safety agencies relates to accident-producing factors in the case of vehicles (defective brakes, tires, steering mechanism, and lights, among others) and roads (defective shoulders, holes and ruts or bumps, and loose material on roadway surface, among others), but do not relate to accident-producing factors in the case of drivers. Among factors which appear to determine driver aptitudes and skills in vehicle operation are:

1. Eyesight
   a. Visual acuity (ability to see fine detail)
   b. Phoria (vertical and horizontal coordination of the eyes)
   c. Depth perception
   d. Color perception
2. Hearing
3. Complex reaction time
4. Glare recovery
5. Intelligence
6. Emotional stability, self-sufficiency, and dominance
7. Mechanical comprehension

Regular accident investigations and reports by Commonwealth highway safety agencies are inade-

---

[2] Comparison of a sample of 100 operators' reports of non-fatal accidents with investigation reports of the Pennsylvania State Police (who investigate approximately 20 percent of all accidents occurring in the state) showed that all 100 operators' reports were to some extent inconsistent with police reports and that in 94 the inconsistencies related to the manner in which accident occurred, resulting injuries, or operator's experience. Of these 94 reports, 44 contained less than 5 such inconsistencies, 43 contained 5 but less than 10, and 7 contained 10 or more.

quate with respect to these factors, among others. For example, not included on the accident report form or generally determined by test are data relating to vision, hearing, reaction time, and amount of driver training or driver experience in terms of familiarity with vehicle, road, and traffic conditions similar to those in accident situations.

Among information currently collected by Commonwealth highway safety agencies for drivers involved in accidents are sex, age, occupation, years of driving experience, violations of Motor Vehicle Code at time of accident, and "condition."

Data on years of driving experience, reported by operators involved in accidents, are currently tabulated by Commonwealth highway safety agencies to provide several classifications for experience of less than one year, but only one classification for experience of one year or more. The vast majority of drivers involved in accidents fall in the latter category. Among so-called experience classifications is "out-of-state driver," which relates to residence rather than experience.

Categories provided for reporting "condition" of driver are: "had been drinking," "sick," "very tired," "apparently asleep," "body defects," "inattentive," "no apparent defect," "not stated," and "blinded by headlights." Although these items reflect physical and mental aptitudes for vehicle operation and experience and training in vehicle operation, none represents a single measurable element.

Cataloguing driver violations of provisions of the Vehicle Code, although of value for enforcement purposes, does not provide a precise basis for inferences on accident causes. Not separately listed as one of twenty-one violation categories provided on accident report forms is violation of the stopped school bus law. (Act No. 559, Session of 1949 [1949, May 26, P. L. 1884] provides that, outside of business or residential districts, drivers approaching a stopped school bus shall

stop their vehicles and keep them stationary until the bus resumes motion or until the bus driver signals other operators to proceed.)

With respect to drivers' occupations, classifications used in certain cases are so broad that valid inferences cannot be drawn from accident data. For example, one occupational category includes both laborers and truck drivers. It is almost certain that accident involvement of these two groups is different.

DEVELOPMENT OF EFFECTIVE ACCIDENT-REDUCTION PROGRAMS AND EVALUATION OF ALTERNATE HIGHWAY SAFETY MEASURES

Effective accident-reduction programs must be based on information relating to drivers involved in accidents and drivers as a whole. Specifically, controlled observations of accident situations taken in conjunction with data showing general levels of aptitudes and skills of drivers as a whole are the bases for inferences concerning aptitude and skill deficiencies which generate significant numbers of traffic accidents.

For valid comparisons of accident involvement for groups of drivers having different attributes (levels of aptitudes and skills or physical characteristics associated with them), accident rates must be computed in a manner which takes into account differences in numbers of drivers or accident exposure (for example, miles driven). For these rate computations, reliable estimates of the bases (numbers of operators or miles driven) are needed.

Current data are inadequate with respect to both levels of aptitudes and skills and valid estimates of bases necessary for rate computation.[3] Among information currently compiled are tabulations showing numbers of drivers involved in accidents, by age and sex groups. Although it is reasonable to expect that there are differences in chance of

accident involvement among different sex and age groups of Pennsylvania drivers, lack of reliable data relating to numbers of drivers and miles driven (exposure) makes computation of meaningful rates impossible. *Currently available Commonwealth data are not adequate to establish valid ratios of accident chance for any age or sex groups.* For example, the chance of involvement in a fatal accident for *all* drivers is computed as follows (1953 data):

$$\text{Chance of involvement in a fatal accident for all drivers} = \frac{\text{Number of drivers involved in fatal accidents}}{\text{Total number of licensed operators}}$$

$$= \frac{2,039}{4,316,654}$$

$$= .000472 \text{ or } 47 \text{ per hundred thousand licensed operators}$$

The chance of involvement in a fatal accident for drivers under age 25 would be computed similarly:

$$\text{Chance of involvement in fatal accident for drivers under 25} = \frac{\text{Number of drivers under 25 involved in fatal accidents}}{\text{Total number of licensed operators under 25}}$$

Chart V shows that valid computations of chance of fatal accident involvement for drivers aged 25 and over and drivers under age 25 cannot be made because reliable estimates of total numbers of operators in these groups are not available. Consequently, differences between

[3] In 1953, the Bureau of Highway Safety, Pennsylvania Department of Revenue, conducted an exploratory study with a view to developing bases for rate computations. However, since information for more than half (52.2 percent) of the drivers included in the study sample was not obtained, the degree to which the characteristics of the respondent group represent the characteristics of Pennsylvania motor vehicle operators as a whole—of critical importance for valid estimates of rates bases—cannot be accurately specified.

