REPORT OF THE

VIRGINIA DEPARTMENT OF TRANSPORTATION SAFETY

ON

BICYCLE SAFETY

TO

THE GOVERNOR

AND

THE GENERAL ASSEMBLY OF VIRGINIA

HOUSE DOCUMENT NO. 4

COMMONWEALTH OF VIRGINIA
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COMMONWEALTH of VIRGINIA

Department of Transportation Safety

300 Turner Road

JOHN T. HANNA
DIRECTOR

RICHMOND, VA. 23225
(804) 276-9600

November 6, 1980

REPORT OF THE
VIRGINIA DEPARTMENT OF TRANSPORTATION SAFETY
TO THE
GOVERNOR AND GENERAL ASSEMBLY
IN RESPONSE TO HOUSE JOINT RESOLUTION #105

TO: The Honorable John N. Dalton, Governor of Virginia,

Mr. George M. Walters, Secretary of Transportation,

and

Members of the Virginia General Assembly.

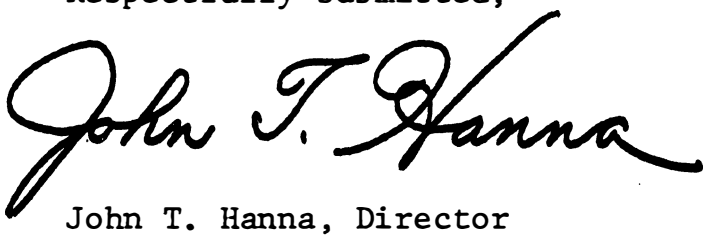
On behalf of the Virginia Department of Transportation Safety, we are pleased to transmit, in accordance with House Joint Resolution #105, the results of the study of the operation of bicycles on the highways of the Commonwealth. At the request of this agency, the study was conducted by staff members of the Highway and Transportation Research Council. They were assisted by an Advisory Panel composed of representatives of federal, state, and local governmental agencies, numerous bicycling organizations, and other groups.

The data indicate that bicycle-motor vehicle crashes occur primarily at intersections, that the bicyclist is at fault in most incidents, and that the two most common faults of both bicyclists and motorists are failure to yield and inattention.

While children under 14 riding in residential areas have accounted for most of the bicyclists killed and injured, there has been a shift to an increasing number of adults riding in business-commercial areas involved in bicycle-motor vehicle crashes. Because of this change in trend, revisions to the Code of Virginia to define the status of the bicycle, its position on the roadway, and the responsibilities of a bicyclist at intersections have been recommended by the Research Council. We have been informed that a legislator will introduce legislation to implement the report recommendations.

In addition to changes in the Code, the initiation of education and information programs and a modification of the system for collecting and storing bicycle-motor vehicle crash data are recommended. This Department will monitor the status of any proposed statutory amendments and will carry out such education and information programs as may be required.

Respectfully submitted,



John T. Hanna, Director
Department of Transportation Safety

REVIEW AND ANALYSIS OF VIRGINIA TRAFFIC LAW AFFECTING BICYCLE SAFETY

by

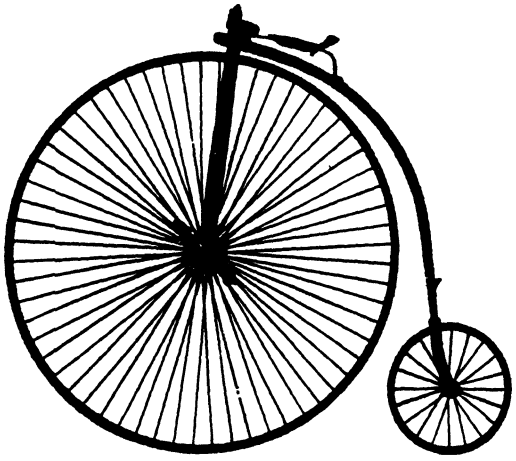
Charles B. Stoke

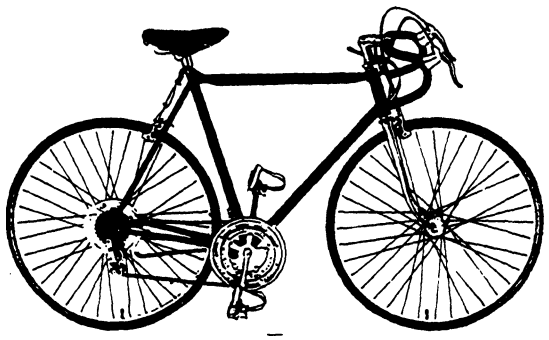
Research Scientist

and

Owen J. Shean

Graduate Legal Assistant





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MR. LEON CLANCY, Virginia Bicycling Federation

MRS. CHERYL CLARK, Division of Motor Vehicles

MR. R. W. DUVAL, Department of Transportation Safety

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MR. KEN E. LANTZ, JR., Department of Highways and Transportation

MR. ROGER O'DELL, Charlottesville Bicycling Club

MR. LARRY PAVLINSKI, U. S. Department of Transportation, NHTSA

MR. ARTHUR H. RATCLIFFE,Capital Community Cyclists

MR. E. W. TIMMONS, Tidewater Automobile Association of Virginia

MR. ALLEN A. TURNBULL, Williamsburg Bicycling Association

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Charles B. Stoke
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(The opinions, findings, and conclusions expressed in this report are those of the authors and not necessarily those of the sponsoring agencies.)

Virginia Highway & Transportation Research Council
(A Cooperative Organization Sponsored Jointly by the Virginia Department of Highways & Transportation and the University of Virginia)

Charlottesville, Virginia

September 1980
VHTRC 81-R16

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Virginia Highway and Transportation Research Council

MR. A. L. THOMAS, Assistant Traffic and Safety Engineer,
Virginia Department of Highways and Transportation

MR. G. L. WHITE, JR., Driver Serivces Administrator,
Division of Motor Vehicles

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ACKNOWLEDGEMENTS

The authors express deep appreciation to the members of the study Advisory Panel who provided advice, assistance, and both oral and written comments throughout the course of the study. From the experience and knowledge contributed by the panel members, the authors were able to gain insight and perspective on bicycling safety problems that many hours of research could not have provided. It should be pointed out, however, that the report in no way represents a consensus of the views of the group. While there was general unanimity on the majority of the findings, conclusions, and recommendations, there were instances in which panelists disagreed. Consequently, the authors must assume responsibility for judgements made in the preparation of the final report.

Philip Harris of the Council staff is recognized for his role in accessing the data from the crash tapes for use in the analysis of the crash data. Also, the authors appreciate the efforts of their co-workers who reviewed and commented upon the report; of Toni Thompson, who typed the several drafts; and of H. T. Craft, who edited the final draft, and Jean Vanderberry, who typed the final manuscript.

ABSTRACT

In response to House Joint Resolution #105, passed during the 1980 session of the Virginia General Assembly, a study was made to assess the nature and scope of the bicycle-motor vehicle crash problem in the Commonwealth, to determine which provisions of the Code of Virginia were inadequate to address the recent trend toward increased bicycle use, and to make recommendations for changes in the Code to improve the safety and mobility of bicyclists in the Commonwealth.

The study consisted of a review of the literature relevant to bicycle riding and bicycle-motor vehicle crashes; analysis of Virginia data for 1977 through 1979 on bicycle-motor vehicle crashes; and a review and analysis of the Code of Virginia, the Uniform Vehicle Code, and the Codes of Maryland, Massachusetts, North Carolina, and California.

The study was carried out with the advice and assistance of an advisory panel composed of representatives of federal, state, and local governmental agencies, numerous bicycling organizations, the National Committee on Uniform Traffic Laws and Ordinances, and the Tidewater Automobile Association of Virginia.

The results of the literature review and analysis of Virginia bicycle-motor vehicle crash data indicate that accidents and injuries are experienced primarily by youths 10 to 14 years of age riding the streets of residential areas. While this is the predominant crash pattern, there is evidence that increasing numbers of adults riding in business and commercial areas are being killed and injured in bicycle accidents.

The data also indicate that crashes occur primarily at intersections, that the bicyclist is at fault in most incidents, and that the two most common faults of both bicyclists and motorists are failure to yield and inattention.

The review of the Code of Virginia revealed that a number of typical bicycle riding situations are not clearly defined by statute and that some revisions to the Code are needed to define the status of the bicycle, the bicyclist's position on the roadway, and the responsibility of the bicyclist at intersections. Suggested revisions to the Code are offered.

SUMMARY OF FINDINGS

1. Bicycle Riding

Research has suggested that the greater proportion of regular bicycle riders are youths rather than adults. Adults who regularly ride bicycles travel an average of between 2,000 and 3,000 miles a year. School age children ride between 550 and 750 miles a year.

Both research and Virginia data indicate that bicyclists between 10 and 14 years of age are involved in more crashes, and experience more injuries and fatalities than those in the other three age groups of less than 9, 15 to 19, and 20 and over.

Virginia crash data for the last 3 years indicate that bicycle riders 15 years of age and older were involved in an increasing percentage of crashes, and that during 1979 they accounted for 53% of the reported injury crashes.

2. Bicycling as Recreation and Transportation

Bicycling is an important and increasingly popular activity in Virginia. A recent study by the Virginia Polytechnic Institute and State University for the Virginia Commission of Outdoor Recreation has indicated that bicycling is the leading outdoor recreational activity in the state, accounting for about 24% of the total. In contrast, swimming and fishing account for about 7% and 6%, respectively. This high use of bicycles for recreation is projected to continue through 1990. There are no similar data regarding the use of bicycles as a transportation mode in the state.

Research has indicated that from 50% to 60% of bicycle trips among regular adult riders are for travel to work, school, and shopping. Research also has indicated that the number of adult trips for transportation purposes is greater than the number for recreation, but that more bicycle miles of travel occur on recreational trips.

Although the transportational and recreational uses of the bicycle are not mutually exclusive, the use among youth tends to be for recreation and that among adults for transportation.

Because Virginia accident data do not discriminate between the transportational and recreational users, no measure of the relative risk involved in each activity is now possible.

3. Time and Weather Factors

The accident data indicate that 70% of the reported bicycle-motor vehicle crashes occur during daylight, between 2 p.m. and 8 p.m., and in clear weather.

4. Bicycle-Motor Vehicle Crash Location

In excess of 50% of bicycle riding is done on streets and highways as opposed to bike paths, sidewalks, and other areas, and the proportion of adults riding on the streets of the community is greater than that for children.

Between 50% and 60% of bicycle-motor vehicle crashes occur in residential areas, approximately 30% in business-commercial areas, and 10% to 20% in all other areas. Research has shown that intersection or intersection-related crashes account for from 47% to 72% of all crashes, depending upon variables such as traffic, highway configuration, population density, and other environmental factors.

The Code of Virginia does not adequately address the status of the bicycle when operated on either the highways or the sidewalks of the Commonwealth. Nor does the Code define the proper position of the bicycle on the roadway. Finally, the Code does not define the responsibility of the bicyclist to obey traffic signs, signals, and markings at intersections.

5. Actions Leading to Bicycle-Motor Vehicle Crashes

Between 15% and 20% of bicycle accidents involve collisions with motor vehicles, and these crashes result in more severe injuries to bicyclists than do other types of accidents. The results of research reported in the literature indicate that in more than 60% of the bicycle-motor vehicle crashes the bicyclist is judged to be at fault, but that fault decreases with increasing age of the cyclist. The most common actions of bicyclists leading to crashes are failure to yield, failure to obey traffic control devices, and inattention.

Motor vehicle operators under the age of 24, as opposed to operators in other age groups, and drivers of trucks, as opposed to drivers of other vehicles, are overrepresented in bicycle-motor vehicle crashes in Virginia. The most common faults of motorists are failure to yield, improper passing, speeding, and inattention.

The Code of Virginia does not adequately define the relationship between the bicycle and the motor vehicle, especially for actions such as overtaking and passing and turning and signaling.

6. Injury Severity

The most severe injuries to bicyclists stem from crashes with motor vehicles. Both previous research and Virginia crash data indicate that the risk of severe injury to bicyclists increases with the posted speed limit.

The Virginia data indicate an increase in the percentage of serious injuries in business-industrial areas. Likewise, the data show an increase in serious injuries to bicyclists over the age of 15.

CONCLUSIONS

1. Crash Trends

Severe injuries to bicyclists continue to be the result of crashes with motor vehicles. However, increases in severe injuries among adults, rather than children, and increases of severe injuries in business-commercial areas, rather than in residential areas, indicate an increased participation of bicyclists in the traffic mix. This trend can be expected to continue.

2. Code Revisions

In light of these trends, revisions to the Code of Virginia are appropriate to define the relationship between the bicyclist and the motorist. Specifically, revisions are needed to define the status of the bicycle, the position of the bicycle on the roadway, and the responsibility of a bicyclist at intersections.

3. Bicycle Safety Countermeasures

There are several countermeasures that could and should be considered to improve bicycle safety in the Commonwealth. Improved methods of education and selected techniques of enforcement are necessary to address violations of traffic regulations by both bicyclists and motorists, and innovative engineering approaches may be necessary to accommodate the needs of all roadway users, especially those of the young and inexperienced bicyclist.

