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A Course on Motor Vehicle Trauma:
Instructor's Guide-Final/Users Manual

University Research Program

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16. Abstract

Health professionals are key to any progress in reducing motor vehicle-related injury and death, yet they have been slow to recognize their role in this important area. One contributing factor to this situation has been the absence from the curriculums of health professional schools of courses on motor vehicle related crashes and occupant protection. A comprehensive survey course on motor vehicle injury and death was developed, implemented and evaluated at the University of Illinois at Chicago School of Public Health. The most important overall course objectives were that students: comprehend that highway deaths and injury are a major public health problem; understand that mitigation of this problem can be accomplished by proven public health preventative techniques; understand and be able to engage in multidisciplinary solutions. It was hoped that students would thus champion the prevention of road related trauma as a high priority for public health agencies, professional health associations, and community organizations. The initial objectives and curriculum were reviewed by 45 injury professionals from 7 different fields. The course was presented, revised, and presented again (the second time without benefit of NHTSA funding). The draft guide was re-reviewed by faculty at 13 of the Schools of Public Health. This final guide contains a discussion of some practical aspects of introducing and implementing the course, overall course objectives, specific learning objectives, content, and suggested readings for 9 topic areas, an annotated film list, organizational resources, materials from which vugraphs or slides could be made, a sample examination, information on ordering materials, and a list of resource persons by geographical area. The objectives of this guide are to provide a practical model for such a course, to acquaint health profession faculty with the resources available to them for course development, and to provide those new to the field of motor vehicle trauma with a network of professionals who are willing to aid them in their efforts. This guide is not a programmed learning text or a collection of canned lectures, rather it is intended to provide a framework as well as encouragement to those who seek to develop such a course at other institutions.

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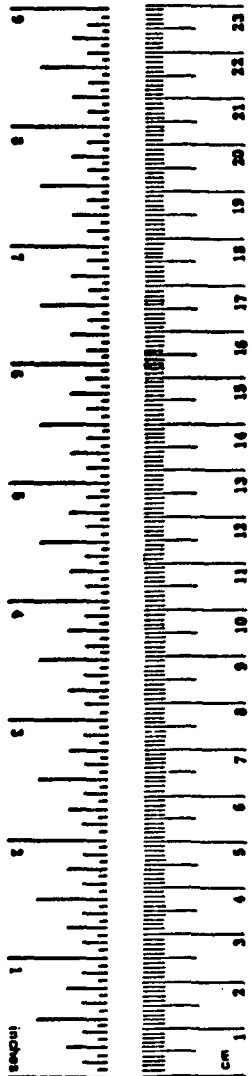
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

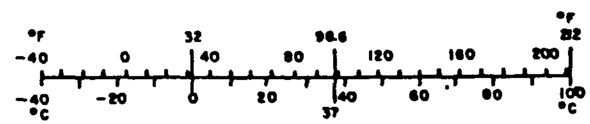
Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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Foreword

As with any document which is subject to a drawn out review and re-review process, many of the statistics used in this guide are no longer the most recent ones available. The user of this guide is therefore urged to obtain the most recent edition of the data sources described herein. Also, while an attempt was made to define terms spectific to the traffic safety field as they are first used in the text, undoubtedly the result is incomplete. The reader is urged to use the Glossary (Appendix 5) for those terms which are unfamiliar and are not explained adequately in context.

Preface

In 1983, the School of Public Health of the University of Illinois at Chicago received funding-support from the U.S. Department of Transportation to facilitate the preparation, presentation, and "packaging" of a comprehensive survey course on motor vehicle injury and death that could serve as a practical model for similar courses at other institutions. By demonstrating an optimal approach to the presentation of a motor vehicle injury and death course, both encouragement and assistance would be offered to those at other Schools of Public Health interested in introducing a course of this type.

Of course there can never be a truly "model" course that can simply be plugged into a school's curriculum. Not only is every school at which course adoption might be considered a unique institution with its own special advantages and disadvantages, but the institution at which the "model" was developed is also unique. Certainly the most unique, nonreplicable aspect of the motor vehicle injury and death course as actually presented at the University of Illinois School of Public Health was the project funding itself. This funding was used for three categories of activity: (1) functions which benefited the students enrolled in the course and which can also benefit students enrolled in courses patterned on this model course (including use of consultants to develop an optimal course curriculum and readings, lecture notes and graphics, specific teaching approaches); (2) functions which benefited the students enrolled in the course but which cannot benefit students enrolled in courses patterned on this model course, including specific guest speakers and (3) functions which can benefit students enrolled in courses patterned on this model course but which did not benefit the students enrolled in this initial offering (including materials prepared for presentation of the model course "package" to other schools of public health).

The course offered at the University of Illinois had special advantages and resources underlying its presentation. Yet it should be noted that when this course was offered a second time at the University of Illinois, using the guide and materials developed in the first offering, the result was arguably even more favorable than in the original offering. The main point that should be emphasized here is that adequate resources for a course of this type exist virtually everywhere. The most important task in presenting a motor vehicle injury course is bringing together and integrating these resources. By drawing upon surgery departments, rehabilitation centers, engineering schools, state transportation departments, and various citizen activist groups, it is possible to tie together individuals who may not only be valuable for classroom presentations but who also afford opportunities for students to conduct meaningful field practice.

The most important overall course objectives for our course was that students comprehend that highway deaths and injury are a major public health problem and that mitigation of this problem can be accomplished by proven public health methods of prevention and techniques of control. We were concerned that students understand, appreciate and be able to engage in solutions to road related trauma using a multidisciplinary approach, and that they understand why efforts to bring public health and highway safety professionals together on this problem have not been more successful. The hoped for result was that students will champion the prevention of road related trauma as a high priority for public health agencies, professional health associations, civic and community organizations.

These objectives indicate a considerable breadth of coverage, which meant that some topics of considerable complexity could not be analyzed in detail and that several topics were left out completely because of time limitations. However, it should be emphasized that the model course was developed to focus on the breadth of the issues rather than techniques used by specialists.

While this guide should be useful in presenting a motor vehicle injury course where none has been offered before, it should be emphasized that the guide is not a programmed learning text or a collection of canned lectures. The guide can be used successfully as a framework only by an instructor who already possesses some basic understanding of injury and/or public health. This understanding need not approach expertise, but a person coming completely new to the injury control or public health fields would have great difficulty making effective use of the materials included herein. The curriculum presented in Chapter VII of this guide has been field tested by faculty who fit this description, with backgrounds in injury and public health but no particular expertise in traffic safety.

The true value of this guide, therefore, is to provide a "pattern" or "model" for a relatively unique type of course. In so doing it also seeks to provide encouragement and assurance.

This guide has been distributed to the faculty member identified as interested in receiving it at each of the Schools of Public Health (Appendix 9). Copies of the guide have also been sent to individuals who indicated an interest in the final product of the course. This distribution was through the usual NHTSA distribution of a Final Report.

A considerable number of people contributed time, ideas, and constructive criticism to the preparation of this guide. Appendix 1 lists the individuals to whom we offer thanks for their contributions. We owe a special debt of gratitude to those directly involved in presenting the motor vehicle injury course at the University of Illinois: Wayne Andersen, Sam Anthony, Ruth Azeredo, Mary Beth Berkhoff, Katherine Kaufer Christoffel, Viron Diefenbach, Theodore Doege, Carol Golin, Ann Guild, James Hofferberth, Lois Kimmelman, Elaine Weinstein Lawless, Rudolf Mortimer, Leslie Nickles, Robert Paaswell, Barbara Procanyn, Nagui Rouphail, Gwendolyn Slaughter, Clark Staten, Julian Waller, B.J. Whitfield, and Gary Yarkony.

PREPARING AND PRESENTING A COMPREHENSIVE INTRODUCTORY COURSE ON MOTOR VEHICLE INJURY AND DEATH: AN INSTRUCTOR'S GUIDE FOR USE IN SCHOOLS OF PUBLIC HEALTH

I. Introduction

Nearly 45,000 people each year die in motor vehicle crashes in the United States--the equivalent of an airline disaster with 123 deaths every day. Motor vehicle crashes constitute the sixth leading cause of death in the United States and the leading cause of death for those 5-34 years old. (For 1-4 year olds motor vehicle crashes are second only to non-transport injuries as the leading cause of death and for 34-44 year olds third behind cancer and heart disease.) Of the leading causes of death, motor-vehicle related trauma is second only to cancer in its economic burden on the society. Two million people a year suffer disabling injuries in motor vehicle crashes--one every eight seconds. Motor-vehicle crash injuries produce more new cases of quadriplegia and paraplegia each year than all other causes combined, and they contribute significantly to the incidence of epilepsy and brain damage. They constitute the single leading cause of severe facial lacerations and fractures.

Many of these deaths and injuries need not occur. Improvements in vehicle design, occupant protection, and trauma care can produce--and have produced--significant health improvements. Health professionals are key to any progress in reducing motor vehicle-related injury and death. These professionals are in positions to understand the nature of the injuries to be prevented or mitigated, to frame solutions, and to implement these solutions.

But despite the fact that motor-vehicle deaths and injuries are largely preventable conditions, the public health profession has been slow in responding to the challenge. A crucial failure has been the absence from the curriculums of public health, medical, and other health profession schools of courses and materials on motor vehicle-related crashes and occupant protection. Since effective prevention requires involvement and leadership on the part of health care professionals, it is especially unfortunate that this area of concern has not received more attention as a part of health professional education.

The time is particularly ripe for developments in this area. Recently several health care specialty groups (e.g., pediatricians and orthopedists) have become actively concerned with the threat to life and health posed by motor vehicle trauma. Moreover, the public has become increasingly aware of the magnitude of the motor vehicle crash problem and appears receptive to advice and leadership from the health professions. Schools of public health are the logical place to begin systematic education in this area. These schools already bring together several areas of expertise which can be usefully applied to the study of motor vehicle-related injury and death; e.g., epidemiology, biostatistics, public policy analysis, environmental health, health law, health education and marketing, and benefit-cost analysis. Moreover, public health graduates end up in the very professional roles and positions from which effective preventive efforts can emanate: local health departments, state and federal health-related agencies, voluntary health organizations, and the like. Included among these graduates are also significant numbers of students from the developing nations, where motor vehicle-related injury and death often constitute even more of a public health problem than is the case in the United States.

If this subject area makes so much sense as a part of the school of public health curriculum, why are there not more such courses in existence? There are several reasons. First, it should be noted that the subject is usually covered in courses on injury control or the epidemiology of injury at those schools of public health where such courses exist. (Unfortunately, these broader injury courses face most of the difficulties about to be described.) It should also be noted that a few courses specifically on motor vehicle injury and death are available to students at some schools of public health (e.g., North Carolina) through other units of their university. Second, the very fact that schools of public health offer a broad, interdisciplinary curriculum means that students have programs of study already quite full with basic required courses and elective courses in the student's specific area of focus. Little room remains for courses that do not traditionally fit into such a program. Third, the interdisciplinary approach of schools of public health brings together faculty each of whom offers expertise in one or another of a broad range of specialty areas. But it is unlikely that any single faculty member will possess the proper combination of knowledge to allow that person to feel confident covering the entire range from the biomechanics of trauma to public policy analysis. And finally, the fact is that the epidemiology of injury is a relatively new area and injury prevention receives short shrift within schools of public health, despite their claims of being centers of preventive health concern.

There is another important consideration. While motor vehicle injury should be an important public health concern, and while important research expertise and progress has emerged in the last decade, these factors do not in themselves automatically make for a good introductory course. The fact is that introducing a largely novice audience to the complicated field of motor vehicle injury is not easy. Considerable attention must be paid to adequately presenting all of the significant concept areas in some logical sequence, a difficult task if one is to avoid confusing or overloading--and thus discouraging--the students.

II. Educational Objectives

In a background paper prepared for Healthy People, The Surgeon General's Report on Health Promotion and Disease Prevention (USDHEW, Washington, D.C., 1979) a report of the U.S. Surgeon General, Susan P.

Baker and Park Elliott Dietz noted that:

> Compared with many diseases of far less consequence, the prevention of injuries has received relatively little scientific attention. Moreover, despite the importance of the manmade environment in determining the occurence and severity of injuries, the possibilities for prevention through environmental modification are often eclipsed by attention to the role of human behavior. Although individual behavior is clearly important to injury causation, emphasis on personal responsibility ignores the important role of the social, political, economic, and physical environments that largely determine behavior. Television heroes rarely buckle seatbelts, movies delethalize high speed car chases, magazines glamorize alcohol consumption, ammunition is sold for its "kill power." Against such a pervasive, well-financed background, pleas for safer lifestyles are unlikely to be effective. Efforts to modify individual behavior will surely continue, but caution is necessary lest more successful approaches be underutilized--especially "passive" approaches (such as electric fuses and fire-resistant materials) that give automatic protection without requiring any special attention on the part of the people who are protected.

This observation is quoted at length because it outlines a conceptual approach behind much of the development of the course described in this curriculum guide. Certainly behavioral aspects of the motor vehicle injury and death problem are covered--e.g., alcohol--but never at the expense of attention to environmental considerations.

It should also be noted that the quoted observation relates to injury prevention in general. An argument can be made against including a motor vehicle injury course in a public health curriculum simply because it may become, de facto, the sole attention devoted to injury prevention in the curriculum. Thus, it is argued by some, it would be better to begin with a more generic injury course before introducing one that is more narrowly focused. There are two main responses to this argument. First, local circumstances will be the best guide to whether such a danger actually exists. In some schools attention is already devoted to generic injury prevention. Second, a course on motor vehicle injuries can serve the function of drawing previously uninterested persons to the general area of injury control. In our experience, the motor vehicle injury course did seem to inspire a broader concern and interest in injury control in general.

Just as this course does not supply the techniques for highway or restraint device design, this course is not meant to be a health education, program design, program management, advocacy, public policy or evaluation course per se. Rather it is meant to supply the necessary motivation and factual information which students can then use together with the public health practice techniques learned in such courses. Information on the nuts and bolts of establishing, managing and evaluating community, employer, institutional, etc. programs in traffic safety has been developed by other NHTSA grantees and is found in other NHTSA documents. Those documents are referenced here in the appropriate sections but they are not repeated.

III. Target Audience

Before discussing individual lecture topics, several observations need to be made regarding the educational objectives underlying a motor vehicle injury curriculum. This curriculum guide is for a course aimed at students at a post-baccalaureate level, with such diverse backgrounds as medicine, engineering, nursing, business, and psychology. Students are assumed to have at least an introductory-level familiarity with statistics and a grounding (or first course) in epidemiology is desirable. The orientation is toward breadth rather than depth, and the result is a course that is ambitious in its breadth. Outside of a school of public health this might present problems, but the school of public health environment should assure some pre-existing familiarity with epidemiological and biomedical concepts, as well as legal and policy issues.

IV. Course Objectives

The specific overall course objectives for our curriculum were as follows:

1. Students will comprehend that highway deaths and injury are a major public health problem in the United States and that mitigation of this problem can be accomplished by proven public health methods of prevention and techniques of control.

2. Students will be able to use biostatistical and epidemiological techniques to analyze road related trauma data.

3. Students will understand, appreciate and be able to engage in solutions to road related trauma using a multidisciplinary approach.

4. Students will understand why efforts to bring public health and highway safety professionals together on this problem have not been successful.

5. Students will understand the relationship between the prevention of crashes and the protection of crash victims.

6. Students will champion the prevention of road related trauma as a high priority for public health agencies, professional health associations, civic and community organizations.

7. Students will be convinced of the importance of the role of the driver with regard to restraint, substance abuse, and speed in the prevention of crashes and mitigation of injury to the point that they will provide an example of appropriate behavior in these areas in their own driving habits.

These objectives indicate a considerable breadth of coverage; this in turn carries several costs. First of all, specific topics of considerable complexity (e.g., the drinking driver problem) cannot be analysed in detail. Secondly, several topics are left out completely because of time limitations: these include accident investigation techniques, cost-benefit analyses, hazardous material transport and resource allocation for safety management. Even so, some course consultants argued for a narrowing of the focus of the course to a few specific problem areas. But our experience convinces us that the broader approach is both feasible and desirable.

V. Readings

A final cost incurred due to the breadth of the objectives is that while lecturers can attempt to distill their subject matter down to fit the limited time frame, in most instances it is quite difficult to find reading materials that succinctly present an adequate overview of a topic in a manageable amount of time. (Moreover, a reading intended to fill in gaps not covered in a companion reading will often duplicate much of that companion reading.)

Readings are intended to provide the student with an overview of a particular topic before the actual lecture presentation. As with any graduate level course, the most current research reported in the literature should be used wherever possible and appropriate. The suggested readings given for each topic in this guide were suggested by guest lecturers and consultants. The readings were reviewed by the course staff and additions and deletions made when needed. Readings which would not be readily available - e.g. unpublished reports - have not been included. The objective was to provide approximately 100 pages of text per topic per week, with a minimum of duplication. (This varied depending on the technical level of the topic.) Obviously, updating the list of current research articles for each topic is beyond the scope of this guide. It is hoped that the list of readings provided here will serve as a source of information regarding the organizations and publications in the traffic safety field. Those new to the field will find a surprising amount of material is published in reports and proceedings rather than the refereed literature. Information on ordering such publications is given in Appendix 7.

Several reviewers have asked that we recommend one text, citing the prohibitive cost of distributing photo copies. Unfortunately we found this to be impossible. Injury Control: A Guide to the Causes and Prevention of Trauma, by Waller (see p. 19) is highly recommended for any health professional in the injury field and several chapters have been listed as readings. However, it does not cover all of the topics in the model course and would have to be supplemented. At the same time, it covers many non-motor-vehicle topics. The National Academy of Science's report, Inury in America: A Continuing Public Health Problem (see page 20), also is an excellent summary of the current knowledge regarding the injury control field and contains an extensive bibiliography. Again, it addresses many non-motor vehicle topics but does provide an overview of injury as a public health issue. Our experience is that students resist purchasing expensive texts if only certain sections are to be used. We found a satisfactory solution to this problem to be placing copies of the required readings at the library reserve desk. Students were then free to decide whether or not to purchase a text after having read several chapters.

VI. Course Sequencing

In developing the curriculum presented herein, considerable attention was devoted to the sequence to be followed. It was decided to reverse the order of the often used pre-crash, crash, post-crash model. This sequencing was found to be highly successful in our trial presentation, but since some of our consultants were disturbed by this non-traditional approach, it seems important to explain the rationale.

The overall framework of the entire course is the application to the motor vehicle crash problem of public health techniques of prevention and control, rather than a medical, health care services, or traffic engineering/vehicle design perspective. Most of the course is therefore devoted to the pre-crash phase of the injury event. However, before the students can comprehend and appreciate the issues involved in the pre-crash phase, a great deal of background material must be provided. It was felt that for an audience with no exposure to the field, focusing on the post-crash outcomes first made most sense, i.e. the physiological and medical aspects of a crash, the extent of the problem (in epidemiological terms), and the role of rehabilitation and emergency medical services. This provided a more familiar and meaningful context for the typical public health student. In addition, explaining the biomechanics of the crash phase was necessary to any meaningful discussion of preventive measures used to mitigate the effects of the crash.

The flow of the course sequence begins with general background, definitions and themes are presented showing the magnitude and impact of the problem by way of considerable statistical information. The post-crash phase follows, illustrating the types and severity of injuries and the role of health care services dealing with injuries after the fact. The crash phase is then considered, with an emphasis on vehicle design and driver protection measures. The focus here is very much health oriented - i.e., injury control and diminishing the consequences of crashes. The aspect of the pre-crash least directly involved in public health--roadway design and traffic engineering--is presented next. Again, knowledge of the terminology involved and an understanding of the roles of the various engineering professionals and the various constraints under which they work is important for the public health professional.

The first five topic areas in the curriculum thus provide necessary background information for the remaining pre-crash portion of the course and also introduce the public health student to the other types of professionals involved in the traffic safety field.

The remainder of the course focuses on other pre-crash aspects, with special attention devoted to environmental and prevention measures. The underlying message is that the legislative and enforcement systems have demonstrated some progress, making it important to now evaluate what has been done, to determine what still needs to be done, and how it can be done. Legislative and public policy concerns are combined in looking at these issues.

In short, the course moves from an overview (terminology, the extent of the problem, the players involved) into a discussion of the role students can play as future health professionals in the mitigation of one of the largest public health problems of the day.

VII. Curriculum

This chapter presents a model curriculum for a course on motor-vehicle injury for presentation in a school of public health. The curriculum is presented in nine weekly units, but could readily be adapted to a different (presumably greater) number of class sessions by spreading the units over the appropriate number of sessions. As discussed earlier, because of the relatively novice audience the standard pre-crash, crash, post-crash sequencing is altered. Outcomes (post-crash) are considered first, with injury statistics and rehabilitation information providing a meaningful context and motivation for the student. The biomechanics of the crash phase are considered next, as a necessary background to any meaningful discussion of preventive measures.

Sections of this curriculum could also be presented as short courses or workshops, either alone or with miminal information from previous sections.

Materials from which viewgraphs (overheads) could be made are found in

Appendix 10. Points for which such materials are supplied are indicated with an asterisk in the curriculum. However, it must be emphasized that many of these lecture visuals could be used for more than one purpose and thus at more than one point within the sections indicated or with other sections.

****

Week 1

Introduction and Overview

Objectives

The student will be able to:

1. describe the magnitude of the U.S. roadway trauma problem in terms of morbidity and mortality rates.

2. order injuries due to highway crashes in relation to other types of injuries and public health problems.

3. recognize statistical trends relating to motor vehicle injury and their implications for prevention.

4. define terms commonly used in the pre-crash, crash, and post-crash phases of roadway trauma.

5. recognize that roadway trauma is a public health problem in need of preventive intervention.

Content

I. What is being studied? The terms used to describe traffic crashes must be carefully defined.

   A. it is important to dispel past beliefs about "accidents" being fortuitous events:

      1. "accident...an event or condition occurring by chance or arising from unknown or remote causes... a usually sudden event or change occurring without intent or volition through carelessness, unawareness, ignorance, or a combination of causes and producing an unfortunate result"

      2. totally random ("act of God")

      3. entirely due to driver carelessness

   B. a crash can be defined as an abrupt change in speed. This will involve some form of energy transfer. In the typical crash situation the type of energy involved is mechanical/kinetic; other types of energy are chemical, thermal, electrical, and radiation.

   C. injury results from energy transfer or-in a few instances, such as freezing--the interference with energy transfer. Injury occurs when energy is transfered in such ways and amounts and at such a rapid rate that inanimate and animate structures are damaged. Usually this is force acting with speed. An injury can be fatal or non-fatal.

D. an "unintentional injury event":

   1. is sudden

   2. is unintentional/not sought

   3. involves an energy transfer that overwhelms the body's ability to respond

   4. implies a need for prevention and does not assume the event was a fortuitous or chance happening

E. current injury control approach uses Haddon's three phase model:

   1. pre-crash phase includes those things which determine whether a crash takes place (e.g., impaired driver, excessive speed, defective vehicle, poor visibility, confusing traffic pattern, etc.)

   2. crash phase includes those things which will determine whether injury occurs, type of injury, and severity of injury (e.g., safety belt use, type of windshield glass, "forgiveness" of struck object, etc.)

   3. post-crash phase includes those things that determine the consequences of the injury (e.g., victim's general health, access to effective emergency medical system, funds available for rehabilitation, etc.)

   Haddon developed a matrix for looking at these three phases in conjuction with the three main factors commonly involved in the epidemiological study of all disease or injury:

   1. host (driver/passenger)

   2. agent (vehicle)

   3. environment (physical and socio-economic)

HADDON'S MATRIX

		HOST	VEHICLE	PHYSICAL AND SOCIOECONOMIC ENVIRONMENT
	pre-crash			
PHASES	crash			
	post-crash			

F. Other traffic crash terms of importance include:

- accident prone: the belief that a few people (because of character or other chronic internal defects) are responsible for most traffic crashes; the term is not as widely used as it once was because, while there may be individuals who are particularly likely to become involved in crashes, they cannot be prospectively identified in any meaningful way;

- highway crash death: NHTSA labels as a "death" or "fatality" any person who dies within 30 days of a crash, but some other agencies consider 90 or even one year appropriate definitional cutoffs; there is presently no agreement among traffic safety agencies on exactly what time span to use for listing a death.

- environment: surrounding conditions and elements; as applied to crashes, the external factors contributing to a crash (e.g., road design and weather).

- injury severity: relative degree of gravity of an injury. The Abbreviated Injury Scale (AIS) is an attempt to classify or score injuries sustained in a crash according to body area and severity, ranging from minor injury (1) to maximum--virtually unsurvivable injury (6).

- morbidity rate: the frequency of illness or injury in a specific population.

- mortality rate: the frequency of death in a specific population.

- property damage accident: a traffic crash resulting in property damage but no injury.

II. Magnitude of traffic crash problem

A. Motor vehicle crashes are a large contributor to mortality and morbidity in the U.S. (and worldwide).

1. 44,250 motor-vehicle deaths in 1984 (down from peak of 56,528 a decade earlier)*

2. Motor-vehicle injury is the fourth leading cause of death in the U.S.*

3. Second only to cancer in years of potential life lost.*

4. Leading cause of death for ages 5-34.

5. 4.9 million motor-vehicle injuries annually--2 million of them disabling

6. motor vehicles are the major cause of spinal-cord and brain injuries

7. a 1984 study based on hospital discharge data from Rhode Island found that motor-vehicle crashes were the cause of injury in approximately 2/3 of patients hospitalized with injuries to the chest organs, liver, and spleen, and approximately 1/3 of those with traumatic pneumothorax or hemothorax and injuries to the head, kidney, intestine, distal femur, pelvis, patella

B. Both indirect and direct costs of motor vehicle injury should be considered. Cost of injury in terms of medical care + lost productivity (1975 figures)*

cancer......................$23.1 billion
motor-vehicle injury..........14.4 billion
coronary heart disease........13.7 billion
stroke.......................6.5 billion

C. Comparison to other types of injury

Motor-vehicle crashes cause more deaths (ages 1-75) than any other form of injury. Motor-vehicle crashes account for one-third of all injuries; other unintentional events account for another one-third of all injuries; and intentional injuries account for the final one-third.* Of the various types of unintentional injuries, the next most frequent cause after motor-vehicles crashes is falls, which is responsible for one-fourth the number of deaths as compared to motor-vehicles.*

III. Data

A. Motor-vehicle crash data are inadequate in several respects.

1. Reports and records are often incomplete, inaccurate, or illegible.

2. The many different reporting systems (e.g., police "accident" reports and hospital emergency department reports) are uncoordinated, focus on different concerns, and use inconsistent terminology.