Chart V

Basic Data for Computing Chances of Involvement in Fatal Accidents for Drivers in Specified Age Groups
Pennsylvania: 1932-1953

NUMBERS OF DRIVERS INVOLVED IN FATAL ACCIDENTS

Aged 25 and Over   Under Age 25

NUMBERS OF LICENSED OPERATORS

Aged 25 and Over

Under Age 25
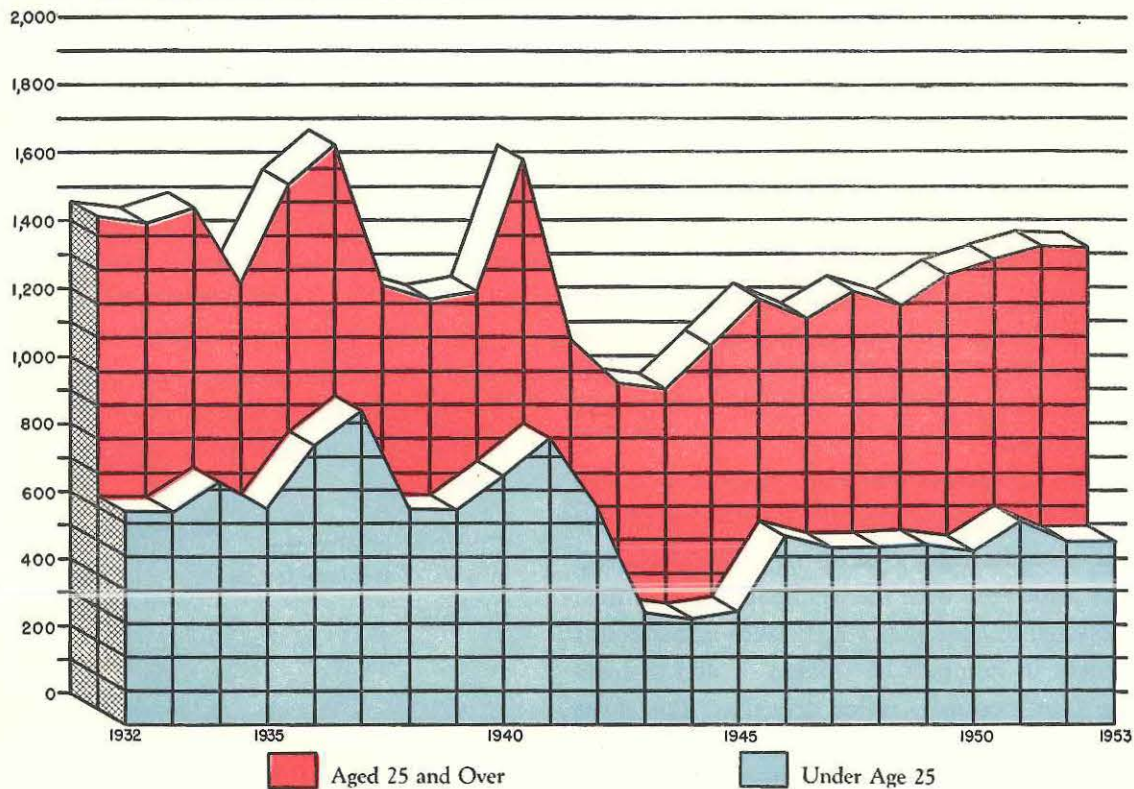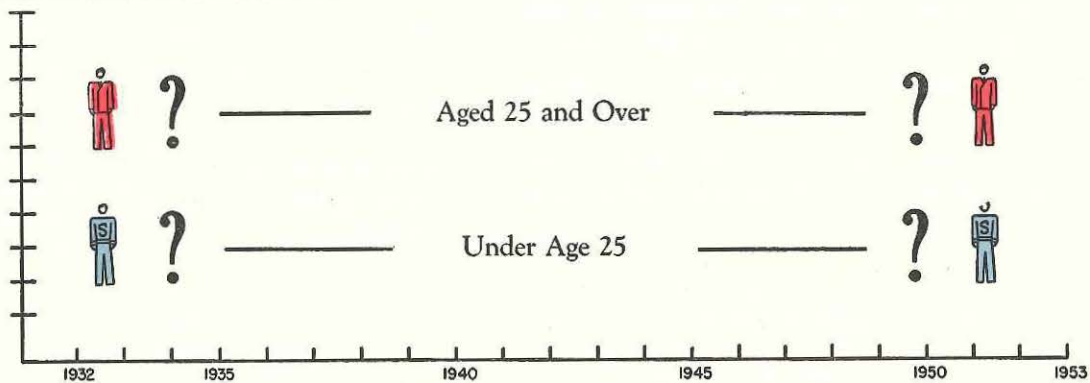
Chart VI