RECOMMENDATIONS

1. Status of the Bicycle

   a. That the definition of bicycle in the Code of Virginia be revised to read as follows:

      §46.1-1(a) Bicycle — A device propelled solely by human power and having pedals, two or more wheels, and a seat height of more than twenty-five inches from the ground when adjusted to its maximum height. For purposes of chapter four of this title, a bicycle shall be a vehicle while operated upon the highway.

   b. That moped be defined as a bicycle-like device, and that the definition read as follows:

      §46.1-1(b) Moped — a bicycle-like device with a helper motor rated at less than one brake horsepower and which produces only ordinary pedaling speeds up to a maximum of twenty miles per hour, provided such a device so equipped shall not be operated upon any highway or public vehicular area of this State by any person under the age of sixteen. For purposes of chapter four of this title, a moped shall be a vehicle while operated upon the highway.

   c. That the definition of vehicle in §46.1-1(34) be revised to read:

      Vehicle — Every device in, upon, or by which any person or property is or may be transported or drawn upon a highway, except devices moved by human power or used exclusively upon stationary rails or tracks. For purposes of chapter four of this title, a bicycle and a moped shall be vehicles while operated upon the highway.

   d. That §46.1-190(d) and §46.1-190(d1) be revised to read as follows:

      §46.1-190 Same; specific instances — A person shall be guilty of reckless driving who shall:

      (d) Pass or attempt to pass two other vehicles abreast, moving in the same direction except on highways having separate roadways of three or more lanes for each direction of travel, or on designated one-way streets or

highways; provided, however, this subsection shall not apply to a motor vehicle passing two vehicles, in accordance with provisions of this chapter, when one or both of the vehicles is a bicycle or moped; nor shall this subsection apply to a bicycle or moped passing two vehicles in accordance with the provisions of this chapter.

(d1) Drive any motor vehicle, including any motorcycle, so as to be in and parallel to another vehicle in a lane designed for one vehicle, or drive any motor vehicle, including any motorcycle, so as to travel parallel to any other vehicle traveling in a lane designed for one vehicle; provided, however, this subsection shall not apply to any validly authorized parade, motorcade, or motorcycle escort; nor shall it apply to a motor vehicle traveling in the same lane of traffic as a bicycle or moped.

e. That, as a consequence of the separation of the definitions of bicycle and moped, existing provisions of the Code making explicit reference to bicycle be revised to include the words "or moped:". Such revision is required for:

§46.1-171	Power of State Highway and Transportation Commission to Prohibit Use of Controlled Access Highways.
§46.1-229.1(b)	Riding Bicycles Two Abreast on the Highway.
§46.1-229.2	Carrying Articles on Bicycles.
§46.1-235(b)	Bicyclists Attaching to Vehicles on Highway.
§46.1-263	Lamps on Bicycles.
§46.1-277(b)	Brakes for Bicycles.

2. Negligence of Children

That a new section be added to the Code to read as follows:

§46.1-XXX Negligence of Children —

A violation of any provision of this title by a child under the age of 14 shall not constitute negligence per se, although a violation may be considered as evidence of negligence.

3. Rights and Duties

That Section 46.1-171 be revised to specify that a bicyclist riding on the highway has the rights and the duties of the driver of a vehicle, to wit:

> §46.1-171 — Persons Riding Bicycles or Riding or Driving Animals — Every person riding a bicycle or an animal upon a highway, and every person driving any animal thereon, shall be subject to the provisions of this chapter and shall have all the rights and all of the duties applicable to the driver of a vehicle, unless the context of the provision clearly indicates otherwise.

4. Riding Bicycles on Sidewalks

That the prohibition contained in §46.1-229 against riding or driving vehicles on sidewalks be amended so as to omit reference to bicycles, and that a section be added to the Code to read as follows:

> §46.1-XXX Riding Bicycles on Sidewalks —
>
> (a) A person riding a bicycle upon and along a sidewalk, or across a roadway upon and along a crosswalk, shall yield the right-of-way to any pedestrian and shall give an audible signal before overtaking and passing such pedestrian.
>
> (b) A person shall not ride a bicycle upon and along a sidewalk, or across a roadway upon and along a crosswalk, where such use of bicycles is prohibited by official traffic control devices.
>
> (c) A person riding a bicycle upon and along a sidewalk, or across a roadway upon and along a crosswalk, shall have all the rights and duties of a pedestrian under the same circumstances.
>
> (d) The foregoing provisions notwithstanding, local authorities may prohibit the riding of bicycles on designated sidewalks or crosswalks.

5. Position of Bicycle on the Roadway

a. That Subsection (a) of §46.1-229.1 be deleted, and that a new section be inserted in its place to read as follows:

§46.1-229.1 Riding Bicycles on Roadways and Bicycle Paths —

(a) Any person operating a bicycle or moped upon a roadway shall ride as close as practicable to the right-hand curb or edge of the roadway, except under any of the following situations:

(1) When overtaking and passing another vehicle proceeding in the same direction.

(2) When preparing for a left turn at an intersection or into a private road or driveway.

(3) When reasonably necessary to avoid conditions including, but not limited to, fixed or moving objects, parked or moving vehicles, pedestrians, animals, surface hazards, or substandard width lanes that make it unsafe to continue along the right-hand curb or edge.

For purposes of this section, a "substandard width lane" is a lane too narrow for a bicycle or moped and another vehicle to pass safely side by side within the lane.

b. That a section be added to the Code to require any person riding a bicycle or moped which impedes traffic to yield the right-of-way to the impeded traffic. This section shall read as follows:

§46.1-XXX Bicycle or Moped to Allow Vehicles to Pass —

Any person riding a bicycle or moped which impedes traffic shall, upon an audible signal, yield the right-of-way by pulling off the roadway at the earliest reasonable opportunity and allowing traffic to proceed.

c. That a section be added to the Code to specifically require the driver of a motor vehicle to exercise due care in passing a bicycle or moped. This section shall read as follows:

§46.1-XXX Motor Vehicles Passing a Bicycle or Moped —

In approaching or passing a person on a bicycle or moped, the operator of a motor vehicle shall pass at a safe distance and at a reasonable and proper speed.

d. That a section be added to the Code to prescribe the method by which a bicyclist should pass another vehicle. This section shall read as follows:

§46.1-XXX Overtaking and Passing Vehicles —

(a) A person riding a bicycle or moped may overtake and pass another vehicle on either the left or right side, staying in the same lane as the overtaken vehicle, or changing to a different lane, or riding off the roadway as necessary to pass with safety.

(b) A person riding a bicycle or moped may overtake and pass another vehicle only under conditions which permit the movement to be made with safety.

(c) A person riding a bicycle or moped shall not travel between two lanes of traffic moving in the same direction, except where one lane is a separate turn lane or a mandatory turn lane.

(d) Except as otherwise provided in this section, a person riding a bicycle or moped shall comply with all rules applicable to the driver of a vehicle when overtaking and passing.

6. Bicycles at Intersections

a. That section 46.1-173(a) be revised to require the rider of a bicycle or moped to obey traffic control devices. Section 46.1-173(a) shall be revised to read:

> The driver of a vehicle shall obey and comply with the requirements of road signs erected upon the authority of the State Highway and Transportation Commission or subject to the provisions of §33.1-39 and 33.1-47 by local authorities in cities and towns.

b. That a section be added to the Code to specify the manner in which the operator of a bicycle or moped should execute a left turn. This section shall read as follows:

§46.1-XXX Left Turns —

(a) a person riding a bicycle or moped and intending to turn left shall follow a course described in §46.1-215 or in subsection (b).

(b) A person riding a bicycle or moped and intending to turn left shall approach the turn as close as practicable to the right curb or edge of the roadway. After proceeding across the intersecting roadway, the rider shall comply with traffic signs or signals and continue his turn as close as practicable to the right curb or edge of the roadway being entered.

(c) Notwithstanding the foregoing provisions, the State Highway and Transportation Commission and local authorities, in their respective jurisdictions, may cause official traffic control devices to be placed, and thereby require and direct that a specific course be traveled by turning bicycles and mopeds; and when such devices are so placed, no person shall turn a bicycle or moped other than as directed and required by such devices.

c. That a subsection be added to §46.1-217 to specify that the bicycle or moped rider has a duty to signal his intention to turn or change direction and to relieve him of the duty to signal continuously for the distances specified in §46.1-217(b). This subsection should read:

> §46.1-217(c) — "A person riding a bicycle or moped shall signal his intention to stop, turn, or change direction. However, such signals need not be given continuously, if both hands are needed in the control or operation of the bicycle or moped.

7. Educational Programs

a. That the Department of Transportation Safety initiate a public education and information program that points out the changing trend in crash patterns and the disproportionately large number of young drivers and trucks involved in bicycle-motor vehicle crashes.

b. That the State Department of Education provide additional information to all Driver Education teachers, with a request for added emphasis in areas of the curriculum dealing with sharing the roadway with bicycles. The data on the age of the motor vehicle operators involved in crashes place added responsibility on the proper training of beginning drivers.

c. That State Department of Education officials further emphasize the importance of teaching materials on safe bicycle riding habits to young children, especially in light of the fact that children have made up a large proportion of persons killed and injured in bicycle-motor vehicle crashes.

d. That the Division of Motor Vehicles develop materials dealing with bicycle use of the streets and highways for inclusion in the Driver's Manual and develop related questions for inclusion on the examination for an original operator's license. This recommendation is especially significant in light of the number of young operators of motor vehicles involved in crashes with bicycles.

8. Modification to Data Base

That an improved statewide system be developed for recording and computerizing crash data in which a bicycle is one of the involved vehicles. This would require changes in the current accident investigation procedures and a modification to the data processing procedures.

REVIEW AND ANALYSIS OF VIRGINIA TRAFFIC LAW AFFECTING BICYCLE SAFETY

by

Charles B. Stoke
Research Scientist

and

Owen J. Shean
Graduate Legal Assistant

INTRODUCTION

For bicyclists in this country, 1970 is an important date. It divides the periods of bicycle use according to the type and style of the bicycle,* and the changes in the characteristics of bicycle users. Prior to that year, most bicycles were of the balloon-tire, one-gear, coaster-brake type. They were sold primarily for use by youths, and any increase in sales was dependent on an increase in the number of children and the affluence of their parents.

With the introduction of the lightweight, multi-geared bicycles in the U. S. during the midsixties, an increasing number of adults discovered the advantages of using bicycles for both recreational and transportational purposes. With the lightweight bicycles, a person can go faster and further than was possible with the old style. Before lightweights became popular in this country, they were in widespread use in many European countries. While lightweight bicycles did not cause the boom in bicycle sales in this country, the expansion would not have been nearly as great without them.

Federal, state, and local governmental bodies, and commercial and private organizations have all become increasingly interested in promoting bicycle use. The benefits to the individual and society have been widely advertised. These include physical exercise, savings of motor fuel, a decrease in air pollution and traffic congestion, and savings in time, transportation, and parking costs.

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*The terms bicycle, moped, motor vehicle, vehicle, roadway, and highway are used in this report as defined by the Code of Virginia.

Although the increased use of bicycles has already been an advantage to society and future benefits may even be greater, some of the benefits gained are offset by an increase in the number of deaths and injuries resulting from accidents. In an attempt to reduce these accidents, society has used a three-pronged approach which includes enforcement and adjudication, engineering, and education.

In February 1980, the General Assembly of Virginia adopted House Joint Resolution No. 105 calling upon the Department of Transportation Safety to evaluate Virginia's traffic laws governing bicycle safety. Further, the resolution calls upon the Department to recommend revisions to the Code of Virginia necessary to provide for safety in bicycle travel. (See Appendix A.)

The increased use of the bicycle in recent years has placed bicyclists in competition with motorists and pedestrians for use of the Commonwealth's thoroughfares. The absence of clear standards jeopardizes not only the safety of bicyclists, but also that of motorists and pedestrians. In addition, the uncertainty regarding the rights and obligations of bicyclists prevents effective safety education and enforcement of traffic laws.

The regulation of bicycle traffic is a difficult task. The bicycle is both a means of recreation and a form of transportation. Under a number of circumstances, it occupies a legitimate position on the roadway. Nevertheless, traffic rules devised for motor vehicles cannot be uniformly applied to bicycles. The bicycle's size and speed differentiate it from motor vehicles. There are traffic situations in which a bicycle is unable to safely compete with the motor vehicle and is acutely vulnerable to accidents. However, the wide differences in age and skill among bicyclists create problems in regulating bicycle traffic. For these reasons, it may be necessary to design specific rules of operation particularly applicable to bicycle travel rather than make the bicyclists subject only to regulations formulated for operators of motor vehicles.

On the other hand, exhaustive regulation of bicycle traffic may diminish the attractiveness of the bicycle as a means of recreation and transportation. It is relatively inexpensive to purchase and to operate, requires only basic manipulative skills, and is usable in a wide variety of geographic areas. Consequently, one must be careful in recommending proposals to require additional equipment, to mandate methods of operation, and to restrict the areas in which bicycles may be operated, for regulations have a potential for discouraging use by some riders.

Thus, while public policy and public safety dictate the adoption of clear standards for the use of bicycles, the standards must accommodate the interest in maintaining the bicycle as an inexpensive and accessible means of both transportation and recreation.

PURPOSE

The purpose of this research was to evaluate the provisions of the Code of Virginia pertaining to the operation of bicycles on the highways and to recommend any revisions deemed necessary for traffic safety. The evaluation was necessary to determine the extent to which the Code fails to address the safety problem created by the bicycle-motor vehicle mix. If there are deficiencies in the Code, appropriate revisions are necessary to make clear the standard of care expected of those who use the Commonwealth's thoroughfares and to promote safety programs.

SCOPE

The primary focus of the study was on traffic regulations designed to promote bicycle safety. Such regulations include requirements for safety equipment, required methods for the operation of bicycles, and designations of appropriate areas for bicycle use. Previously published research on bicycle safety and Virginia data on bicycle-motor vehicle crashes were reviewed and analyzed to determine the degree of the bicycle safety problem and those areas that could be effectively dealt with by making changes in the Code of Virginia.