3. Mortality is emphasized, morbidity underemphasized.

4. Outcomes are emphasized, rather than possible causes.

5. Reasons for unsafe conditions and unsafe actions not adequately identified; multiple causation is neglected in favor of over-simplified single causes.

6. Police forms emphasize driver behavior/manuvers, rather than all of the other circumstances surrounding crashes and injuries.

7. Researchers tend to be oriented toward their own specialty, rather than adopting a multidisciplinary approach.

8. Data often based on self-reporting (surveys, interviews), which distorts reality.

9. International comparisons are extremely difficult because of underreporting and other inadequacies.

B. The population at risk is enormous, virtually the entire U.S. population of over 230,000,000 people. In 1984 there were 171,997,000 registered vehicles and 155,391,000 licensed drivers in the U.S. Together they traveled 1,717,000,000 miles and were involved in a total of 18,800,000 reported "accidents." The estimates of deaths and injuries based only on the number of police reported accidents are:

44,241 fatalities
5,563,000 injured survivors
1,231,000 survivors transported to emergency rooms
2,240,000 days of hospitalization
11,468,000 lost work days

C. Data on numbers of traffic deaths come from two main sources: the National Center for Health Statistics and the Fatal Accident Reporting System (FARS) of the National Highway Traffic Safety Administration. These data are well summarized in Baker et al, The Injury Fact Book.

D. Data on nonfatal injury is less complete and available. Current data (from the National Health Interview Survey and the National Accident Sampling System) are estimates based on representative sampling.

E. Data problems notwithstanding, it is important to look at sub-groups of the motor-vehicle crash victim population. For example:

- o <u>pedestrians</u>........account for 20 percent of motor-vehicle fatalities, consisting almost entirely of children, the elderly, and alcohol impaired walkers.
- o <u>passengers</u>.........infants and children are particularly fragile and vulnerable passengers.
- o <u>drivers</u>...........especially teenagers (inexperienced in driving and drinking) and drunk drivers (teenage, social drinkers, alcoholics)

IV. Statistical Profile

A. The "typical" or most frequently occurring fatal crash involves a single vehicle on a rural road at night.

B. The "typical" non-fatal crash occurs on an urban street during the day.

C. Alcohol consumption is implicated in about half of all fatal motor vehicle crashes. Between midnight and 4 am of any night, 75-90% of all fatally injured drivers had been drinking prior to driving.

D. Safety belts

1. most people still do not wear them*
   -at most, 15-20% of drivers
   -10.5% of front-seat passengers
   -even fewer back-seat passengers

2. non-usage can be related to other "risk-taking behaviors" such as smoking*

E. Age

1. Nearly one-half of motor-vehicle fatalities are among those under 25 years old.*

2. Males 15-24 years old are three times more likely to die in a motor-vehicle crash than any other way.

F. Overall, U.S. motor vehicle fatality rates have been decreasing recently*

1. There was a steady decline in deaths per vehicle mile from 1920-1960, then an increase in the early 1960s.

2. A general downward trend has continued for over a decade:

1972	56,528
1979	51,900
1981	49,301
1983	43,150

3. The big factors in 1973 decline were the oil embargo, the resulting lowered speed limit, and the effects of Federal Motor Vehicle Safety Standards.

4. A major factor in 1982-83 decline was the recession.

5. All categories, except deaths associated with motorcycles, declined during the early 1980s, but 1984 deaths were up 4% over 1983 (1983:42,589; 1984: 44,241).

6. Significant gains have resulted from advances in highway design, vehicle design, and occupant protection. (Leon Robertson estimates that between 85,000 and 125,000 lives were preserved by motor-vehicle safety regulations in 1975-1982.)

7. Other causes of decline in fatalities is uncertain: drunk driving crackdowns, etc?

8. Some regions of U.S. still have much higher rates than others. The Injury Fact Book provides valuable descriptions of these and other variations.

V. Prevention of motor vehicle crashes

A. Traditional types of prevention in public health:

1. primary (pre-crash)

a. work to prevent crash itself

b. focus on roadway/vehicle/driver

c. roadway: such things as contours, grades, surfaces, visibility, flow control, intersection and interchange design, elimination of roadside hazards

d. vehicle: such things as control mechanisms, information presentation

e. driver: such things as driver education, identification of impaired drivers, limited licenses, 21 year old drinking laws

2. secondary (crash)

a. assume crashes will occur; provide most protection

b. focus on crashworthiness and occupant restraint

c. roadside barriers

3. tertiary (post-crash)

a. minimize the intensity or severity of traffic crash trauma once it has occurred

b. emergency medical system, trauma center designation, rehabilitation

B. In terms of epidemiological components (host-agent-environment) an injury can be viewed in the same way as a disease. Concern with extent of exposure to potentially damaging forces, ability to control and/or tolerate those forces.

C. Trend away from viewing injury reduction as a voluntary behavioral change problem, (i.e., in terms of fault, blame, and human error) and toward acknowledging it as a health problem. This does not mean that traditional behavioral approaches, such as education, are abandoned. Rather, it means that increased attention is paid to restructuring the environment to provide "passive" protections, i.e., those which do not require positive acts by those being protected.

D. Main elements of prevention today:

1. Minimize exposure to second collison

2. Minimize exposure to alcohol impaired drivers

3. Minimize exposure to less competent drivers

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Week 2

Epidemiology: A Closer Look at the Problem

Objectives

The student will be able to:

1. locate federal, state, and local highway crash data.

2. understand the biases introduced by various data collection and reporting systems.

3. correlate the information on population subgroups most at risk with prevention measures.

Content

I. Motor vehicle injury data: finding the numerator

   A. Sources:*

      1. Centers for Disease Control (CDC)
      2. Fatal Accident Reporting System (FARS)
      3. National Accident Sampling System (NASS)
      4. National Center for Health Statistics (NCHS)
      5. National Health Interview Study (NHIS)
      6. National Safety Council (NSC)
      7. National Electronic Injury Surveillance System (NEISS)
      8. Police accident reports
      9. Pedestrian Injury Causation Study (PICS)
      10. NHTSA surveys and reports
      11. Medical records
      12. EMS reports
      13. Death certificates
      14. Independent studies (e.g., medical examiner data)

   B. Gaining access to data

C. Shortcomings and biases

1. dissimilar definitions of death (time of event up to one year)
2. reports and records often incomplete, inaccurate, or illegible
3. coding of data is often poor or nonexistent
4. variations in reporting requirements and practices
5. nonreporting is not random
6. mortality often emphasized, not morbidity
7. outcomes often emphasized, rather than possible causes
8. vehicle information sparse
9. multiple causation neglected in favor of oversimplified, single cause
10. police are concerned with law enforcement (i.e., fault) not crash understanding; police forms emphasize driver maneuvers and law violations rather than all the surrounding circumstances of crashes and injuries
11. mislabeling (e.g., suicide)
12. researchers often biased toward their own specialty, e.g. engineering; emphasis should be placed on a multidisciplinary approach to causation
13. linkage and aggregation of records difficult to impossible
14. data based on self-reporting are questionable e.g. surveys, interviews, etc.
15. data comparisons (by locality, state, nation) difficult
16. restraint use and substance abuse inconsistently reported on accident reports

D. Possible improvements

1. Make trauma a reportable condition?
2. Establish trauma registries?
3. Establish national trauma sampling system?

4. Improve linkages between existing systems?

II. Focusing on what's really going on:
finding the right denominator

A. Introduction

Certain subpopulations have higher mortality/morbidity rates from traffic crashes. The challenge is to understand the variables at work so that the appropriate groups can be targeted in injury prevention programs.

Exposure is a critical consideration here. Do subgroups with higher rates simply reflect higher exposure? Do subgroups with lower or average rates have reduced exposure? Is exposure best calculated per vehicle mile traveled or in some other way? Is it important to look at exposure to special high risk conditions (e.g., speeding)?

These questions affect the conclusion drawn regarding trends. In recent years, trends have been downward in most respects: absolute numbers, per vehicle mile traveled, per 100,000 population. Yet relative to other major causes of fatal and non-fatal injury, motor-vehicle crashes cannot be said to present an optimistic picture.

Magnitude of motor vehicle injury problem is unescapable

- 43,000-53,000 motor-vehicle deaths per year over last decade
- one-half of these deaths are among those under 25
- 4-5 million injuries/year
  (.5 million requiring hospital admission with average length of stay of 9 days; one-third of the population annually require medical treatment and/or miss at least one day of normal functioning as the result of motor-vehicle injury)
- leading cause of death, ages 5-34
- sixth leading cause of death, all ages
- for ages 5-29, one-fifth of all deaths are motor-vehicle related
- for the late teens-early twenties, two-fifths of all deaths are motor-vehicle related
- costs from $25 to 57 billion (1980 dollars)
- motor-vehicle injury costs exceeded only by cancer among health-related societal costs

B. At risk groups

1. Children less than one-year old have higher injury rates

   - body acts like missile if unrestrained in a crash

- car seats must be used and used properly

2. Children over age one: motor vehicle injury is leading cause of death and disability

   - car seats and safety belts should be used

3. Pedestrians account for about 20% of traffic fatalities. Target groups:

   a. children, especially males aged 4 to 9 (in urban areas).

      i) injury mainly to head, lower extremities, and abdomen

         - they are "run under" rather than run over

      ii) child's inexperienced in traffic and behavioral or perceptual problems often contributing factors in a crash

      iii) bumpers and car exterior must be designed with children's proportions in mind

      iv) need for parent education and better supervision of children

   b. teenagers

   c. adults over 60

         - fatalities often related to alcohol

4. Pedalcyclists*

   a. Children sustain more than half of all bicycle fatalities

      i) injuries to face, genitals, and legs

      ii) crashes usually due to child's error

      iii) failure to use safety equipment and apply the rules of the road

5. Teenage drivers*

   a. inexperienced in driving and drinking

   b. solutions:

      i) raise licensing age: no shift to older group would be seen in peak of fatalities

- however some drive without license anyway

ii) raise drinking age

iii) eliminate early licensure programs

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Week 3

Post Crash Dynamics:
Stabilizing, Repairing, and Rehabilitating the Injured

Objectives

The student will be able to:

1. describe the phases of trauma care.
2. demonstrate the need for early injury identification techniques.
3. understand the role and importance of the various injury assessment systems (AIS, ISS).
4. analyze the effectiveness of the components of an emergency medical services system in terms of prevention of death/reduction of injury severity.
5. discuss the controversy surrounding regionalization of emergency medical care.
6. contrast trauma care in the presence and absence of a trauma center in terms of prevention of death/reduction of injury severity.
7. describe the levels of injury requiring rehabilitative care.
8. describe the practical limits of rehabilitation.

Content*

> "When a person has been injured, the likelihood of death or the duration and degree of disability are influenced by the promptness and quality of emergency measures and the subsequent care received."
>
> --Haddon and Baker

I. Emergency Medical Services
(with special contribution by John R. Lumpkin, MD, FACEP)

A. Recommendations of the 1966 National Academy of Science study, Accidental Death and Disability: The Neglected Disease of Modern Society, outlined the necessary components for an EMS system:

1. provision of manpower
2. training of personnel
3. communications
4. transportation

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* The order of presentation followed here and in the following session reflects the organization of the course as orginally presented. An alternative organizational logic would be to begin with a discussion of the types of injuries (see Week 4) and to follow that with a discussion of the types of responses needed and ways in which responses can be organized.

5. facilities
6. critical care units
7. use of public safety agencies
8. consumer participation
9. accessibility to care (especially in rural areas)
10. patient transfer
11. coordinated record keeping
12. public information and education
13. review and evaluation (medical and efficiency)
14. disaster linkage
15. coordination between regions (mutual aid agreements)

B. National Highway Safety Act of 1966
1. states to include EMS in highway safety planning
2. funding to match local expenditures on equipment, training, and management
3. standards developed for ambulances and for training of personnel
4. purchases under the Act intended for prehospital care and initial access to hospital
5. Act administered by DOT (with FCC defining communications guidelines)

C. Other notable developments
1. First paramedic system - Miami, Florida in 1968
2. GSA ambulance standard (GSA-KKK-A-1822) in 1970
3. Emergency Medical Services System Act of 1973
   -$215 million in funding
   -regional implementation

D. Illinois (or similar content for your state)
1. EMS falls under the Illinois Department of Public Health (IDPH)
2. Responsibilities of the Illinois Department of Public Health
3. Goal: to provide the state with an integrated, coordinated EMS system
4. Major obstacles to meeting goals

E. Clinical classification of emergencies
1. trauma
2. burns
3. cardiac
4. high-risk and premature infants
5. toxicologic
6. psychiatric
7. substance abuse

F. The injury care continuum
1. Pre-hospital care
2. ER
3. Inpatient care
4. Rehabilitation

G. System structure
1. State lead agency
2. EMS system (group of hospitals that selects one of group to be the system resource hospital)
3. Off-line control
   - project medical director
   - EMS co-ordinator
   - project director
   - education director
4. On-line control
   - base station physician
   - critical care nurse

H. System components
1. EMS personnel
   - o EMT-A (A = ambulance)
     - training of between 80-120 hours of non-invasive emergency medical care
     - CPR skills
     - skilled regarding hemorrhage control, use of pneumatic antishock garmet, immobilization and extrication, splinting and bandaging

   - o EMT-I (I = intermediate)
     - EMT-A capabilities plus training in use of esophageal intubation device and/or esophageal intubation device with gastric tube
     - IV use

   - o EMT-P (P = paramedic)
     - minimum of 800 hours of training (some programs with up to 1500 hours training)
     - full Advanced Life Support (ALS) capabilities
       - IV therapy
       - parenteral drug therapy
       - cardiac monitoring
       - defibrillation and cardioversion
       - endotracheal and esophageal intubation
       - invasive emergency medical care

2. Vehicles
   - o basic life support capability
   - o advanced life support capability
   - o fixed and rotor wing aircraft
   - o special vehicles

3. Communications systems
   - o MERCI
   - o telemetry
     - non-duplex
     - duplex
   - o configuration
     - a. X configuration
       - resource/base station hospital
       - participating/receiving hospitals

b. Y configuration
- -resource/base station hospital
- -associate/base station/receiving hospitals
- -participating/receiving hospitals

I. Trauma centers

-generically, a hospital with a specialized team available to deal with trauma

-American College of Surgeon's guidelines for the categorization of trauma systems:

-Category One (similar to regional trauma center)
- o 24 hour <u>in-house</u> trauma service
- o qualified specialists and subspecialists also constantly available

-Category Two (similar to areawide trauma center)
- o 24 hour trauma surgeon availability
- o less stringent requirements re other specialties

-Category Three (similar to local trauma center)
- o ability to stabilize trauma patient

-there are also regional and local standards for trauma center designation (e.g., San Francisco, San Diego, New York, Tacoma, Scottsdale, Seattle)

J. The need for early injury identification techniques

1. Selection criteria for trauma patients
   - -inability to ventilate
   - -inability to control bleeding
   - -hemorrhagic shock
   - -gunshot wounds to head, neck, thorax, or abdomen
   - -falls from greater than 20 feet
   - -hit by train
   - -difficult or prolonged extrication
   - -ejected from vehicle
   - -inadequate blood flow to limb
   - -partial or complete amputation
   - -spinal immobilization

2. Injury scoring systems
   (need to be simple due to confusion at scene)
   (especially important with multiple injuries, none of which is in itself threatening)

- o Champion Trauma Index Scoring System
  - -respiratory rate
  - -respiratory effort
  - -systolic blood pressure
  - -capillary refill
  - -level of consciousness
- o Glasgow Coma Scale (level of consciousness)
- o Abbreviated Injury Scale
- o Injury Severity Score
- o Burn Severity Index

K. The effectiveness of emergency medical services: Controversies and problems

1. Effectiveness of the system: study problems
   - -lack of scientific studies with good experimental design
   - -studies use various markers for determining the problems and outcomes of patients
   - -studies use different index systems for scoring severity of trauma
   - -success in the field with cardiac victims seems significantly greater than success in the field with trauma victims

2. Effectiveness of the system: findings to date
   - -effectiveness of prehospital care has yet to be established
   - -crux of debate involves load-and-go vs. field stabilization
   - -Orange County study and two county study vs. Goldberg et al.
   - -field <u>treatment</u> of trauma seems to be a losing proposition

3. Control: Medical control vs. paramedic licensure (are paramedics doing too much)

4. Role of free standing "urgent care" centers

5. Use of the system appropriately
   - -most patients tend to ignore importance and availability of emergency medical services system
   - -system can be abused when non-emergent medical transport system is lacking

6. Costs

7. Much of U.S. still lacks true EMS system

II. Rehabilitation

A. Spinal Cord Injury

1. Characteristics of the average patient
2. Etiology:

auto accident	38%
fall or jump	16%
gunshot	13%
diving	9%
falling/flying object	5%
pedestrian	2%

3. Primary cause of death used to be renal but is now cardiovascular.
4. Classification of spinal cord injury (People generally stay at the level at which they were intitially diagnosed.)
5. Eighteen spinal cord centers in U.S.
6. Cost: $14,390/person, total of $380 million.

B. Head Injury (cardio-cerebral trauma)

1. Frequency of brain injury as compared to other types of injuries sustained in motor vehicle crashes
2. Types of head injury
3. Secondary problems associated with brain injury
4. Definitions of coma

C. Limitations to what can be accomplished with rehabilitative techniqes

D. Costs associated with rehabilitation: $4,114/person, total of $3.9 billion.

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Week 4

Crash Dynamics: Biomechanics of Impact Trauma and Occupant Protection

Objectives

The student will be able to:

1. understand how forces from different types of crash configurations produce different types of injuries

2. relate the kinematics and human tolerance levels to both exterior and interior vehicle design

3. define "crashworthiness"

4. explain the "second collision" and how different types of restraint systems prevent this collision

5. understand the design, use, and misuse of restraint systems, including the relative protection provided by manual belts, automatic belts, airbags, and an airbag-belt combination.

Content

I. Introduction

An understanding of the biomechanics of automobile crashes is essential for the proper design of occupant protection systems and vehicle structures. Crashworthiness involves designing the vehicle itself to minimize injury and death in the event of a crash.

II. Types of trauma

A. Injuries are produced by rapid change in velocity (acceleration/deceleration) having the following effects on the human body:
   - stretching
   - tearing
   - crushing
   - bursting
   - laceration
   - concusion

B. Areas of injuries

1. Head and face:
   - -most frequent site of serious injuries for car occupants, pedestrians, and motorcyclists
   - -includes soft tissue damage, skull fracture, intracranial hemorrhage, brain injury

2. Thoracic:
   - -second only to head injuries as life threatening
   - -safety belts effective against life-threatening thoracic injury, but more needs to be learned about overall safety belt effect for this type of injury
3. Neck:
   - -whiplash, blow to head
4. Abdominal:
   - -5-10 percent of victims, perhaps 20-30 percent of fatalities
   - -lap belts produce a specific type of abdominal injury
5. Lower limbs:
   - -car occupants, 40-50 percent of hospital admissions
   - -pedestrians, 45-70 percent
   - -motorcyclists, 40-50 percent

III. Crash dynamics

A. energy of moving object = $\left(\dfrac{\text{weight}}{\text{acceleration of gravity}}\right)\left(\dfrac{\text{velocity}^2}{2}\right)$

B. injury results when people are subjected to abrupt and excessive changes in speed; such "crash accelerations" occur when energy is transmitted to body in ways, amounts, and rates that exceed the body's ability to tolerate it

C. tolerance to injury is affected by
   - -relative velocity
   - -impact site
   - -mass of impactor
   - -area of contact
   - -geometry of impacted area
   - -surface hardness
   - -surface roughness
   - -direction of impact
   - -impact duration

IV. Types of Crashes

A. The major focus for crashworthiness measures has been the frontal crash, because approximately 50 percent of all crash injuries (61 percent of fatalities) are in frontal crashes, many of which occur at speeds of about 35 mph.

1. Components of a frontal crash*

   a) a graph of speed on the vertical axis and time on the horizontal axis can be used to show the sequence of events in a crash. A car traveling at 35 mph hits barrier at which point the car's speed drops rapidly. The car stops completely one tenth of a second (100 msec) after it first touches the barrier.

b) the slope of the curve which describes this rapid change in speed is the negative acceleration or deceleration, the rate of change of the speed. Acceleration is usually expressed in reference to the acceleration due to gravity (approximately 33 ft/sec). For example, a change in speed of 3 mph in 0.013 sec (13 msec) results in a deceleration of 330 ft/sec^2 or 10 g's.

c) the distance a car travels is calculated by multiplying its speed by the time it travels at that speed. For example, in 0.040 sec (40 msec) at 35 mph, distance traveled is 24 inches, the area under the curve.

d) the distance the car travels after it hits the barrier is the area under the speed curve. In a 35 mph, frontal barrier crash, it is about 36 inches.

e) as the car decelerates, the front end collapses this amount. In a barrier crash the only stopping distance available to the car results from actual shortening of the car's structure.

f) unrestrained occupants continue moving at the speed of the car. Stopping distance available is composed of the free space in the occupant compartment (about 24 inches from forehead to windshield) and the amount by which that front end of the car gets shorter during a crash.

g) second collision: unrestrained occupants hit the windshield or other car interior surface at about the speed of the vehicle before the crash (Newton's first law-an object in motion will remain in motion until subjected to some counterforce). Or occupant may be thrown out of the vehicle onto pavement or other hostile environment.

h) In the "second collision," the occupant experiences an even more severe crash than the vehicle (since the deceleration is faster). The occupant has wasted his free stopping distance and must make his way through the windshield and dash board to find a distance for stopping. Since the car structures are very hard, he may get only 3 to 5 inches of stopping distance and thus his deceleration is very severe.

i) In the "third collision," the organs inside the body in effect "collide" with surrounding bone and tissue, particularly the brain hitting the inside of the skull and the abdominal organs the abdominal cavity.

2. Restrained occupants can take advantage of the collapse of the front end of the vehicle ("crush space") to decelerate gradually. The restrained occupant "rides down" the crush of the vehicle and also benefits from belt stretch or air bag give to provide additional distance over which to decelerate.*

   a) the restrained occupant continues to move forward as the vehicle slows and belts tighten.

   b) the restrained occupant slows down much more slowly, much sooner. He is effectively using some of the free distance inside the compartment and some of the distance created by the crushing of the front end.

   c) in less severe crashes, the safety belt can prevent contact with the steering wheel, windshield or dashboard.

   d) in more severe crashes, forward motion, particularly of the head, may continue and contact will be made. Air bags in combination with belt can prevent this.

3. To prevent injury, crash forces must be controlled:

   a) "crash acceleration" must be kept within tolerable level for restraint system

   b) this is done by taking advantage of crush depth

   c) but crush depth comes at cost of possible penetration or collapse of occupant compartment

   d) thus "crash forces and accelerations must be low to preserve a tolerable acceleration environment for the restraint system used, and yet high enough to protect the physical environment of the crash victims"

   e) one way of easing this paradox is with restraint system that allows high accelerations to be tolerated without injury

4. Different forms of restraint afford varying amounts of protection in frontal crashes - in order of historical introduction:*

   a) lap belt only (active):
      - small load distribution
      - most useful protection in low-speed crashes

   b) lap belt plus shoulder belt (active):
      - better load distribution
      - survival distance (i.e., crush space plus occupant-to-interior surface) better utilized
      - but some "submarining" still possible
      - vehicle-sensitive reels (lock when vehicle starts decelerating) superior to belt-sensitive (lock when occupant moves relative to seat) The difference in effectiveness can be seen on the crash speed curves. The vehicle sensitive reels lock when the car speed curve starts to slope downward. With a belt sensitive reel, a speed difference between the passenger and the car must be detected before locking occurs and so more survival space is utilized. Any slack in the belt and give of the belt material will also take up survival space.

   c) airbag (passive)
      - best load distribution
      - most efficient use of survival distance
      - possibly some hazard to out-of-position child
      -does not deploy at speeds below 12 mph, in rollovers, or rear/sideward crashes

   d) automatic belt (passive)
      -doesn't require occupant action in order to afford protection
      -may be shoulder belt only or lap and shoulder
      -"submarining" can be problem
      -child restraint incompatibility is a problem

   e) belt-airbag combination
      -most complete protection
      -complementary, not redundant

5. In summary, restrained occupants will escape injury if:
   a) occupant compartment not penetrated or crushed
   b) deceleration below 35g's (i.e., 35 times the force of gravity), 45g's with minor injury
   c) loose objects (including unrestrained occupants) don't strike restrained occupant

B. Angled crash
   -3-point belt especially effective

C. The side (lateral) crash

1. Accounts for about 37 percent of all crash injuries (30 percent of fatalities)

2. Restraints: belts and bags only give some protection

3. Car exterior: strengthen side structure (but trend has been to subtract, not add, weight)

4. Car interior: improve indoor side padding

D. Rear crash
-head restraint crucial (adjustable head restraints not desirable)

E. Rollovers:

1. Seven percent of all crash injuries

2. Most random in terms of crash dynamics

3. One of least injurious types of crashes because energy dissipated over long distance

4. Seat belts of significant benefit, airbags afford no benefit

F. Pedestrian accidents

1. Car exterior: when designing hood, bumpers, etc., proportions of different age groups of pedestrians should be considered, but are not

2. Controversy exists over feasibility and value of providing a few inches of pedestrian-protecting crush distance by padding front of vehicles

G. Motorcycle accidents*

1. Motorcycles extremely dangerous; danger inherent in size, instability, lack of rider protection

2. Victims mainly young males

3. Probably great under-reporting

4. Value of helmets; extensive epidemiological data available as result of adoption and repeal of helment laws in so many states

5. Other protections limited (education and licensing, protective clothing)

H. Trucks

1. Trend toward increased length and weight limits

2. Greater length and weight increases hazard presented by trucks:
   - -slower on upgrades, thus greater speed differentials
   - -harder to stop
   - -harder to pass
   - -roadways not capable of safely handling trucks

3. Tractor-trailer incompatibility

4. Some suggestion that large trucks lack sufficient brake capacity

5. Load affects brake performance and control

V. Implementation: more controversy than progress

A. Federal Motor Vehicle Safety Standard 208 passive restraint requirement - almost two decades of controversy

B. Helmet laws
   - -1967: 3 states
   - -1969: 40 states
   - -1975: 47 states
   - -1980: 19 states

   Result of repeal: 40 percent increase in fatal injuries

C. Courts have upheld Federal regulations permitting longer and heavier trucks despite more restrictive state laws

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Week 5 **Prevention: Pre-Crash Dynamics--Roadway Design**

Objectives

The student will be able to:

1. describe the basic road, roadside, intersection, highway and interchange designs used to control traffic.