BASIC DATA FOR COMPUTING CHANCES OF INVOLVEMENT IN FATAL ACCIDENTS FOR MEN AND WOMEN DRIVERS
PENNSYLVANIA: 1932-1953

NUMBERS OF DRIVERS INVOLVED IN FATAL ACCIDENTS

| Men | Women |

NUMBERS OF LICENSED OPERATORS

Men
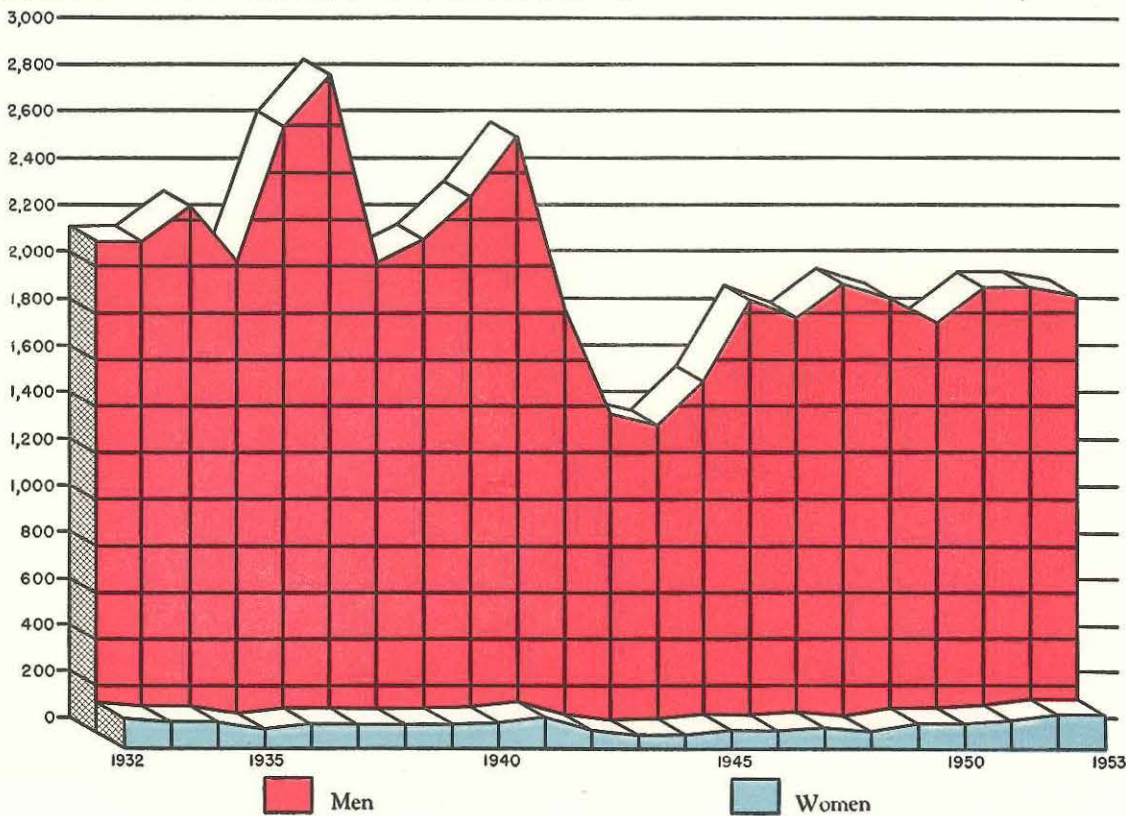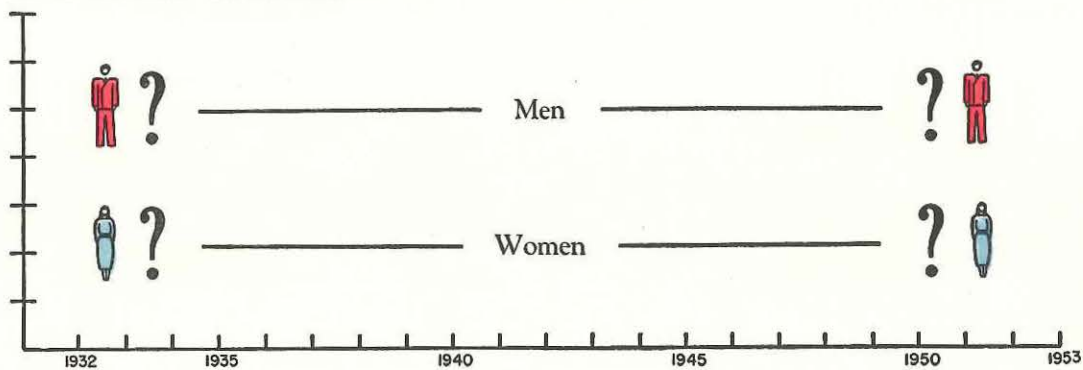
Women

groups and probable changes in chance of involvement cannot be analyzed for the time period shown. Chart VI shows that this is also true with respect to men and women drivers.[4]

Accident involvement rates on a mileage basis are computed by dividing numbers of drivers involved in accidents (as counted by Commonwealth highway safety agencies) by total vehicle travel mileage estimates for Pennsylvania as provided by the United States Bureau of Public Roads and the National Safety Council. The example below illustrates this computation for all highway accidents for the year 1953.

$$\text{Traffic accident involvement rate for all drivers} = \frac{\text{Total number of drivers involved in accidents}}{\text{Estimated total travel mileage in Pennsylvania}}$$

$$= \frac{237,448}{31,412 \text{ million}}$$

$= 756$ drivers involved in accidents per hundred million miles of vehicle travel

Comparable computations cannot be made for sex and age groups and numerous other relevant groups because, although numbers of persons involved in accidents in different groups are tabulated, reliable mileage estimates for these groups are not available.

Chart VII illustrates this with reference to drivers aged 25 and over and drivers under age 25, and Chart VIII, with reference to men and women drivers.[5] Although for each of these age and sex groups numbers of drivers involved in traffic accidents are known, reliable estimates of miles driven by all operators in the groups are lacking.

Meaningful rates for operators grouped according to relevant accident-producing characteristics (aptitudes and skills or associated traits) are needed to identify those driver factors which generate significant numbers of traffic accidents and to analyze interrelations between driver factors and vehicle and road factors. Changes in the incidence of accident-generating factors (as shown by such rates) would provide both criteria of efficiency of current examination and training programs and bases for selection among alternate highway safety measures.

Effective and efficient programs dealing with driver factors—critical in the vast majority of traffic accidents—are essential if the accident toll on Pennsylvania highways is to be materially reduced.

---

[4] Data in Charts V and VI are shown in tabular form in Appendix A, Tables A-8 and A-9.

[5] Data in Charts VII and VIII are shown in tabular form in Appendix A, Tables A-8 and A-9.

Chart VII

Basic Data for Computing Traffic Accident Involvement Rates for Drivers in Specified Age Groups
Pennsylvania: 1932-1953