Because the directive for this study was to evaluate the traffic laws of Virginia, educational programs, engineering principles, and enforcement activities are dealt with only as issues which emerged from analyses of data relating to law.

Bicycle safety, however, cannot be confined to traffic regulations; both education and engineering complement the legislative aspects of bicycle safety. The separation of bicycle traffic from motor vehicle traffic by use of bikeways is an important element in bicycle safety, and many communities have constructed such facilities. Bicycle safety is also within the role of the educator, at both the elementary and secondary grade levels, and that of officials of the Division of Motor Vehicles by virtue of their responsibility for preparing the Driver's Manual and administering the examination for a motor vehicle operator's license.

METHODOLOGY

The study included a review and compilation of accident statistics from agencies of the Commonwealth of Virginia, those contained in research reports published by both federal and state governments,

and those developed by independent contractors. The Code of Virginia (COV) was reviewed to identify areas needing revision. Of major concern was the definition of the bicycle as a vehicle and the rights and duties of bicyclists. Also reviewed were the Uniform Vehicle Code (UVC) and the codes of Maryland, Massachusetts, North Carolina, and California.

Because the study involved laws relating to the safety of bicyclists on the highways, the advice and assistance of numerous individuals, organizations, and agencies were sought. An advisory panel was established for the study and met on four occasions during the course of the research. Among those invited to serve on the panel were individuals suggested by Delegate George Grayson, chief patron of HJR #105. Members included representatives from the Department of Transportation Safety, Department of Highways and Transportation, Department of State Police, Department of Education, Division of Motor Vehicles, and the Office of the Attorney General. Citizen comment came from the League of American Wheelmen, the Virginia Bicycling Federation, Capital Community Cyclists, and other local bicycle clubs. Other members came from the National Highway Traffic Safety Administration, the National Committee on Uniform Traffic Laws and Ordinances, the Tidewater Automobile Association, and the Virginia Beach Traffic Engineering Division.

LITERATURE REVIEW

Upon initiation of the study, abstracts of publications having relevance to the general topic of bicycles, bicycle-motor vehicle crashes, and bicycle law were obtained from the Highway Research Information Service. A number of studies concerned with the safety of bicycle travel were identified and the advisory panel suggested several other studies to be reviewed. These studies reported on a broad range of safety factors including exposure to risk and the characteristics of bicycle travel, bicycle users, and bicycle-motor vehicle accidents. These problems are discussed below.

The findings from the literature review are organized according to who uses a bicycle, how far and for what purposes bicyclists ride, the characteristics that describe the riding and crash environment, the characteristics that describe the crash-involved bicyclist and motorist, the actions that lead to crashes, and the factors that describe the severity of injury to bicyclists.

Exposure to Risk

Two of the studies which attempted to obtain exposure data gathered information from individuals associated with bicycle clubs.(1,2) The data are not representative of those for all bicycle users, but may be considered as the upper range of travel for bicycle users. They showed that bicycle use was less than 1,000 miles per year for nearly a third of the cyclists; while over 10% of these cyclists rode in excess of 5,000 miles. The annual average was between 2,000 and 3,000 miles.

Chlapecka and his associates surveyed the bicycle riding habits of elementary school children.[3] This survey found that children rode between 542 and 755 miles per year, with an average of 667 miles, and that the number of miles was dependent upon the age and skill of the operator.

Characteristics of Bicycle Travel

There has been an increase in the use of bicycles for transportation and for recreation. In a 1977 study, Roggenbuck listed bicycling as the number one statewide outdoor recreation activity in Virginia, stating that it accounted for 24.2% of the annual recreational activity.[4] In contrast, fishing and swimming accounted for about 6% and 7% of all recreational activity, respectively. Also, he estimated that the high recreational use of bicycles would continue through 1990.

A study conducted in Lexington, Kentucky, showed that 34% of the bicycle trips were for travelling to school or work and 15% were for shopping;[5] and a survey of California members of the League of American Wheelmen indicated that 40% of their trips were for recreation, 23% for shopping, and 37% for travel to work or school.[6] The Price and Kaplan studies previously cited found that the work-school trip was the most common type, but that the recreational trip accounted for the most annual miles of travel.

Elementary school children used their bicycles for playing games and "just riding around" about three-quarters of the time. Most of the riding was within five blocks of the child's home. Half of the youngsters said they did most of their riding in the street, and 19% said they rode mostly on the sidewalk.

Characteristics of Bicyclists

A 1975 study by Smith found that two-thirds of the riders using bikeways were males, 78% were over 17 years of age, and 60% were using a bike with five or more gears.[7] These figures were nearly the same for both the recreational and transportational users.

The Price and Kaplan studies reported that the regular, adult bicycle users were male in their 30's. They had 5 or more years of riding experience and used bicycles with five or more gears.

The data collected by Chlapecka et al. from elementary school children and their parents showed that 89% of the male and 87% of the female students rode bicycles. On the days they used their bicycles, they rode a little over an hour. Two-thirds of the bicycles were of the high-rise type.

Characteristics of Bicycle Accidents

Over the past 8 to 10 years a number of studies gathered data on bicycle accidents. Some used data from bicycle-motor vehicle accident reports and some used data extracted from hospital admissions records.

General Crash Factors

When an accident report form is completed on a bicycle-motor vehicle crash, usually only data of a general nature are recorded and coded. Four studies reviewed the data on month, time of day, weather, and lighting conditions at the time of a bicycle-motor vehicle crash.[8,9,10,11] Although there were minor variations in the percentages, the general consensus was that over 70% of such accidents occurred in the spring and summer months, in excess of 80% during daylight, 90% in good weather, and 60% between 2 and 9 p.m.

Crash Site

A number of studies categorized data according to the location of the bicycle-motor vehicle crash. Williams reported that 71% of the cases he studied were in residential neighborhoods. Studies by Wuerdemann and Agent and Zegeer found approximately 60% of all crashes in residential areas, and 30% in business-commercial areas. Hunter reported that in North Carolina, 51% of the nonfatal crashes were in residential areas, but that 62% of the fatal crashes were in open country. Hunter also found an association between speed limit and bicyclist injury. The most serious accidents were in 46-55 mph speed zones. Cross and Fisher reported 59% of all crashes in residential areas and 32% of fatal crashes in rural areas.[12] They also concluded that the likelihood of a fatal accident increased substantially on roads with a posted speed limit above 35 mph.

From a number of studies data were available on whether the crash was at an intersection. Williams found 67% at intersections; Hunter reported that 42% of the fatal accidents and 60% of the nonfatal ones were at intersections or driveways; Wuerdemann found 47% of all reported crashes to be intersection-related; DeHart reported that nearly two-thirds of Baltimore, Maryland, accidents were at intersections or were intersection-related;[13] and Agent and Zegeer showed that 56% of the Lexington, Kentucky accidents occurred at intersections and 16% at driveways.

Although the percentages varied among these studies, it is apparent that bicycle-motor vehicle crashes occur in residential areas and primarily at intersections, or they are intersection-related.

The Bicyclist in the Accident

The studies reviewed reflected a consensus that children less than 15 years of age account for the greatest percentage of bicycle crashes. Data reported through the National Electronic Injury Surveillance System (NEISS) are obtained from 119 hospital emergency rooms throughout the country.[14] These data indicate that 69% of all bicycle-related injuries were to children between 5 and 14. Williams reported that 75% of the bicycle-motor vehicle crashes he studied involved children between 4 and 14 years old. In North Carolina, 60% of the fatal and 62% of the nonfatal bicycle-motor vehicle crashes were to persons 14 years or younger. The Cross and Fisher data showed that 48% of the fatal and 57% of the nonfatal crashes involved children below age 15, and in Lexington, Kentucky, 52% of all bicycle-motor vehicle accidents involved bikers under 14. DeHart found that the percentage of accidents involving adults increased over the past 5 years in the Baltimore area and made up 16% of all cases in 1976.

Several authors have studied the bicycle maneuver related to the crash and determined the party at fault. The NEISS data indicated that 63% of all bicycle-related injuries resulted from the loss of control due to braking, riding double, stunting, etc., which were classified as rider actions. Davis et al. studied hospital emergency room admissions data and found that the two most dangerous bicycle maneuvers were turning and going downhill, which accounted for 59% of the cases. Davis also found the bicyclist to be at fault 42% of the time.[15] Chlapecka, in his study of bicycle accidents among elementary school children, reported that speed (38%) and turning (30%) were activities most often leading to accidents; 30% struck an obstacle, 22% skidded and fell, and 26% lost balance and fell because of these two activities.

In the Agent and Zegeer study, the cyclist was reported to be at fault in 61% of all crashes, with those less than 10 years of age being at fault in 84% of their crashes. Williams reported that the bicyclist was at fault in 78% of the crashes, but as age increased, the responsibility for the crash shifted from the cyclist to the motorist.

The most frequent bicyclist violations reported in the Hunter study were failure to yield, failure to obey signs and signals, and riding against traffic; in the Wuerdemann study the three most common faults of the bicyclist were inattention (13%), failure to yield (12%), and suddenly appearing in the motor vehicle's path (11%); and in the Agent and Zegeer study the bicyclists were most often cited for exiting a driveway into a motor vehicle's path and failure to stop or yield at a controlled intersection.

The Motorist in the Accident

When Cross analyzed his data according to the type of motor vehicle involved, a passenger car was found to be involved in 87% of the crashes. Hunter found that when the motor vehicle driver was charged for a violation, it tended to be for speeding, improper overtaking, or driving under the influence. Agent and Zegeer found that failure to yield and inattention were the most frequent faults of the motorist contributing to a crash. Cross and Fisher found that speeding and changing lane position were the motorists' actions which most often led to crashes with bicycles.

Injury Severity

The Davis study of hospital records and the NEISS data from hospital emergency rooms indicate that injuries to bicyclists, when all types of accidents are considered, are relatively low in severity and of the cuts, bruises, and fractures types. While a number of studies have found that only 13% to 20% of all bicycle crashes involve a motor vehicle, these were the most severe in terms of cyclists killed or seriously injured.[16,17] In Lexington, Kentucky, the most severe bicycle-motor vehicle crashes were related to failure to stop or to yield. Accident severity was also related to other factors: severity increased with age, crashes on the roadway were more severe than those on the sidewalk, and intersection crashes were more severe than non-intersection crashes.

ANALYSIS OF VIRGINIA BICYCLE-MOTOR VEHICLE CRASH DATA

In an effort to supplement the accident data obtained from the review of the published literature, Virginia data on bicycle related crashes for the years 1977 through 1979 were reviewed. Some data were taken directly from the publication Crash Facts and other data were obtained from the State Police crash tapes. The format for the analysis of the Virginia bicycle-motor vehicle crash data is consistent with the format used in the literature review section of this report. Data are presented which describe the crash environment, the location of crashes, bicyclist and motorist characteristics, and factors that describe the severity of injury to the bicyclist.

General Crash Factors

The data presented in Table 1 are categorized by the weather conditions at the time of the crashes. Over 70% took place during clear weather. In the severe inclement weather conditions of rain,

sleet, and snow, bicyclists were involved in relatively few crashes; although there was an increase from 4.1% in 1977 to 4.6% in 1979. Twenty percent of the crashes during 1978 and 24% of those in 1977 and 1979 were in periods of reduced visibility due to fog, mist, smoke, etc..

Generally, it can be said that three-fourths of the crashes between bicycles and motor vehicles occurred during daylight (see Table 2). Nearly 11% happened at night on lighted streets and between 5.0% and 6.3% took place during dusk. Crashes at night in unlighted areas accounted for approximately 5% of the total during these 3 years.

Table 1

Percentage of Bicycle Crashes by Weather Condition

Weather	1979	1978	1977
Clear	70.6	76.1	70.5
Rain	4.6	3.5	4.1
Snow/Sleet	0.1	0.3	0.0
Fog/Mist/Other	24.1	19.9	23.8
Not Stated	0.6	0.3	1.6

Table 2

Percentage of Bicycle Crashes by Light Conditions

Light Condition	1979	1978	1977
Daylight	77.2	74.0	78.4
Dusk	5.6	6.3	5.0
Dark-Street Lighted	10.7	11.6	10.8
Dark — Not Lighted	4.8	5.3	4.4
Dawn	1.2	2.6	0.5
Not Stated	0.5	0.1	0.8

The data were categorized by hour of day in Table 3. Over 60% were in the 2 p.m. to 8 p.m. period, which includes times when bicyclists are returning from school or work and are doing general recreational riding, including play. There was a decline in the percentage of crashes from 19.8% in 1977 to 17.6% in 1979 during the 10 a.m. to 2 p.m. period. There also was a decline in crashes in the 8 p.m. to midnight period, from 11.8% in 1977 to 10.0% in 1979. Over the last 2 years, just over 6% of the crashes were in the 6 a.m. to 10 a.m. period when riders go to school or work.

Table 3

Percentage of Bicycle Crashes by Hour of Day

Time	1979	1978	1977
Midnight — 6 a.m.	2.4	2.3	1.4
6 a.m. — 10 a.m.	6.4	6.7	7.9
10 a.m. — 2 p.m.	17.6	18.6	19.8
2 p.m. — 8 p.m.	62.8	60.1	60.3
8 p.m. — Midnight	10.0	11.5	11.8
Not Stated	0.7	1.0	1.4

Virginia bicycle-motor vehicle crash data, where categorized according to weather, lighting conditions, and time of crash, are consistent with data reported by researchers in other states. Bicycle-motor vehicle crashes occur primarily during clear weather, in daylight, and in the afternoon and early evening hours.