2. understand the statistical and mapping techniques used in analyzing basic traffic flow.

3. describe the implications of various mixes of vehicle types for crash avoidance and crash severity.

Content

I. The highway transportation system

A. Function: to move people and goods in a safe, economical, and efficient manner.

B. System consists of 3.85 million miles (US, 1976)
-17 percent municipal roads and streets
-83 percent rural roads
-municipal streets: 561,422 miles
-state controlled municipal streets: 86,909 miles
-rural (county, town, etc.) roads: 2,263,772 miles
-state highways and roads: 1,422,824 miles
-Federally-controlled rural roads: 233,841
-Federally aided (urban & rural): 768,930 miles
-interstate system: 42,580 miles

C. Federally-aided and interstate system:
-21 percent of U.S. roads
-carry 76 percent of all travel

D. Travel volume
-1.592 trillion vehicle miles (US, 1982)
-76 percent by passenger car
-55 percent in urban areas

E. Economic aspects
-US economy built around highway transportation
-transportation system affects employment, livestyles, health
-annual expenditure on highway construction, maintenance, etc. runs into the tens of billions of dollars (as do motor vehicle sales)

-many elements of our highway system are in various stages of decay and competition for the funds to remedy this situation is very stiff

F. Crashes by roadway and land use*

1. on the average, 60% of all crashes occur in urban areas and 40% in rural areas, while 57% of fatal crashes occur in rural areas, 43% in urban areas.
2. however, 75% of injury crashes occur in rural areas versus 25% in urban areas.
3. 55% of injuries of AIS greater than or equal to 3 occur in rural areas and 45% in urban areas.
4. the percentage of fatal crashes by roadway type and area ((US, 1981):

	All fatalities	Urban	Rural
Freeway	12%	17.5%	8.3%
Principal arterials	26%	26%	26%
Minor arterials	22%	25%	20%
Collectors	20%	10%	28%
Local	16%	19%	14%

G. crashes by location in the roadway environment

1. the roadway environment may consist of a lane, a shoulder, a median strip or barrier, and the off-roadway area immediately adjacent to the lane or shoulder.
2. the first harmful event in a crash usually happens on the actual lane traveled or parking lane.
3. offroadway (shoulder, median, roadside) crashes result in more serious injuries; 23.5% of all fatal crashes were on the roadside, 4.8% on the shoulder, 2.3% on the median, and 8.8% on other than the actual roadway. (US, 1981)

H. Crashes by grade and elevation

1. 23% of all crashes occurred on a grade and 15% of all crashes occurred on a curve. (US, 1981)
2. approximately 25% of single vehicle crashes occur on curves, compared to 14% of multi-vehicle crashes.
3. 45% of single vehicle and 31% of multi-vehicle crashes that take place on curves, occur on curves in which a grade is also present

I. Crashes by road junction

1. 48% of all crashes and 73% of fatal crashes occur at non-junctions. (US, 1981)
2. of those crashes which occur at junctions, the majority occur at intersections or are intersection related (other sites are driveway, alley, rail crossing, etc.).
3. of those crashes which occur at intersections, 38% of the total crashes and 25% of the fatal crashes occur where there is no control device. (US, 1981)
4. 27% of the total crashes occur at intersections controlled by signs, however, 32.5% of fatal crashes occur at such intersections. (US, 1981)

5. 33% of the total crashes occur at intersections controlled by lighted signals, however 24% of the fatal crashes occur at such intersections. (US, 1981)

6. 71% of all crashes occur at junctions on limited access highways, while 15.1% of all fatal crashes occur at such locations; 3.9% of all fatal crashes occur at interchange areas and 3.7% at the entrance/exit ramps of limited access highways. (US, 1981)

II. Roadway planning

A. Is a new roadway needed? Where should it be located?

B. Travel <u>demand</u>

1. 1.592 trillion vehicle miles traveled on US roadway system in 1982

2. Planning aimed at improving or expanding that system; specifically, increasing the ease of getting from A to B

3. expansion of system greatly curtailed during past decade

C. Capacity

1. Capacity = the maximum number of vehicles that have a reasonable expectation of passing over a given section of highway in one--or both--direction(s) under prevailing conditions. (For example an average of 2000 passenger vehicles per hour/lane is the capacity for a 2 or more lanes in one direction highwayunder ideal conditions.)

   a. Conditions needed to sustain capacity flow are frequently not present

   b. At capacity flow, the quality of service of a highway is usually poor in terms of safety, freedom to maneuver, and speed

2. Level of service = a qualitative measure that represents the collective factors of speed, travel time, traffic interruptions freedom to maneuver, safety, driving comfort and convenience, and operating costs provided by a highway facility under a particular volume condition

   a. The maximum volume associated with a particular level of service is termed the service volume

   b. The service volume gives a better indication of the actual operating conditions or quality of service a driver will experience on a highway than does capacity

   c. Surrogates used for the factors in 2 above to define level of service and service volumes are speed and the ratio of volume to capacity in uninterrupted flow conditions.

   d. Trade-offs/considerations in determining service volume

      i. Adequate to take peak demand

ii. Able to disperse queues without excessive buildup

iii. Drivers should be able to select range of speeds

iv. Avoid creating situations that increase driver tension

III. Roadway design: geometry, physical appearance (e.g., where to curve)*

A. Before designing

1. Define interactions between driver, vehicle, and roadway

2. Safe highway = highway in which none of the interactions among its elements (driver, vehicle, roadway) approaches a critical level*

3. Define levels of service desired

B. Composite of driver for whom roadway is designed*

1. Visual acuity - 20 feet

2. Response-reaction time - 2-4 seconds

3. Eye height - 3.75 ft (there is actually considerable variation from this height, due to mix of car sizes)

4. Visual angle/peripheral vision - 160 degrees

5. Possible color blindness affecting red/green

C. Driver behavior

1. The total hazard avoidance process or preception/response consists of:*
   - detection of hazard 0.5 sec
   - recognition of hazard 1.0 sec
   - understanding or perception of hazard 0.5 sec analyses of possible maneuvers 1 sec
   - movement or maneuver to control or avoid hazard 1 sec

2. Design driver reaction times are based on information being presented in expected forms and locations (e.g., more reaction time is needed for a left-hand exit from a freeway than a right hand exit).

3. Drivers will not voluntarily accept the g forces generated by acceleration, deceleration, and cornering that their vehicle could actually achieve.* It is assumed that a driver will not voluntarily maneuver in such a way as to experience greater than 0.3 g when accelerating or cornering and greater than 0.9 g when decelerating (10-15 ft/sec^2 used in design).

D. Average driver performance

1. Confronted with 10 or more traffic events/second

2. Makes two or more observations/second

3. Makes 1-3 decisions/second

4. All of which results in:

   a) Near collision once or twice a month

   b) Collision/six years

   c) Fatality/1600 years

E. Design objectives

1. Straight level segments

   a) Prior to 1965, the designer's approach was "those people who run off the roadway deserve what they get;" after 1965, the concept changed to "many innocent people are killed by hostile roadside environments which can and must be corrected through design."

   b) The "clear zone" design concept is generally stated as "It is desirable to provide a roadside clear of hazardous objects or conditions for a distance consistant with the speed, traffic volumes, and geometric conditions of the site."

   c) The clear zone distance required is dependent on roadside grade, presence and degree of roadway curvature, drainage ditches and similar roadside configurations, and actual speed of travel.

   d) The 30 foot standard clear zone width adopted in 1967 has been replaced by a set of guidelines for determining the needed clear zone for a given roadway (AASHTO guide for Selecting, Locating, and Designing Traffic Barriers, 1977).

   e) Once a roadside has been designed or an existing roadway has been treated to achieve a clear zone, it must be maintained throughout the life of the highway.

2. Geometric features: Curves (horizontal and vertical), intersections, structures

   a) Crashes related to geometric features usually occur where more than one geometric feature is present.

   b) Horizontal curves increase the angle of exit from the roadway in loss of control accidents, while downhill gradients increase stopping distance.

c) Intersection control and type of interchange should be at the level warranted in order to balance "safety versus mobility."

d) The objective in designing geometric features is to minimize the effect of such features as much as possible.

e) Clear zone objectives should be achieved where possible.

F. Elements of roadway design

1. Design must consider a combination of factors (alignment, grade, volume, curvature, etc.) in order to approach reality.

2. Curves, grades, intersections, structures

   a) Contours and grades

   b) Alignments

3. Stopping-sight distance

   a) Stopping sight distance (SSD) = total distance from the point at which driver can detect a hazard and complete a maneuver which is an adequate and appropriate response to the hazard (also called decision sight distance or may be passing sight distance).

   b) SSD is one of the most significant of all highway design features and is usually one of the most costly to improve through treatment.

   c) SSD is a function of perception/response time (considered to be 2 to 3 seconds for the worst case driver) and braking distance. Braking or stopping distance is a function of speed and is designated for different vehicle types by federal standard.

   d) $SSD = 1.47\ (T_r V) + \frac{V}{30f}$ where:*

   V = design speed, selected by the engineer in terms of the geometric elements present and driver capabilities.
   Tr = response time, varies with sources and form of information (driver expectations).
   f = coefficient of friction
   1.47, 30 = conversion constants for the most simplified situation (i.e. straight segment, level grade, dry surface, ultimate desired speed equal to zero).

   e) Other factors:*
   - uphill grade shortens braking distance and so grade factor is added to friction coefficient to yield a shorter SSD.
   - downhill grade lengthens braking distance and so grade factor is subtracted from friction coefficient to yield a longer SSD.

f) Traffic control procedures such as speed limit reductions and no passing zones should be instituted before costly treatments such as obstruction removal, grading, or highway realignment are done.

4. Horizontal curves

a) Must be incorporated into horizontal curve design

b) Distance needed to detect a hazard present on the other side of a horizontal curve is dependent on the radius of curvature (R) the distance between the X lane and any obstructions present on the roadside (m):*

$$M = R \left(1 - \cos \frac{28.65\ SSD}{R}\right)$$

5. Vertical Curves (Hills)

a) Driver should be able to stop when a hazard six inches above the pavement is able to be seen over the crest of a hill.*

b) Driver is assumed to have adequate passing sight distance when the top of the approaching car which can be seen over the crest of the hill has reached a point at which the top of the car is 4.5 feet above the roadway.

c) These AASHTO sight distance design criteria are based on an assumed driver eye height of 3.75 feet which may not be applicable for new, smaller cars.

d) Sags present a problem when they are present in combination with an overpass which obstructs the view of traffic approaching the bottom of the sag from the opposite direction.

e) Sags may also present a problem at night if the grade is such that the headlight distance is shortened due to the headlight beam angle and thus the distance in which hazards may be detected is shortened. SSD is thus a function of headlight beam distance and angle, the length of the curve (most important design parameter), and the grade.*

6. Surface conditions

a) Friction supply furnished by type of surface is also influenced by:

i) speed - as speed increases and tire contact with the pavement decreases friction supply is decreased.

ii) wet pavement conditions - as pavement becomes wetter, vehicle may actually be riding on water and so friction supply is decreased.

b) Geometric features such as down grades and sharp horizontal curves increase friction demands.

c) Therefore, to prevent skids design of pavement surface must consider the combination of friction supply and demand.

IV. Junction Traffic Control Methods

A. Level of control

1) The types or degree of control are no control, signs, signals; channelizations and different types of signalization may be combined depending on the situation.*

2) On controlled access highways control is implemented by interchanges; type of interchange is a function of many factors such as location, volume, speed, geometry (for example, clover leaf or diamond).

B. Warrants

1) The need for control is determined by local highway personnel based on engineering studies.

2) Signal warrants are based on:

a) overall volumes
b) volume by vehicle type
c) pedestrian volume
d) speed
e) physical characteristics such as geometry, sight distance restrictions, bus stops, railroad crossings, etc.
f) accident experience at the intersection and adjacent segments

C. Design considerations

1) Control and SSD are complementary.

2) For an intersection with no control (e.g., rural areas) SSD must be such that a vehicle can clear intersection before an opposing vehicle enters the intersection.*

3) At signed intersections, sight distance must be sufficient to allow a stopped vehicle to clear the intersection before an opposing vehicle with no control reaches the intersection.*

4) Speed control and/or upgrade to a signalized intersection is usually less costly than treatment to correct sight distance constraints. In urban areas, such treatments may be impossible.

5) The length of highway in which a vehicle approaching an intersection during the yellow (amber) light will not clear the intersection if normal speed is maintained and yet will not be able to safely stop at the stop line via normal braking pressures is known as the dilemma zone.*

6) The design objective is to minimize the dilemma zone, ideally setting it equal to zero.

7) The dilemma zone (DZ) is equal to:*

DZ = SSD + width of intersection + length of vehicle - the duration of the yellow light multiplied by speed.

$$= VT + \frac{V}{2d} + W + L - VY$$

Where V = speed
T = response/reaction time 2.5 sec
d = deceleration rate 10-15 ft/sec^2
W = width of intersection
L = length of vehicle
y = duration of yellow light

8) By setting the dilemma zone to 0, the duration of the yellow light is found to be:

$$y = T + \frac{V}{2d} + \frac{W}{V} + \frac{L}{V}$$

9) In practice, the duration of the yellow is usually set at 1 sec for every 10 miles per hour in speed.

10) The duration of the yellow will also be dependent on such considerations as local ordinances, driver behavior, attitudes, etc.

V. The Roadside Environment and Control

A. Crash experience

1) On the average 35 to 40% of fatal single vehicle crashes are fixed object crashes.*

2) The fixed objects most often involved are trees, poles, guard rails, bridge abutments, and median barriers. Thus the equipment designed to control traffic along highway segments with no junctions actually become hazards.

B. Roadside Appurtenances

1) Objective of any highway barrier (median, guardrail, etc.) is to shield a vehicle from hazards on the roadside while inflicting a minimum of hazard to the vehicle and its occupants, redirecting the vehicle back onto the roadway or

shoulder, and enabling the driver to maintain control of the vehicle.

2) Energy absorbing devices (e.g., crash cushions of sand, water, or rubber) are used in areas of possible impact with fixed objects that cannot be moved or treated in some other way, e.g., some guard rail ends, exit ramps or freeway junction points, bridge abutments, etc.

3) Trees should be removed (see Clear Zones above).

4) Sign supports and light poles should be of breakaway design, i.e., designed to yield upon impact with a minimum of damage to the vehicle.

5) While the effectiveness of breakaway installations in the prevention of injury has been shown in the laboratory, the same results are not always achieved in practice due to improper design, installation and maintenance.

6) Road markings (lane delineations and edge markings) have been found to provide the biggest safety return per the cost involved.

C. Roadside Appurtenances and Geometric Characteristics

1) Research has shown that fixed object crashes are more likely to occur: (Wright and Robertson, 1979)

a. "Along arterial and collector roads than along local roads

b. Along the right side of roadways than along the left side from the driver's perspective

c. Along curved sections than along straight sections

d. Along the outside of curves than along the inside

e. In the area downstream from a curve than in the area upstream

f. Along roadways with negative gradient than with positive gradient

g. Along roadways with narrow pavements and shoulders than roadways with wide pavements and shoulders"

2. "For the general population of fixed object accidents, the crash locations are best discriminated from comparison locations by a combination of curvature greater than 9 degrees and downhill gradient steeper than 3 percent." (Wright and Robertson, 1979)

3. "For the fatal fixed-object crash populations, the crash locations are best discriminated from comparison locations by a combination of curvature greater than 6 degrees and downhill gradient steeper than 2 percent." (Wright and Robertson, 1979)

4. These results suggest priorities for the expenditure of resources for the removal or modification of roadside hazards and can alert health personnel to possible high crash rate locations in their communities.

VI. Problem identification and needs assessment

A. Data*

1. Identify available information

2. Develop/collect information which is not available

3. Identify areas of greater than expected association with crashes

B. Analysis

1. Identify characteristics contributing to overrepresentation through accident pattern analysis

2. Determine whether this constitutes a problem

3. Determine whether this is a design problem

VI. Implications of vehicle mix

A. Downsizing of automobiles

B. Increased size and weight of trucks

C. Increased use of vans/recreational vehicles

VII. Government programs [also see Week 7 outline]

A. Several times since 1966, Congress has directed the Department of Transportation to conduct studies of highway safety needs

B. Section 402 of the Highway Safety Act of 1966 required that "each state shall have a highway safety program, in accordance with uniform standards promulgated by the Secretary [of DOT]"*

C. In a 1982 action, these requirements were modified. Instead of implementing the eighteen uniform standards, states must use their federal 402 funds to concentrate on six most effective NHTSA and FHWA highway safety programs.* Additional programs are eligible for funding as well, providing the state can furnish additional justification, over and above that necessary for federal approval of programs within the six national priority program areas.

D. Highway engineers and transportation administrators must make moral/political judgments, which will include trading off:
- -rates vs. numbers
- -levels of severity (property damage only to fatality)
- -reduce overall number vs. equalize rates
- -public harm vs. public savings
- -highway safety vs. new construction vs. traffic flow improvements vs. maintenance projects

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Week 6

Pre-Crash Dynamics: The Driver

Objectives

The student will be able to:

1. describe the driving task in terms of human function.

2. describe the relationship between the following items and performance of the driving task:

   a) design of the driver's workplace, including such aspects as information displays and vehicle controls

   b) visibility, vehicle lighting and signals

   c) vehicle braking and steering response

   d) night driving conditions

   e) various climatic conditions

   f) roadway construction/maintenance activities

3. relate the attitude of the driver towards the driving task and function of the vehicle to driving performance.

4. identify and describe medical conditions which interfere with the driving task, differentiating between temporary and permanent medicalconditions.

5. describe the concept of "accident prone" and the impact it has had upon injury control.

7. describe preventive programs aimed at specific driving task problems and specific driving impairments.

Content

I. Introduction

A. Driving a motor vehicle is a difficult, complicated, and demanding task (in some ways more so than flying an airplane).

B. In some 80 percent of motor vehicle crashes the driver is thought to be a contributing factor. But what does this mean? For example, driver misjudgment in "safe" vs. confusing environment. Answer depends in large part on explanatory model used. Waller (building on Benner) outlines five possible models:

1. Single cause model: in this model each injury event is viewed as being the direct and total result of a single, identifiable cause; this is the "least accurate, but most commonly accepted" model

2. Random interaction of multiple factors model: "neither accurate nor useful"

3. Pre-injury/injury/post-injury phases model: model preferred by Waller and others who stress human/environmental interaction

4. Systems-analysis model: "cumbersome and potentially rather superficial in dealing with human components"

5. Multilinear events sequencing: more limited than #3; ignores post-injury phase

C. Causal factors* (based primarily on the Indiana Model as described in Rose; see reading list, below)

1. Primary causation factors "generally occur early in a chain of events, and if blocked or appropriately countered negate the likelihood of an accident"

2. Secondary causation factors "generally occur later in the accident chain and/or may represent inappropriate responses to an already initiated accident chain."

3. Four basic categories:
   a. human direct causes
   b. human conditions and states
   c. vehicular factors
   d. environmental factors

II. The driving task*

A. Position on road relative to other vehicles, maintain speed, observe signs, accelerate, brake; with all these under control, react and respond.

B. A closed loop task for the majority of the time; open looped for small amounts of time.*

C. Performance capabilities regarding perception and response spread over a broad range.

D. Proficiency and alertness change and vary between drivers and for every single driver from moment to moment.

E. The average driver in his/her driving task is confronted with:*

1. Ten or more highway and traffic events per second
2. Two or more driver observations per second
3. One to three driver decisions per second
4. Thirty to 120 driver actions per minute
5. At least one driver error every two minutes
6. A hazardous situation every hour or two
7. A near collision once or twice a month
8. A collision every six years of driving
9. An injury every 40 years of driving
10. A fatality every 1600 years of driving

F. The average driver in his/her lifetime will:

1. Overtake and pass 15,000 vehicles on 2-lane rural highways
2. Overtake and pass 50,000 vehicles on freeways
3. Cross one million intersections

III. Vehicles*

A. Cars should be designed to accommodate 95 percent of drivers

B. Workplace design involves:

1. information displays and vehicle controls
2. visibility, vehicle lighting, and signals
3. vehicle braking and steering response
4. night driving and climatic considerations
5. vehicle ride factors
6. force application factors (shifting, parking, brakes, etc.)

IV. Vehicular causal factors

A. Indiana study found definite vehicular contribution to causation in 6 percent of crashes, possibly as much as 13 percent. Still, Waller notes that "the frequency with which vehicular design, defect, or outright failure contribute to crashes is still largely conjecture."

B. Old and poor most at risk because their vehicles are older, more likely to be in disrepair.

C. Problems

1. brakes (43 percent of vehicular contribution) (system failure, soft, grab, imbalanced)

2. tires and wheels (26 percent of vehicular contribution) (design and production defects, improper inflation, mismatch)

3. transmission (inappropriate response, self-shifting)

4. steering (failure, locking, loose)

5. communication systems (communication signals fail, display fails, vision or hearing ability impaired)

6. other (suspension, exhaust, driver control position, doors, hood)

V. Environmental causal factors

A. Roadway [see Week 5]

1. Design

2. Obstructions and hazards

3. Traffic control

4. Maintenance

B. Conditions

1. Surface

2. Weather

3. Roadside obstructions and hazards

VI. Human performance considerations: perception, information processing, reaction time, response*

A. As information input increases, the driving task becomes more complicated; as the decisions to be made increase, the ability to react must increase or response ability will be degraded.

B. How is information presented?

The way information is displayed makes a difference in reaction time. As the compatability between stimulus and response decreases, the reaction time increases By increasing information involved the system is made more complicated and reaction time increases

Communication by Light Signals*

1. Includes presence, turn signals, brake lights, backup, distress

2. Might also include speed, acceleration/deceleration rate.

3. Should be easily understood, automatic, fail-safe, compatible with other vehicles, not open to misinterpretation if not working, and cost effective.

4. Effective communication/light signals can include number of lights on, intensity, lamps located in different places, different colors, flashers and flash rate, and different shapes for information.

C. When is information presented?

Important to present information at right times so driver can read and react properly

D. Attitude of the driver toward the driving task can affect functioning

E. Examples of types of information to be processed/monitored

-center line: color, width
-signs: warning, direction, speed, etc.
-traffic
-grade crossings

VII. Special functional needs related to type of vehicle (e.g., private cars, tractor-trailers, motorcycles)

VIII. Crash avoidance

A. Task demand: Injury results from uncontrolled, harmful exposure to physical energy. Control of energy is function of both human performance level and task demand.

When performance becomes less than the task demands, the result can be a crash.*
How can task exceed performance ability?

1. Driver continues to perform at same level, but the driving task becomes more demanding

2. Driver's performance deteriorates/falls below demand

3. Driver's performance falls and task demand increases

Most drivers have some spare capacity, but:

-some may not (see IX, below)
-excessive demand can override spare capacity

Thus given wide range of people on the road, anyone (driver or pedestrian) can be pushed to error/crash point beyond spare capacity.

Most common crash situation on interstate highways is rear-end collision. The greater the difference in speed between two vehicles, the greater the probability of a rear-end collision.

B. Human causal factors include:

1. intentional crashes (suicide)

2. non-performance (dozing, blackout)

3. recognition errors

4. decision errors

5. performance errors

Clayton found the following driver errors in a study of 210 crashes:

-no driver error, 48.6%
-excessive speed, 13.7%
-misperception, 11.2%
-failure to look, 10.8%
-panic reaction, 5.2%
-other decision error, 10.4%

Rear-end collision and vehicle following are important concerns

IX. Medical impairment

A. Medical impairment is part of the problem in 50 percent of serious crashes

Certain diseases and conditions may predispose people toward crashes by limiting or eliminating spare capacity*

1. Serious medical impairments

2. Subtle impairments (dark adaptation, glare resistance, etc.) crashes

Often crashes attributed to behavior, e.g. "inattention," are actually related to medical impairments.

B. "Accident proneness":

1. There are individuals who--for a variety of different reasons--are more likely to be involved in crashes

2. But even within such high-risk groups, only a small minority will be involved in crashes (and an even smaller number involved more than once/the great majority of drivers involved in crashes are involved for the first and only time)

3. This means that it is not practical to screen out "accident prone" drivers to prevent crashes. Waller notes (citing Bernacki and Farmer & Chambers) that "removal of drivers with three or more crashes in year one would remove 28 percent of drivers but reduce subsequent crashes by only 9 percent. Removing persons with the worst 25 percent of driving tests would delete 23 percent of drivers but 7 percent of crashes, while removal of both groups would deny licenses to 44 percent of drivers to prevent 13 percent of crashes."

Not enough, however, to say that a person got into trouble because of impairment. Must also ask: If person was impaired, why did they get into trouble at this time?

C. Indiana model developed following human "conditions and states" categories:

1. physical/physiological
   - -alcohol impairment
   - -other drug impairment
   - -fatigue
   - -physical handicap
   - -reduced vision
   - -chronic illness

2. mental/emotional
   - -emotionally upset
   - -pressure or strain
   - -in hurry
   - -mental deficiency

3. experience/exposure
   - -driver inexperience
   - -vehicle unfamiliarity
   - -road over-familiarity
   - -road/area unfamiliarity

D. Specific subgroups

1. Older people: Elderly have increased risk of crashes (related both to increased likelihood of specific disease conditions and to decreased night vision) but have lower instances of crashes; less tolerance to alcoholic beverages; alcohol and others drugs interactive

2. Chronic and acute disease (including diabetes and caridovascular disease)

3. Permanent handicaps

4. Temporary conditions

X. Self-inflicted impairment

1. Alcohol and other substance abuse
   - -Problem drinker less likely to wear seat belt

2. Smoking and carbon monoxide exposure
   - -Smokers have higher fatal crash involvement
   - -Smoker-drinkers have highest
   - -Heavy smokers are group least likely to wear safety belts

XI. Success of preventive programs

1. Young, healthy drivers have higher serious crash rates than any other group, yet society has been extremely resistant to preventive efforts that could limit their exposure (e.g., raising the legal driving age, restricting young drivers to day-time driving only)

2. For alcoholic--Motor Vehicle Departments are getting them into the medical system (success unknown). But getting them into the system requires crash event and/or apprehension, and both are rare events (e.g., police are able to detect 1 out of 200 drunk drivers by observation)

3. For elderly and impaired pedestrians--simplify crossings

4. Elderly drivers with senile dementia--medical history more valid indicator than driving tests (which are time dependent).