Numbers of Drivers Involved in Traffic Accidents

Aged 25 and Over   Under Age 25

Total Miles Driven

Operators Aged 25 and Over

Operators Under Age 25
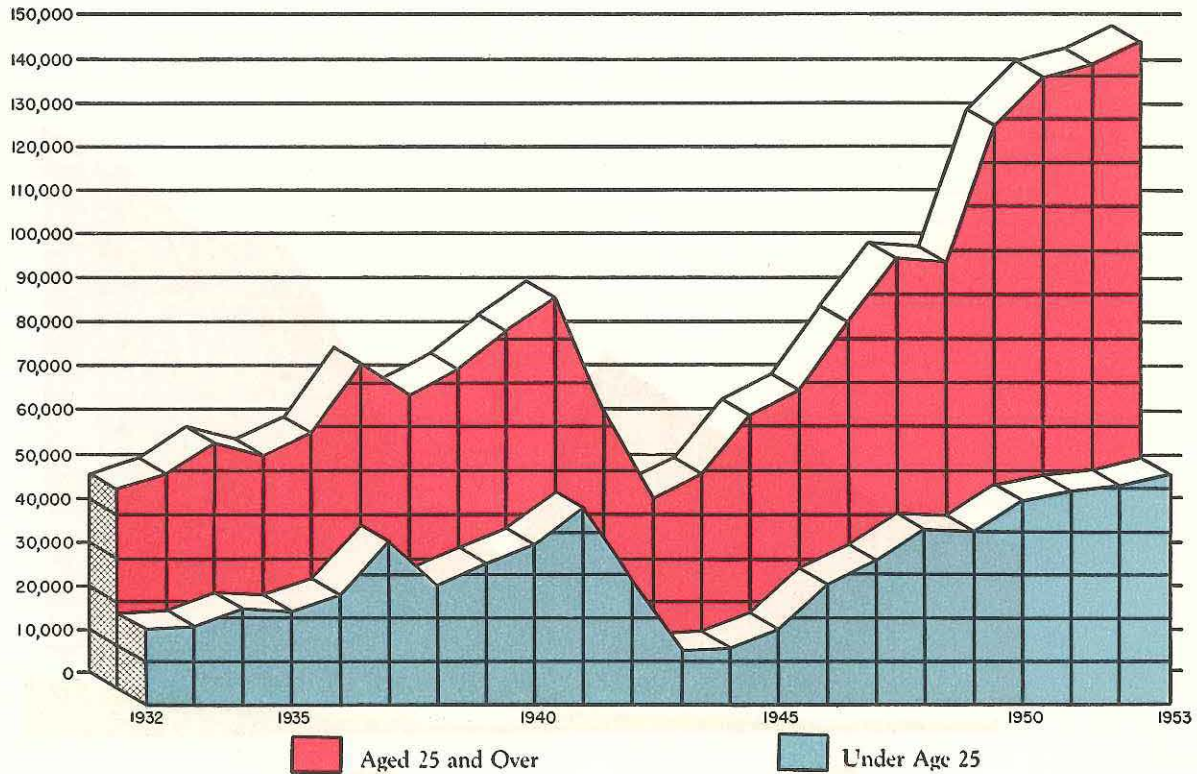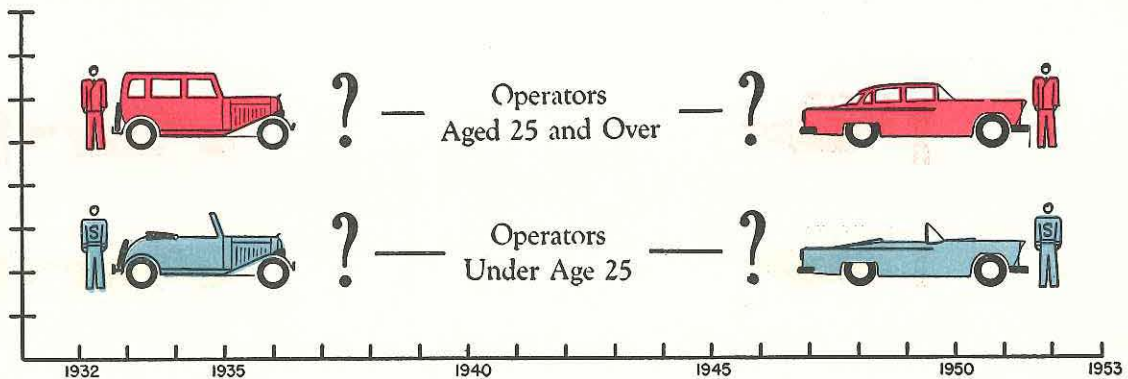
Chart VIII

BASIC DATA FOR COMPUTING TRAFFIC ACCIDENT INVOLVEMENT RATES FOR MEN AND WOMEN DRIVERS
PENNSYLVANIA: 1932-1953

NUMBERS OF DRIVERS INVOLVED IN TRAFFIC ACCIDENTS

Men   Women

TOTAL MILES DRIVEN

? — Men — ?
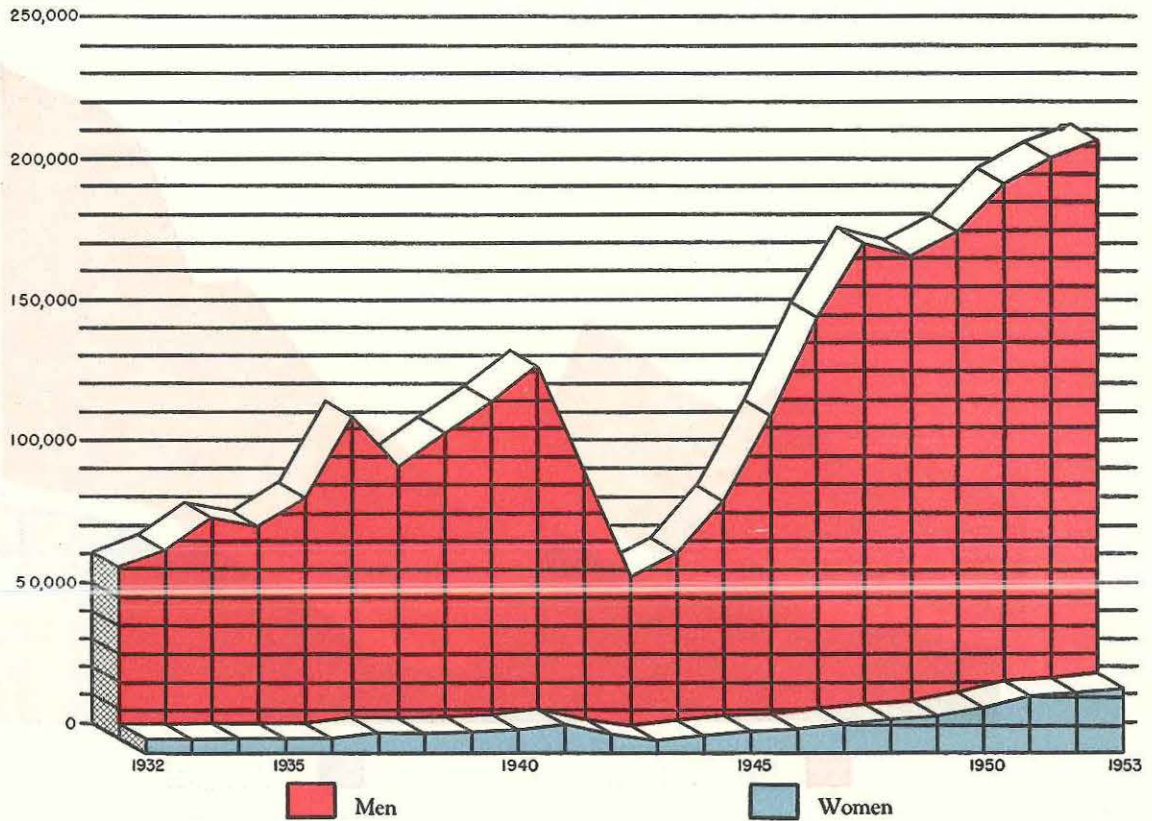
? — Women — ?
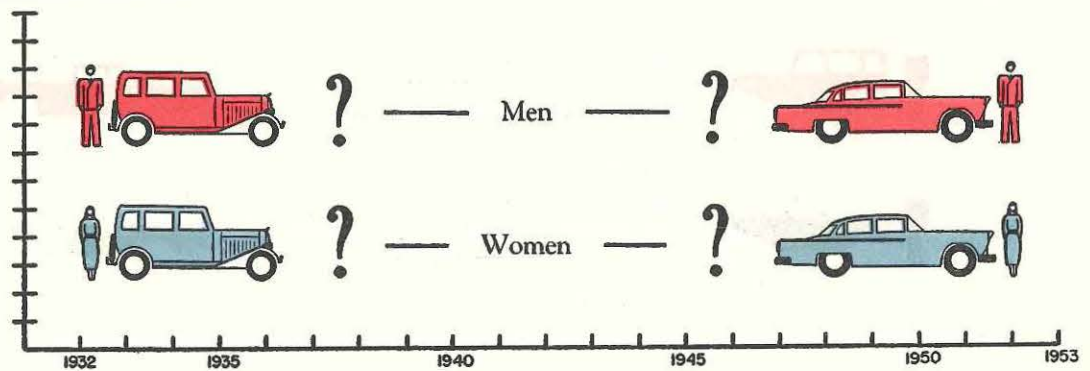
Appendix A