Crash Site

The figures in Table 4 show the numbers of fatal and injury bicycle-motor vehicle crashes. During 1979 there were fewer fatal crashes than in the previous two years, but there was a 12% increase in injury crashes. In both urban and rural areas, there was a decrease in fatal crashes in 1979. Approximately two-thirds of all fatal crashes occurred in rural areas. The posted speed limit is typically higher in rural areas than in urban areas. There was a 3% increase in rural injury crashes, but nearly a 16% increase in urban injury crashes during 1979.

In Table 5, data are categorized according to the location within the community where the crash occurred. For each of the last 3 years, over half of the crashes were in residential neighborhoods. During 1979, there was an increase from the previous 2 years in the percentage of crashes in business-industrial areas. These areas now account for nearly a third of the crashes. Figures for open country crashes were variable, ranging from 8.2% in 1979 to 12.0% in 1978. School and playground areas were the sites of over 3% of the crashes in the last 2 years.

Table 4

Bicycle Crashes by Location

Type	1979	1978	1977
		Urban	
Fatal	5	7	8
Injury	864	700	758
		Rural	
Fatal	9	17	14
Injury	336	323	328
		Total	
Fatal	14	24	22
Injury	1200	1023	1086

Table 5

Percentage of Bicycle Crashes by Locality

Locality	1979	1978	1977
Residential	53.3	53.2	56.2
Business-Industrial	32.5	29.1	29.4
Open Country	8.2	12.0	10.8
School-Playground	3.6	3.2	1.8
Other	1.5	1.3	0.0
Not Stated	1.0	1.3	1.8

The Bicyclist in the Crash

Table 6 gives age group data on the numbers and percentages of bicyclists killed in the state during the 1977-1979 period. Because the number of persons killed in each age category is so few, there is a wide variability in the percentages during the 3 years.

Each year the 10-14 age category had the most deaths; nearly 43% in 1977 and 1979 and 50% in 1978. Half of all persons killed in 1977 and 1979 were less than 15 years of age, but during 1978 this age category accounted for nearly 80% of the state's bicycle fatalities. During 1979 the same number of adults 20 and older were killed as were children between 10 and 14; perhaps signaling a new trend in ridership.

The numbers and percentages of bicyclists injured by age group are given in Table 7. The 10-14 age group had the greatest number of injuries during each year, but there was a decrease from 37.6% (1977) to 28.8% (1979) over the 3 years. This drop was accompanied by a rise in the number of injuries for the 15-19 group of 22.4% in 1977 to 26.0% in 1979. In the 20 and up age category, injuries during the last 2 years were nearly 27% of the total, showing an increase from 23% in 1977. There were similar figures for the 0-9 group; 18.3% in 1978 and 18.4% in 1979, an increase from 16.9% in 1977. Virginia crash data for the last 3 years indicate that bicycle riders 15 years of age and older were involved in an increasing percentage of crashes, and that during 1979 they accounted for 53% of the reported injury crashes.

Table 6

Bicyclists Killed by Age Group

Age	1979		1978		1977	
	No.	%	No.	%	No.	%
0-9	1	7.1	7	29.2	2	9.5
10-14	6	42.9	12	50.0	9	42.9
15-19	1	7.1	3	12.5	5	23.8
20 & Up	6	42.9	2	8.3	5	23.8
Total	14	100.0	24	100.0	21	100.0

Table 7

Bicyclists Injured by Age Group

Age	1979		1978		1977	
	No.	%	No.	%	No.	%
0-9	232	18.4	205	18.3	191	16.9
10-14	363	28.8	368	32.9	424	37.6
15-19	327	26.0	245	21.9	253	22.4
20 & Up	338	26.8	302	27.0	259	23.0
Total	1,260	100.0	1,120	100.0	1,127	99.9

The Motorist in the Crash

The percentages of motor vehicles involved in crashes with bicycles by vehicle type are given in Table 8. During 1979, 78% of the registered vehicles in Virginia were passenger cars and 78% of the bicycle-motor vehicle crashes involved passenger cars. It is for vehicles registered as trucks that the data are most significant. While 1979 truck registrations made up 4.6% of all vehicles, trucks were involved in 12.4% of the crashes in 1979, 13.2% in 1978, and 10.7% in 1977. These figures show that trucks were overrepresented by 2½ times in bicycle crashes.

It should be pointed out that trucks are overrepresented, based on the percentage of registered vehicles, in all motor vehicle crashes. The situation for bicycle-truck crashes is no worse than that found for truck involvement in other types of crashes.

The ages of the crash-involved motor vehicle operators are given in Table 9. These data indicate that in 1979 licensed operators less than 18 years of age were involved in nearly 7% of the bicycle-motor vehicle crashes, those between 18 and 19 in about 7.5%, and those between 20 and 24 in 18.8%. In each of these age categories, the operators were overrepresented in crashes in relation to the number of licensed drivers. The under 17 group had more than double their expected number of crashes and the 18-19 group had 1.5 times their expected number based on licenses in force.

Young drivers also are overrepresented in other categories of motor vehicle crashes. Their involvement in bicycle-motor vehicle crashes is no worse than that found for their involvement in other types of crashes.

Table 8

Types of Motor Vehicles Involved in Bicycle Crashes

Vehicle Type	Percent of Registered Vehicles — 1979	Percent Involved in Crash 1979	1978	1977
Passenger Cars	78.4	78.1	77.8	81.5
Trucks	4.6	12.4	13.2	10.7
Motorcycles	2.0	2.0	1.4	1.8
Buses	N/A	0.9	0.4	0.4
Others	15.0	6.7	7.2	5.6

Table 9

Age of Motor Vehicle Operators Involved in Crashes

Operator Age	Percent of Licenses in Force — 1979	Percent Involved in Crash		
		1979	1978	1977
Under 17	3.1	6.7	5.2	6.1
18-19	5.1	7.4	7.9	6.7
20-24	14.6	18.8	15.7	19.6
25-34	27.0	21.8	23.7	21.2
35-54	31.0	23.2	24.7	24.1
55-64	11.1	7.9	9.0	9.3
65 & Over	8.0	5.4	4.4	3.5
Not Stated	—	8.8	9.5	9.4

For the other age groups, those between 25 and 34 had nearly 22% and those between 35 and 54 were involved in approximately 24% of the crashes during each year. There was a decrease in involvements from 9.3% in 1977 to 7.9% in 1979 for the 55- to 64-year-old operators. In addition, over these 3 years there was an increase from 3.5% in 1977 to 5.4% in 1979 for motor vehicle operators 65 and over. For each of these four age categories, bicycle-motor vehicle crashes were underrepresented as compared to the percentages of operator licenses in force.

Table 10 presents data on the maneuvers of motor vehicles involved in crashes with bicycles. Because of changes made in the Accident Report in 1978, similar data are not available for 1977. During both 1978 and 1979, just over two-thirds of the motor vehicles were going straight at the time of the crash. In 22.2% of the 1978 crashes and 23.3% of those in 1979, the motor vehicle was making a turn. Left-turning vehicles were involved in a slightly greater percentage of crashes than were right-turning vehicles. Left turns accounted for 11.7% in 1978 and 12.8% in 1979, while right-turn crashes accounted for 10.5% each year. Although only 2% of the bicycle-motor vehicle crashes were coded as having involved a passing maneuver, some crashes coded as motor vehicle going straight ahead could have been a passing situation because of the shared lane concept of bicycle travel; i.e., both the bicycle and motor vehicle could have been proceeding straight while occupying the same traffic lane.

In a number of the bicycle-motor vehicle crashes, the driver's action was recorded on the accident report form. A summary of these actions is given in Table 11. There was a drop in the percentage of times no charge was placed against the motor vehicle

operator from 68.8% in 1977 to 62.9% in 1979. Most often, the actions included right-of-way violations, inattention, and hit and run. These cases made up 17.5% of the cases in 1978 and 18.5% in 1979. Although speed, turning, and passing violations increased over the past 3 years, they still accounted for only 5.5% of the total in 1979. Thus, the motor vehicle operator was not charged for being at fault in the majority of crashes.

Table 10

Maneuvers of Motor Vehicles in Bicycle Crashes

Maneuver	1979	1978
Straight	67.5	68.1
Right Turn	10.5	10.5
Left Turn	12.8	11.7
Passing	2.0	1.8
Other	6.7	6.8
Not stated	0.6	1.1

Table 11

Driver Actions — Motor Vehicle Operator

Driver Actions	1979	1978	1977
None	62.9	64.9	68.8
Not Have Right-of-Way	6.3	6.0	2.5
Inattention	5.6	3.8	Not Coded
Hit and Run	6.6	7.7	5.7
Speed Infractions	2.3	1.9	0.4
Turning Infractions	2.0	0.3	1.8
Passing Infractions	1.2	0.8	0.2
Others	9.1	11.1	20.4
Not Stated	4.0	3.5	—

Injury Severity

Data on the severity of injuries to the bicycle operator are shown in Table 12. Over the last 3 years, a death occurred in less than 2% of the bicycle-motor vehicle crashes. An injury in which there was a bleeding wound, broken bones, or the victim

was carried from the scene — which is classified as a serious injury in Virginia — was sustained in over 40% of the crashes in each of the last 2 years. Injuries in which bruises or abrasions were sustained accounted for 56.3% of the cases in 1978 and 54.5% in 1979.

In Table 13, the data are categorized according to the ages of the crash-involved bicyclists and the severity of their injuries. There was a decline in the percentage of serious injury to those 10 to 14 years of age, from 38.6% of the total in 1977 to 28.3% in 1979. This decline was accompanied by a rise in serious injuries in two age groups. For those 15-19, the change was from 20.3% to 25.6%, and for those 20 and up, the increase was from 21.2% to 24.2%. Minimal injuries of the bruise-abrasion type also declined in the 10-14 age category from 36.5% in 1977 to 29.2% in 1979. There were slight increases in minimal injuries in all of the other age categories, with those less than 9 years of age showing the greatest change — from 14.7% in 1977 to 18.0% in 1979. While children less than 14 continued to account for most injuries, both serious and minimal, there was a decline in their totals and injuries to adults increased.

Table 12

Percentage of Bicyclist Injury by Severity

Severity	1979	1978	1977
Fatal	1.1	2.1	1.8
Serious	42.9	40.0	53.7
Slight	38.6	40.1	20.1
Pain	15.9	16.2	14.0
Not Stated	1.5	1.6	10.3

Table 13

Percentage of Bicyclist Injury by Age and Severity

Age	1979		1978		1977	
	Serious	Minimal	Serious	Minimal	Serious	Minimal
0-9	19.0	18.0	17.0	19.2	18.8	14.7
10-14	28.3	29.2	31.4	33.8	38.6	36.5
15-19	25.6	26.2	22.9	21.1	20.3	25.1
20 & Up	24.2	22.9	27.1	23.3	21.2	20.4
Not Stated	2.9	3.8	1.5	2.6	1.1	3.3

The severity of the injury to the bicyclist categorized by the maneuver of the crash-involved motor vehicle is reflected in Table 14. (These data were not available for 1977 because of differences in the recording of the information on the accident report form used that year.) In all 3 categories of severity (fatal, serious, and minimal), most crashes occurred while the motor vehicle was going straight. A turning maneuver was involved in just over 25% of the accidents resulting in minimal injury to the cyclist and over 17% of the serious injuries during both years. Left-turning vehicles produced a higher percentage of serious injuries than did right-turning vehicles during both 1978 and 1979.

Data on injury severity and the kind of locality in which the crash occurred are given in Table 15. The percentages of fatal crashes were extremely variable because of the small numbers of these crashes. For the 1977-1979 period, approximately half of the fatal crashes were in open country and half were in residential and business-industry areas.

Slightly over half of all serious injury crashes were in residential areas, but there was a decrease from 56.6% in 1977 to 52.7% in 1979. There also was a drop in the percentage of crashes resulting in serious injury to bicyclists in open country areas, with these areas accounting for only 9.5% of the crashes in 1979. Serious injury crashes rose in business-industrial areas, going from 26.9% in 1977 to 33.1% in 1979.

Over these 3 years, there was little change in the rates of crashes producing minimal injuries. Residential areas accounted for over half, business-industrial for nearly a third, and open country for approximately 7% of the crashes resulting in bruises and abrasions to the bicyclist.

Table 14

Percentage of Bicycle Accidents by Motor Vehicle Maneuver and Injury Severity

Maneuver	1979			1978		
	Fatal	Serious	Minimal	Fatal	Serious	Minimal
Straight	78.6	70.0	66.2	91.7	73.8	63.4
Right Turn	7.1	8.0	12.3	0.0	6.6	13.3
Left Turn	0.0	13.5	12.8	0.0	11.1	12.5
Passing	7.1	2.7	1.3	4.2	2.2	1.5
Other	0.0	5.1	7.0	0.0	5.9	7.9
Not Stated	7.1	0.5	0.4	4.2	0.4	1.4

Table 15

Percentage of Bicycle Accidents by Locality and Injury Severity

Locality	1979			1978			1977		
	Fatal	Serious	Minimal	Fatal	Serious	Minimal	Fatal	Serious	Minimal
Residential	0.0	52.7	55.1	37.5	54.1	54.1	28.6	56.6	56.1
Business-Industrial	50.0	33.1	31.7	12.5	25.3	31.6	23.8	26.9	32.5
Open Country	42.9	9.5	6.5	45.8	15.5	8.2	47.6	12.6	7.3
School-Playground	0.0	2.8	4.2	0.0	2.8	3.3	0.0	2.4	1.6
Other	0.0	0.9	1.8	4.2	1.1	1.2	0.0	0.0	0.0
Not Stated	7.1	1.1	0.7	0.0	1.1	1.7	0.0	1.5	2.5

Summary

In obtaining data from the state police crash tapes, it became evident that there were some missing elements in the data base that could have been useful in establishing the nature and scope of the bicycle safety problem. In an effort to alleviate these problems in future projects concerned with bicycle travel, a cooperative effort should be initiated by state and local police authorities to record additional data when a bicycle is involved in a crash.