5. The medically impaired seem to do better after their problems are brought to their attention.

6. But among risk takers, 60 percent continue to drive the same way after their problems have been brought to their attention.

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Week 7 Legal and Public Policy Aspects: Federal or Local Concerns?

Objectives

The student will be able to:

1. describe the authority and functions of the federal, state, and local governments with regard to crash prevention and injury control.

2. explain the various ways in which statutes, regulations, and civil litigation can be used to effect crash prevention and injury control.

3. describe potential legal, political and policy difficulties with such legal solutions.

4. analyze crash prevention and injury control from a public policy perspective.

Content

I. Introduction

A. What can be done to minimize motor-vehicle death and injury?

B. Answer requires:

1. Problem identification and needs assessment

2. Focus on high risk groups and high risk types of crashes

3. "Mixed strategy" that focuses on pre-crash, crash, and post-crash phases

4. Evaluation

C. Note that any wish list of countermeasures assumes a heavy, perhaps pre-eminent, role for government

II. Is this an appropriate role/task for government?

A. Rationales for governmental intervention

1. Market failure

2. Utilitarianism

3. Social justice (Rawls)

4. Communitarianism

5. Paternalism

6. Pragmatism

B. Alternatives to government intervention

1. Non-governmental (e.g., employer belt use programs, insurance incentives)

2. Civil litigation (e.g., negligence suits against automobile manufacturers for injury resulting from failure to install airbags)

But tort law may be "law too late," it may provide inaccurate feedback, and courts can be as political as legislative and regulatory forums

III. If governmental intervention is appropriate, at what level?

IV. Introduction to the legal system

A. Distinguish Constitutional, statutory, regulatory, and common law

B. Define the Federal-state relationship

C. State authority

1. State police power
   a) basis
   b) limits
   c) extent

2. History of extensive public health interventions

D. Federal authority

1. Commerce power (e.g., Motor Vehicle Safety Standards)

2. Spending power (e.g., 402 Standards)

V. Early history of federal involvement with traffic issues

1. Federal Aid Act of 1916
   (roadway design standards; 50/50 matching funds)

2. 1924 National Conference on Street and Highway Safety
   (Hoover Conference)

3. 1926 National Conference
   (draft of model Uniform Vehicle Code)

4. 1935 Manual on Uniform Traffic Control Devices

5. Highway Act of 1944
   (authorized 40,000 mile Interstate Highway system)

6. 1946 President's Highway Safety Conference
   (established model for Action Programs)

7. 1954 White House Conference on Highway Safety

8. Federal Aid Act of 1956
   (90/10 matching funds; Highway Trust Fund; Manual of Uniform Traffic Control Devices)

9. 1960 National Driver Registry

This pre-1966 period of federal involvement was characterized by:

a) concentration on roads and traffic control devices

b) an advisory role for the Federal government

VI. The current period

A. Highway Safety Act of 1966

-Act directed Secretary to promulgate standards for state highway safety programs

-these "Section 402" Highway Safety Program Standards were developed in consultation with the states

-the 402 standards currently cover the following areas (notation following each indicates agency with primary administrative responsibility for that standard: National Highway Traffic Safety Administration or Federal Highway Administration)

1. Periodic motor vehicle inspection (NHTSA)
2. Motor vehicle registration (NHTSA)
3. Motorcycle safety (NHTSA)
4. Driver education (NHTSA)
5. Driver licensing (NHTSA)
6. Codes and laws (NHTSA)
7. Traffic courts (NHTSA)
8. Alcohol in relation to highway safety (NHTSA)
9. Indentification & surveillance of accident locations (FHWA)
10. Traffic records (NHTSA)
11. Emergency medical services (NHTSA)
12. Highway design, construction & maintenance (FHWA)
13. Traffic control devices (FHWA)
14. Pedestrian safety (NHTSA & FHWA)
15. Police traffic services (NHTSA)

16. Debris hazard control and cleanup (NHTSA)
17. Pupil transportation safety (NHTSA)
18. Accident investigation & reporting (NHTSA)

-to qualify for Federal assistance under the Act, states were required to develop highway safety programs which were:
 a) consistent with the 402 standards
 b) approved by the Secretary of Transportation

-the Act specifies that the Governor of each state shall carry out state obligations under the Act through a <u>Governor's Highway Safety Representative</u>

-originally monetary sanctions were built into the Act, but this provision was never used and was suspended in 1976

-one major result of the Act and the 402 standards has been greater uniformity and consistency among the states as regards those factors affecting traffic safety

B. National Traffic & Motor Vehicle Safety Act of 1966

-this Act gives NHTSA the authority to establish Federal Motor Vehicle Safety (MVS) Standards, which must:
 a) be practicable
 b) meet the need for motor vehicle safety
 c) provide objective criteria

-the Act [specifically, 15 U.S.C. 1397(a)] prohibits the manufacturing or offering for sale any new vehicle or equipment not in conformity with the applicable Federal safety standards

-the Act also provides authority to monitor use, to require notification of vehicle owners of safety defects, as well as authority to order recalls and/or fines

-the Act does not provide for any system of premarket review

-the standards developed under the Act fall into three categories

- o 100 series standards are aimed at reducing the frequency of crashes (e.g., standards for brakes, tires, windshield wipers)

- o 200 series standards are aimed at reducing injury in crashes (e.g., padded dash, head restraints, collapsing steering column; Standard 208 - Occupant Crash Protection - is perhaps the best known of all MVS Standards; it specifies requirements for both active and passive occupant protection)

- o 300 series standards are aimed at reducing the severity of post-crash events (e.g., fuel system integrity, fire standards for upholstery)

-Robertson estimates 85,000 to 125,000 lives were preserved due to standards in effect from 1975 through 1982 (see Reading #8)

C. Other statutes and other federal agencies are concerned with motor-vehicle safety

- o the National Transportation Safety Board is an independent administrative agency which investigates transportation crashes, holds public hearings, and makes policy recommendations

- o the Department of Health and Human Services, particularly its component U.S. Public Health Service, is concerned with protecting, promoting, and enhancing the public's health; the Centers for Disease Control collects information on injury; various divisions within HHS are concerned with alcoholism and alcoholism treatment

- o the Justice Department assists in training police officers

- o the Defense Department carries on an extensive motor-vehicle safety program

VII. Political and policy concerns

The political forces involved with motor-vehicle transportation include not only the system users, but the vehicle manufacturing and service industries, highway construction, insurance companies, law enforcement officials, public health and educational professionals, safety agency personnel, and many others. This makes for complex alliances and cross-pressures as the governmental role is implemented and reformed.

Much of our knowledge regarding injury control is new, changing, and the focus of sharp theoretical debate. For example, recent studies have challenged long held beliefs regarding the value of severe punishment of drunk drivers; yet while this research has done much to show what won't work in deterring the drinking driver, less has emerged on what will work. The result is an emotionally-charged political issue with no clear policy recommendations.

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Week 8 Occupant Protection Through Occupant Restraint

Objectives

The student will be able to:

1. understand the value and limits of various occupant restraint approaches.

2. understand various means of promoting and compelling restraint usage.

3. identify the special needs of infants and children in traffic crashes.

4. understand the role of the public health professional in the promotion of child restraints and safety belts.

5. describe state, local, and grassroots activities with regard to child and mandatory restraint legislation, use, and education and the relationship of these efforts to federal activities.

6. understand the history of Standard 208, including the relative merits of airbags and automatic safety belts.

Content

I. Each year over 30,000 motor vehicle occupants are killed and some half million moderately to severely injured.

There is "unequivocal evidence" (NHTSA, Effectiveness and Efficiency of Safety Belt and Child Restraint Usage Programs) that occupant restraint systems could prevent close to half of these fatal and non-fatal injuries.

What do occupant restraint systems do?*

1) take advantage of the crash "ride down"
2) distribute impact over time
3) spread out impact over the body and direct it against portions of the anatomy best suited to tolerate impact
4) contain occupant within the vehicle
5) prevent occupant from striking protrusions, windshield, etc.

II. Promoting safety belt usage

A. Front-seat lap belts required in U.S. autos as of 1966.
Front-seat lap & shoulder belts required as of 1968.
Integrated front-seat lap & shoulder belts required as of 1973.

B. Seat belts have been shown to be extremely effective in preventing serious or fatal injuries, with close to 50 percent effectiveness.

C. Yet only 23.3 percent of drivers wear safety belts*
(NHTSA estimates that 180 lives would be saved annually for every one percent increase in belt usage nationwide: National Safety Belt Usage Program, p. 2.)

D. Reasons for non-use (in no particular order of importance):*
perceived low probability of crash
discomfort
inconvenience
fear of being trapped
believe its safer to be thrown free of crash
don't understand crash physics and role of belt
don't believe belts work
believe belts cause more good than harm
laziness
forgetfulness
haven't made belt use a habit
believe that safe drivers won't crash
use only on long trips and/or on highways
want to avoid thinking of danger
less risk adverse (non-users more likely to smoke, to be in serious crash, to follow other cars more closely)

E. Use of belts correlates with:*
higher education
long trips/highway driving
driver education
smaller vehicles
health concern
purchase of new car
comfortable/convenient belt system
West Coast driving
metropolitan area
women

F. Efforts to encourage use/develop the use habit

1) Mass media campaigns (to increase & reinforce awareness)
-radio & TV (public service announcements/paid ads)
-print advertising
-billboards, posters, bumper stickers, etc.
-brochures, mailers, etc.
-history is not one of notable media success (perhaps in part because campaigns not sustained over time)

2) Educational campaigns
-longer, more informative, more persuasive than mass media
-smaller target audience, therefore more expensive
-programs through elementary schools, drivers education, and voluntary & service organizations (e.g., American Academy of Pediatrics/First Ride, Safe Ride; National Safety Council/Make It Click)

3) Economic incentives
   - -individuals, organizations, auto makers, states
   - -insurance
     - i. reduced premium/increased coverage
     - ii. insurance companies hesitant (verification problems, small savings, limited effect)
   - -employer
     - i. safety belt non-use very costly to employers
     - ii. fewer verification, savings, effect worries
   - -public reward programs

4) Employer belt use policies

5) Contributory negligence (plaintiff's failure to exercise reasonable care, thus making an injury more likely and serving to limit the amount of damages collectable)

All of these voluntary approaches are aimed at developing a belt-use habit. But voluntary programs to increase use are unlikely to achieve usage rates above 20 percent for mass media campaigns and 30-40 percent for targeted educational programs. (NHTSA, Effectiveness and Efficiency of Safety Belt and Child Restraint Usage Programs)

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6) Mandatory legislation
   - -experience in other countries*
   - -if enforced, laws result in large increase in belt use with moderate reducation in injury and death
   - -in U.S. several states have adopted safety belt laws (or seem close to doing so).
   - -primary reason for these laws is legislative effort by U.S. motor vehicle manufacturers in response to USDOT belt-law-or-air-bag regulation
   - -under current Federal automatic restraint requirement, if 2/3 of U.S. population covered by mandatory safety belt laws by 4/1/89, requirement will be rescinded.
   - -issues in controversy
     - -individual "rights" vs. societal protection
     - -limited effectiveness (injury and fatality reduction of perhaps 15 percent with mandatory use law)
     - -laws enacted now may help forestall airbag requirement

III. Promoting child restraint usage

A. There are 1500 deaths and 125,000 injuries annually involving motor vehicle occupants 14 years old or younger.

B. The size and anatomy of infants and children makes them especially vulnerable in traffic crashes
   - -higher proportion of body mass in head
   - -cars not designed for children (e.g., protrusions

placed lower where they form special hazard)

C. Yet lap and shoulder belts are not designed for infants and children
- higher center of gravity
- lower neck
- undeveloped anterior iliac spines
- can slip out (submarining)
- can suffer internal injury

D. Types of child restraints*
1) rear-facing infant seat
2) front-facing car seat
   a) tether required
   b) tether not required
3) shield
4) booster seat

E. Child restraints of proven effectiveness <u>when used properly</u>
- effectiveness as demonstrated in various studies ranges from 30-90 percent
- effectiveness in preventing fatalities has been found to be 71 percent
- effectiveness in reducing hospitalization 67 percent

F. To achieve such effectiveness requires:

1) appropriate child restraint: In 1981 USDOT implemented a 30 mph dynamic crash test requirement which allows for a maximum allowable forward excursion of the child's head and knees; maximum allowable head and chest acceleration and maximum rotational movement of a rearward facing seat.

2) use: for infants under one year old, usage rates are about 65 percent; for children 1-4 years old, usage rates are about 55.1 percent.

3) proper use: only about two-fifths of child restraints are used properly.
   Misuse usually involves:
   - child seat not properly secured with seatbelt
   - child seat straps not adequately fastened
   - child seat not teethered

G. Reasons for non-use
- parental disregard
- child discomfort
- child resistance
- consider car seat unnecessary
- expensive
- inconvenient
- mistaken belief that child safe in "mother's arms"

H. Efforts to encourage use/develop the use habit
[FOR DETAILS, SEE II.F., ABOVE]
1) mass media campaigns
2) educational campaigns

Such campaigns should not only emphasize the protection offered to the child by the child restraint, but also the fact that the restrained child is better behaved, less distracting to the driver, and less of a hazard to others in a crash.

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3) loaner programs
4) incentives
5) restraint laws
   - First child restraint law enacted in Tennessee in 1978
   - restraint laws now exist in all 50 states plus D.C.
   - laws vary in their provisions regarding:
     a) children coverage (age/height)
     b) drivers covered
     c) vehicles covered
     d) penalties
     e) exemptions
     f) safety belt use option
   - data suggests
     a) increased usage
     b) correlation with decrease in death & injury
     c) high level of <u>non</u>-compliance
     d) high level of <u>improper</u> use
     e) there is therefore a continuing role for 1-4, above.

I. School buses

Although epidemiological data suggests that installation of safety belts on school buses should be a low priority, considerable attention has been focused on such installation.

1) Because of strong grassroots support from citizens

2) Because absence of safety belts on school buses <u>could</u> convey the wrong message to children

J. Evaluation
- nature of observational usage studies (including ongoing NHTSA selected cities study)*
- difficulty of relating restraint use/non-use to death and, especially, non-fatal injury data

K. Resources for occupant restraint programs
- $640 million spent 1966-75 on Highway Safety Standard programs
  - 49 percent on changing or regulating people
  - 35 percent on police traffic services/driver education
  - 13 percent on changing the environment
  - 2 percent on vehicle inspection & regulation

-in 1978, in order to increase the portion of resources devoted to occupant protection, Congress mandated that states spend at least two percent of their highway funds on safety belt and child restraint programs

IV. Passive restraints

A. Rationale for passive over active approaches
(potential to prevent 12,000 deaths annually)

B. Extent of current passive measures
-FMVSS 100 series--reduce frequency of crashes
(e.g., standards for brakes, tires, windshield wipers)
-FMVSS 200 series--reduce injury
(e.g., padded dash, head restraints, collapsing steering column)
-FMVSS 300 series--reduce impact of post-crash events
(e.g., fuel system integrity, fire standards for upholstery)
-effectiveness: Robertson estimates 85,000 to 125,000 lives preserved due to standards, 1975-82

C. History of FMVS Standard 208
-regulation first issued in 1969
-since then, passive restraint requirement has been imposed, amended, rescinded, reimposed, rescinded again, and reimposed under court order
-controversy and litigation continues

D. Airbags vs. automatic belts vs. "new technologies"

E. Sec. Dole 1984 FMVSS 208 regulation (49 CFR Sec. 571.208)

1) Automatic restraint can be:
a) airbag
b) nondetachable automatic safety belt
c) any new technology that passes 30 mph crash test (e.g., "friendly or passive car interiors")

2) Automatic restraints required in:
a) 10% of cars sold in U.S. after 9/1/86
b) 25% of cars sold in U.S. after 9/1/87
c) 40% of cars sold in U.S. after 9/1/88
d) 100% of cars sold in U.S. after 9/1/89

3) But if 2/3 of U.S. population covered by mandatory safety belt laws by 4/1/89, the automatic restraint requirement is rescinded.

4) As of January 1986, sixteen states and the District of Columbia had enacted mandatory safety belt usage laws

5) Preliminary data shows that during the first three months of New York State's mandatory safety belt law, the number of drivers killed in motor-vehicle crashes declined 27 percent (New York Times, May 1, 1985)

V. Role of the public health professional

A. In community health education

1) local health departments have considerable potential for health education on occupant restraint

2) such efforts should be coordinated with a network involving the maximum feasible number of community groups to reinforce and sustain the educational impact

3) a well done program should include:
   a) community awareness (information and education)
   b) incentives
   c) evaluation

4) education continues to be important with mandatory safety belt and child restraint laws

5) a precondition of effectiveness is sensitizing health professionals to the importance of occupant protection

B. As public health advocates

1) Requires knowledge regarding both health education and legislation

2) Requires involvement in promoting health education programs and in supporting legislative efforts

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Week 9 Alcohol and Motor-Vehicle Safety

Objectives

Student will be able to:

1. understand the role of alcohol in traffic crashes
2. understand the strengths and weaknesses of various proposed remedies to the alcohol impaired driving problem.

3. relate the certainty of apprehension and degree of punishment to the effectiveness of alcohol impaired driving deterrence programs.

4. describe local initiatives on control of alcohol impaired drivers through the licensing and judicial process.

Content

I. Nature of the problem

A. According to NHTSA's Facts on Alcohol and Highway Safety:

o 60 percent of driver fatalities involve drivers who had been drinking

o 50 percent (40-55 percent) of driver fatalities involve drivers with blood alcohol concentrations (BACs) above 0.10*

o in single vehicle crashes this percentage rises to 65 percent

o driver fault is six times more likely to have been involved when the driver had been drinking as when the driver had not been drinking

o the majority of alcohol-related fatal crashes are caused by heavy (problem) drinkers--"about 7% of the driving population account for over 66% of all alcohol-related fatal crashes"

o 50 percent of adult pedestrian victims had been drinking

B. This statistical connection has a causal explanation in the performance-impairing effects of alcohol consumption.*

Julian Waller points out that:

o It is important to distinguish between intoxication (classic symptoms such as slurred speech, unsteady gait, etc.) and impairment (ability to perceive and respond). Impairment may happen well before any signs of intoxication are apparent.

o "heavy drinker" can be defined as one whose normal consumption pattern is five drinks or more per sitting

o "drink" can be defined as:
-12 oz. beer, or
-5-6 oz. wine, or
-1 oz. 100-proof liquor

o with a BAC of 0.05 or lower <u>impairment</u> is seen in:
-many occasional drinkers
-a few moderate drinkers
-no heavy drinkers

o with a BAC of 0.05-0.10 <u>impairment</u> is seen in:
-all occasional drinkers
-most moderate drinkers
-one-half heavy drinkers

o with a BAC above 0.10 <u>impairment</u> is seen in:
-all occasional drinkers
-all moderate drinkers
-all heavy drinkers

o the effect of various BAC can be shown in crash rates
-under 0.05...no increased risk of crash (except teens)
-0.05-0.10....2-3 time increase in risk of crash
-0.10.........6-8 time increase in risk of crash
-0.15.........25-30 time increase in risk of crash

In <u>The Culture of Public Problems: Drinking-Driving and the Symbolic Order</u>, Joseph Gusfield asks why drinking-driving--a social problem that does not usually involve malicious intent--has become a public problem. He questions the commonly accepted figures regarding the magnitude of alcohol-related traffic fatalities and attacks the "harsh and punitive attitude toward drinking-driving" as moral crusading by those who want to interfere with the drinking practices of others. Gusfield provides little factual support for his unique argument, but the book is still worth noting (1) because of the attention it has received from others and (2) as a reminder of the emotional force behind the drinking-driving debate.

II. Response to the problem

A. Traditional attitudes and interpretations of law

1. alcohol impaired driver historically not considered a criminal.

-hard to prove intent
-often no damage done

2. judges often sympathetic - reflect public's* traditional attitudes:

   -"there but for the grace of God go I"
   But: crashes often involve true alcoholics, not just social drinkers

   -judges fear loss of driving privilege will prevent convicted driver from getting to work
   But: often drivers can find other methods of commuting

3. although there is continuing interest in the education and rehabilitation of the drinking driver, the evidence suggests that this approach is most effective when long-term and combined with traditional sanctions.

B. Federal government funded Alcohol Safety Action Programs (ASAP) in 1970s. Evaluation of effectiveness weak; failed to show any educational and rehabilitation impact on crashes. (See Nichols, et al, Additional Reading #10)*

C. Current emphasis toward more stringent legislation and enforcement:

1. implied consent laws

2. elimination of 90-minute waiting period before a blood test is taken

3. fewer court-ordered supervisions (which can include alcohol remedial education program), and more convictions, with such penalties as

   -loss of license for at least one year
   -possible imprisonment
   -fines up to $1000
   -mandatory alcoholism treatment program

4. deterrence programs including roadblocks, etc.

   -the greater the perceived certainty of punishment, the more effective

Ross and others have demonstrated, severity of punishment is not effective in deterring drunk driving since drivers know that the likelihood of their drinking and driving leading to crash and/or arrest is extremely small. Some 99.5 percent of alcohol-impaired driving goes undetected.*

D. Deterrence consists of a combination of:
   -severity of punishment
   -certainty of apprehension and of prosecution
   -swiftness of prosecution

-deterrence can only work if the perceived certainty of apprehension (and punishment) is high
-this is the logic behind the drunk-driving checkpoints (i.e., roadblocks)

-even then, deterrence can only work in the short run

-the progress in reducing alcohol-related crashes will perhaps come from programs combining short-term deterrence approaches with long-term prevention/intervention measures

III. The community vigilance approach to curbing drunk drivers

A. The public has historically been the missing element in the traffic crash issue because:

1. public only now has begun to unite into grass roots groups

2. in the past traffic crashes were not considered a public health problem

B. Grass roots groups such as MADD (Mothers Against Drunk Drivers) are forming to translate personal tragedy into action

1. appeal ranges from the emotional to the more moderate

2. attempt to affect and monitor the legal system through:

-lobbying for stiffer laws and penalties
-working to raise the legal minimum drinking age
-citizen "extra eyes patrols" to supplement police on highways
-court-watching

3. attempt to publicize the drinking and driving issue

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VIII. History of a model course and application to other schools of public health

In 1983, the School of Public Health of the University of Illinois at Chicago received funding-support from the U.S. Department of Transportation to facilitate the preparation, presentation, and "packaging" of a comprehensive survey course on motor vehicle injury and death that could serve as a practical model for similar courses at other institutions. The hope underlying the model course project was that, while there were no magical solutions for the problems facing courses of this type, some needless difficulties could be eliminated. By demonstrating an optimal approach to the presentation of a motor vehicle injury and death course, both encouragement and assistance would be offered to those at other schools of public health interested in introducing a course of this type.

Of course there can never be a truly "model" course that can simply be plugged into a school's curriculum. Not only is every school at which course adoption might be considered a unique institution with its own special advantages and disadvantages, but the institution at which the "model" was developed is also unique. Certainly the most unique, nonreplicable aspect of the motor vehicle injury and death course as actually presented at the University of Illinois School of Public Health was the project funding itself. This funding was used for three categories of activity: (1) functions which benefited the students enrolled in the course and which can also benefit students enrolled in courses patterned on this model course (including use of consultants to develop an optimal course curriculum and readings, lecture notes and graphics, specific teaching approaches); (2) functions which benefited the students enrolled in the course but which cannot benefit students enrolled in courses patterned on this model course, including specific guest speakers; and (3) functions which can benefit students enrolled in courses patterned on this model course but which did not benefit the students enrolled in the initial offering (including materials prepared for presentation of the model course "package" to other schools of public health).

The major advantage of the funding support is a shared one: the unique opportunity to draw upon the leading academic experts in the various sub-areas of motor vehicle injury and death. One major sources of such expertise was the American Association for Automotive Medicine, members of which played an active role in the initial curriculum planning for the course. After an in-house tentative curriculum had been developed, a curriculum planning meeting was held to review and redo the curriculum. The resulting curriculum was then circulated widely in order to get further input. As a result of this input, further alterations were made. Table I lists the individuals involved in the initial stage of the curriculum planning process. In addition, further alterations were made on the basis of the experience of actually presenting the course.

The course offered at the University of Illinois had special advantages and resources underlying its presentation. It is important to emphasize, however, that adequate resources for a course of this type exist virtually everywhere. The most important task in presenting a motor vehicle injury course is bringing together and integrating these resources. By drawing upon surgery departments, rehabilitation centers, engineering schools, state transportation departments, and various citizen activist groups, it is possible to tie together individuals who may not only be valuable for classroom presentations but who also afford opportunities for

TABLE I: Curriculum planning meeting participants

Wayne Anderson
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University of Birmingham
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Kimball T. Maull
Department of Surgery
University of Tennessee
Health Science Center

Rudolph Mortimer
Department of Health and Safety
University of Illinois-Champaign

Robert Paaswell
Urban Transportation Center
University of Illinois at Chicago

Elaine Petrucelli
American Association for Automotive Medicine
Arlington Heights, IL

Susan Wilson
Illinois Department of Transportation
Springfield

students to conduct meaningful field practice. (Appendix 4 lists potential resource people by geographic area in which there is a School of Public Health.)

An evaluation instrument used for each of the course sessions allowed for feedback from the participants. This was particularly useful in gauging how well we had accommodated the rather wide-range of student backgrounds. This evaluation information has been used in developing the final manual.

The course was offered again at the University of Illinois without benefit of funding by using the draft manual and materials and resources supplied and/or recommended by those experts involved in the first offering. The curriculum presented in Chapter VII has thus been field tested by faculty who fit the description given in the Preface, those with some background in injury and curriculum development but with no particular expertise in traffic safety.

IX. Course presentation: practical guidelines

The development and presentation of this course on motor vehicle injury provided an opportunity to test a variety of approaches for both developing interest in the course and in effectively presenting course materials. The following pages present several of the more notable lessons learned from this experience.

Field trips and demonstrations.

Drunk driving court: A variety of field trips and/or demonstration experiences were considered and several attempted. In most instances the expectation exceeded the result. The most successful field trip involved observation of drunk driving proceedings in traffic court, along with informal meetings with prosecutor and judge. This experience allowed students to gain an appreciation of the volume and routine of a traffic court handling thousands of cases on an average day.