SOURCE TABLES

Table A-1

NUMBERS OF TRAFFIC ACCIDENTS, LICENSED OPERATORS, AND REGISTERED MOTOR VEHICLES, AND ESTIMATED TOTAL ANNUAL MILES OF MOTOR VEHICLE TRAVEL— PENNSYLVANIA: 1929 THROUGH 1953

| Year	Traffic Accidents	Licensed Operators	Registered Motor Vehicles	Estimated Total Annual Motor Vehicle Travel (Millions of Miles)
(1)	(2)	(3)	(4)	(5)
1929	43,776	2,057,085	1,788,593	10,660.0
1930	47,917	2,112,337	1,802,602	11,230.0
1931	46,588	2,165,247	1,787,265	13,080.0
1932	41,004	2,100,627	1,712,144	12,210.0
1933	45,374	2,088,865	1,677,157	12,390.0
1934	52,157	2,185,286	1,747,266	13,460.0
1935	49,930	2,259,862	1,799,499	14,160.0
1936	55,727	2,421,023	1,930,030	17,323.0
1937	73,466	2,582,715	2,057,515	19,016.0
1938	63,000	2,714,457	2,036,731	18,632.0
1939	69,818	2,827,800	2,165,084	19,572.8
1940	75,852	2,949,877	2,230,194	20,843.4
1941	83,413	3,117,669	2,348,788	22,414.0
1942	59,218	3,070,637	2,197,784	16,910.7
1943	37,340	2,909,953	2,016,564	12,584.9
1944	42,616	2,638,998	1,939,317	13,581.0
1945	53,231	2,754,983	2,059,244	15,230.9
1946	69,968	3,090,128	2,269,730	20,817.7
1947	89,067	3,404,483	2,470,199	22,240.4
1948	103,478	3,517,643	2,656,775	23,964.3
1949	102,081	3,670,911	2,840,133	25,686.9
1950	113,748	3,820,032	3,281,903	27,173.5
1951	123,088	3,992,083	3,241,822	29,077.0
1952	126,820	4,168,875	3,330,554	30,050.5
1953	129,791	4,316,654	3,477,331	31,412.2

SOURCE: Column 2, annual Statistical Summary of Motor Vehicle Traffic Accidents (files of the Pennsylvania Department of Revenue, Bureau of Highway Safety, Harrisburg), 1929-1953; columns 3 and 4, "Monthly Reports" (in mimeographed form from the Pennsylvania Department of Revenue, Bureau of Motor Vehicles, Harrisburg); column 5, correspondence from the National Safety Council, Chicago, Illinois.

Table A-2

NUMBER OF DRIVERS INVOLVED IN TRAFFIC
ACCIDENTS PER HUNDRED THOUSAND
LICENSED OPERATORS AND NUMBER OF
MOTOR VEHICLES INVOLVED IN ACCIDENTS
PER HUNDRED THOUSAND REGISTERED
VEHICLES—PENNSYLVANIA:
1929 THROUGH 1953

Year	Number of Drivers Involved in Accidents per 100,000 Licensed Operators	Number of Motor Vehicles Involved in Accidents per 100,000 Registered Vehicles
(1)	(2)	(3)
1929	3,477	3,999
1930	3,744	4,387
1931	3,556	4,308
1932	3,139	3,852
1933	3,430	4,271
1934	3,831	4,792
1935	3,562	4,473
1936	3,761	4,718
1937	4,725	5,932
1938	3,839	5,116
1939	4,111	5,369
1940	4,344	5,745
1941	4,581	6,081
1942	3,285	4,589
1943	2,131	3,076
1944	2,727	3,711
1945	3,355	4,488
1946	3,980	5,418
1947	4,689	6,462
1948	5,341	7,071
1949	5,033	6,505
1950	5,385	6,268
1951	5,624	6,926
1952	5,562	6,962
1953	5,501	6,828

SOURCE: Computed from annual Statistical Summary of
Motor Vehicle Traffic Accidents (files of the Pennsylvania De-
partment of Revenue, Bureau of Highway Safety, Harrisburg),
1929-1953, and "Monthly Reports" (in mimeographed form
from the Pennsylvania Department of Revenue, Bureau of
Motor Vehicles, Harrisburg).