This would require only minor modifications in the accident investigation procedures and a change in the data processing procedures. The bicycle could be coded on the form in the space allocated to the second vehicle and all data applicable to motor vehicles could be furnished. Once the accident report form is filed with state authorities, the complete bicycle data could be computerized for access by state officials. In this manner, actions of the bicyclist, including violations of the law, maneuvers which might have led to the crash, roadway defects, intersection location, etc., would be available for analysis. These data are potentially useful in making bicycle travel safer for all users of the road network.

While the principal focus of this study was on revisions to the Code of Virginia, it is recognized that these revisions will not eliminate bicycle-motor vehicle crashes. There are other countermeasures that should also be used in an attempt to make bicycling safer. These include innovative educational programs, improved engineering concepts, and selected techniques of law enforcement, each of which could in itself be the focus of a report.

There are three findings resulting from the data analysis which should be incorporated into public education and information programs. The first is that trucks are overinvolved in crashes with bicycles. The truck data do not include pickup trucks, unless they are specifically registered and have a T tag, because in Virginia they are included as passenger cars.

The second is the overrepresentation of young drivers in bicycle-motor vehicle crashes. Because the greatest degree of overrepresentation is with the drivers having just completed driver education, increased emphasis should be placed on topics dealing with the motorist's responsibility to other users of the roadway in the high school driver education curriculum. To reinforce the sharing of the roadway concept with young drivers, the Virginia Driver's Manual and the knowledge test for an original license should include material on bicycle-motor vehicle safety.

And, finally, in Virginia there appears to be a shift in the bicycle-motor vehicle crash situation. An increasing number of crashes are occurring in business-industrial areas with a corresponding decrease in crashes in residential areas, and an increasing number of adults are being involved in crashes.

The data clearly indicate that several types of countermeasures must be undertaken. Education remains a critical need. The preponderance of fatalities among children ages 10-14 demonstrates the necessity of continued educational programs emphasizing bicycle safety. Selective enforcement of traffic laws is a second type of countermeasure that is necessary to reduce bicycle injuries and fatalities. In a majority of the crashes reported, the bicyclist has been at fault. Often he has disobeyed a traffic control device or failed to yield the right-of-way. Furthermore, in addition to providing bicycle paths where practical and demanded by bicycle traffic, there are a number of improvements that can be made to the present road system to increase the safety of bicycle riding. Serious injuries and fatalities among bicyclists are clearly associated with the bicyclists's proximity to motor vehicles and the speed of motor vehicles.

And, finally, changes in traffic laws are necessary to clarify the status of the bicycle and to provide the basis for educational or enforcement programs. Revision of the Code of Virginia is the primary focus of this study. However, education, traffic engineering, and selective enforcement all are needed in any program to improve bicycle safety. See Appendix B for selected sources of information on each of these countermeasures.

ANALYSIS OF THE CODE OF VIRGINIA

Title 46.1 of the Code of Virginia regulates the use of the Commonwealth's highways and roadways. (See Appendixes C and D.) This title of the Code defines "bicycle" and sets forth provisions governing its operation. Provisions of the Code apply to bicycles in two ways. First, some provisions make explicit reference to bicycle. These sections mandate safety equipment for bicycles, specify the manner of operating a bicycle, and specify where a bicycle may be operated. Secondly, for purposes of chapter four of title 46.1, the Code applies the rights and duties of the driver of a vehicle to the rider of a bicycle operating on the roadway.(18) Thus, provisions in chapter four referring to vehicles in general implicitly apply to a bicycle.

Six sections of title 46.1 make explicit reference to bicycles. The Code requires that bicycles being operated between sunset and

sunrise be equipped with a front light capable of being seen from a distance of 500 feet and a rear reflector visible from 50 to 500 feet. A red light visible from 500 feet is permissible in lieu of a rear reflector.(19) All bicycles operated upon the highway must be equipped with a brake capable of stopping the bicycle on a clean, dry pavement.(20)

When riding upon the highway, bicyclists must ride in a single file fashion as near to the right side of the highway as practicable.* The Code specifically prohibits persons riding a bicycle from clinging to any vehicle on the roadway.(21) Persons operating bicycles on a highway are not permitted to carry any package, bundle, or article which prevents the rider from keeping at least one hand upon the handlebars.(22)

The Code prohibits the operation of bicycles on sidewalks.** The Code also empowers the State Highway and Transportation Commission to prohibit the use of interstate highways and controlled access highways by bicycles.(23) When a bicycle path is available, local authorities may prohibit use of the roadway by bicyclists.(24)

Finally, the Code empowers local authorities to adopt ordinances for the licensing of bicycles.(25) Local authorities also have the power to adopt ordinances to establish and regulate bikepaths.(26)

The more important provisions of the Code affecting bicycle safety do not explicitly refer to bicycles. In March 1980, the General Assembly amended §46.1-171 of the Code to read: "Persons riding bicycles or animals upon a roadway and any person driving any animal thereon shall be subject to the provisions of this chapter and shall have all the rights and duties applicable to drivers of a vehicle, unless the context of the provision clearly indicates otherwise."

The previous language of §46.1-171 did not explicitly clothe the bicyclist with the rights applicable to the driver of a vehicle. No judicial authority exists for an interpretation of §46.1-171. Nevertheless, authority does exist for the proposition that §46.1-171

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*"As near to the right of the highway as practicable" in §46.1-229.1(b) of the Code has been interpreted to mean either the right-hand edge of the roadway or the shoulder. Cooke v. Griggs 183 Va. 851, 33 S.E. 2d 764 (1945). Laubach v. Howell 194 Va. 674, 74 S.E. 2d 794 (1953).

**§46.1-229 of the Code exempts Arlington and Henrico Counties from this provision. Other local jurisdictions may permit riding on sidewalks in certain areas.

is an incorporation of the traffic rules set forth in chapter four. Even prior to the revision of §46.1-171, the Virginia Supreme Court declared a bicycle a vehicle for purposes of traffic rules.(27) Furthermore, courts in other jurisdictions have interpreted provisions similar to §46.1-171 with statements that a bicycle is a vehicle for purposes of the rules of the road.(28) Therefore, it is reasonable to interpret §46.1-171 as meaning bicycles are subject to the provisions of chapter four referring to vehicles, unless clear reason exists in the text for their exclusion.* The text of the Code indicates exclusion in three principal ways: First, compliance with the provision by the bicyclist or bicycle is impossible, thus indicating exclusion; secondly, language of the provision refers explicitly to bicycles, thus indicating its precedence over provisions of similar character making general reference to vehicles; and thirdly, language of the provision refers to a particular type of vehicle (e.g., motor vehicle), thus indicating bicycles are excluded.

Under this analysis, §46.1-171 addresses the rights and duties of bicyclists in the major areas listed below. These are discussed under the succeeding subheadings.

Turning and signaling
Passing and overtaking
Obedience to traffic signals
Speed limits
Right-of-way
Duty to stop and report in case of accidents
Serious traffic offenses
Equipment requirements

Turning and Signaling

The Code of Virginia makes no explicit mention of the method of turning or signaling for bicyclists. The turning and signaling sections of chapter four make general reference to all vehicles. Such provisions, therefore, are applicable to bicyclists under §46.1-171.

Chapter four mandates specific methods for making turns. A right turn must be made as close as practicable to the right-hand

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*The language of §46.1-171 applies the rights and duties to bicycles operated on the roadway. However, judicial interpretation of §46.1-171 (prior to the 1980 revision) for purposes of civil liability applied the rights and duties to horses and bicyclists on the shoulder as well as roadway.

curb or edge of the roadway.[29] A bicyclist turning left from a two-way roadway onto a two-way roadway must begin his turn from the right half of the roadway nearest the centerline, must enter the intersection to the right of the centerline, and must leave the intersection to the right of the roadway being entered.[30] A bicyclist making a left turn on other than a two-way roadway must approach the intersection in the extreme left-hand lane lawfully available to traffic and, after entering the intersection, must leave the intersection in the extreme left-hand lane available to traffic moving in the same direction.[31]

Similarly, chapter four mandates the use of hand, arm, mechanical, or electrical signals for all drivers of vehicles who intend to start, back, stop, turn, or partly turn from a direct line, when the operation of any other vehicle may be affected by such a movement.[32] Where the speed limit is more than 35 miles per hour such signals must be given continuously for at least 100 feet; where the speed limit is 35 miles per hour or less, such signals must be given for at least 50 feet.[33] The Code, however, does not describe a manual signal for a driver's intention to start or back. Furthermore, requiring the bicyclist to signal continuously for 100 or 50 feet means he must maintain his signal for a period which is likely to be longer than that required for the driver of a motor vehicle. Thus, some of the signals required by §46.1-217 may be both impractical and unsafe. Nevertheless, §46.1-171 imposes upon the bicyclist the duty to give these signals when the operation of another vehicle may be affected by his movement.

Finally, the bicyclist is under a duty to remain on his signaled course. The driver of the vehicle receiving the signals is under a duty to keep his vehicle under control and to avoid an accident.[34]

Passing and Overtaking

The duties of a passing and overtaking vehicle apply to bicyclists. Bicyclists passing and overtaking a vehicle proceeding in the same direction must signal their intention to do so, must pass on the left, and must give at least a 2-foot clearance.[35] Passing on the right is prohibited except in the following situations: (1) to pass a vehicle making a left turn, (2) to pass a vehicle on a one-way street of sufficient width to permit two lines of traffic, or (3) to pass a vehicle on a street or highway unobstructed by parked cars and of sufficient width for two or more lines of traffic in each direction.[36] The Code specifically prohibits a vehicle from leaving the roadway to pass or overtake another vehicle.[37] Although passing to the right may be the safest passing maneuver for a bicyclist, the Code either restricts or prohibits this maneuver.

The passing of a bicyclist by the driver of a motor vehicle is one of the most dangerous traffic situations for the bicyclist. The risk of collision and severe injury to the bicyclist is due to the proximity of the bicyclist to the motor vehicle and the speed of the motor vehicle. Despite the inherent risks of this situation, the respective rights of the bicyclist and the motorist are unclear. The driver of a motor vehicle has a clear duty to pass the bicyclist on the left and afford the bicyclist reasonable clearance. However, the bicyclist is under an obligation to ride to the right and, upon an audible signal from an overtaking vehicle, to give way to the right. In the case of motor vehicles, it has been decided that the preceding vehicle has the superior right and may keep its position in the center of the roadway, if there is sufficient space on its left to enable the following vehicle to pass safely.(38) Therefore, it is reasonable to conclude that a bicyclist being overtaken by a motorist has a superior right entitling him to maintain his position on the right side of the highway as set forth in §46.1-229.1.

Right-of-Way

Right-of-way provisions declare more than mere courteous customs; they impose a legal duty upon the driver of a vehicle to permit another vehicle driver or pedestrian to precede them.(39) Failure to yield the right-of-way is a major factor in both motor vehicle accidents and bicycle accidents, as indicated in previous sections of this report. The language of the provisions in the Code regarding right-of-way embraces bicyclists. Specifically, bicyclists turning left must yield the right-of-way to vehicles approaching from the opposite direction.(40) Bicyclists entering the highway or sidewalks must stop and yield the right-of-way to vehicles approaching on the highway or pedestrians approaching on the sidewalks. Bicyclists approaching an intersection on the left at the same time as another vehicle must yield to the vehicle approaching from the right, unless posted signs or signals indicate otherwise.(41) Finally, bicyclists must yield the right-of-way to emergency vehicles.(42) Each of these provisions govern all vehicles and no reason exists to exclude bicycles.

The right-of-way provisions confer important rights upon the bicyclist. Under §46.1-223, a bicyclist operating on the roadway enjoys the right-of-way over vehicles entering the highway. Similarly, a bicyclist entering an uncontrolled intersection is entitled to the right-of-way from vehicles approaching the intersection on the left at approximately the same time.(43) The right-of-way is forfeited by any bicyclist or vehicle travelling at an unlawful speed.(44)

Obedience to Traffic Signals, Signs, and Markings

Although the purpose and function of §46.1-171 almost certainly dictate that bicyclists abide by traffic signals and signs, the relevant language of the Code does not compel such a conclusion. Section 46.1-173 states that drivers of motor vehicles, trailers, and semitrailers, shall obey traffic signs and signals erected by the State Highway and Transportation Commission or by local authorities. Use of the words motor vehicles, trailers, and semitrailers, is specific in other sections of the Code. Specific use indicates an intent to exclude other types of vehicles.* This omission is noteworthy, since research has indicated that neglect of traffic control devices is one of the three most common violations in accidents when the bicyclist is at fault.

The Code does not explicitly require the drivers of vehicles to obey the instructions of police officers or persons authorized to direct traffic. The Code empowers peace or police officers to direct traffic by use of signals and to enforce the provisions of the Code.(45) The duty of the driver of vehicles to obey the instructions of an officer stems from his duty to obey the provisions of the Code. Local ordinances frequently empower police officers not only to direct traffic in accordance with established rules of the road, but also to direct traffic as deemed necessary in case of emergency.(46)

Speed Limits

Although maximum speed limits are of little practical importance to bicyclists, bicyclists are bound by the maximum speed limits set forth in chapter four. The language of the provision governs all vehicles and there is no basis for exempting the bicycle. Therefore, the bicyclist must abide by the speed limits set forth in §46.1-193 or any speed limits posted by the State Highway and Transportation Commission or local authorities.