Alcohol-impaired obstacle course: An alcohol-impaired obstacle test course was explored as a possible field trip but was not used for this course. Either participating in or witnessing such a demonstration could provide one of the most convincing experiences for students on the effects of alcohol on driving. During the time period in which this course was offered, a demonstration was conducted by the Illinois State Police for a suburban county drunk driving task force. There were several reasons that this particular demonstration was considered unsuitable for classroom use. According to the demonstration protocol, volunteers drove the test course three times before any alcohol intake. They then had two drinks and drove the course again. This was repeated until each volunteer reached a blood alcohol concentration of 0.10 or slightly above. By the end of the demonstration most volunteers had driven the course six or seven times (including the pre-test). Therefore, they were familiar with the course and drove it with few points deducted for errors even at a BAC of 0.10. Such a demonstration clearly would not have the optimal effect on the students (although it might be useful to illustrate a point often discussed in epidemiology courses). The fact that most students drive to school and therefore could only observe such a demonstration was also considered. It should be noted that the police will normally not set up this type of demonstration unless a sizeable audience can be guaranteed. For a small class this would mean an expenditure of time for advertising and organizing to assure a sufficient audience. However, such a demonstration would be a valuable addition to a health fair or other activity sponsored by an entire campus. If such a demonstration is not thought possible in a campus setting, the State Police should be contacted regarding the times and locations of such demonstrations scheduled elsewhere in the vicinity. It should be noted that the testing effect drawbacks discussed above may be unique to this particular drunk driving obstacle demonstration.

<u>Alcohol impaired computer simulation</u>: An easier, more time efficient version of this type of demonstration was used in the course with greater success. It was a computer simulation -- called <u>Limit</u> -- developed at the University of Iowa to show the effects of alcohol intake on driving ability. After indicating weight and food intake, the participant is given an opportunity to "attend" a party through the computer program, indicating number and type of drinks and interval between individual drinks. Participants then use the computer keyboard to

"drive" along a roadway without leaving the road or hitting stationary or moving obstacles. Besides being fun and interesting, Limit was found to be an effective teaching tool for the concepts of alcohol consumption and blood alcohol concentration as a function of previous food intake, body weight, and time. It is recommended for future classes of this type as well as for short courses or workshops on traffic safety. (For information, contact Michael Reberry, 962 Sun Burst Lane, Altoona, Iowa 50009. Limit requires an Apple II or IIe.)

Breathalyzer: An in-class demonstration of breathalyzer measurement proved to be of mixed value. It would be too time consuming to warrant inclusion in a course if done as a demonstration alone. But if the demonstrator can use the waiting time required for the test--while volunteers consume alcohol, while the machine is readied and while it performs its analysis--a useful discussion of the technical, legal, and administrative issues surrounding the use of breathalyzer tests can be conducted. The demonstration would then be moderately useful as a means of emphasizing just how large an intake of alcohol is involved in producing BACs approaching 0.10. Breathalyzer testing devices marketed to consumers can also be demonstrated. (One such device is available from Tim Hansen, Product Manager, The Swede Group, Inc., 7200 Ohms Lane, Minneapolis, Minnesota 55435.)

Rehabilitation hospital: A field trip to a rehabilitation hospital was originally planned for the course but never carried out. Such a visit could serve to highlight in human terms the nature and cost of the injuries motor vehicles can produce. On the other hand, rehabilitation medicine merits only cursory coverage in an introductory motor vehicle injury course for public health professionals, and the main points to be made--the costs involved and the limits to what can be achieved--can be made without any field demonstration. Thus on reconsideration, a field trip of this type does not appear to be a useful adjunct to a public health course on motor vehicle injury.

Police auto pound: Another planned field trip would have taken students to the Chicago Police Department auto pound to examine vehicles that had been involved in crashes. This particular field trip had to be cancelled when the police personnel who were to serve as guides became suddenly unavailable because of departmental reassignment. It seems to us that this type of field trip would be a useful addition to a motor vehicle injury course, but only if the tour were conducted by someone with a background in crash dynamics and accident reconstruction who could explain the significance and meaning of various types of crash damage. Large metropolitan area Police Departments have such personnel or could locate such personnel through the State Police Department. The film Human Collision, essentially depicts this same type of tour (see Appendix 3), however, the opportunity to take part in such a tour personally would be much more beneficial than the film.

Safety Belt Convincer: Most state Traffic Safety offices and/or State Police Departments own and operate safety belt "convincers" in which a volunteer experiences a 7 to 10 mph "crash." Although we could not schedule a demonstration of the convincer during our course offerings, the use of such a demonstration is recommended. We were not able to schedule such a demonstration on University property due to the objections of the Office of Risk Management and faculty at other institutions might experience the same problem.

However, some of the students in the class worked with the State Department of Transportation personnel and made the arrangements for the convincer to be used at several school health fairs in Chicago. This was a new use of the convincer, and combined with a Traffic safety display developed by the SPH students, was an immediate example of the possible role of the knowledgable public health professional as a liaison between traffic safety program and school health program personnel.

Other points

Student projects: Our experience suggests that a critically important part of the motor vehicle injury course was a requirement that students prepare projects for classroom and written presentation. Several of our expert consultants had advised against including a class project requirement in the motor vehicle injury course, predicting that such a requirement would prove to be a waste of student and faculty time. As it turned out, however, these projects were a highpoint of the course for most students, providing a means by which the information and techniques learned during the course could be integrated and applied to a particular problem. Because the entire area of motor vehicle injury was completely new for the students (and the epidemiological approach new to the non-public health students), hands-on experience in using newly acquired knowledge made that knowledge more meaningful.

It is therefore strongly recommended that student projects be included when offering a course of this sort. Obviously considerable thought needs to be given to the specific projects that will be accepted as fulfilling the student project requirement. Data based projects seem particularly appropriate. Possible projects include: observation of safety belt and child safety seat use in traffic; development/implementation/evaluation of a traffic safety program for a school, agency, organization, etc.; investigating loaner programs; analysis of specific crash sites; analysis/evaluation of specific state and local laws or policies such as drunk driving deterrents, safety belt usage, reverse flow bus lanes, driver education, licensing specifications, helmet usage, etc. It is particularly appropriate if the project requires the student to interact with motor vehicle crash professionals--state department of transportation staff, local traffic planning officials, police, local traffic safety program personnel, etc. The use of a project as a method of student evaluation especially for a graduate level course, is also highly appropriate, rather than basing such evaluation on tests alone. If class size permits, having students work on projects in groups is a valuable learning experience. Not only do most public health professionals work as part of a team throughout their careers, but the investigation and analysis of traffic crash problems is more realistically accomplished in a team setting.

Scheduling A most important consideration in developing and presenting a public health course on motor vehicle injury is attracting students to the course. Unfortunately, there are not at present many public health students whose career goals are oriented to the injury prevention field. Thus at most schools of public health, a course on motor vehicle injury will not fit neatly into student programs, i.e., such a course will not fill specific degree requirements nor will it form a logical part of a student's course of study. This creates a scheduling dilemma: in order to make it likely that students will add the course to their schedules a course of relatively few contact hours is most desirable. Yet even the most abbrieviated of introductory courses will require about 30 hours of classroom contact. A second type of dilemma also exists, at least at those institutions whose courses are open to non-degree, continuing - education students. On the one hand, a public health course reviewing the basics of motor vehicle injury could be of considerable value to individuals whose professional activity brings them into contact with some aspect of this problem: e.g. department of transportation staff, insurance industry staff, health care professionals, and the like. These individuals would presumably be most interested in a course that was offered in the evenings. On the other hand, at schools strongly oriented toward daytime classes, late-in-the-day offerings tend to present a disincentive to the student.

For a non-required course on the fringe of student degree programs, these considerations can be especially significant. Experience at the University of Illinois suggests as many things not to do as things to emulate. Trying to finesse this dilemma by scheduling the course for late in the afternoon (and overlapping the dinner hour) proved not to be a desirable approach. Public health degree students were discouraged from participating, yet only a small number of non-degree participants were attracted to the course.

Certainly there is no universal answer to this problem, suitable to all institutions. The primary advice to be offered here is that scheduling needs to be given considerable attention, even more so than is the case with other courses. Surveys of potential interest should be undertaken where possible; both among public health students and among the relevent non-degree student audience. If the latter group is the larger of the two and/or if there are seemingly unresolvable scheduling conflicts between the two groups, then consideration should be given to a non-traditional format, such as a two or three-day intensive workshop or shortcourse. And if the non-degree student audience is significant, considerable attention must be devoted to marketing the course/workshop to all members of the intended audience.

The University of Illinois course was initially offered on a 4 credit, 4 contact-hour-per-week basis. (Part of this time was devoted to evaluating the course itself and part to experimental presentations which would not normally take up course time.) Based on our experience, the course was offered again on a 3 contact hours per week basis for a ten week quarter (2 contact hours per week for a 15 or 16 week semester). This was found to be sufficient for the course as outlined in Section VII, above. Schools on a semester basis could also offer a 3 hour course, with the additional time used by expanding and enlarging upon the topics discussed in Section VII. It is strongly suggested that additional depth per topic be added if time permits, rather than additional breadth. Not all of the resources and demonstrations discussed in Section VII were fully utilized in the model course. Those offering a course on a semester basis are in the enviable position of making greater use of the wide variety of educational resources, field trips, and local experts available to them.

Marketing: Promotion is important to any new, out-of-the-ordinary effort of this sort. Efforts to promote a motor vehicle injury course must be tailored to specific audiences: if both degree and non-degree students are involved, then two separate promotional efforts are in order. In order to interest public health degree students in the motor vehicle injury course, a variety of efforts were made during the academic quarter preceding the offering of the course. Faculty lectured on various aspects of motor vehicle injury in several existing public health courses. Notices announcing the course were distributed to students and faculty, not only in the School of Public Health but also throughout the Health Sciences and General University campuses. A course announcement also appeared in the campus newspaper in the form of a news article describing the course. And as a means of calling attention to the importance of the motor vehicle injury problem and to the new course, a film series was conducted throughout the quarter (see description, below).

Individuals outside the University who were identified as potential students were physicians, nurses, rehabilitation specialists, public health workers, emergency medical personnel, health planners, health educators, police, insurers, and others professionally interested in motor vehicle injury. In order to reach potential non-degree students a variety of efforts were undertaken. A course announcement appeared in the literature distributed by the School's Office of Continuing Education, along with a brief news article regarding the course published in a Continuing Education Newsletter. A press release announcing and describing the course was distributed to organizations whose membership and staff were likely to be interested in the course (e.g., American Academy of Pediatrics, Illinois Department of Public Health). And letters describing the course were sent to individuals identified as potentially interested in the course. All of this publicity also contained information regarding registration requirements.

<u>Film series</u>: As an adjunct to on-campus promotion, a nine-week film series was presented during the quarter preceding the one in which the course was to be offered. The series served to publicize the course, provided an opportunity to preview films which could be used during the course, and offered a means of obtaining additional input with respect to the quality and appropriateness of the films shown.

Suggestions for films to screen had been solicited from the film departments of the Insurance Institute for Highway Safety, the University of Michigan Transportation Research Institute, and Transport Canada. In addition, several of the curriculum consultants had offered comments on films.

In general the films turned out to be dated and aimed at a very general audience. Many relied on the same film footage. Certainly the intended target audience for these films was not a graduate student one. The result was that no film could be unequivocally recommended for use elsewhere. The films which were used in our course presentations were <u>Boobytrap</u>, <u>Crashes That Need Not Kill</u>, <u>Children and Infants Riding Restrained and Unrestrained</u>, and <u>Vehicle Crash Rescue for Physicians</u>. The use of films is discussed further in Appendix 3.

APPENDIX 1: ACKNOWLEDGEMENTS

We would like to thank the following individuals for their assistance in developing the University of Illinois motor-vehicle course on which this manual is based. Their willingness to share their time and expertise is greatly appreciated. We, not they, are responsible for whatever errors and weaknesses persist in the model curriculum.

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APPENDIX 2: ORGANIZATIONAL RESOURCES

The following list includes organizations, manufacturers, and trade associations known to be involved in some aspect of the traffic crashes problem. We recognize that this list is not complete and offer our apologies to any omitted groups who identify themselves with traffic safety. All organizations which we have inadvertantly omitted are encouraged to contact us so that we bring them to the attention of the Schools of Public Health.

Many of these organizations have state or local chapters, such as Child Passenger Safety Associations, Safety Councils, and American Automobile Associations. For state and local information and statistics, the State Office of Highway (Traffic) Safety, Governor's Highway Safety Representatives, Regional Office of the NHTSA, Regional Office of HHS, Regional Office of the Environmental Protection Agency, and State and local Health Departments should be contacted (see APPENDIX 9).

ROSTER OF ORGANIZATIONAL RESOURCES

GENERAL

Alliance of American Insurers
1501 Woodfield Road
Suite #400 West
Schaumburg, IL 60195-4980
(312) 490-8500

American Association of Motor
Vehicle Administrators
1201 Connecticut Avenue, N.W.
Suite #910
Washington, D.C. 20036
(202) 296-1955

American Association of Retired Persons
1909 K. Street, N.W.
Washington, D.C. 20049
(202) 872-4700

American Automobile Association
Traffic Safety Division
8111 Gatehouse Road
Falls Church, VA 22047
(703) 222-6000

American Driver and Traffic Safety
Education Association
123 North Pitt Street
Alexander, VA 22314
(703) 836-4748

Association of State Supervisors of
Safety and Driver Education
600 18th Street
West Des Moines, IA 50265
(515) 281-5811

American Red Cross
18th and D Streets, N.W.
Washington, D.C. 20006
(202) 737-8300

American School and Community Safety Association
Association of the Alliance for Health,
Physical Education, Recreation and Dance
1900 Association Drive
Reston, VA 22091
(703) 476-3440

American Seat Belt Council
Post Office Drawer F
Jamesburg, N.J. 08831
(201) 521-4441

American Society of Safety Engineers
850 Busse Highway
Park Ridge, IL 60068
(312) 692-4121

Association for The Advancement of
Health Education
1900 Association Drive
Reston, VA 22091
(703) 476-3440

Center For Automotive Safety
2001 South Street, N.W.
Suite #410
Washington, D.C. 20008
(202) 328-7700

Consumers Association of Canada
2660 Southvale Crescent, Level #3
Ottawa, Ontario
K1B 5C4
CANADA
(613) 733-9450

Consumers Product Safety Network, Incorporated
909 First Street
Seattle, WA 98104
(206) 442-5276

Council for Safe Transportation
of Hazardous Articles
1054 31st Street, N.W.
Washington, D.C. 20007
(202) 342-5250

Highway Safety Research Center
University of North Carolina
197-A
Craige Trailer Park
Chapel Hill, NC 27514
(919) 962-2202

Highway Users Federation for Safety and Mobility
1776 Massachusetts Avenue, N.W.
Washington, D.C. 20036
(202) 857-1200

Insurance Information Institute
110 William Street
New York, NY 10038
(212) 669-9200

Insurance Institute for Highway Safety
Watergate #600
Washington, D.C 20037
(202) 333-0770

Kemper Insurance
Long Grove, IL 60049
(312) 540-2000

League Insurance Companies
c/o James M. Edwards
SPO Box 430-A
Detroit, Michigan 48232
(313) 557-3200

Michigan Driver & Traffic Safety
Association
Michigan State University
Highway Traffic Safety Program
70 Kellogg Center
East Lansing, MI 48824-1022
(517) 353-1790

National Association of Governor's
Highway Safety Representatives
444 North Capitol
Suite #524
Washington, D.C. 20001
(202) 624-5877

National Association of Women Highway
Safety Leaders
7206 Robinhood Drive
Upper Marlboro, MD 20870
(301) 868-7583

National Coalition for Seatbelts
on School Busses
P.O. Box 781
Skokie, IL 60076

National Health Information Clearinghouse
P.O. Box 1133
Washington, DC 20013
(800) 336-4797

National PTA
Safety Belt Program Director
700 North Rush Street
Chicago, IL 60611
(312) 787-0977

National Passenger Safety Association
1705 DeSales Street, N.W.
Suite #300
Washington, DC 20036
(202) 429-0515

National Safety Council
Federal Affairs
Suite #300
1705 DeSales Street, N.W.
Washington, DC 20036
(202) 293-2270

National Safety Council
Traffic Safety Division
444 North Michigan Avenue
Chicago, IL 60611
(312) 527-4800 or 1-800-621-7619

National School Transportation Association
P.O. Box 2639
Springfield, VA 22152
(703) 644-0700

National Transportation Safety Board
800 Independence Avenue, S.W.
Washington, D.C. 20594
(202) 382-6800

Public Citizen
2000 P Street, N.W.
Washington, D.C. 20036
(202) 293-9142

Road Safety Research
University of Manitoba
158 - 750 Bannatyre Avenue
Winnipeg, Manitoba
R3E 0W3
CANADA

Society For Public Health Education
703 Market Street, Suite #535
San Francisco, CA 94103
(415) 546-7601

Transportation Research Board
National Academy of Sciences
2101 Constitution Avenue, N.W.
Washington, DC 20418
(202) 334-2934 or 1-800-424-9818

University of Michigan Transportation
Research Institute
The University of Michigan
Ann Arbor, MI 48109
(313) 763-2171

CHILD RESTRAINT COMPANIES AND GROUPS

Babyhood Industries
508 Boston Turnpike
Shrewsbury, MA 01545
(617) 845-4231

Century Products, Incorporated
Rosco - Peterson
1366 Commerce Drive
Stow, OH 44224
(216) 686-3000

Collier - Keyworth Company
P.O. Box 528
Gardner, MA 01440
(617) 632-0120

Cosco/Peterson
2525 State Street
Columbus, Indiana 47201
(812) 372-0141

Graco Children's Products
P.O. Box 100
Elverson, PA 19520
(215) 286-5952

Hamill Manufacturing Company
Love Seat Sales
New Product Department
P.O. Box 305-LS
Washington, MI 48094
(313) 752-9639

International Manufacturing Company
2500 Washington Street
Boston, MA 02119
(617) 442-9700

Juvenile Products Manufacturers' Association (JPMA)
66 E. Main Street
Moorestown, NJ 08057
(609) 234-9155

Kolcraft Products, Incorporated
3455 West 31st Place
Chicago, IL 60623
(312) 247-4494

National Automobile Dealers Association
8400 West Park Drive
McLean, VA 22102
(703) 821-7000

Questor/Evenflo Juvenile Furniture Company
1801 Commerce Drive
Piqua, OH 45356
(513) 773-3971

Rupert Industries Division
C & J Associates Incorporated
851 East Palatine Road
Wheeling, IL 60090
(312) 537-0036

Strolee of California
P.O. Box 5786
Rancho Dominquez, CA 90224-5786
(213) 639-9300

Welsh Company
1535 South Eighth Street
St. Louis, MO 63104
(314) 231-8822

ALCOHOL-IMPAIRED DRIVING GROUPS AND PROGRAMS

Allstate Insurance Company
Advocacy Programs
Allstate Plaza, F-3
Northbrook, IL 60062
(312) 291-5199

Alliance Against Intoxicated Motorists (AAIM)
P.O. Box 10716
Chicago, IL 60610
(312) 441-6313

Anheuser Busch
1 Busch Place
St. Louis, MO 36118
(314) 577-2000

BACCHUS (Boost Alcohol Consciousness Concerning
the Health of University Students)
University of Miami
P.O. Box 248106
Coral Gables, FL 33124
(305) 284-5353

Community Alcohol Safety Effort (CASE)
302 East Commercial
149 Park Central
Springfield, MO 65803
(417) 831-5016

Distilled Spirits Council of the United
States, Incorporated
1300 Pennsylvania Avenue
Washington, DC 20004
(202) 628-3544

Educational Systems and Programs
Systems Innovations, Incorporated
P.O. Box 430
Hallstead, PA 18822
(717) 879-4164

MADD (Mothers Against Drunk Drivers)
310 Willow Creek Office Plaza
669 Airport Freeway
Hurst, TX 76053
(817) 268-MADD

National Association of State Alcohol & Drug Abuse Directors
444 N. Capitol St., NW
Suite #550
Washington, D.C. 20001
(202) 783-6868

National Restaurant Association
311 First Street, N.W.
Washington, D.C. 20001
(202) 638-6100

Office of Alcohol and Highway Safety
Empire Motor Vehicle District Office
State of New York
Department of Motor Vehicles
Albany, NY 12228
(518) 473-5595

Paramedics Against Drunk Drivers
2808 Amsden Road
Winter Park, FL 32792
(305) 671-5866

RID (Remove Intoxicated Drivers)
P.O. Box 520
Schenectady, NY 12301
(518) 372-0034

SADD (Students Against Driving Drunk)
110 Pleasant Street
Corbin Plaza
Marlboro, MA 01752
(617) 481-3568

The Swede Group, Incorporated
7200 Ohms Lane
Minneapolis, MN 55435
(612) 893-0066

Traffic Improvement Association of Oakland County
2510 South Telegraph Road
Bloomfield Hills, MI 48013
(314)

United States Brewers Association
1750 K Street, N.W.
Washington, DC 20006
(202) 466-2400

HIGHWAY DESIGN AND CRASHWORTHINESS GROUPS

American Association of State Highway
and Transportation Officials
444 North Capitol Street, N.E., Suite #225
Washington, DC 20001
(202) 624-5800

American Road & Transportation Builders
Association
525 School Street, S.W.
Washington, DC 20024
(202) 488-2722

Potters Industries, Incorporated
377 Route 17
Hasbrouck Heights, NJ 07604
(201) 288-4700

Society of Automotive Engineers, Incorporated
400 Commonwealth Drive
Warrendale, PA 15096
(412) 776-4841

Southwest Research Institute
P.O. Drawer 28510
San Antonio, TX 78284
(512) 684-5111

HEALTH AND MEDICINE GROUPS

American Academy of Family Physicians
Scientific Activities Division
1740 West 92nd Street
Kansas City, MO 64114
(816) 333-9700

American Academy of Pediatrics
1300 North 17th Street
Arlington, VA 22209
(703) 525-9560

American Academy of Pediatrics
Every Ride/Safe Ride Program
P.O. Box 927
141 Northwest Point Road
Elk Grove Village, IL 60007
(312) 228-5005

American Association of Oral
and Maxillofacial Surgeons
211 East Chicago Avenue
Suite #1930
Chicago, IL 60611
(312) 642-6446

American Association for Automotive Medicine
40 Second Avenue
Arlington Heights, IL 60005
(312) 640-8440

American College of Emergency Physicians
P.O. Box 619911
Dallas, TX 75261-9911
(214) 659-0911

American College of Obstetricians and Gynecologists
Nurse Associates of ACOG
600 Maryland Avenue S.W.
Washington, D.C. 20024
(202) 638-5577

American College of Preventive Medicine
1015 15th Street N.W.
Suite #403
Washington, D.C. 20005
(202) 789-0003

American Dental Association
Council on Dental Health and Health Planning
211 East Chicago Avenue
Chicago, IL 60611
(312) 440-2500

American Public Health Association
1015 15th Street, N.W.
Washington, DC 20005
(202) 789-5600

American Hospital Association
Center for Health Promotion
840 North Lake Shore Drive
Chicago, IL 60611
(312) 280-6048

American Medical Association
535 North Dearborn Street
Chicago, IL 60610
(312) 751-6200

American Optometric Association
1730 M Street, N.W.
Washington, D.C. 20036
(202) 484-9400

American Trauma Society
P.O. Box 13526
Baltimore, MO 21203
(301) 528-6304

Epilepsy Foundation of America
4351 Garden City Drive
Landover, MD 20785
(301) 459-3700

International Association for
Accident and Traffic Medicine
P.O. Box 10043
Stockholm S-100 55
SWEDEN

Karen Haun
Aero Products (EMS training materials)
708 Industry Road
Longwood, FL 32750
(305) 331-0941

National Association of Emergency Medical Services Directors
Paul Anderson
Department of Health and Welfare
450 W. State Street
Boise, Idaho 83720
(208) 334-4245

National Association of Emergency Medical Technicians
P.O. Box 414
Boulder, Montana 59632
(406) 225-4222

National Council of State Emergency Medical Services Training Coordinators
P.O. Box 414
Boulder, Montana 59632
(406) 225-4222

National Association of Community Health Centers,
Incorporated Community Health Connection
1625 I Street, N.W.
Suite #420
Washington, D.C. 20006
(202) 833-9280

National Head Injury Foundation
18 A Vernon Street
Framingham, MA 02176
(617) 879-7473

National Society of Emergency Medical Services Administrators
Jonathan Best, President
2625 Park Avenue
Suite #14F
Bridgeport, CN 06604
(203) 335-0058

National Spinal Cord Injury Association
149 California Street
Newton, MA 02158
(617) 964-0521

Physicians for Automotive Safety
P.O. Box 430
Armonk, NY 10504
(914) 273-6446

POLICE AND LAW ENFORCEMENT GROUPS

International Association of Chiefs of Police
13 Firstfield Road
Gaithersburg. MD 20878
(301) 948-0922

National Association of State Directors
of Law Enforcement Training
Room #205
50 Tremont Street
Melrose, MA 02176
(617) 662-2422

National Sheriff's Association
1450 Duke Street
Alexandria, VA 22314
(703) 836-7827

VEHICLE MANUFACTURERS AND SAFETY GROUPS

American Motorcyclist Association
P.O. Box 141
Westerville, OH 43081
(614) 891-2425

American Trucking Associations
1616 P Street, N.w.
Washington, DC 20036
(202)797-5000

Bicycle Federation
1101 15th Street, N.W.
Washington, DC 20005
(202) 659-5540

Bicycle Manufacturers Association
of American, Incorporated
1101 15th Street, N.W., Suite #304
Washington, DC 20005
(202) 452-1166

Council for Safe Transportation
of Hazardous Articles
1054 31st Street, N.W.
Washington, DC 20007
(202) 342-5250

Chrysler Corporation
Automobile Safety Relations
P.O. Box 1919
Detroit, MI 48288
(313) 956-5741

David Viano, Ph.D.
Biomedical Science Department
General Motors (GM) Research Labs
General Motors (GM) Tech Center
Warren, MI 48090
(313) 322-3000

Ford Motor Company
3000 Schaefer Road
P.O. Box 1902
Dearborn, MI 48121
(313) 322-3000

General Motors Corporation
International Regulations
Environmental Activities Staff
30400 Mound Road
General Motors (GM) Tech Center
Warren, MI 4809-09015
(313) 575-1025

General Motors Corporation
Transportation Affairs Section
Suite #810
1660 L Street, N.W.
Washington, D.C. 20036
(202) 982-6200

Kawasaki Motors Corporation
6110 Boat Rick Boulevard, S.W.
Atlanta, GA 30336
(404) 349-2000

Moped Association of America
85 Metroway
Secaucus, NJ 07094
(201) 865-0135

Motor Vehicle Manufacturer's Association
300 New Center Building
Detroit, MI 48202
(313) 872-4311

Motorcycle Industry Council, Incorporated
2400 Michelson Drive, Suite #110
Irvine, CA 92715
(714) 752-7833

Motorcycle Safety Foundation
P.O. Box 5044
Costa Mesa, CA 92628
(714) 241-9922

National Automobile Dealers Association
8400 West Park Drive
McLean, VA 22102
(202) 429-0515

Recreation Vehicle Dealers
Association of North America
3251 Old Lee Highway, Suite #412
Fairfaz, VA 22030
(703) 591-7130

Recreation Vehicle Industry Association
14650 Lee Road
P.O. Box 204
Chantilly, VA 22021
(703) 968-7722

Volvo of America Corporation
Rockleigh, NJ 07647
(201) 768-7300

APPENDIX 3: FILM LIST

As an adjunct to on-campus promotion, a nine week film series was presented during the Winter quarter preceeding the course presentation. The series served to publicize the course, provided an opportunity to preview films which could be used during the course, and offered a means of obtaining additional input with respect to the quality and appropriateness of the films shown. Suggestions for films were solicited from those who were asked to comment on our proposed curriculum as well as individuals from NHTSA, the film departments of the Insurance Institute for Highway Safety, the University of Michigan Traffic Research Institute and Transport Canada.