Table A-3

NUMBERS OF TRAFFIC ACCIDENTS, BY TYPE, TRAFFIC FATALITIES, AND PERSONS INJURED IN
TRAFFIC ACCIDENTS—PENNSYLVANIA: 1932 THROUGH 1953

Year	All Traffic Accidents	Fatal Accidents	Injury Accidents	Property-damage Accidents	Fatalities	Persons Injured
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1932	41,004	1,778	26,623	12,603	1,926	41,836
1933	45,374	1,807	31,282	12,285	1,926	47,908
1934	52,157	1,941	33,819	16,397	2,075	51,847
1935	49,930	1,747	31,499	16,684	1,887	48,398
1936	55,727	2,229	32,845	20,653	2,411	50,854
1937	73,466	2,372	39,800	31,294	2,564	61,445
1938	63,000	1,742	33,754	27,504	1,896	50,598
1939	69,818	1,830	37,471	30,517	1,971	55,821
1940	75,852	1,917	37,874	36,061	2,074	57,137
1941	83,413	2,120	39,227	42,066	2,298	60,499
1942	59,218	1,549	27,126	30,543	1,683	41,122
1943	37,340	1,211	18,128	18,001	1,374	27,312
1944	42,616	1,160	19,667	21,789	1,244	29,928
1945	53,231	1,264	22,994	28,973	1,380	35,686
1946	69,968	1,538	29,348	39,082	1,700	45,883
1947	89,067	1,440	32,839	54,788	1,552	49,938
1948	103,478	1,524	33,912	68,042	1,671	52,709
1949	102,081	1,488	34,776	65,817	1,607	54,290
1950	116,139	1,442	44,003	70,694	1,593	62,727
1951	123,088	1,494	43,672	77,922	1,642	65,643
1952	126,820	1,470	44,745	80,605	1,671	67,134
1953	129,791	1,464	45,916	82,411	1,643	70,531

SOURCE: Annual Statistical Summary of Motor Vehicle Traffic Accidents (files of the Pennsylvania Department of Revenue, Bureau of Highway Safety, Harrisburg), 1932-1953.

Table A-4

TRAFFIC ACCIDENT RATES, BY TYPE OF ACCIDENT, AND TRAFFIC FATALITY AND INJURY RATES
PENNSYLVANIA: 1932 THROUGH 1953

Year	Rates—Numbers per Hundred Million Miles of Motor Vehicle Travel					
	All Traffic Accidents	Fatal Accidents	Injury Accidents	Property-damage Accidents	Fatalities	Persons Injured
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1932	336	14.6	218	103	15.8	343
1933	366	14.6	252	99	15.5	387
1934	387	14.4	251	122	15.4	385
1935	353	12.3	222	118	13.3	342
1936	322	12.9	190	119	13.9	294
1937	386	12.5	209	165	13.5	323
1938	338	9.4	181	148	10.2	272
1939	357	9.4	191	156	10.1	285
1940	364	9.2	182	173	10.0	274
1941	372	9.5	175	188	10.3	270
1942	350	9.2	160	181	10.0	243
1943	297	9.6	144	143	10.9	217
1944	314	8.6	145	160	9.2	220
1945	349	8.3	151	190	9.1	234
1946	336	7.4	141	188	8.2	220
1947	400	6.5	148	246	7.0	225
1948	432	6.4	142	284	7.0	220
1949	397	5.8	135	256	6.3	211
1950	427	5.3	162	260	5.9	231
1951	423	5.1	150	268	5.6	226
1952	422	4.9	149	268	5.6	223
1953	413	4.7	146	262	5.2	225

SOURCE: Computed from annual Statistical Summary of Motor Vehicle Traffic Accidents (files of the Pennsylvania Department of Revenue, Bureau of Highway Safety, Harrisburg), 1932-1953, and correspondence from the National Safety Council, Chicago, Illinois.

Table A-5

NUMBERS OF PERSONS KILLED AND INJURED
IN TRAFFIC ACCIDENTS PER HUNDRED
THOUSAND POPULATION—PENNSYLVA-
NIA: 1930, 1940, 1950, AND 1953

	Number per Hundred Thousand Population	
Year	Traffic Deaths	Persons Injured in Traffic Accidents
(1)	(2)	(3)
1930	20.1	413.2
1940	21.0	577.1
1950	15.2	597.5
1953	15.4	660.7

Table A-6

TRAFFIC FATALITY RATES IN THE UNITED STATES, BY STATES: 1951, 1952, AND 1953

State	Number of Fatalities per Hundred Million Miles of Vehicle Travel			State	Number of Fatalities per Hundred Million Miles of Vehicle Travel		
	1951	1952	1953		1951	1952	1953
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
United States	7.7	7.3	7.0	Montana	7.5	8.8	7.9
Alabama	10.6	9.2	8.5	Nebraska	6.1	6.1	5.8
Arizona	12.3	10.3	9.8	Nevada	9.7	11.8	10.4
Arkansas	8.5	8.5	7.2	New Hampshire	5.3	4.0	4.9
California	7.1	7.2	6.5	New Jersey	4.5	4.4	3.9
Colorado	6.5	6.2	5.6	New Mexico	12.6	10.8	11.1
Connecticut	3.9	3.0	3.0	New York	6.0	5.5	5.6
Delaware	6.1	6.0	7.0	North Carolina	8.5	8.1	7.9
Florida	7.9	7.6	7.3	North Dakota	7.1	7.5	8.2
Georgia	8.8	8.3	7.5	Ohio	6.4	6.5	6.4
Idaho	9.5	8.4	7.3	Oklahoma	7.0	6.2	5.8
Illinois	7.2	7.3	6.9	Oregon	6.7	6.3	5.5
Indiana	8.4	7.7	7.5	Pennsylvania	5.4	5.1	4.9
Iowa	6.0	5.1	5.5	Rhode Island	2.9	2.4	2.4
Kansas	7.8	7.3	7.2	South Carolina	11.6	12.1	10.7
Kentucky	9.3	9.8	9.3	South Dakota	4.0	7.9	6.4
Louisiana	8.8	8.7	8.5	Tennessee	8.6	8.0	7.8
Maine	4.8	4.3	5.3	Texas	7.3	6.7	6.3
Maryland	7.7	6.6	6.4	Utah	8.1	8.8	7.0
Massachusetts	3.6	3.4	3.8	Vermont	6.7	4.3	5.3
Michigan	7.2	6.7	7.1	Virginia	9.2	7.9	7.4
Minnesota	6.1	4.7	5.9	Washington	6.2	5.6	5.0
Mississippi	8.2	7.7	6.9	West Virginia	7.1	7.4	8.6
Missouri	6.4	6.2	6.2	Wisconsin	7.0	7.3	6.9
				Wyoming	10.5	9.1	8.8

SOURCE: *Public Safety* (Chicago: National Safety Council, February, 1952, 1953, and 1954).