The bicyclist is not bound by the general prohibition of §46.1-193(2)(a) against operating a motor vehicle at such a slow speed as to impede the normal and reasonable flow of traffic. The language refers explicitly to motor vehicles. However, the bicyclist must abide by minimum speed limits when posted, unless safe operation or compliance with the law requires otherwise.

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*For example, the licensing provisions of §46.1-349 make specific reference to motor vehicles. They do not apply to bicycles.

Duty to Stop and Report in Case of Accident

The Code imposes upon the drivers of all vehicles the duty to stop and report to police any accident involving death, bodily injury, or property damage.[49] This duty involves not only reporting the accident to police, but also providing name, address, operator's license number, and vehicle registration number to the other involved party. These duties have been interpreted as being disjunctive, thus requiring the driver of a vehicle to report to police or to report to the other party.[50]

The references to operator's license number and vehicle registration numbers have little application to the bicyclist, since he is not required to have a license or to register his bike. Nevertheless, the duty to provide name and address to the other party or to report to police is applicable to the bicyclist by virtue of §46.1-171. This duty as applied to bicyclists conforms with the general purpose of the provision which is to prevent hit and run incidents.[51,52]

The Code also imposes specific duties to report in particular types of accidents. A vehicle driver must give immediate notice to a police officer of an accident involving death or bodily injury; also the Code requires the driver of a vehicle to file a written report with the Division of Motor Vehicles (DMV) for an accident resulting in the death of any person, bodily injury, or property damage of $350 or more.[53] However, both of these provisions are contained in chapter six of title 46.1. Therefore, they are not within the scope of §46.1-171. Thus, the bicyclist is bound by the hit and run provision of §46.1-176, but not the reporting provision of §46.1-399 or §46.1-400.

Serious Offenses

The Code has a specific provision prohibiting the operation of a vehicle in a reckless manner that endangers life, limb, or property. It is a separate offense, the essence of which is serious disregard of safety — not simply unlawful conduct.[54] Although there is no case authority for interpreting this section as applying to bicycles, there is strong reason for such an interpretation. Like several other provisions of chapter four, s46.1-187 makes general reference to all vehicles. In addition, the reckless operation of a bicycle may jeopardize the safety of pedestrians or drivers of other vehicles. Finally, bicyclists are capable of committing some of the acts specified in the Code as constituting reckless driving. These include: failure to give adequate and timely signals of intention to turn, slow down, or stop as required by §46.1-216 through §46.1-220; and failure to bring the vehicle to a stop immediately before entering a highway from a side road when there is traffic approaching upon such highway within 500 feet of such point of entrance, unless a

"Yield Right-of-Way" sign is posted; or where such a sign is posted, failure upon entering such a highway, to yield the right-of-way to a vehicle approaching on such a highway from either direction, §46.1-190(j).

Reckless driving is a sanction which can be used to encourage safe behavior by both bicyclists and motorists. It recognizes that certain behavior by bicyclists or motorists poses a serious threat to life, limb, or property. However, the bicycle, because of its size and speed, lacks the same potential for damage or injury as the motor vehicle. Therefore, application of the reckless driving sanction to bicyclists is likely to require a greater degree of culpability.

Improper driving is applicable only when a driver is charged with reckless driving. It is a sanction which the court, in its discretion, may impose in lieu of reckless driving.(55) The prohibition against driving while under the influence of intoxicants applies only to the operation of motor vehicles, engines, trains, or pedal bicycles with helper motors.(56)

Equipment Requirements

As noted previously, two sections of chapter four make explicit reference to required equipment for bicycles.(57) These explicit requirements for bicycles indicate their precedence over the general equipment requirements for vehicles. Thus, provisions regarding a reflector requirement for slow-moving vehicles do not apply to bicycles despite the general language referring to any vehicle designed for operation at speeds less than 25 miles per hour.(58)

Most of the provisions concerning required equipment refer to motor vehicles and thus explicitly exclude bicycles. Other required equipment such as safety glass and mufflers have no application to bicycles. Section 46.1-284, however, prohibits the use of a siren by any vehicle, thus implicitly including bicycles within its scope.

REVISIONS OF THE CODE OF VIRGINIA

The Code contains a wide range of provisions concerning the bicycle and the bicyclist. However, it does not effectively address several areas of traffic safety. There is general ambiguity within the Code regarding the status of the bicycle and the relationship of the bicyclist to other users of the highway. Specifically, the Code is indefinite in several areas where accident data indicate serious conflicts between bicyclists and drivers of motor vehicles.

Accident data indicate that the severity of accidents is related to the proximity of bicycles to motor vehicles and the speed of motor vehicles. Yet the Code prohibits riding of bicycles on sidewalks and does not define the bicycle's position on the roadway. Research has indicated that the passing of a bicyclist by a motorist accounts for a large number of serious bicycle accidents. However, the Code does not explicitly outline the respective duties of the bicyclist and motorist during such a maneuver. Intersections are the location of a significant portion of bicycle accidents. Nevertheless, the Code does not specifically require bicyclists to obey traffic control devices. Nor does the Code give practical guidance to bicyclists turning at intersections. Revisions of the Code are appropriate in these areas.

Any recommended revisions of the Code must be clearly designed to prevent accidents and to promote the convenient flow of traffic. Traffic regulations improve traffic safety by establishing preferred standards of conduct and encouraging existing practices to conform with those standards.[59,60,61] To be effective, however, the standards must be acceptable to the public as reasonable measures designed for the prevention of accidents and traffic congestion. Traffic regulations, especially those concerning pedestrians or bicyclists, cannot rely upon penalties as means of encouraging compliance. The penalties for traffic infractions are slight and enforcement is not frequent.* Therefore, provisions of the Code must be as clear as possible, leaving little doubt as to their nature and purposes. Equally important, they must function not only to prevent accidents but also to promote the convenient flow of traffic and thus demonstrate their value and reasonableness to all users of the highway.

Status of the Bicycle

A fundamental problem exists with the present definition of "bicycle". This definition does not specify the type of device which is subject to the provisions of the Code. It simply states that motorized bicycles are bicycles for the purposes of the Code. (See Appendix D for a complete definition of bicycle.) The definition of bicycle is important because it sets forth the scheme for outlining the bicyclist's status and his relationship to other users of the highway. The definitions of bicycle contained in the Code of Maryland and

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*Personal communication. Larry Pavlinski, Chief, Pedestrian Cyclist Branch, NHTSA, contained in a contractor's report on Pedestrian Laws/Ordinances.

the Uniform Vehicle Code more clearly delineate the characteristics of the bicycle as quoted below.

> Maryland Code Ann.
>
> §11.104. Bicycle
>
> "Bicycle" means a vehicle that:
> (1) Is designed to be operated by human power;
> (2) Has two or three wheels, of which one is more than 14 inches in diameter.
> (3) Has a rear drive; and
> (4) Has a wheel configuration as follows:
> (i) If the vehicle has two wheels, with both wheels in tandem;
> (ii) If the vehicle has three wheels, with one front wheel and with two rear wheels that are spaced equidistant from the center of the vehicle. (An. Code 1957, art. 66½, §1-104, 1977, ch. 14, §3: 1978, ch. 328.)
>
> §11-176. Vehicle.
>
> "Vehicle" means any device in, on, or by which any individual or property is or might be transported or towed on a highway. (An. Code 1957, art, 66½, §1-209; 1977, ch. 14, §2.)
>
> Uniform Vehicle Code §1.105 — Bicycle — Every vehicle propelled solely by human power upon which any person may ride, having two tandem wheels, except such vehicles with a seat height of no more than 25 inches from the ground when the seat is adjusted to its highest position, and except scooters and similar devices. (REVISED, 1975 & 1979).

These definitions (1) identify characteristics such as seat height and wheel configurations, (2) separate the bicycle from the category of mopeds, and (3) explicitly place the bicycle within the category of vehicle.

The Code should define bicycle so as to identify the type of device subject to the provisions of the Code. The use of seat height or wheel diameter permits differentiation between children's bicycles and larger bicycles. Children's bicycles and tricycles should not be subject to the provisions of the Code since they are designed for use on sidewalks and around the home. Both the Uniform Vehicle Code and the Consumer Product Safety Commission distinguish children's bicycles from larger bicycles on the basis of maximum seat height.(62)

Use of maximum seat height as a defining characteristic will establish uniformity with federal definitions relied upon by bicycle manufacturers. Furthermore, compliance with the Commission's definition is advisable since the Commission is of the opinion that its exclusion of children's bicycles from its regulations preempts states from imposing equipment requirements upon children's bicycles. The relevant language is as follows:*

> The Commission found that sidewalk bicycles "are intended to be ridden by young children inside the house and on sidewalks and are not meant for use after dark and on streets" (40 FR 25485, June 16, 1975). Further, "the Commission's intention was . . . that small bicycles ridden by very young children inside houses or on sidewalks not be subject to all requirements applicable to bicycles suitable for use by older children on streets" (40 FR 25481, June 16, 1975). Based on this assessment of the risk of injury presented by sidewalk bicycles, the Commission specifically exempted them from the reflectivity and braking requirements applicable to all other bicycles covered by the regulation.
>
> In this situation, the Commission believes that states are preempted from issuing non-identical braking or reflectivity requirements for sidewalk bicycles. Since the Commission's regulation contains no such requirements, states are prohibited from issuing any, as well. We believe that this conclusion is mandated by the statutory language and legislative history of the FHSA preemption provision.
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> Please note that the Commission has approved this advisory opinion.

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*Correspondence from Ms. Margaret A. Freeson, Acting General Counsel for Consumer Product Safety Commission to Mr. Edward F. Kearney, Executive Director of National Committee on Uniform Traffic Laws and Ordinances, Sept. 12, 1978. (The Commission has reaffirmed this opinion as indicated by a phone conversation with the General Counsel's Office on August 25, 1980.)

The definition of bicycle should also distinguish between bicycles and mopeds. The motorized character of the moped justifies more strict regulation of its operation than that of the bicycle.(63) Existing provisions of the Code distinguish between the bicycle and the moped. Section 46.1-1(a) prohibits the operation of a moped upon the highway by any person under the age of 16 years. Furthermore, §18.2-266 prohibits the operation of a moped while under the influence of intoxicants. Thus, separating the definition of bicycle and moped is consistent with their different characteristics and their different treatment within the Code.

For purposes of chapter four of title 46.1, the bicycle should be defined as a vehicle while it is operated upon the highway. Section 46.1-171 grants the bicyclist on the roadway the rights and duties applicable to the driver of a vehicle. This section resolves the ambiguities associated with issues of civil liability. Prior to its revision, §46.1-171 simply stated that bicyclists riding on the roadway were subject to the provisions of chapter four of title 46.1. As revised, §46.1-171 makes it clear that drivers of vehicles must extend to the bicyclist a duty of care commensurate to the duty owed to the driver of another vehicle.

However, §46.1-171 is a cumbersome mechanism for defining the status of the bicycle. Section 46.1-171 fails to state definitively whether or not the bicycle is a vehicle or under what circumstances it is a vehicle. Furthermore, this section implies that there is a difference between possessing the rights and duties applicable to the driver of a vehicle and possessing the status of a vehicle. For purposes of chapter four, such a distinction is without merit. Thus, the definition of bicycle rather than §46.1-171 is a more direct means for addressing the issue of the bicycle as a vehicle.

The status of the bicycle is best defined according to where it is ridden. While the bicycle is on the highway, it should be designated a vehicle and be subject to the provisions of chapter four of title 46.1 governing the operation of vehicles. This is appropriate since a bicycle on the highway is in close proximity to other vehicles and thus should be operated similarly to other vehicles. Such a definition does not subject the bicycle to regulations in other chapters of title 46.1 pertaining to vehicles. Further, such a definition permits special consideration of the bicycle's status when it is ridden in particular areas. Clearly, when the bicycle is ridden on the sidewalk it should not be designated a vehicle. While on the sidewalk, the bicycle is in close proximity to pedestrians, and rules for its operation on sidewalks should make reference to the system of rules regulating pedestrians. Likewise, when the bicycle is on a playground or bicycle path it should be subject to specific rules designed for those particular areas.

Therefore, it is recommended that the definitions of bicycle, moped, and vehicle be revised to read as follows:

> §46.1-1(a) Bicycle — A device propelled solely by human power and having pedals, two or more wheels, and a seat height of more than twenty-five inches from the ground when adjusted to its maximum height. For purposes of chapter four of this title, a bicycle shall be a vehicle while operated upon the highway.
>
> §46.1-1(b) Moped — A bicycle-like device with a helper motor rated at less than one brake horsepower and which produces only ordinary pedaling speeds up to a maximum of twenty miles per hour, provided such a device so equipped shall not be operated upon any highway or public vehicular area of this State by any person under the age of sixteen. For purposes of chapter four of this title, a moped shall be a vehicle while operated upon the highway.
>
> §46.1-1(34) Vehicle — Every device in, upon, or by which any person or property is or may be transported or drawn upon a highway, except devices moved by human power or used exclusively upon stationary rails or tracks. For purposes of chapter four of this title, a bicycle or moped shall be a vehicle while operated upon the highway.

The recommended definitions of bicycle and moped will not place upon the bicycle or moped the licensing, registration, or insurance requirements applicable to motor vehicles. The licensing, registration, and insurance requirements of title 46.1 make explicit reference to motor vehicles, thus they do not apply to the broader category of vehicles. Furthermore, these requirements are contained in chapters other than chapter four and thus are outside the scope of the definitions.