All viewers were asked to fill out a Film Evaluation Questionnaire for each film seen. Viewers represented all program areas of the School of Public Health. Both students and faculty participated. Most viewers were not professionally involved in the area of motor vehicle safety. Those who did indicate that they were professionally involved were employees of the Illinois Department of Public Health (Implied Consent Section, Toxicology Section), registered nurses, a physical therapy instructor, research assistants and an individual in the field of alcohol and drug abuse.

The primary criteria used in both selecting the films to be reviewed and in judging the films was their appropriateness for graduate level education both in terms of content and format. When considering the ratings reported here it should be noted that the number of viewers per film varied. Also, there was no way to determine each individual's criteria used for the ratings given. Ratings might have been affected by the number of films which an individual had seen previously so that films shown later in the series could have been judged more stringently. However, these ratings do give a relative indication of the worth of a film in terms of conveying useful information to a graduate level audience.

Many traffic-crashes related films are meant to be used in health promotion settings, for the general public and are thus aimed at approximately a ninth grade level of education. Such films, whose overall objective is to convince someone to change their behavior or to supply basic health education for a specific segment of the population (e.g., a prenatal class), would thus not necessarily receive a high rating here. However, the original objective of these films may have been met in an excellent manner. No attempt was made to evaluate traffic related films for use by health educators in community settings. In addition, the many public service announcements available to groups sponsoring a safety belt or drunk driving campaign were not evaluated. Evaluation of these films and tapes in terms of their health education objectives would be an extremely worthwhile and timely project for a Health Education Program to undertake, however, it was beyond the objectives of this project.

The Planning and Evaluation Support Division of NHTSA is currently conducting an evaluation of the materials that have been developed for use in safety belt promotion activities. The films and slide presentations that are being evaluated as part of this process are:

Egg	Safety Belts: Facts and Fiction
Pumpkin	Risk
Headache	Do You Buckle Up
Dynamics of a Crash	Otto the Auto Buckle Up
Safety Belts Save Lives	Rediscover the Safety Belt
Safety Belts and You	Lucky 13
Are You Convinced	Children and Infants in Car Crashes
Child Restraints	Childsafe

Detailed information is presented about these materials in the document "A Guide to Audiovisual and Print Materials on Safety Belts and Child Car Safety Seats," DOT HS 806 482, July 1983 (see APPENDIX 8). These films and slides are available from the Occupant Restraint Coordinators at the regional NHTSA offices. Information about how they were rated for use with various groups and in various settings will be available. Such information would be of interest to SPH students focusing on the health education and program development aspects of traffic crashes.

FILM RATING

	Importance of Subject	Content	Recommend to Others	Appropriate for graduate level class	Overall Rating
Are You Convinced?	4.6	4.1	2.9	2.4	2.6
The Automatic Answer	5.0	3.0	3.0	2.5	3.0
Booby Trap	4.5	4.5	4.3	4.0	5.0
Children and Infants Riding Restrained and Unrestrained	5.0	4.6	4.4	4.2	4.2
Crashes That Need Not Kill	5.0	4.3	4.3	3.4	4.8
Dice In A Box	5.0	4.0	4.5	4.5	4.0
Don't Risk Your Child's Life	5.0	4.1	4.4	3.5	4.1
DWI Phoenix	5.0	2.8	2.5	3.8	3.0
Faces In Crashes	5.0	4.5	4.0	3.5	4.0
Highway Rescue Single Handed	4.5	3.0	3.0	2.5	2.5
The Human Collision	4.8	4.6	4.0	3.8	4.5
Life Is Precious, Buckle Them In	4.9	4.3	4.3	3.4	4.3
Motorcycle Safety Helmet Effectiveness	5.0	4.7	4.9	4.7	4.6
Passive Restraints: Ready When You Are	5.0	4.3	4.0	4.3	4.3
The Price You Pay	5.0	4.0	4.6	3.8	4.4
Reliable Airbag	4.5	3.0	3.5	3.0	3.3
Safety Belts and You	4.0	3.0	2.0	1.0	2.0
Traffic Law Observance and Enforcement	5.0	1.0	1.0	1.0	1.0
Unrestrained Flying Objects	5.0	3.7	3.3	4.0	4.0
Until I Get Caught	5.0	4.5	4.6	4.5	4.4
Vehicle Crash Rescue for Physicians	3.5	4.3	3.3	3.0	3.8

Ratings are the averaged results of viewer ratings on a scale of 1 to 5, where 1 is the least desirable and 5 the most desirable. Viewers were faculty and students from all programs within the School of Public Health, nurses, a physical therapist, implied consent and alcohol programs personnel. The number of reviewers for each film varied.

ANNOTATED LIST OF FILMS BY TOPIC

The following information is included for each film, whenever possible: date, running time, film and/or videotape, distributor, and price. Film distributors and their addresses are listed separately at the end. Films marked with an asterisk (*) are highly recommended.

AIRBAGS

Note: Some of the following airbag films have footage which is duplicated in the others. Ordering one film in this category should be sufficient.

"The Automatic Answer" (1979) - 2 versions - (6 min., 11 min.) - 16 mm film or 3/4 inch videotape

How passive restraints (primarily airbags) can prevent injuries. Includes testimony of crash survivors.

Insurance Institute for Highway Safety: purchase.

Film: 11 min.: $90
6 min.: $75
Video: $40 for both versions

or

Modern Talking Picture Service: loan.

"Crashes That Need Not Kill" (1976) - 28 min. - 16 mm film or 3/4 inch videotape

How airbags could save thousands of lives and prevent tens of thousands of injuries. The film includes testimony of several crash victims who were "saved" by their airbags.

Insurance Insurance for Highway Safety: purchase.

Film: $200
Video: $ 80

or

Modern Talking Picture Service: loan.

"Dynamics of a Crash" (1979) - 3 min. excerpt of "Crashes That Need Not Kill"

University of Michigan Transportation Research Institute: loan.

"Passive Restraints, Ready When You Are" (1978) - 20 min.

Focuses on airbags including their technology. Discusses some of the myths which have prevented the implementation of federal safety standards which would have required them.

Allstate Insurance Company: loan.

or

University of Michigan Transportation Research Institute: loan.

"Reliable Airbags" (1981) - 20 min.

Produced by Allstate (promotional). Includes an interview segment with Ralph Nader. Shows the airbag sensor system.

University of Michigan Transportation Research Institute: loan.

CHILD RESTRAINTS

*"Children and Infants In Car Crashes: Restrained and Unrestrained" (1979) - 2 versions - (5 min., 10 min.) - 16 mm film or 3/4 inch videotape

Crash test footage with anthropomorphic dummies showing the forces which act in various crash configurations and occupant seating positions.

Insurance Institute for Highway Safety: purchase.

Film:	10 min.:	$90
	5 min.:	$80
Video:	5 min.:	$40

or

Modern Talking Pictures Service: loan.

"Don't Risk your Child's Life: How To Protect Young Automobile Passengers" (1983) - 14 min. - 16 mm, Super 8, or Videotape

Crash test footage. Shows the correct use of child restraints and seat belts for older children. Explains top tether straps.

Physicians for Automotive Safety: purchase.

16 mm:	$190
Super 8 cassette:	$195
Video cassette:	$170

or

Rental $45 - 1 showing - (preview possible)

"Life Is Precious, Buckle Them In" 14 min.

A pediatrician explains the "human collision" with emphasis on pregnant women, newborns, and young children.

Shows different types of child restraint devices and how to use them. Includes footage on the danger of holding an infant on the mother's lap.

Target: pre-natal classes. Of interest to others as well.

Transport Canada: loan.

SAFETY BELTS

"Are You Convinced?" (1976) - 5 min. - 16 mm

Attempts to demonstrate the importance of safety belt use with the seat belt "Convincer."

FLI Learning Systems: purchase: $92. (preview possible)

or

NHTSA Regional Offices: loan.

"Belted and Unbelted Crash Tests" - 4 min. videotape

Barrier crash tests at 30 mph for various General Motors (GM) cars from 1929-1982.

General Motors (GM) Research Labs: loan.

"Corporate Safety Belt Program"

Slide-tape program aimed at upper-level management. Presents the corporate safety director's approach to selling and implementing a corporate safety belt policy.

F.L.I. Learning Systems: purchase (preview possible): $175.

"Dice In A Box" - 22 min.

Canadian film on safety belt use. Includes a good presentation of an auto wrecking yard. Discusses potential safety belt injuries and shows that seat belts can enable a driver to escape a burning or submerged vehicle. Also discusses incorrect shoulder belt usage.

Transport Canada: loan.

*"The Human Collision - 30 min.

Explains the function of safety belts and refutes some of the popular arguments against their use such as:

"it's better to be thrown clear of the vehicle."
"Belts make it harder to escape from a burning or surmerged vehicle."

Includes a description by an otolaryngologist of the biomechanics of injury for the driver and passenger.

Transport Canada: loan (2-week preview)

or

Film House: purchase: $127.58

"Safety Belts and You" (1980) - 8 1/2 min. 16 mm

Produced by the Ford Motor Company. Shows safety belt effectiveness in various crash configuratins.

University of Michigan Transportation Research Institute: loan.

or

Ford Motor Company: purchase.

Film: $80
Video cassette: $75

"Unrestrained Flying Objects" - 15 min.

Safety belts, how to wear them, and the excuses people give for not wearing them. Includes details on the use of anthropomorphic dummies, their construction, and testing. Shows the safety features in the car interior such as the padded dashboard and the energy-absorbing steering column.

General Motors (GM) Research Labs: loan.

ALCOHOL-IMPAIRED DRIVING

"America's Greatest Tragedy"

Regional NHTSA offices: loan.

"<u>But If You Live...</u>" - 15 min. - 16 mm - or videotape (Betamax, 3/4 inch, VHS)

Drunk driving accident survivors and their subsequent rehabilitation.

Kemper Group: schools and organizations allowed to copy video at no charge. Or if school sends Kemper a blank video, Kemper will copy it free for the school.

"<u>The Decision</u>" - 11 min. - 16 mm

Target audience: employees.

National Safety Council: purchase.

Member: $375
Nonmember: $470

"<u>Social Drinking - Fun and Fatal</u>" - 13 min. - 16 mm

Target audience: employees

National Safety Council: purchase.

Member: $340
Nonmember: $425

*"<u>Until I Get Caught</u>" - 27 min. film or videotape

Footage from original TV Documentary.

Regional NHTSA offices: loan.

or

Southerby Productions: purchase.

film: $527 for schools
video: $435
or rental: $135

INJURY

"<u>But If You Live....</u>" (See "ALCOHOL-IMPAIRED DRIVING")

"Faces In Crashes" (1981) - 10 min. - 16 mm or 3/4 inch videotape.

The problem of severe facial injuries which are caused in motor vehicle crashes. "Faces" was originally produced to show between films of double features at movies. Includes information on both laminated and Securiflex windshields.

Modern Talking Picture Service: loan.

or

Insurance Institute for Highway Safety: purchase.

film: $90
video: $40

"In The Crash" (1970) 22 min. - 16 mm film or 3/4 inch videotape.

What happens to car occupants in a crash and how the redesign of cars and highways could prevent injury.

Insurance Institute for Highway Safety: purchase.

film: $195
video: $ 80

EMERGENCY MEDICAL SERVICES

"Highway Rescue Single-Handed" 18 min.

Demonstration of the extrication procedure at a crash scene.

Oklahoma Highway Safety Office: loan.

"Life or Death" 20 min.

Story contrasting a good and a very poor emergency medical service.

Oklahoma Highway Safety Office: loan.

"Vehicle Crash Rescue for Physicians" 20 min.

A current film on extrication. Of interest to others besides physicians. A good introduction to other aspect of EMS besides extrication.

Karol Media: loan.

University of Virginia: purchase.

MISCELLANEOUS

"The Big Test" 15 min. videotape

History and promotion of General Motors (GM) proving grounds. Shows phases of development and types of testing. Also discusses interaction between the driver, the roadway and the vehicle.

General Motors (GM) Research Labs: loan.

"Booby Trap" (1972) - 28 min. - 16 mm film or 3/4 inch videotape.

Common roadside hazards such as rigid light poles, blunt-end guard-rails, and bridge abutments, and options for accident prevention. Still very usable despite discussion of current practices in future tense.

Insurance Institute for Highway Safety: purchase.

film: $200
video: $ 80

or

Modern Talking Picture Service: loan.

*"Motorcycle Safety-Helmet Effectiveness" 22 min.

USDOT sponsored research on helmet effectiveness, conducted at USC Head Protection Research Lab. Dispells many of the myths associated with helmet usage. Excellent presentation of crash investigation research.

Modern Talking Picture Service: loan.

or

University of Southern California: purchase.

Videotape: $80

"Report On Bumpers" (1983) - 14 min. - 16 mm film and videotape.

Uses crash test footage to demonstrate the differences in effectiveness between older bumpers, the 5 mph bumpers which were required (1973-1982), and the newer, less effective bumpers.

Insurance Institute for Highway Safety: purchase.

16 mm: $125
3/4 inch videotape: $60
1/2 inch VHS and Betamax: $60
or
Modern Talking Picture Service: loan.

FILM PRODUCERS AND DISTRIBUTORS

Allstate Insurance Company
Automotive Engineering Division
Allstate Plaza, F-3
Northbrook, IL 60062
(312) 291-5199

Chicago Motor Club
Safety and Traffic Engineering Department
66 East South Water Street
Chicago, IL 60601
(312) 372-1818

Film House
22 Front Street
Ontario, Canada
M5J1C4
(416) 364-4321

F.L.I. Learning Systems Incorporated
P.O. Box 2233
Princeton, NJ 08540
(609) 466-9000

Ford Motor Company
Room #988
American Road
Dearborn, MI 48121
(313) 575-3493

GM Research Labs
GM Tech Center
12 Mile and Mound Road
Warren, MI 48090
(313) 575-3493

Insurance Institute for Highway Safety
Communications Department
Watergate 600
600 New Hampshire Avenue, N.W.
Washington, D.C. 20037
(202) 333-0770

Karol Media
22 Riverview Drive
Wayne, NJ 07470-3191
(201) 628-9111

Kemper Group
Kemper Television Center, F6
Long Grove, IL 60049
(312) 540-2000

National Safety Council
444 North Michigan Avenue
Chicago, IL 60611
(312) 527-4800 or 1-800-621-7619

Neff/Rosenthal Video Communications
214 South Bemiston
St. Louis, MO 63105
(314) 863-0717

Modern Talking Picture Service
5000 Park Street North
St. Petersburg, FL 33709
(813) 541-5763

Oklahoma Highway Safety Office
200 N.E. 21st Street
Oklahoma City, OK 73105
(405) 521-3314

Physicians for Automotive Safety
P.O. Box 430
Armonk, NY 10504
(914) 273-6446

PBS
9689 Lindenbrook Street
Fairfax, VA 22031
(703) 281-2260

Southerby Productions
500 East Anaheim
P.O. Box 15403
(213) 498-6088

Transport Canada
1201 Wilson Avenue
Downsview,
Ontario,
CANADA
(416) 248-3210

University of Michigan Transportation Research Institute
Public Information Materials Center
2901 Baxter Road
Ann Arbor, MI 48109
(313) 764-2171

University of Southern California
Head Protection Research Lab
Los Angeles, CA 90089-0021
(213) 743-6514

APPENDIX 4: RESOURCE PEOPLE FOR THE SCHOOLS OF PUBLIC HEALTH

The following list of resource persons has been compiled through the course development and evaluation process. National organizations, manufacturers, and federal government agencies located in a particular city are found in APPENDIX 2, Roster of Organizational Resources. Although it was not always possible, an attempt was made to locate at least one physician, one engineer, one public programs director or administrator, and one academic researcher for each geographical area who would be willing to serve as a source of information and advice about motor vehicle crashes. In addition, it is hoped that these initial contact people can provide leads regarding other persons and data sources in a specific locality. The fact that a person is listed under a specific geographical area/School of Public Health is not meant to imply that they cannot be contacted by persons outside that area.

School of Public Health
University of Alabama/Birmingham
The Medical Center
University Station
Birmingham, Alabama 35294

School of Public Health
and Tropical Medicine
Tulane University
1430 Tulane Avenue
New Orleans, Louisiana 70112

D.I. Clemmer
Tulane University Medical Center
Department of Biostatistics
and Epidemiology
School of Public Health
and Tropical Medicine
1430 Tulane Avenue
New Orleans, LA 70112
(504) 588-5263

D. Covalt
School of Engineering
Geogia Institute of Technology
Atlanta, GA 30332
(404) 894-2000

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Safety Belt Coordinator
City of Natchitoches
P.O. Box 37
Natchitoches, LA
(318) 352-2535

Nancy Long, Executive Director
Mississippi Safety Council
P.O. Box 53
Jackson, MS 39205
(601) 969-9112

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Department of Surgery
University of Tennessee
Health Science Center
1924 Alcoa Highway
Knoxville, TN 37920
(615) 544-9230

Peter Parsonson
School of Engineering
Georgia Institute of Technology
Atlanta, GA 30332
(404) 894-2000

Paul Wright
School of Engineering
Georgia Institute of Technology
Atlanta, GA 30332
(404) 894-2000

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Boston University
80 E. Concord Street
Boston, MA 02118

School of Public Health
Harvard University
677 Huntington Avenue
Boston, MA 02115

Division of Public Health
School of Health Sciences
University of Massachusetts
Amhurst, MA 01003

Patricia A. Bartoshesky
State Safety Belt Coordinator
Massachusetts Governor's Highway Safety Bureau
100 Cambridge Street, Room #2104
Boston, MA 02202
(617) 727-5074

Richard Colletti, M.D.
University Pediatrics
1 South Prospect
Burlington, VT 05401
(802) 862-5744

Robert E. Gross
Emergency Medical Services
Department of Human Services
295 Water Street
Augusta, ME 04330
(207) 289-3953

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School of Public Health
Boston University
80 E. Concord Street
Boston, MA 02118
(617) 353-2000

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Executive Director
Natinal Association of State Directors
of Law Enforcement Training (NASDLET)
50 Tremont
Melrose, MA 02176
(617) 662-2422

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Department of Medicine
Given Building
University of Vermont
Burlington, VT 05405
(812) 656-2528

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University of California/Berkeley
19 Earl Warren Hall
Berkeley, CA 94720

School of Public Health
University of California/
Los Angeles
Center for Health Sciences/
Rm. #16-035
Los Angeles, CA 90024

School of Public Health
Loma Linda University
Loma, Linda, CA 92350

School of Public Health
San Diego State University
San Diego, CA 92182

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101 City Drive South
Orange, CA 92668
(714) 634-5540

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Fresno Safety Belt Coordinator
San Joaquin Valley Health Consortium
1055 North Van Ness Avenue, Suite F
Fresno, CA 93728
(209) 226-6104

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Loma Linda Center for Health
Promotion
11188 Anderson Street
Loma Linda, CA 92354
(714) 824-4496

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Division of Epidemiology
School of Public Health
University of California/
Los Angeles
Los Angeles, CA 90024
(213) 825-8579

Allan R Magie
School of Public Health
Loma Linda University
Loma Linda, CA 92350
(714) 824-4546

Robert O. Olson
County of Monterez
Department of Health
1270 Natividad Road
Salinas, CA 93906
(408) 757-1061

Janice Seaman, President
Weiner/Seaman Productions
Educational Programs
1505 Winchester
Glendale, CA 91201
(818) 244-3263

David Sleet
School of Public Health
San Diego State University
San Diego, CA 92182
(619) 265-5528

Sandra K. Sparks
California Child Passenger
Safety Association
3320 Kemper Street, Suite #102
San Diego, CA 92110
(800) 224-2731

Clark Swenson
Health Department of Utah County
107 East 100, South
Provo, UT 84601
(801) 375-8100

Lawrence Wallack
School of Public Health/Berkeley
19 Earl Warren Hall
Berkeley, CA 94720
(415) 642-2523

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Department of Public Health
1700 Pacific Highway
San Diego, CA 92120

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University of Hawaii
1960 East-West Road
Honolulu, Hawaii 96822

Arthur Kodama
University of Hawaii
1960 East-West Road
Honolulu, Hawaii 96822
(808) 948-8491

Paul J. Phillipson
Motor Vehicle Safety Office
79 S. Nimitz Highway
Honolulu, HI 96813
(808) 548-6507

School of Public Health
University of Illinois at Chicago
P.O. Box 6998
Chicago, IL 60680

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Coordinator, Safety Center
Southern Illinois University
Carbondale, IL 62901
(618) 453-2121

John Barrett, M.D.
Trauma Office
Cook County Hospital
835 West Harrison Street
Chicago, IL 60612
(312) 633-6000

Mary Beth Berkoff
Traffic Institute
Northwestern University
405 Church Street
Evanston, IL 60204
(312) 491-5476

James Dillon, M.D.
School of Medicine
Indiana University
635 Barnhill Drive
Indianapolis, IN 46223
(317) 264-8157

Garry Gardner, M.D.
Chairman, Injury Prevention
Committee
American Academy of Pediatrics
141 Northwest Point Road
P.O. Box 927
Elk Grove Village, IL 60007
(312) 228-5005

Paul Meyer, M.D.
Director, Midwestern Regional
Spinal Cord Injury Care
Northwestern Memorial Hospital
250 East Superior
Chicago, Il 60611
(312) 908-2000

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University of Indiana
2203 Moores Pike
Bloomington, IN 47401
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University of Illinois at Champaign
Champaign, IL 61820
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(312) 996-4820

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615 North Wolfe Street
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(313) 764-1817

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The Pennsylvania State University
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(814) 863-1907

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(606) 277-0056

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San Juan, PR 00936
(809) 753-5236

Clementina Escandon
Box 21187
Rio Piedras, PR 00928
(809) 723-7308

School of Public Health
University of South Carolina
Columbia, South Carolina 29208

Russ Arend, Director
Institute of Police Traffic
Management
University of North Florida
4568 St. Johns Bluff Road, S.
Jacksonville, FL 32216
(904) 646-2722

J. Edwin Clark
Department of Civil Engineering
College of Engineering
Clemson University
Clemson, SC 29631
(803) 656-3000

William R. DeLoache, M.D.
South Carolina Chapter
AAP
701 Grove Road
Greenville, SC 29605
(803) 242-8890

Albert A. Neal
Health Education
School of Public Health
University of South Carolina
Columbia, SC 29208
(803) 777-3858

Ms. Frances C. Righi, R.N., M.Ed.
Child Restraint Programs
419 N. Seagull Circle
Barefoot Bay, FL 32958
(305) 388-1439

Neil Robar
Institute of Police Traffic Management
Motorcycle Safety Coordinator
University of North Florida
4567 St. Johns Bluff Road, S.
Jacksonville, FL 32216
(904) 646-2722

Chris Slater
BACCHUS
University of Miami
5602 Merrick Street
Building 21H
Coral Gables, FL 33146
(305) 284-2211

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Medical College of Georgia
Pediatric Department CK-276
Augusta, GA 30912
(404) 828-3782

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University of Texas
Health Sciences Center at Houston
P.O. Box 20186
Houston, Texas 77025

Marilyn Faber
UT HSC Division of Sociology
7703 Floyd Curl Drive
San Antonio, TX 78284
(512) 691-6369

Ronald P. Fischer
Department of Surgery
University of Texas at Houston
4631 Fannin
Houston, TX 77030
(713) 792-5400

Ralph Frankowski
School of Public Health
University of Texas
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Houston, TX 77025
(713) 792-4425

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Seattle, Washington 98195

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APPENDIX 5: GLOSSARY OF TERMS RELATING TO MOTOR VEHICLE CRASHES

Prepared by **Lois Kimmelman**

Terms believed to be in common usage by public health professionals are not included in this list (e.g., CDC, APHA). Those adapting or using sections of this manual whose primary field is not public health are welcome to contact the authors for clarification of any public health terms not defined below.

abutment = the end support of a bridge; also, used loosely, "abutment" refers to the end of a guard rail or highway divider.

acceleration = rate of change of velocity (speed) with time; change in velocity divided by change in time; measures as feet per second per second (ft per sec) or meters per second per second (m per sec) or as decimal fraction of acceleration of gravity (g).

acceleration of gravity (g) = acceleration of a falling body due to the force of gravity; 32.2 ft per sec ; a standard of comparison for acceleration due to other forces.

accident = an event that usually leads to property damage, injury, or death; "accident" implicitly refers to an unintentional event. also called a "fortuitous event."

accident prone = descriptive term used to characterize any individual who is found or believed to experience a greater number of injury events in a given time frame than would be experienced by chance by other individuals in the same population in the same time interval. Also used to refer to those persons of a certain clinically defined psychological makeup, irrespective of their actual accident experience. Although certain groups have been found to be definitely at higher risk of unintentional injury (e.g., children, teenagers, elderly, alcohol abusers), the term has not proved useful in identifying in advance which persons within the groups are likely to have large numbers or more severe injury events. Removal of the small number of injury event repeaters has been determined to prevent an even much smaller percentage of the total number of injury events.

accident rate = the ratio of the frequency of accidents to the frequency of some exposure measure such as vehicle miles traveled (see EXPOSURE).

active restraint system = see manual restraint.