Table A-7

DRIVER VIOLATIONS OF THE VEHICLE CODE AT TIMES OF ACCIDENTS AND IDENTIFIABLE VEHICLE DEFECTS AT TIMES OF ACCIDENTS: NUMBERS, AND NUMBERS AS PERCENTS OF TOTAL NUMBERS OF TRAFFIC ACCIDENTS—PENNSYLVANIA: 1932 THROUGH 1953

Year	Total Number of Traffic Accidents	Driver Violations of the Vehicle Code at Times of Accidents		Identifiable Vehicle Defects at Times of Accidents	
		Number	As Percent of Total Accidents	Number	As Percent of Total Accidents
(1)	(2)	(3)	(4)	(5)	(6)
1932	41,004	23,857	58.18%	9,281	22.63%
1933	45,374	24,035	52.97	9,635	21.23
1934	52,157	28,603	54.84	8,299	15.91
1935	49,930	27,557	55.19	6,882	13.78
1936	55,727	37,006	66.41	8,575	15.39
1937	73,466	51,279	69.80	10,163	13.83
1938	63,000	39,622	62.89	7,824	12.42
1939	69,818	42,301	60.59	8,170	11.70
1940	75,852	47,469	62.58	15,122	19.94
1941	83,413	63,858	76.56	14,136	16.95
1942	59,218	53,114	89.69	11,263	19.02
1943	37,340	33,298	89.18	3,931	10.53
1944	42,616	37,448	87.87	4,384	10.29
1945	53,231	49,410	92.82	5,516	10.36
1946	69,968	62,675	89.58	4,997	7.14
1947	89,067	78,963	88.66	7,189	8.07
1948	103,478	93,363	90.22	8,430	8.15
1949	102,081	87,572	85.79	8,915	8.73
1950	113,748	102,865	90.43	4,006	3.52
1951	123,088	112,373	91.29	3,582	2.91
1952	126,820	118,335	93.31	4,133	3.26
1953	129,791	120,059	92.50	5,092	3.92

SOURCE: Columns 2, 3, and 5, annual Summary of Motor Vehicle Traffic Accidents (files of the Pennsylvania Department of Revenue, Bureau of Highway Safety, Harrisburg), 1932-1953; columns 4 and 6 computed from columns 2, 3, and 5.

Table A-8

DRIVERS UNDER AGE 25 AND DRIVERS AGED 25 AND OVER INVOLVED IN ALL TRAFFIC ACCIDENTS AND IN FATAL TRAFFIC ACCIDENTS: NUMBERS AND PERCENTS— PENNSYLVANIA: 1932 THROUGH 1953

[Includes only those drivers whose ages were reported]

	Drivers Involved in All Traffic Accidents					Drivers Involved in Fatal Accidents				
	Number			Percent		Number			Percent	
Year	Under Age 25	Aged 25 and Over	Total	Under Age 25	Aged 25 and Over	Under Age 25	Aged 25 and Over	Total	Under Age 25	Aged 25 and Over
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1932	17,506	45,702	100.0%	27.7%	72.3%	639	1,458	100.0%	30.5%	69.5%
1933	18,090	49,258	100.0	26.9	73.1	636	1,440	100.0	30.6	69.4
1934	22,041	56,099	100.0	28.2	71.8	726	1,485	100.0	32.8	67.2
1935	21,649	53,172	100.0	28.9	71.1	645	1,260	100.0	33.9	66.1
1936	25,224	58,539	100.0	30.1	69.9	834	1,551	100.0	35.0	65.0
1937	37,592	74,296	100.0	33.6	66.4	939	1,672	100.0	36.0	64.0
1938	27,470	67,036	100.0	29.1	70.9	641	1,254	100.0	33.8	66.2
1939	32,434	72,855	100.0	30.8	69.2	640	1,209	100.0	34.6	65.4
1940	36,977	81,975	100.0	31.1	68.9	743	1,436	100.0	34.1	65.9
1941	45,676	89,592	100.0	33.8	66.2	857	1,625	100.0	34.5	65.5
1942	28,695	63,922	100.0	31.0	69.0	648	1,096	100.0	37.2	62.8
1943	12,662	43,856	100.0	22.4	77.6	334	964	100.0	25.7	74.3
1944	13,076	49,383	100.0	20.9	79.1	314	947	100.0	24.9	75.1
1945	17,487	62,424	100.0	21.9	78.1	338	1,074	100.0	23.9	76.1
1946	27,600	68,239	100.0	28.8	71.2	564	1,217	100.0	31.7	68.3
1947	35,160	83,860	100.0	29.5	70.5	527	1,158	100.0	31.3	68.7
1948	40,790	98,154	100.0	29.4	70.6	529	1,234	100.0	30.0	70.0
1949	40,079	97,423	100.0	29.1	70.9	536	1,194	100.0	31.0	69.0
1950	47,345	128,495	100.0	26.9	73.1	515	1,282	100.0	28.7	71.3
1951	49,594	139,362	100.0	26.2	73.8	605	1,328	100.0	31.3	68.7
1952	50,765	142,446	100.0	26.3	73.7	545	1,370	100.0	28.5	71.5
1953	53,145	147,560	100.0	26.5	73.5	547	1,363	100.0	28.6	71.4

SOURCE: Columns 2, 3, 7, and 8, annual Statistical Summary of Motor Vehicle Traffic Accidents (files of the Pennsylvania Department of Revenue, Bureau of Highway Safety, Harrisburg), 1932-1953; other columns computed.

Table A-9

SEX OF DRIVERS INVOLVED IN ALL TRAFFIC ACCIDENTS AND IN FATAL TRAFFIC ACCIDENTS:
NUMBERS AND PERCENTS—PENNSYLVANIA: 1932 THROUGH 1953

[Includes only those drivers whose sex was reported]