The definition of bicycle as a vehicle, however, requires clarification of §46.1-190. Since it is permissible for a motor vehicle and a bicycle or moped to travel in the same lane, neither the driver of a motor vehicle nor the rider of a bicycle or moped should be subject to the reckless driving provisions of §§46.1-190(d) or 46.1-190(d1).

Therefore, it is recommended that §46.1-190(d) and §46.1-190(d1) be revised to read as follows:

§46.1-190 Same; specific instances — A person shall be guilty of reckless driving who shall:

(d) Pass or attempt to pass two other vehicles abreast, moving in the same direction, except on highways having separate roadways of three of more lanes for each direction of travel, or on designated one-way streets or highways; provided, however, this subsection shall not apply to a motor vehicle passing two vehicles, in accordance with provisions of this chapter, when one or both of the vehicles is a bicycle or moped; nor shall this subsection apply to a bicycle or moped passing two vehicles in accordance with the provisions of this chapter.

(d1) Drive any motor vehicle, including any motorcycle, so as to be in and parallel to another vehicle in a lane designed for one vehicle, or drive any motor vehicle, including any motorcycle, so as to travel parallel to any other vehicle traveling in a lane designed for one vehicle; provided, however, this subsection shall not apply to any validly authorized parade, motorcade or motorcycle escort; nor shall it apply to a motor vehicle traveling in the same lane of traffic as a bicycle or moped.

In addition, the separation of the definitions of bicycle and moped requires that existing provisions of the Code making explicit reference to bicycle be revised to include the words "or moped." Such revision is required for:

§46.1-171	Power of State Highway and Transportation Commission to Prohibit Use of Controlled Access Highways
§46.1-229.1(b)	Riding Bicycles Two Abreast on the Highway.
§46.1-229.2	Carrying Articles on Bicycles.
§46.1-235(b)	Bicyclists Attaching to Vehicles on Highway.
§46.1-263	Lamps on Bicycles.
§46.1-277(b)	Brakes for Bicycles.

Negligence of Children

Since the provisions of chapter four of title 46.1 apply to a bicycle on the highway whether or not it is ridden by an adult or a child, the Code should clearly specify that violation of provisions in chapter four by a child under 14 years of age is not negligence as a matter of law. Violation of a statute designed for the protection of persons or property is generally deemed negligence as a matter of law, negligence per se, and can function to bar recovery for damages in a civil action. Likewise, it can establish liability for injuries resulting from an accident.

However, the law does not hold children to the same standard of conduct as adults. Judicial decisions in Virginia make clear that a child under 7 years of age is conclusively presumed to be incapable of negligence; a child between the ages of 7 and 14 is presumed incapable of negligence, unless rebutted by sufficient proof to the contrary; a child 14 years of age and older is presumed capable of negligence.(64) Application of negligence per se to children under 14 years of age runs counter to the presumption they enjoy. Thus, judicial decision has established that violation of a statute by a child under 14 years of age does not constitute negligence per se.(65)

Therefore, it is recommended that a section be added to the Code to read as follows:

> §46.1-XXX Negligence of Children — A violation of any provision of this title by a child under the age of 14 shall not constitute negligence per se, although a violation may be considered as evidence of negligence.*

This addition to the Code ensures that provisions of chapter four will not be harshly applied to children for purposes of determining civil liability.

Rights and Duties of a Bicyclist

A revision of the definition of bicycle would obviate to a large degree the need for §46.1-171. Nevertheless, §46.1-171 should be retained. The section contains a prescriptive statement of the bicyclist's rights and duties. Such a statement is useful for purposes of public education. Furthermore, retention of §46.1-171 is necessary to grant adequate protection to those persons riding or driving animals.

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*The language of this provision is taken from §9-401 of the Uniform Vehicle Code.

However, the language of §46.1-171 should be revised to provide that a person riding a bicycle or driving an animal upon a highway shall have all the rights and duties applicable to the driver of a vehicle. This revision makes it clear that a bicyclist or person riding or driving animals on the shoulder of the highway is subject to the provisions of chapter four. The revision corresponds to judicial decisions that a bicyclist on the shoulder or person riding an animal on the shoulder has the rights and duties applicable to the driver of a vehicle on the highway.(66)

Therefore, it is recommended that §46.1-171 be revised to read as follows:

> §46.1-171 Persons Riding Bicycles or Riding or Driving Animals — Every person riding a bicycle or an animal upon a highway, and every person driving any animal thereon, shall be subject to the provisions of this chapter and shall have all the rights and all of the duties applicable to the driver of a vehicle, unless the context of the provision clearly indicates otherwise.

Riding Bicycles on Sidewalks

The prohibition contained in §46.1-229 against riding bicycles on sidewalks is a serious deficiency. The prohibition is defective in two respects. First, it completely ignores the common practice of riding on sidewalks, thus making it difficult to enforce. Secondly, the provision compels bicyclists to use the highway, even though many bicyclists may prefer the sidewalks for reasons of safety and convenience. The Code should not discourage these bicyclists from using the sidewalk. Unskilled bicyclists should recognize their lack of proficiency, and be able to choose their route accordingly. The risk of serious injury to the bicyclist and others is less when the bicyclist is riding on the sidewalk. Thus, the prevention of traffic collisions and traffic congestion is furthered by removing this prohibition for bicyclists.

Permitting bicyclists to use the sidewalks produces conflicts between bicyclists and pedestrians. However, such conflicts can be reduced by clearly stating that bicyclists operating on sidewalks or crosswalks must yield the right-of-way to pedestrians. In addition, §46.1-229 should be revised to remove the prohibition only for bicycles. The prohibition should be retained for motorcycles and other vehicles.

Therefore, it is recommended that the language of §46.1-229 be amended to exclude reference to bicycles and that a section be added to chapter four to read as follows:

§46.1 - XXX Riding Bicycles on Sidewalks —

(a) A person riding a bicycle upon and along a sidewalk, or across a roadway upon and along a crosswalk, shall yield the right-of-way to any pedestrian and shall give an audible signal before overtaking and passing such pedestrian.
(b) A person shall not ride a bicycle upon and along a sidewalk, or across a roadway upon and along a crosswalk, where such use of bicycles is prohibited by official traffic control devices.
(c) A person riding a bicycle upon and along a sidewalk, or across a roadway upon and along a crosswalk, shall have all the rights and duties of a pedestrian under the same circumstances.
(d) The foregoing provisions notwithstanding, local authorities may prohibit the riding of bicycles on designated sidewalks or crosswalks.*

Localities retain the power under such a revision to exclude bicycles from using the sidewalks. However, this proposed revision does not subject localities to additional tort liability for failure to enact ordinances prohibiting bicycles on sidewalks or for bicycle accidents resulting from defects in the condition of the sidewalk. A municipality is not liable for its failure to adopt or enforce an ordinance.(67) However, a municipality is charged with the duty of maintaining its streets and sidewalks in reasonably safe condition. The municipality must maintain its sidewalks free from defects or obstructions dangerous to pedestrians exercising ordinary care; it is not an insurer against all accidents. Even though a defect may have caused an injury it is not grounds for liability, unless it endangered persons exercising ordinary care and the municipality failed to take reasonable steps to correct the defect.(68) Since the proposed revision grants to the bicyclist the rights and duties of a pedestrian, the municipality will owe to the bicyclist a duty commensurate to the one it presently owes to pedestrians.

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*Language for subsection a, b, and c is taken from §11-1209 of the Uniform Vehicle Code.

Position of the Bicycle on the Roadway

While on the roadway, a bicyclist is in close proximity to motor vehicles moving at speeds frequently three to four times the speed of the bicycle. As indicated by available accident data, the potential for serious injury is substantial. The respective positions of the bicyclist and motorist on the roadway deserve elaboration. Bicyclists are entitled to ride on the right-hand edge of the roadway.(69) The purpose of requiring the bicyclist to ride to the right side of the roadway is to ensure the right-of-way for vehicles traveling at a lawful speed and complying with rules of the roads.(70) However, the bicyclist should not be required to place himself in peril.(71) He should be able to move to the left when preparing for a left turn or passing. Likewise, he should be able to deviate temporarily from his position on the right when necessary to travel through a substandard width lane or to avoid obstructions in the roadway. The Code should delineate the circumstances under which the bicyclist is permitted to move from his position on the right side of the roadway.

However, the convenient flow of traffic dictates that the right-of-way be available for vehicles traveling at a lawful speed. The bicyclist should not be permitted to unnecessarily impede traffic. The Code must accommodate the safety of the bicyclist while at the same time preserving an orderly flow of traffic.

Therefore, it is recommended that §46.1-229.1(a) be revised to read:

> §46.1-229.1 Riding Bicycles or Mopeds on Roadways —
> (a) Any person operating a bicycle or moped upon a roadway shall ride as close as practicable to the right-hand curb or edge of the roadway, except under any of the following situations:
>
> (1) When overtaking and passing another vehicle proceeding in the same direction.
> (2) When preparing for a left turn at an intersection or into a private road or driveway.
> (3) When reasonably necessary to avoid conditions including, but not limited to, fixed or moving objects, parked or moving vehicles, pedestrians, animals, surface hazards, or substandard width lanes that make it unsafe to continue along the right-hand curb or edge.
>
> For purposes of this section, a "substandard width lane" is a lane too narrow for a bicycle or moped and another vehicle to pass safely side by side within the lane.*

*Language for this revision is based upon §11-1205 of the Uniform Vehicle Code.

It is also recommended that a section be added to chapter four to read:

> §46.1 - XXX Bicycle or Moped to Allow Vehicles to Pass — Any person operating a bicycle or moped which impedes traffic shall upon an audible signal, yield the right-of-way by pulling off the roadway at the earliest reasonable opportunity and allowing traffic to proceed.*

Similar considerations affect the proper positions of motor vehicles and bicycles during passing maneuvers. Research has found that improper overtaking is one of the three most common violations in a bicycle-motor vehicle accident. Maintenance of a steady traffic flow dictates that motorist be able to pass bicyclists. However, safety dictates that when the bicyclist is properly positioned on the roadway, the motorist pass him at a safe speed and afford him reasonable clearance.

Safe passing maneuvers depend upon reciprocity; the motorist and bicyclist must respect each other's position on the roadway. Defining the bicyclist's proper position on the roadway and requiring the motorist to exercise due care in passing bicyclists will establish a safe manner in which motorists may pass bicyclists.

Therefore, it is recommended that a section be added to chapter four to read as follows:

> §46.1 - XXX Motor Vehicle Passing a Bicycle or Moped — In approaching or passing a person on a bicycle or moped, the operator of a motor vehicle shall pass at a safe distance and at a reasonable and proper speed.**

Another means of incorporating a due care provision within the Code is the following paragraph based upon §11-504 of the Uniform Vehicle Code.

> Notwithstanding other provisions of this chapter or the provisions of any local ordinance, every driver of a vehicle shall exercise due care to avoid colliding with any pedestrian or any person riding a bicycle and shall give an audible signal when necessary and shall exercise proper

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*Language for this revision is taken from Code of Indiana Ann. §47-2006 and Code of Vermont Ann. §1082.

**The language of this proposal is taken from Code of Massachusetts Ann. Chapter 90, §14.

precaution upon observing any child or any obviously confused, incapacitated, or intoxicated person (REVISED, 1971 & 1975).

This proposal does not change the existing duty of care the driver of a motor vehicle owes to a bicyclist. The law requires that all persons, in the exercise of their rights or in the performance of their duties, act with reasonable regard for the preservation of human life and prevention of serious bodily harm.(72) The motorist passing a bicyclist riding on the right-hand edge of the roadway or on the shoulder must pass at a reasonable speed and afford the bicyclist reasonable clearance.(73) Therefore, adoption of this proposal will make explicit what is suggested by the rules of chapter four and recognized by judicial decision.

Accident data do not specifically address bicyclists passing vehicles. Virginia statistics do not contain information on the passing maneuvers of bicyclists. Nevertheless, the increase in bicycle injuries in areas of heavy traffic, such as business areas, suggests that the bicyclist's method for passing vehicles should be addressed.

The Code requires the bicyclist to ride as near to the right side of the highway as practicable and exercise due care in passing a standing vehicle or one proceeding in the same direction. However, §46.1-210 prohibits bicyclists from leaving the roadway to pass and restricts the right of a bicyclist to pass to the right. It is inconsistent to require the bicyclist to ride as near to the right side of the highway as practicable and yet restrict or prohibit his ability to pass to the right. More importantly, passing other vehicles by leaving the roadway or passing to the right may be safer for a bicyclist than passing to the left. Thus, the Code should not prohibit these maneuvers.

However, the bicyclist should not be permitted to travel between two lanes of traffic except where it is clear that one lane is going to turn. This prohibition is consistent with the prohibition against motorcycles traveling in between lanes of traffic.(74) Traveling between lanes of traffic exposes the bicyclist to injury from traffic crossing between lanes. Also, if the speed of traffic suddenly accelerates, the bicyclist is left in the center of traffic where he obstructs traffic and risks collision with vehicles.

Therefore, it is suggested that a section be added to chapter four to read as follows:

> §46.1 - XXX Overtaking and Passing Vehicles —
> (a) A person riding a bicycle or moped may overtake and pass another vehicle on either the left or right side, staying in the same lane as the overtaken vehicle, or changing to a different lane, or riding off the roadway as necessary to pass with safety.