ASAP = Alcohol Safety Action Project. The U.S. DOT sponsored 35 ASAPs during the 1970's to combat the drunk driving problem in various states and communities; their main thrust was to identify and treat "problem drinkers" via the legal and medical systems.

automatic (passive) belt = a diagonal safety belt that is usually attached to the door of a car and to a retractor on the floor of the car in the center, which is activated by closing the door. This type of automatic belt is also known as a two-point automatic belt. There are also three point automatic or passive belt systems, although they are not commonly used. The opposite of an automatic belt is the more common "manually operated belt."

ADT = average daily traffic. Mathematically, this is the total traffic volume during a given time period (up to one year) divided by the number of days in that time period. (see "traffic volume").

agent = a source of a disease; as applied to crashes, an object which inflicts injury or property damage, or the car itself.

airbag = a type of passive restraint that involves a bag built into a car, that inflates on impact of the car against another car or obstacle. Also known as an "air cushion" or an "inflatable restraint." (see "passive restraint").

AIS = Abbreviated Injury Scale. This scale is an attempt to classify or score injuries sustained in a crash by body area and severity; it ranges from 1 (minor injury) to 6 (maximum injury--virtually unsurvivable).

alignment (or alinement) = the interconnection of roads as seen from above, viewed as a series of straight lines connected by curves.

angle collision = a collision of the front of one car with the side or corner of another, or a frontal collision between two cars that are not on colinear or parallel paths.

anthropomorphic dummy = a humanlike mannikin with movable parts that is used in crash tests to gauge the types and extent of injuries that would be sustained by a human driver or passenger under comparable crash forces.

arterial = see Roadway Function Class.

BAC = blood alcohol concentration (or content). This is a measurement of the weight of alcohol in a fixed volume of blood, and is usually expressed at a percentage. In most states, a BAC of 10 parts of alcohol per 10,000 parts of blood (i.e., BAC of 0.10%) is the legal standard used to establish that a person was driving under the influence (DUI) of alcohol/driving while intoxicated (DWI). (In Oregon, Utah, and the Canadian provinces this standard is set at 0.08%.)

belt-sensitive reel = a safety belt reel that locks as a result of the belt pulling out of the reel during a crash. (see "vehicle-sensitive reel").

breakaway = constructed to break, shatter or bend with pressure or upon impact. A "breakaway sign", for example, is attached to a pole that "gives" when a car crashes into it.

Breathalyzer = an instrument used to test a driver's breath to measure his or her degree of intoxication. (see "BAC")

capacity = the maximum number of cars a given road or intersection can be expected to handle under prevailing conditions. Capacity is measured as the maximum number of cars that pass a certain point per hour.

child safety seat (child restraint device) = seats designed to confine and support children who are sitting in a motor vehicle which have been determined to meet FMVSS 213 30 mph dynamic crash test requirements. Such seats are manufactured in three categories; infant, convertible infant-toddler (some toddler only) and booster seats.

CRD = child restraint device, see child safety seat.

closing speed = the speed at which two cars collide in a crash. In a head-on collision, this would equal the sum of the speeds (in miles per hour) of both the cars. In a crash of a moving car with a stopped car, the closing speed would roughly equal to the speed the moving car is traveling.

coefficient of friction = a number representing the resistance to sliding of two surfaces in contact; the force parallel to a surface required to keep an object sliding on that surface in motion divided by the weight of the object against that surface, measured in pounds per pound.

collision diagram = a map of a specific segment of a road or intersection which shows the locations, frequency, and configurations of crashes that occurred there during a defined period of time (often a year).

critical speed = a velocity above which a particular curve in the roadway could not be negotiated by a driver without sideways motion of the motor vehicle; the speed at which centifugal force of a vehicle exceeds the traction force of the tires on the road surface.

crash = an abrupt change in speed. This definition is useful for introducing the graphical analysis of crash mechanics in terms of the speed changes that occur. This term is prefered over "accident."

crash avoidance = a combination of human and vehicle factors, such as alertness plus good brakes, which enable a driver to avoid a crash.

crash configuration = type of crash, i.e. multi-vehicle vs. single vehicle, frontal vs. side, etc.

crashworthiness = the ability of a car to protect its occupants against fatalities and injuries in crashes through the design of that car. Sometimes crashworthiness is dependent on humans using (or properly using) a car's built-in safety devices, such as safety belts and head restraints. (This term was coined in 1942 by John Lane in his writings on aircraft safety.)

crash space (crush depth) = see dynamic crush.

day = the interval between sunrise and sunset. (see "night")

death = as of now there is no agreement among traffic safety agencies on exactly what time span to use when listing a death. NHTSA labels a "death" or "fatality" any person who dies within 30 days of a crash, yet other agencies consider 90 days or even one year appropriate. A "fatal accident" according to NHTSA, is a crash which results in one or more deaths within 30 days.

debris = material, such as vehicle parts, cargo, liquids, dirt, etc., strewn on the road as a result of a traffic crash.

degree of curve = the number of degrees of central angle subtended by an arc of 100 ft on the circumference; 5370 ft divided by the degree of curve equals the radius of the curve.

design vehicle = a standard car used in highway design having specified dimensions, weight, and operating characteristics such as turning radius.

designated driver program = a program in which one person in a group of two or more volunteers to limit his or her alcohol consumption and then drive the rest of the group home.

DOT = United States Department of Transportation.

dram shop liability = a provision that a third party can sue a bar owner for serving intoxicating drinks to someone who has a crash with that third party later.

DUI = driving under the influence. (see "DWI")

DWI = driving while intoxicated. This often refers to a type of law providing that a driver is presumed to be under the influence of liquor and therefore legally intoxicated, if his or her BAC is over a certain limit (usually .10%). (see "BAC" and "illegal" per se")

dynamic crush = the maximum distance that the front of a car collapses during a frontal crash. Afterwards the car front "rebounds" somewhat; the distance of the collapse is then called "residual crush" or "static crush."

edge line = a painted line which indicates the edge of the roadway.

EMS = emergency medical service.

environment = surrounding conditions and elements; as applied to crashes, the external factors contributing to a crash such as road design and weather.

exposure = measures that express the risk of an accident involvement to a person. For traffic crashes, common exposure measures are vehicle miles traveled (VMT), and number of licensed drivers.

FARS = Fatal Accident Reporting System, operated and maintained by NHTSA's National Center for Statistics and Analysis which issues an annual FARS Report.

fatality, fatal traffic accident = see death.

FHWA = Federal Highway Administration, a unit of the USDOT.

first harmful event = the first event during a traffic accident that caused injury or property damage, usually the first contact in impact; grouped into noncollision, collision with an object not fixed, and collision with a fixed object.

fixed objects = objects naturally attached to the terrain; stationary objects intentionally placed along the roadside for a particular purpose.

FMVSS = Federal Motor Vehicle Safety Standard.

<u>forgiving</u> = an attribute of any roadway or vehicle which allows a greater degree of error on the part of a person involved in the use of the roadway system without repercussion or with less serious repercussion, i.e. in crash avoidance, an Interstate is more "forgiving" for a sleepy driver than is a 2 lane secondary road; in crash dynamics, air bags are more "forgiving" than safety belts because higher accelerations may be experienced without injury; in vehicle design, big cars are more "forgiving" than small cars, the rear seat is more "forgiving" than the front seat, etc.

<u>friendly interior</u> = interior of a vehicle designed to meet the FMVSS dynamic crash standard for injuries sustained while using restraint systems without the use of a restraint system.

<u>g</u> = acceleration due to gravity, see acceleration.

<u>gore</u> = the area within the angle between two roadways where one roadway divides into two.

<u>grade</u> = the slope of a road, measured in percent of incline or fall from level distance. Also called "vertical curve."

<u>grade crossing</u> = the intersection of a road and a railroad track at the same level.

<u>headway</u> = the amount of time between one car and the next, measured from the front of one car to the front of the next.

<u>HIC</u> = head injury criterion, used to indicate relative levels of head injury sustained in a crash.

<u>host</u> = the recipient of a disease; as applied to crashes, the recipient of crash forces, i.e. the driver or passenger.

<u>illegal per se</u> = a law which prohibits the operation of a car by a driver with a BAC above the legally prescribed limit. (see "BAC").

<u>impact attenuator</u> = a device (a barrel of sand, for example) which would cause a car to decelerate more gradually in the event of a collision between the car and an object.

<u>implied consent</u> = a law stating that obtaining a driver's license is tantamount to agreeing to submit to a chemical test by a police officer of one's blood, breath, or urine to determine its alcohol content before an arrest is made. (see "DWI")

<u>incapacitating injury</u> = any nonfatal injury that prevents normal functioning; often this is equivalent to any injury requiring hospitalization.

incidence rate = the ratio of the number of new events, e.g., car crashes reported during a defined time period to the averaged population at risk of experiencing such events in the same time period.

injury = damage inflicted to the body by an external force which can be fatal. (see "death")

injury event = a sudden energy exchange due to a force acting with speed. (see "crash")

injury rate = the ratio of the frequency of some measure of injury to some measure of exposure.

interchange = a system of interconnecting roadways in conjunction with one or more grade separations, providing for the movement of traffic between two or more roadways on different levels.

intersection = the area within which vehicles traveling upon different highways may come in conflict; the area in which two roadways join one another, usually but not always, at right angles.

intrusion = the extent to which one car or object pushed into the passenger compartment of a second car as a result of a crash.

junction = the general area where two or more highways join or cross within which are included the roadway and roadside facilities for traffic movement; may include several intersections.

lap belt = a safety belt without a shoulder strap. Also called a "two-point belt system."

level of service = a qualitative measure indicating the "travelability" of a certain road. A grading system is used to indicate level of service, ranging from A (safest, fewest interruptions of traffic flow, etc.) to F (least safe, most congested). The level of service depends on the ratio of traffic volume to capacity of the road in question. (see "capacity" and "traffic volume")

MADD = Mothers Against Drunk Drivers.

MAIS = Maximum Abbreviated Injury Scale, see "AIS."

maneuver = the way a car was moving immediately prior to a crash. Maneuvers include left and right turns, braking, accelerating, decelerating, etc.; usually refers to intentional actions. (A sleeping driver does not execute maneuvers.)

median = that portion of a divided highway separating the roadways for traffic in opposite directions.

manner of collision = only applies to accidents in which the first harmful event was a collision between two motor vehicles in transport and is described as one of the following:

Angle = refers to those collisions which are not head-on, rear-end, rear-to-rear, or sideswipe.

Head-on = refers to a collision where the front end of one vehicle collides with the front end of another vehicle while the two vehicles are traveling in opposite directions.

Rear-end = refers to a collision between the rear of one vehicle and the front of another vehicle.

Rear-to-rear = refers to a collision between the rear of one vehicle and the rear of another.

Sideswipe = refers to a collision between two vehicles in which the sides of both vehicles sustained minimal engagements.

manual (active) restraint system = a type of restraint system which must be manually activated by the occupant, such as a shoulder belt, lap belt, lap and shoulder belt, child safety seat or helmets for motorcycle or pedalcycle riders.

morbidity rate = refers to either incidence or prevalence and thus is not usually the term of choice; the frequency of illness or injury in a specific population, measured as the number of events in a specified period divided by the averaged population at risk of experiencing the event in the same time period times 10 ™ where ™ is whatever number is needed to yield a whole number. (See injury rate, exposure.)

mortality rate = the frequency of death in a specific population, measured as the number of deaths in a specified time period divided by the averaged population at risk in the same time period times 10 ™ where ™ is whatever number is needed to yield a whole number. (See death, exposure.)

NASS = National Accident Sampling System, operated and maintained by NHTSA's National Center for Statistics and Analysis; provides basic information on a yearly basis on a representative sample of police reported accidents in the U.S.

NHTSA = National Highway Traffic Safety Administration, a unit of the USDOT.

night = the interval between sunset and sunrise. Some accident reporting systems differentiate between night and "dusk," see "day."

noncollision = a class of accidents in which the first harmful event does not involve a collision with a fixed object or a nonfixed object. This includes overturn, fire/explosion, gas inhalation, fell from vehicle and injured in vehicle.

nonoccupant = any person who is not an occupant of a motor vehicle in transport and consists of the following persons: (1) pedestrians, (2) pedalcyclists, (3) occupants of a non-traffic unit vehicle (e.g., parked motor vehicle), and (4) other types such as skateboard riders, persons riding on an animal, persons riding in animal-drawn conveyance, etc.

non-tow-away accident = an accident not satisfying any of the criteria for a tow-away accident based upon information on the police report; actual numbers of such accidents is unknown.

objects not fixed (nonfixed objects) = objects that are movable or moving but are not motor vehicles, pedestrians, pedalcyclists, animals, or trains.

occupant = any person who is in or upon a motor vehicle in transport and includes the driver, passengers, and persons riding on the exterior of a motor vehicle (e.g., a skateboard rider who is set in motion by holding on the vehicle).

override = used as either a noun or a verb. The primary crash energy absorbing structure of one vehicle fails to engage the primary crash energy absorbing structure in the other vehicle in a crash by slipping over it, e.g., the bumper and frame of the striking car "override" the bumper and frame of the struck car in a frontal or rearend crash or the bumper of the striking car overrode the side frame rail (under the door) in the struck car in a side crash. (also see underride)

passing sight distance = the distance ahead that must be available to a driver of one car to pass another car safely and comfortably, without interfering with the speed of an oncoming car.

passive restraint = a device which affords protection to an occupant of a car without the occupant having to activate it first; specifically, this refers to airbags and automatic belts, but taken more generally, passive restraints also include energy-absorbing steering columns, penetration-resistant windshields, etc., see "airbag" and "automatic belt."

pedestrian-actuated signal = a traffic light or other signal that can be activated by a pedestrian, see "traffic-actuated signal."

pedalcyclist = a person who rides a bicycle or other vehicle propelled only by his or her own (leg) power; this does not include someone who rides a moped or motorcycle.

personal injury accident = a crash producing injury and often property damage as well.

police-reported accident = an accident investigated or reported by a police officer, documented with a completed form which is signed by the investigating officer, and reported to the State. Driver reports submitted only to motor vehicle officials are excluded.

PBT = preliminary breath test. This often refers to a type of law stating that a police officer may request a suspected drunk driver to submit to a roadside breath test, which will help the officer decide whether there is probable cause to charge the driver with DWI or an illegal per se violation. (see "Breathalyzer," "DWI," and "illegal per se")

prevalence = the number of instances of a given disease or other condition in a given population at a designated time; sometimes used to mean prevalence rate. When used without qualification the term usually refers to the situation at a specified point in time (point prevalence).

prevalence, lifetime = the total number of persons known to have had the disease or attribute for at least part of their life.

prevalence, period = the total number of persons known to have had the disease or attribute at any time during a specified period.

prevalence rate = the total number of all individuals who have an attribute or disease at a particular time (or during a particular period) divided by the population at risk of having the attribute or disease at this point in time or midway through the period.

primary prevention = prevention of a disease before that disease has actually begun to run its course through prevention of exposure to the causative factors of that disease or through decreasing the susceptibility of the host; as applied to crashes, primary prevention measures would include age limits on drinking and/or driving, construction of divided highways, etc., see "secondary prevention" and "tertiary prevention."

property damage accident = a crash resulting only in property damage, no injury. (see "personal injury accident")

queue = the line of cars that forms in one lane of a road if traffic becomes too congested.

RID = Remove Intoxicated Drivers.

ridedown = the act of decelerating at the same time as the car during a frontal crash; this is only possible if an occupant is restrained which allows the occupant to take advantage of the crush distance of the front end. (See "dynamic crush")

road = the part of a trafficway which includes both the roadway and any shoulder alongside the roadway.

roadway = is that part of a trafficway used for motor vehicle travel or, where various classes of motor vehicle travel are segregated, that part of a trafficway used by a particular class, exclusive of the shoulder.

roadway function class = a code, based on the classifications used by the Federal Highway Administration, describing the role of the highway in the region.

Interstate = a limited access divided facility of at least four lanes designated by the Federal Highway Administration as part of the Interstate System.

Other Freeways and Expressways = limited access facilities not on the Interstate System, with full grade separation.

Other Principal Arterial = major streets or highways with grade crossings, serving high volume traffic corridors that connect major generators of travel.

Minor Arterials = streets and highways serving a connecting function between less concentrated traffic generating areas such as neighborhood shopping centers and schools, with a predominant function of movement of through traffic.

Collectors = streets providing direct access to neighborhoods as well as direct access to abutting land.

Local Streets and Roads = streets whose primary purpose is providing direct access to abutting land, with little or no through traffic.

rural = a term applied to a town or area of less than 5,000 inhabitants, see "urban."

school bus = refers to a specific type of vehicle which, independent of ownership or usage at the time of the accident, is primarily designed for transporting children to and from school.

school bus related accident = any accident in which a vehicle of body type school bus or vehicle used as a school bus but not necessarily of school bus body type is directly or indirectly involved, such as an accident involving children alighting from a school bus. The vehicle itself does not have to be a traffic unit in the accident.

second collision = the collision between an occupant and the windshield or other interior surface of the car after the car has collided with another car or object.

secondary prevention = early detection and screening of a disease; as applied to crashes, secondary prevention measures would include periodic automobile inspection, license renewal tests, etc., see "primary prevention" and "tertiary prevention."

serious injury = injury severity of AIS 3 or greater, including, for example, compound fractures and internal organ injuries.

shoulder = that portion of the road contiguous with the roadway for accomodation of stopped vehicles, for emergency use, and for lateral support of the roadway structure.

sled test = a simulation of a crash using a subject (anthropomorphic dummy, etc.) typically placed in a seat which travels down a track at such speeds that crash accelerations, or velocity changes, are replicated. The sled may also be called a "crash simulator," see "anthropomorphic dummy."

stopping sight distance = the distance a driver needs to bring his or her car to a stop after an unexpected obstacle (a stalled car on the road ahead, for example) becomes visible, in order to avoid the hazard. Mathematically, stopping sight distance equals perception/response distance plus braking distance.

submarining = an effect seen with lap belts, where during a crash the belt rises above the wearer's hips and the abdomen slides forward, leading to abdominal injury, see "lap belt."

tertiary prevention = prevention measures used to minimize injury and suffering and prevent death due to a disease, or in this case, a crash. This type of prevention is carried out "after the damage is done," and includes rehabilitation and emergency medical services, see "primary prevention" and "secondary prevention."

three-point belt system = a safety belt including a shoulder (or diagonal) belt plus a lap belt where the shoulder and lap belt have a common inboard buckle. (There are also 4 point lap and shoulder belts, although they are now obsolete) (See "lap belt")

tether = a strap by which a child safety seat (CRD) is bolted to a motor vehicle; found only on currently manufactured booster seats when used without a lap and shoulder belt, but still needed on many types of previously manufactured infant-toddler seats.

towaway accident = a broad term referring to any crash noted on a police report as containing a pedestrian, motorcycle, truck, fatality, person suffering from an incapacitating injury, or vehicle that had to be removed from the scene of the crash.

traffic-actuated signal = a type of traffic light whose intervals are determined by the amount of traffic passing by, which activates detectors connected to the light. (see "pedestrian-actuated signal")

traffic volume = the actual number of vehicles passing a certain point in a road or intersection per hour, usually expressed in terms of ADT, (See "ADT")

trafficway = any right-of-way open to the public as a matter of right or custom for moving persons or property from one place to another, including the entire width between property lines or other boundaries.

trauma = an injury caused by a mechanical or physical agent. A traffic crash injury is one form of trauma, along with gunshot wounds and power tool injuries. (See "agent" and "injury")

trauma center = a hospital where the medical staff has made a commitment to provide 24-hour service for trauma patients, i.e., such personnel as surgeons and anesthesiologists will be available, see "trauma."

triage = classification of casualties to determine priority of need and proper treatment.

trip risk = the danger to any user of a trafficway system in undertaking a particular trip; influenced by, among others, road, vehicle and driver characteristics, weather, traffic, and schedules.

underride = the primary crash energy absorbing structures of one car pushing under that of another car during a crash. "Underride" can be used as a noun or a verb. (See "override")

unreported accident = an accident which is not reported by the police, but may be reported by drivers to the police, to an insurance company, doctor, etc., or to no one.

urban = a term applied to a town or area of 5,000 or more inhabitants, or any other place classified as urban by the U.S. Census Bureau. (See "rural")

vehicle-sensitive reel = a safety belt reel that locks as a result of the crash deceleration itself instead of waiting for the belt to start pulling. (See "belt-sensitive reel")

warrant = a justification for the installation of traffic signals at a certain location based on factors such as traffic volume, school crossings, and the number of accidents at that location in the past. (see "traffic volume")

wraparound distance = the distance from the ground directly below the leading edge of the bumper at the point the bumper first contacts the pedestrian, up and around the contour of the vehicle, to the point of head impact, typically on the hood. approximately equal to the standing height of the pedestrians head above the ground for impact speeds of 30 mph or less.

APPENDIX 6: EXAMINATION QUESTIONS

The following questions are given as examples of possible exam items. Multiple choice or other objective type questions were not felt to be appropriate for a course of this level and type, however, this reflects the biases of the instructors and is not meant to imply that such tests should not be used. We would like to acknowledge Dr. Patricia Waller of the University of North Carolina for her assistance with this section.

OVERVIEW

1. The president of the local PTA comes to you, the local District Health Officer, to say that a traffic signal should be erected at an intersection in town because two children have been killed there during the past year. How would you answer the president about your role in solving this public health problem? · What advice would you give the president about how the PTA could function in this situation?

2. The editorial from the American Journal of Public Health (64 (14): 301, 1974) was unfortunately premature and overly optimistic. The Injury Control and Emergency Health Section of APHA died for lack of members. Discuss the impediments to dealing with injury control as a distinct area of public health.

3. The Presidential election of 1988 is now history. The electoral victory was the most lopsided in history, with President-elect Ed Asner defeating Sylvester Stallone in every state except Idaho. The President-elect's transition team has been relying heavily on foreign and domestic policy recommendations prepared by the Washington-based Institute for Policy Studies, all of which call for dramatic policy changes. On the domestic front, the IPS identifies motor-vehicle injury as one of the top ten "action priorities." It calls for a multi-faceted program to drastically reduce motor-vehicle crashes and their effects. Included are the following:

   a) upgrading the Federal Motor Vehicle Safety Standards to include aspects of vehicle design and construction which are currently not covered: weight, center of gravity, amount of crush space, and hood ornamentation.

   b) requiring a "perception and response interlock" on all vehicles, a computerized device which tests driver perception and response and prevents engine ignition unless an acceptable level is measured by the test.

   c) a total ban on the production, sale, and use of motorcycles.

   d) requiring a 35 mph speed limit on all rural roads not complying with Federal roadside hazard standards.

   e) a 21 year old minimum driving age.

4. Describe the main characteristics of an "unintentional injury event" and explain how such an event is related to chronic disease.

EPIDEMIOLOGY

5. Motor-vehicle crash rates are given as number/year, number/population, number/VMT, number/licensed drivers, number/registered vehicles, etc. From a public health viewpoint, how useful is each rate? Can any of these rates be misleading as to the seriousness/lack of seriousness of the motor-vehicle crash problem? What are some of the factors that influence the various rates?

6. Describe motor-vehicle injury relative to other causes of morbidity and mortality.

7. What are some of the shortcomings and biases of the motor-vehicle injury data system?

8. The 55 mph National Maximum Speed Limit was enacted to conserve fuel. However, the speed limit has had other effects as well. Describe these effects and discuss some of the arguments both for and against the 55 mph speed limit.

EMERGENCY MEDICAL SERVICES

9. What is "skill decay" as related to EMS? How is it prevented? What are the implications for the efficacy of EMS personnel in highway crashes in particular?

10. Helicopters were heralded as a crucial breakthrough in the provision of EMS. Give three reasons why this has not been the case.

11. Has a trauma system been found to improve injury outcome in the United States?

12. Describe the main components of an EMS system.

13. Distinguish between emergency medical services and advanced life support systems.

VEHICLE

14. How effective have periodic motor vehicle inspection (PMVI) programs been with respect to crash reduction? As the public health representative on a state committee to decide whether PMVI should be continued (instituted) in your state, what is your recommendation and why?

15. Explain "ride down" and discuss the paradox of "soft" versus "stiff" vehicles for occupant protection during crashes.

16. What are the four classifications of crashes? How do the motor vehicle safety standards protect occupants in each type of crash? (Remember: be brief!)

17. Some vehicle properties are related to accident avoidance rather than injury reducing crashworthiness. Discuss how the following features affect accident avoidance: vehicle handling, visibility (mirrors, windows), location of controls, their mis-identification, etc.

18. Over the last decade, there has been a considerable shift to smaller cars. According to accident statistics, unbelted occupants in these smaller cars fare considerably worse in crashes than do similar occupants of larger cars. Discuss why.

19. Discuss the relative safety for unbelted drivers in:

    1) Small cars in accidents with small cars
    2) Small cars in accidents with large cars
    3) Large cars in accidents with small cars
    4) Large cars in accidents with large cars

ROADWAY

20. Much of the current roadside hardware has been designed for larger cars. Discuss the specific accident problems that occur when small vehicles strike:

    a) the ends of guardrails
    b) the center sections of guardrails
    c) non-breakaway sign supports
    d) breakaway sign supports

21. Compare the level of safety in the Interstate roadway system to other roadways. Discuss specific reasons why the Interstate system is different for specific accident types.

22. List the three types of intersections in order of traffic control (least control to most control). Then discuss how moving from least control to most control relates to the issue of "safety versus mobility."

DRIVER

23. In what ways can the driving task exceed performance ability?

24. Should we move to a system of flashing blue brake lights, with the flash rate increasing as braking pressure increases. Explain why or why not.

25. Suppose you are on a committee that has the responsibility for deciding whether, in the face of limited financial resources, driver education should be discontinued in the public schools. What position would you take and why?

26. Describe the concept of accident proneness and explain how it relates to the problem of motor vehicle crashes. Elaborate on its usefulness in developing countermeasures for motor vehicle crashes.

27. Given the information available on drunk driving countermeasures both here and in other countries, how much can be expected from measures that focus primarily on enforcement and penalties? What other measures might be expected to be beneficial in combatting drunk driving?

APPENDIX 7: ORDERING PUBLICATIONS AND DOCUMENTS

NHTSA

For the most current information on the activities and functions of NHTSA, contact the free documents office below and ask for the most recent Annual Reports, one for highway safety and one for motor vehicle safety. Regional NHTSA offices have some materials - films for free loan, etc.