Year	Drivers Involved in All Traffic Accidents					Drivers Involved in Fatal Traffic Accidents				
	Number		Percent			Number		Percent		
	Male	Female	Total	Male	Female	Male	Female	Total	Male	Female
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1932	60,916	5,033	100.0%	92.4%	7.6%	2,108	130	100.0%	94.2%	5.8%
1933	66,471	5,168	100.0	92.8	7.2	2,108	121	100.0	94.6	5.4
1934	78,119	5,605	100.0	93.3	6.7	2,262	119	100.0	95.0	5.0
1935	75,059	5,429	100.0	93.3	6.7	2,020	86	100.0	95.9	4.1
1936	85,399	5,656	100.0	93.8	6.2	2,598	110	100.0	95.9	4.1
1937	114,197	7,847	100.0	93.6	6.4	2,821	109	100.0	96.3	3.7
1938	96,551	7,652	100.0	92.7	7.3	2,017	105	100.0	95.1	4.9
1939	108,345	7,909	100.0	93.2	6.8	2,115	108	100.0	95.1	4.9
1940	119,579	8,554	100.0	93.3	6.7	2,300	113	100.0	95.3	4.7
1941	132,079	10,745	100.0	92.5	7.5	2,558	137	100.0	94.9	5.1
1942	93,758	7,105	100.0	93.0	7.0	1,822	82	100.0	95.7	4.3
1943	57,311	4,711	100.0	92.4	7.6	1,372	58	100.0	95.9	4.1
1944	65,828	6,132	100.0	91.5	8.5	1,327	62	100.0	95.5	4.5
1945	84,464	7,963	100.0	91.4	8.6	1,508	78	100.0	95.1	4.9
1946	114,449	8,533	100.0	93.1	6.9	1,860	79	100.0	95.9	4.1
1947	149,424	10,210	100.0	93.6	6.4	1,780	94	100.0	95.0	5.0
1948	175,756	12,107	100.0	93.6	6.4	1,926	78	100.0	96.1	3.9
1949	171,167	13,592	100.0	92.6	7.4	1,867	109	100.0	94.5	5.5
1950	179,536	16,429	100.0	91.6	8.4	1,762	108	100.0	94.2	5.8
1951	196,845	20,432	100.0	90.6	9.4	1,906	120	100.0	94.1	5.9
1952	206,047	21,629	100.0	90.5	9.5	1,909	150	100.0	92.7	7.3
1953	212,331	23,233	100.0	90.1	9.9	1,882	149	100.0	92.7	7.3

SOURCE: Columns 2, 3, 7, and 8, annual Statistical Summary of Motor Vehicle Traffic Accidents (files of the Pennsylvania Department of Revenue, Bureau of Highway Safety, Harrisburg), 1932-1953; other columns computed.

Appendix B

DRIVER TRAINING IN PENNSYLVANIA PUBLIC SCHOOLS

Teaching of safe driving of motor vehicles in the public schools is authorized by Act No. 475, Session of 1947 (1947, June 28, P. L. 1109, as amended).

Act No. 499, Session of 1951 (1951 [January 8, 1952], P. L. 1859), increased the motor vehicle learner's permit fee from $2.00 to $4.00 and provided that as much of the fee received for each permit as necessary, but not more than $2.00, should be appropriated to the Department of Public Instruction for expenses in carrying out a standardized program of driver education and for making payments to school districts complying with the standardized program.

During the registration year 1953, the number of learners' permits issued was 425,612; during 1954, the number issued was 401,006. In other words, about $850,000 in receipts for the year 1953 and about $800,000 in receipts for the year 1954 were available for both administration of the driver-training program and subsidy payments to school districts having approved driver-training programs.

Commonwealth reimbursement to a given district is calculated by multiplying the amount of available funds by the ratio of average daily membership of pupils over 15 years of age in the driver-training program in the given district to the total average daily membership of pupils over 15 years of age in driver-training courses in all school districts of the Commonwealth. However, under the statute, payments may not exceed the sum of $10.00 for each such pupil per school year.

During the school year 1953-54, average daily membership in approved driver-education programs was 25,448, and Commonwealth reimbursement on account of driver-education programs for the school year 1953-54 amounted to $254,480, an 18.7 percent increase from the 1952-53 reimbursement of $214,330. *Total numbers of pupils in driver-education programs (in classroom courses, only, and in classroom and practice-driving courses) and Commonwealth reimbursement for approved driver-training programs for the school year 1953-54 are shown, by county, in Appendix Table B.*

Reliable data for evaluation of this program in terms of estimated reductions in numbers of accidents are not currently available.

Appendix Table B

NUMBER OF PUPILS IN PUBLIC SCHOOL DRIVER-EDUCATION COURSES AND COMMONWEALTH REIMBURSEMENT FOR APPROVED DRIVER-EDUCATION PROGRAMS: FOR THE SCHOOL YEAR 1953-54

County	Number of Pupils *	Commonwealth Reimbursement
(1)	(2)	(3)
TOTAL	35,214	$254,480
Adams	342	2,520
Allegheny	2,335	21,530
Armstrong	485	3,760
Beaver	1,078	7,810
Bedford	213	1,150
Berks	1,289	5,230
Blair	623	3,040
Bradford	295	2,140
Bucks	1,027	5,460
Butler	379	3,290
Cambria	752	7,200
Cameron	44	440
Carbon	380	3,090
Centre	426	4,070
Chester	911	5,620
Clarion	177	1,150
Clearfield	232	2,060

* In classroom courses only, or in classroom and practice-driving courses.

County	Number of Pupils *	Commonwealth Reimbursement
(1)	(2)	(3)
Clinton	360	2,010
Columbia	205	1,910
Crawford	395	1,500
Cumberland	428	3,480
Dauphin	547	3,540
Delaware	813	4,940
Elk	125	1,250
Erie	860	7,880
Fayette	803	8,030
Forest	55	540
Franklin	313	2,690
Fulton	....	.....
Greene	82	820
Huntingdon	258	1,300
Indiana	356	3,430
Jefferson	266	2,610
Juniata	96	780
Lackawanna	2,033	6,570
Lancaster	980	6,530
Lawrence	144	1,400
Lebanon	302	2,540
Lehigh	561	4,780
Luzerne	1,973	13,390
Lycoming	264	2,410
McKean	547	2,820
Mercer	340	2,610
Mifflin	397	2,450
Monroe	141	760
Montgomery	1,718	9,170
Montour	19	190
Northampton	1,235	5,730
Northumberland	404	3,130
Perry	119	510
Philadelphia	2,416	23,680
Pike	25	220
Potter	....	.....
Schuylkill	406	2,450
Snyder	168	1,230
Somerset	642	5,970
Sullivan	69	690
Susquehanna	217	1,330
Tioga	215	1,930
Union	21	200
Venango	154	1,540
Warren	388	2,620
Washington	649	6,490
Wayne	119	1,180
Westmoreland	1,035	9,430
Wyoming	43	140
York	520	4,120

* In classroom courses only, or in classroom and practice-driving courses.