(b) A person riding a bicycle or moped may overtake and pass another vehicle only under conditions which permit the movement to be made with safety.
(c) A person riding a bicycle or moped shall not travel between two lanes of traffic moving in the same direction, except where one lane is a separate turn lane or mandatory turn lane.
(d) Except as otherwise provided in this section, a person riding a bicycle or moped shall comply with all rules applicable to the driver of a vehicle when overtaking and passing.*

Bicycles at Intersections

Finally, revision of sections in the Code pertaining to the operation of bicycles at intersections is appropriate in view of reported findings from research. Previous accident research consistently show that a major portion of bicycle crashes are intersection-related. Increases in the number of bicycle crashes in areas of heavy traffic, such as business and industrial areas, suggest that intersections will continue to be areas of conflict between bicyclists and motorists. Therefore, language of the Code should provide safe and practical methods for operating bicycles at intersections.

Revision of §46.1-173 is necessary to clearly require all vehicles, thus including bicycles and mopeds, to obey traffic signs and signals. Traffic signs and signals regulate traffic and prevent collisions. Because devices have particular importance at intersections, there should be no question regarding the duty to obey them. The present language of §46.1-173 does not embrace bicyclists.

Therefore, it is recommended that the language of §46.1-173(a) be revised to read:

§46.1-173(a) — The driver of a vehicle shall obey and comply with the requirements of road signs erected upon the authority of the State Highway and Transportation Commission or subject to the provisions of §§33.1-39 and 33.1-47 by local authorities in cities and towns.

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*Language for subsections (a), (b), and (d) is taken from the draft of proposed addition to Uniform Vehicle Code, Agenda for National Meeting, April 1975, p. 170.

The Code requires that a right turn be made as close as practicable to the right-hand edge or curb of the roadway. This is probably the safest method for making a right turn and corresponds to the common practice of most bicyclists. However, the method outlined in the Code for making a left turn requires the bicyclist to enter the middle of the intersection. This method may be appropriate for experienced bicyclists; however, inexperienced bicyclists should have an alternative method, especially at busy intersections. One alternative resembles the way a pedestrian crosses an intersection. It permits the bicyclist to cross the intersecting roadway as close as practicable to the curb or right-hand edge and then, after complying with traffic signs or signals, to continue his turn as close as practicable to the curb or edge of the roadway being entered. This method does not require the bicyclist to enter the center of the intersection, nor does it require him to dismount and cross on foot. Thus, it is a practical alternative to the way a vehicle executes a left turn.

Therefore, it is recommended that a section be added to chapter four to read as follows:

> §46.1 XXX Left Turns —
> (a) A person riding a bicycle or moped and intending to turn left shall follow a course described in §46.1-215 or in subsection (b).
> (b) A person riding a bicycle or moped and intending to turn left shall approach the turn as close as practicable to the right curb or edge of the roadway. After proceeding across the intersecting roadway, the bicyclist shall comply with traffic signs or signals and continue his turn as close as practicable to the right curb or edge of the roadway being entered.
> (c) Notwithstanding the foregoing provisions, the state Highway and Transportation Commission and local authorities, in their respective jurisdictions, may cause official traffic control devices to be placed and thereby require and direct that a specific course be traveled by turning bicycles and mopeds, and when such devices are so placed, no person shall turn a bicycle or moped other than as directed and required by such devices.*

A third element concerning the operation of bicycles at intersections concerns the duty of the bicyclist to signal his intention

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*Language for this revision is taken from §11-1207 of the Uniform Vehicle Code.

to turn or change direction. The Code requires him to signal continuously for a distance of 100 feet when the speed limit is more than 35 miles per hour and for a distance of 50 feet when the speed limit is 35 miles per hour or less. The safety of the bicyclist and drivers of vehicles requires that he signal his intention to turn or change direction, especially at intersections. However, requiring the bicyclist to signal continuously for distances of 50 or 100 feet jeopardizes his safety, if the use of both arms is required for control of the bicycle. The safety of other drivers can be accommodated without jeopardizing the safety of the bicyclist.

Therefore, it is recommended that a subsection be added to §46.1-217 to read as follows:

> §46.1-217(c) — A person riding a bicycle or moped shall signal his intention to stop, turn, or change direction. However, such signals need not be given continuously, if both hands are needed in the control or operation of the bicycle.*

This provision maintains the duty of the bicyclist to signal, but does not require that he do so continuously.

Some revisions of the Code are specifically not recommended. The registration of bicycles should remain a local function as set forth in §15.1-133. The number of bicycles in use varies widely among localities. Thus localities should have discretion in allocating resources for registration programs. Likewise, no recommendation is made concerning regulations for bicycle parking. Local ordinances are best suited to deal with parking problems. Finally, localities should have the authority, as outlined in §15.1-16.2, to regulate the use of bike paths according to local traffic needs. A locality should have the authority to restrict use of the roadway when a bicycle path is available. Thus, no revision of §46.1-229.1(c) is recommended.

No recommendations are made concerning required equipment for bicycles. Research in other states and accident data for Virginia indicate that most bicycle crashes occur during daylight and result from driver or rider behavior. At night, the visibility of the bicyclist is an important factor in accidents. However, the reflector requirements of the Consumer Product Safety Commission appear to preempt stricter state regulations in this area.

Therefore, those recommendations which are deemed most appropriate and for which changes to the Code of Virginia should be made fall into three categories: the status of the bicycle, the bicycle's proper position on the roadway, and the operation of the bicycle at intersections.

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*Language for this revision is taken from §11-1208 of the Uniform Vehicle Code.

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21. Ibid. §46.1-235(b).

22. Ibid. §46.1-229.2

23. Ibid. §46.1-171.1.

24. Ibid. §46.1-229.1(c).

25. Ibid. §15.1-133.

26. Ibid. §15.1-162.

27. Phillips v. Schools 211 Va. 19, 175 S.E. 2d 279 (1970).

28. Lowe v. Futrell 271 N.C. 550, 157 S.E. 2d 92 (1967).
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30. Ibid. §46.1-215(b)

31. Ibid. §46.1-215(c).

32. Ibid. §46.1-216 and §46.1-217(a).

33. Ibid. §46.1-217(b).

34. Ibid. §46.1-218 and §46.1-219.

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36. Ibid. §46.1-210.

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40. Ibid. §46.1-222.

41. Ibid. §46.1-220.

42. Ibid. §46.1-224.

43. Ibid. §46.1-221.

44. Ibid.

45. Va. Code Ann. §46.1-183, §46.1-6, §46.1-37.

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APPENDIX A

ENGROSSED

HOUSE JOINT RESOLUTION NO. 105
House Amendments in ( ) - February 14, 1980

Requesting the Department of (~~Highways and~~) Transportation (Safety) to study Virginia's laws pertaining to operation of bicycles on the highways.

Patrons - Grayson, McClanan, Murray, and Stambaugh

Referred to the Committee on Roads and Internal Navigation

WHEREAS, the Commonwealth of Virginia governs the safety and convenience of users of the public roads; and

WHEREAS, the motorists, bicyclists, and pedestrians of Virginia desire to use the same public roads in greater safety and less apprehension of accident and mishap; and

WHEREAS, bicycles are being used in dramatically increasing numbers as a basic means of transportation, in lieu of the motor vehicle; and

WHEREAS, the use of bicycles is being encouraged as a highly effective means to save energy and reduce pollution; and

WHEREAS, the improvement of safety for bicyclists would also have a beneficial and lasting effect on the safety of other users of the public roads; and

WHEREAS, it is desirable that Virginia have traffic laws which define clearly and systematically the rights and responsibilities of all users of the public roads in relation to each other; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That the Department of (~~Highways and~~) Transportation (Safety) is hereby requested to conduct a study to evaluate the traffic laws of Virginia and determine what, if any revisions or additions are necessary to improve safety for bicyclists, taking into consideration the character of bicycle and rider.

The Department, in conducting its study, shall take into consideration the existing reports and studies which are relevant to the subject.

The Department shall prepare for consideration such legislation or recommendations as it deems appropriate on the basis of its study.

The Department, in conducting this study, should seek information and technical assistance from other State agencies and departments, members of the General Assembly, private persons and organizations who have knowledge, expertise, interest in or jurisdiction over the matters considered.

The Department shall complete its study and report to the General Assembly no later than December one, nineteen hundred eighty.

APPENDIX B

EDUCATION, ENGINEERING, AND ENFORCEMENT PROGRAMS

Education

Education is an essential element in any bicycle safety program. Bicyclists and motorists must be informed of laws concerning the operation of bicycles. Furthermore, education must emphasize techniques for recognizing road hazards and avoiding them. Sources of information that may be useful in the development of educational programs include the following.

Sources for Classroom Materials

American Automobile Association
National Safety Council
Bicycle Manufacturers Association
Virginia Department of Transportation Safety
Schwinn Bicycle Company

Virginia Department of Education Curriculum Guides

Health Education — Grades K through 7
Health Education — Grades 7 through 12
Driver Education in Virginia
Street and Bus Safety Guide for Virginia Schools

Effective Cycling by John Forester

"A Balanced Approach to Bicycle Safety" by C. L. Lefler (in Proceedings, Seminar on Planning, Design, and Implementation of Bicycle-Pedestrian Facilities, San Diego, 1974.)

Local bicycling organizations

Bicycle Safety Films

Only One Road (AAA)
Ride On By (AAA)
It's Your Move (Travellers Insurance Co.)
Just Like A Car (Va. Dept. Transp. Safety)
Bicycle Rules of the Road (Va. Dept. Transp. Safety)
The Bicycle Driver (Motion Pictures Consultants)

Engineering

Engineering approaches should take into account the specific needs of both bicyclists and motorists, and thus make roadways safe for all users. Community approaches include the realignment of storm sewer grates and improvements to the road surface. Bicycle paths are one means of reducing the conflict between bicyclists and motorists. The Code of Virginia grants specific authority to localities and appropriate state agencies to establish and regulate bicycle paths (§§15.1-162 and 33.1-223). Sources that emphasize engineering approaches to bicycle safety include the following:

Transportation Research Board, Transportation Research Record No. 570, The Bicycle as a Transportation Mode

Publications of the Institute of Transportation and Traffic Engineering on Bicycle-Pedestrian Facilities

Safetv and Location Criteria for Bicvcle Facilities, U. S. Department of Transportation, Federal Highway Administration, February 1977.

Planning and Design Criteria for Bikeways in California, California Department of Transportation, June 1978.

Bikeway Development Study, Virginia Department of Highways and Transportation, October 1974.

Enforcement

Enforcement is necessary to ensure compliance with traffic laws by bicyclists and motorists. However, enforcement programs are difficult for public officials to formulate and enforce because of variations in the age and skill of the rider and the location of bicycle riding. Sources which may be useful in the development of enforcement programs include the following.

"Enforcement: Program and Problems in Four Communities", by Leslie Baldwin, Bicycle Forum, Fall 1979.

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APPENDIX C

STRUCTURE OF THE CODE OF VIRGINIA

Chapter Four is entitled "Traffic Regulations". The structure of the Code is composed of titles, chapters, and sections. Title 46.1 is entitled "Motor Vehicles". Often this title is referred to as the Motor Vehicle Code. Title 46.1 consists of thirteen chapters:

Chapter One	—	General Provisions
Chapter Two	—	Division of Motor Vehicles
Chapter Three	—	Registration and Licensing
Chapter Four	—	Regulation of Traffic
Chapter Four, One	—	Trial of Certain Traffic Offenses
Chapter Five	—	Operator's and Chauffeur's License Act
Chapter Six	—	Motor Vehicle Safety Responsibility Act
Chapter Six, One	—	Drivers Improvement Act
Chapter Seven	—	Motor Vehicle Dealers
Chapter Seven, One	—	Disposition of Salvage Motor Vehicles
Chapter Eight	—	Parking Facilities
Chapter Nine	—	Open-Air Theaters
Chapter Ten	—	Abandoned Motor Vehicles

APPENDIX D

DEFINITIONS USED IN CODE OF VIRGINIA

§ 46.1-1. Definitions. — The following words and phrases when used in this title shall, for the purpose of this title have the meanings respectively ascribed to them in this section except in those instances where the context clearly indicates a different meaning:

(1a) *"Bicycle"*. — "Bicycle" shall include pedal bicycles with helper motors rated less than one brake horsepower, which produce only ordinary pedaling speeds up to a maximum of twenty miles per hour, provided such bicycles so equipped shall not be operated upon any highway or public vehicular area of this State by any person under the age of sixteen years.

(10) *"Highway"*. — The entire width between the boundary lines of every way or place of whatever nature open to the use of the public for purposes of vehicular travel in this State, including the streets, alleys and publicly maintained parking lots in counties, cities and towns and for law-enforcement purposes, the entire width between the boundary lines of all private roads or private streets which have been specifically designated "highways" by an ordinance adopted by the governing body of the county, city or town in which such private roads or streets are located.

(15) *"Motor vehicle"*. — Every vehicle as herein defined which is self-propelled or designed for self-propulsion except that the definition contained in § 46.1-389 (d) shall apply for the purposes of chapter 6 (§ 46.1-388 et seq.) of this title. Any structure designed, used or maintained primarily to be loaded on or affixed to a motor vehicle to provide a mobile dwelling, sleeping place, office or commercial space, shall be considered a part of a motor vehicle. For the purposes of this chapter, any device herein defined as a bicycle shall be deemed not to be a motor vehicle.

(10a) *"Roadway"*. — That portion of a highway improved, designed or ordinarily used for vehicular travel, exclusive of the shoulder. A highway may include two or more roadways if divided by a physical barrier or barriers or unpaved area.

(34) *"Vehicle"*. — Every device in, upon or by which any person or property is or may be transported or drawn upon a highway, except devices moved by human power or used exclusively upon stationary rails or tracks and except any vehicle as may be included within the term bicycle as herein defined.