Also, publications can be ordered through:

1) NHTSA Headquarters: 400 7th Street
   Washington, D.C. 20590

   - for free consumer pamphlets (limit of 30 per order): call (800) 424-9393. Subjects include child restraint, safety belts, drunk driving, crashing testing, motorcycle safety, etc.

   - for free documents: call the Distribution Office - (202) 426-0874.

2) If documents needed are not in stock at NHTSA's Distribution Office, they are available for a charge from either:

   - National Technical Information Service
     5285 Port Royal Road
     Springfield, VA 22161
     (703) 487-4600
     (must furnish DOT-HS number and date of publication requested)

   - Government Printing Office (202) 655-4000.

3) NHTSA Auto Recall and Defects Hotline (800) 424-9393.

TRANSPORTATION RESEARCH BOARD (TRB)

A free catalogue of publications is published each January and is updated midyear. To be placed on the mailing list to obtain the catalogue call: (202) 334-3213.

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

A free catalogue of publications in the automotive field is published yearly. To order, call (412) 776-4970.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

A free catalogue of publications is published about every 9 months to 1 year. To order, call (202) 624-5800 and ask for publications.

FEDERAL HIGHWAY ADMINISTRATION (FHWA)

To obtain copies of FHWA regulations and standards, call (202) 426-0754.

To obtain FHWA documents, call (202) 426-0660. A listing of publications is available which is periodically updated (no set schedule). If a document is not available for free from FHWA, the NTIS PB order number can be obtained from the above phone number (see information on NTIS above).

The National Highway Institute within FHWA sponsors the development and implementation of training courses and workshops primarily for local and state transportation personnel. Once these courses have been given, copies of the instructional materials are available free of charge to universities, colleges, and any others involved in providing training. Any audiovisual materials from these courses are available on a loan basis.

Descriptions of the materials which are currently available are published on an irregular basis in the Education and Training Information Exchange Bulletin. Some offerings from the most recent Bulletin, for example, are "Accident Research Workshop," developed at the University of North Carolina, "Highway Safety Evaluation," developed by Goodell-Grivas, Incorporated, and the "Highway Safety and Traffic Study Program," developed at Northwestern University.

For information and to be placed on the mailing list to receive the Bulletin, contact Mr. Larry Jones at (202) 426-3100. School of Public Health faculty may find that the engineering department(s) of their college or universities are already taking part in this program.

AMERICAN ASSOCIATION FOR AUTOMOTIVE MEDICINE (AAAM)

A free publications' list is available. Back issues of proceedings are available in limited supply, call (312) 640-8440.

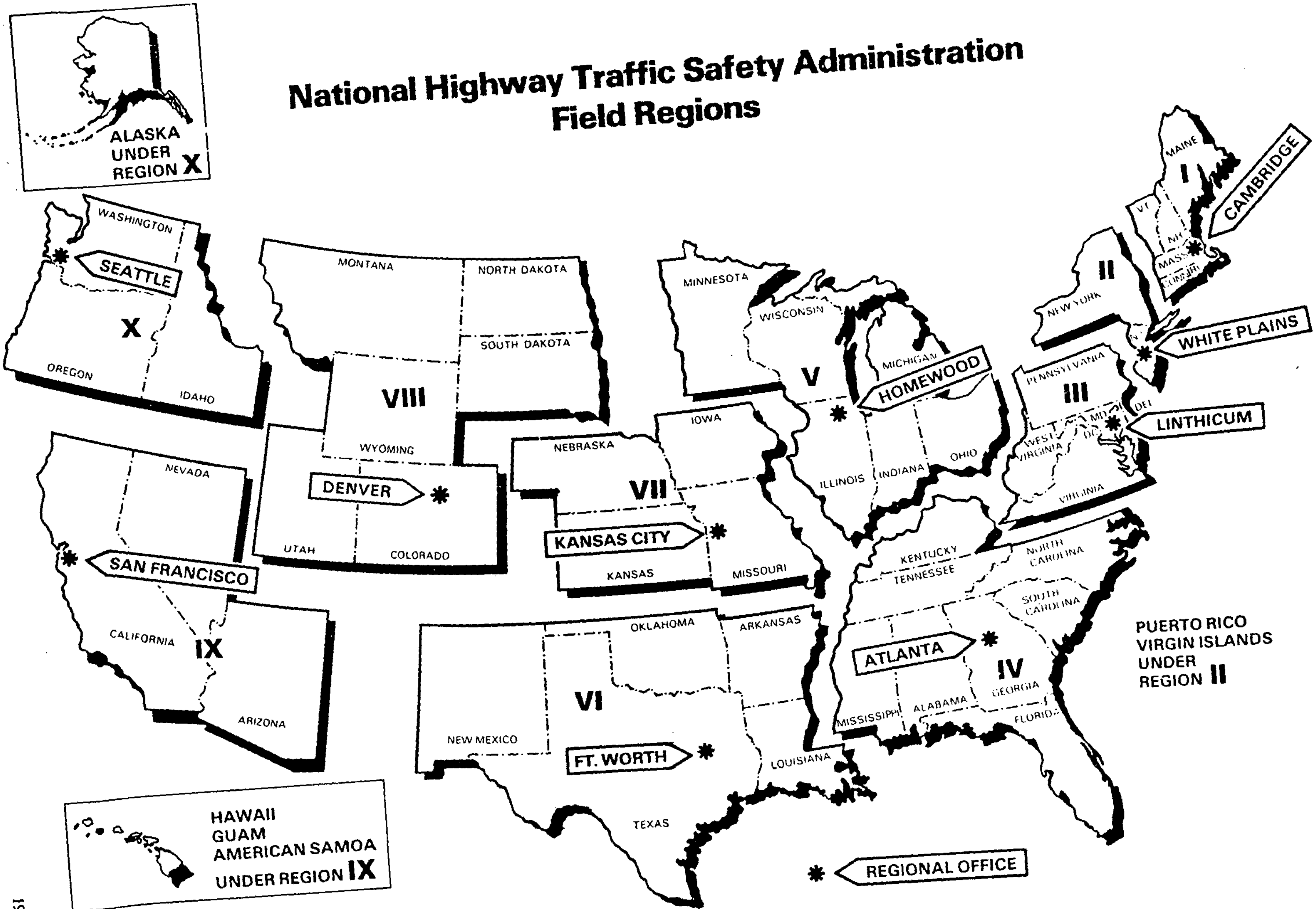
NATIONAL TRANSPORTATION SAFETY BOARD

Studies are available through NTIS. Availability of specific accident investigation reports are listed in the Federal Register as they are completed, however, they may also be obtained if the date and location of the accident is known. Accident investigation reports are invoiced at $.11 per page. For information and to obtain the NTIS number of research/study reports, call (202) 382-6835.

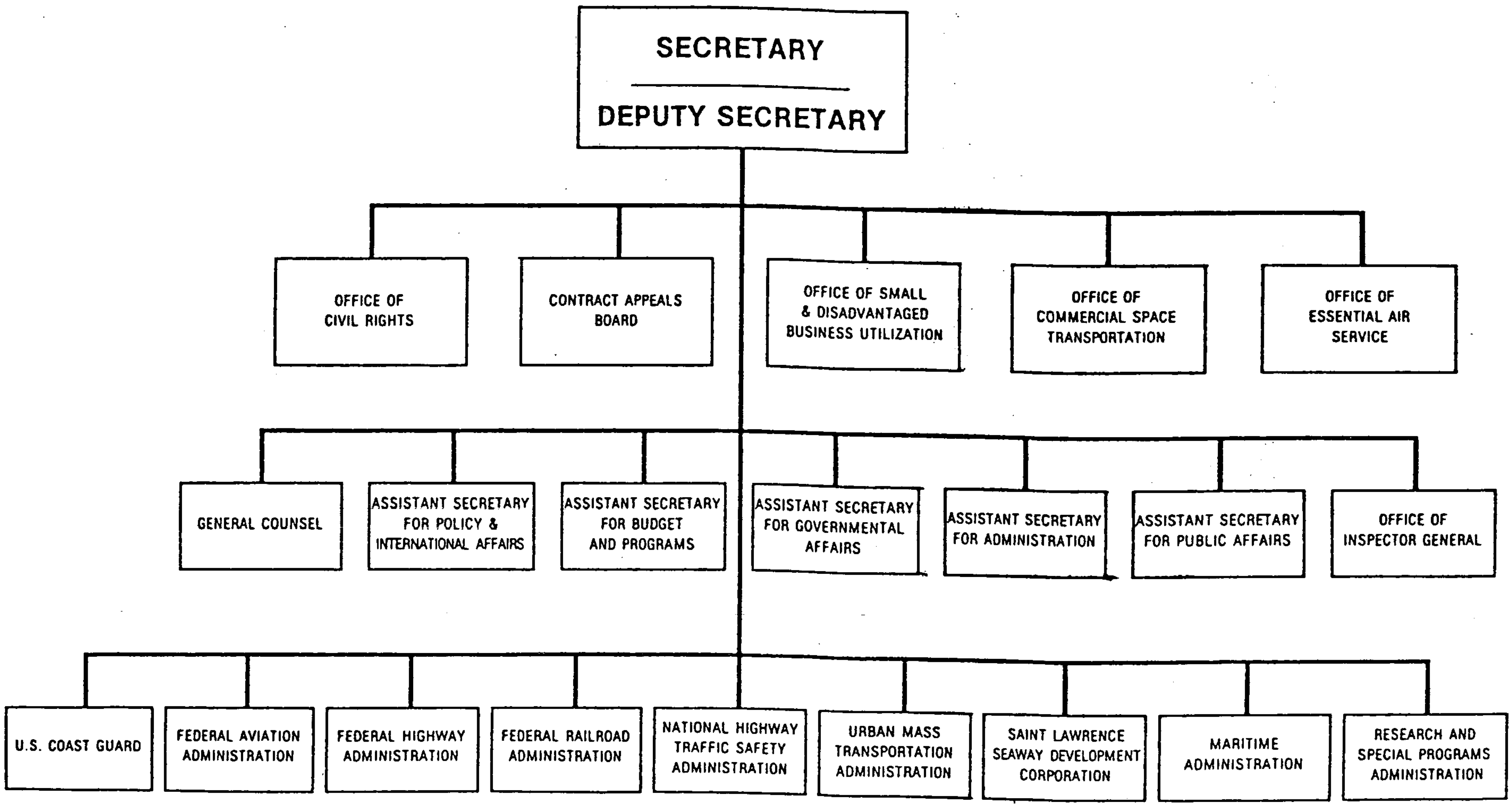
APPENDIX 8: FEDERAL AND STATE AGENCY OFFICES

To request a copy of the free USDOT telephone directory, call the NHTSA Distribution Office, (202) 426-0874, or write NHTSA Headquarters, 400 7th Street, Washington, D.C. 20590.

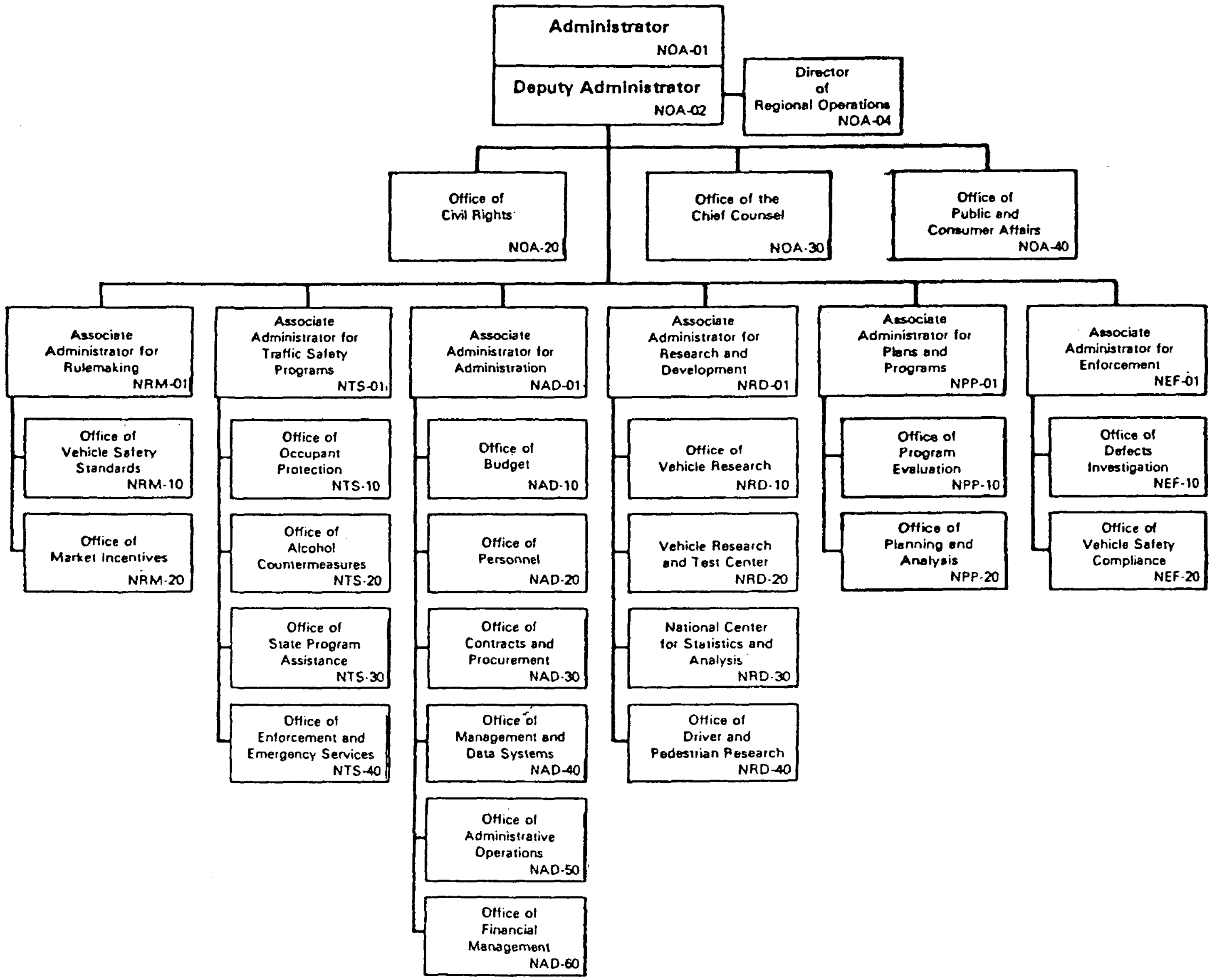
National Highway Traffic Safety Administration Field Regions



U.S. DEPARTMENT OF TRANSPORTATION



NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION



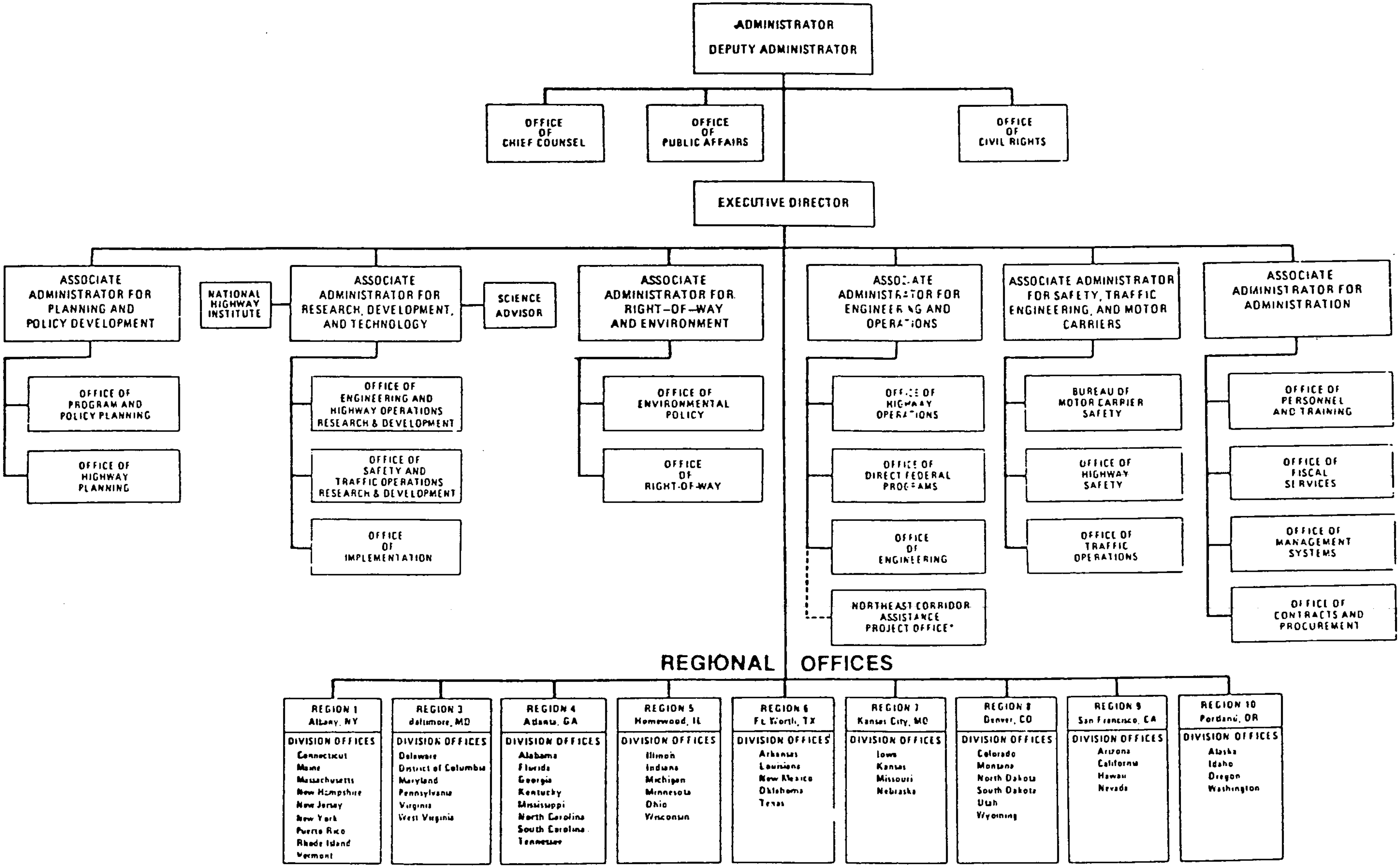
NHTSA REGIONAL OFFICES

Region / States Time	Region Address	Name / Title	FTS / Commercial
REGION I (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont) 7:45 a.m.–4:15 p.m.	NHTSA Regional Administrator Transportation System Center Kendall Square Code 903 Cambridge, MA 02142	John J. Connors Regional Administrator	8-837-2680 (617) 494-2680
REGION II (New Jersey, New York, Puerto Rico and Virgin Islands) 7:45 a.m.–4:15 p.m.	NHTSA Regional Administrator Room 204 222 Mamaroneck Avenue White Plains, NY 10605	Harry B. Nelson Regional Administrator	8-887-9690 (914) 683-9690 Ext. 311, 312, 313, 31
REGION III (Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia) 8:00 a.m.–4:30 p.m.	NHTSA Regional Administrator Airport Plaza Building 793 Elkridge Landing Road Linthicum, MD 21090	Frank Altobelli Regional Administrator	8-922-3877 (301) 962-3877
REGION IV (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee) 7:45 a.m.–4:15 p.m.	NHTSA Regional Administrator Suite 501 1720 Peachtree Road, N.W. Atlanta, GA 30309	Stanley M. Keesling Regional Administrator	8-257-4537 (404) 881-4537
REGION V (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin) 8:00 a.m.–4:30 p.m.	NHTSA Regional Administrator 18209 Dixie Highway Homewood, IL 60430	Donald A. Williamson Regional Administrator	8-370-9169 (312) 799-6067
REGION VI (Arkansas, Louisiana, New Mexico, Oklahoma, and Texas) 8:00 a.m.–4:30 p.m.	NHTSA Regional Administrator 819 Taylor Street, Room 11A26 Fort Worth, TX 76102	E. Robert Anderson Regional Administrator	8-334-3653 (817) 334-3653
REGION VII (Iowa, Kansas, Missouri, and Nebraska) 7:45 a.m.–4:15 p.m.	NHTSA Regional Administrator P.O. Box 19515 Kansas City, MO 64141	Everett L. McBride Regional Administrator	8-926-7887 (816) 926-7887
REGION VIII (Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming) 7:45 a.m.–4:15 p.m.	NHTSA Regional Administrator 555 Zang Street, 1st Floor Denver, CO 80228	Louis R. DeCarolis Regional Administrator	8-776-3444 (303) 236-3444
REGION IX (American Samoa, Arizona, California, Guam, Hawaii, and Nevada) 7:45 a.m.–4:15 p.m.	NHTSA Regional Administrator Suite 1000 211 Main Street San Francisco, CA 94105	Calvin Burkhart Regional Administrator	8-454-9840 (415) 974-9840
REGION X (Alaska, Idaho, Oregon, and Washington) 8:00 a.m.–4:30 p.m.	NHTSA Regional Administrator 3140 Federal Building 915 Second Avenue Seattle, WA 98174	Curtis A. Winston Regional Administrator	8-399-5934 (206) 442-5934

NHTSA FIELD OFFICES

State/ City Time	Field Address	Name/Title	Telephone FTS/Comm
OHIO			
East Liberty 7:45 a.m.-4:15 p.m.	Vehicle Research Test Center P.O. Box 37 East Liberty, OH 43319	Robert L. Carter	(513) 666-4511
	Engineering Test Facility P.O. Box 37 East Liberty, OH 43319	Andrew Detrick	(513) 666-4511
	Safety Research Laboratory P.O. Box 37 East Liberty, OH 43319	James Hofferberth	(513) 666-4511
TEXAS			
San Angelo	Uniform Tire Quality Grading Test Facility P.O. Box 1671 San Angelo, TX 76902	Elvyn Galloway	(915) 655-0546

FEDERAL HIGHWAY ADMINISTRATION



*Provides institutional, technical and professional support to FRA.

GOVERNORS' HIGHWAY SAFETY REPRESENTATIVES AND COORDINATORS

REPRESENTATIVE	COORDINATOR
ALABAMA - Governor George C. Wallace William M. "Bill" Rushton, Director Alabama Department of Economic and Community Affairs Room 101, State Capitol Montgomery, AL 36130 Phone: 205/284-6532	Ruby S. Noonan, Chief Highway and Traffic Safety Division Alabama Department of Economic and Community Affairs 3465 Norman Bridge Road P.O. Box 2939 Montgomery, AL 36105-0939 Phone: 205/284-8790
ALASKA - Governor Bill Sheffield Robert J. Sundberg, Commissioner Department of Public Safety Pouch N Juneau, AK 99811 Phone: 907/465-4322	T. Michael Lewis, Program Director Highway Safety Planning Agency Department of Public Safety Pouch N Juneau, AK 99811 Phone: 907/465-4371
ARIZONA - Governor Bruce Babbitt Ms. Jerri Pastor Governor's Highway Safety Representative Arizona Department of Transportation 1801 West Jefferson St., Room 465 Phoenix, AZ 85007 Phone: 602/255-3216	SAME
ARKANSAS - Governor Bill Clinton Tom Parker, Director Arkansas Highway Safety Program 1 Capitol Mall, Suite 4B-215 Little Rock, AR 72201 Phone: 501/371-1101	SAME
CALIFORNIA - Governor George Deukmejian Peter O'Rourke, Director Office of Traffic Safety Business, Transportation & Housing Agency 7000 Franklin Blvd., Suite 330 Sacramento, CA 95823 Phone: 916/445-0527	G. Van Oldenbeek, Assistant Director Office of Traffic Safety Business, Transportation & Housing Agency 7000 Franklin Blvd., Suite 300 Sacramento, CA 95823 Phone: 916/445-0527 or 5373

COLORADO - Governor Richard D. Lamm

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Larry G. Karsten, Deputy Director
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CONNECTICUT - Governor William A. O'Neill

Norman C. Booth
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DELAWARE - Governor Michael N. Castle

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SAME

DISTRICT OF COLUMBIA - Mayor Marion D. Barry

John E. Touchstone, Director
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William E. Corgill, Ph.D.
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FLORIDA - Governor Bob Graham

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Sandra Whitmire, Chief
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HAWAII - Governor George R. Ariyoshi

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Motor Vehicle Safety Office
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IDAHO - Governor John V. Evans

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IOWA - Governor Terry Branstad

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Sven L. Sterner, Director
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Joe Ann O'Hara, Commander
Highway Safety Standards Branch
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LOUISIANA - Governor Edwin W. Edwards

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Louisiana Highway Safety Commission
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MINNESOTA - Governor Rudy Perpich
Paul Tschida, Commissioner
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MISSISSIPPI - Governor Bill Allain
Roy Thigpen, Director
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MISSOURI - Governor John Ashcroft
Richard Rice, Director
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MONTANA - Governor Ted Schwinden
Albert E. Goke, Administrator
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NEBRASKA - Governor Robert Kerrey
Holly Jensen, Director
Department of Motor Vehicles
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Lincoln, NE 68509
Phone: 402/471-2281

Fred E. Zwonechek, Administrator
Nebraska Office of Highway Safety
Department of Motor Vehicles
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Lincoln, NE 68509-4612
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NEVADA - Governor Richard H. Bryan
Wayne Teglia, Director
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NEW HAMPSHIRE - Governor John H. Sununu	
John B. McDuffee, Coordinator N.H. Highway Safety Agency Pine Inn Plaza 117 Manchester Street Concord, NH 03301 Phone: 603/271-2131	SAME
NEW JERSEY - Governor Thomas H. Kean	
Clifford W. Snedeker, Director Division of Motor Vehicles State of New Jersey 25 S. Montgomery St. Trenton, NJ 08666 Phone: 609/292-4570	William T. Taylor Manager Office of Highway Safety CN-048, Stuyvesant Avenue Trenton, NJ 08625 Phone: 609/292-3900
NEW MEXICO - Governor Toney Anaya	
Judith M. Espinosa Secretary of New Mexico Transportation Department *P.O. Box 1028 P.E.R.A. Bldg., Room 220 Santa Fe, NM 87503-1028 Phone: 505/827- 4653	John D. Fenner, Chief Traffic Safety Bureau Transportation Department P.O. Box 1028 P.E.R.A. Bldg., Room 224 Santa Fe, NM 87503-1028 Phone: 505/827-4776
NEW YORK - Governor Mario M. Cuomo	
John Passidomo Commissioner of Motor Vehicles Governor's Highway Safety Representative Swan Street Building - Empire State Plaza Albany, NY 12228 Phone: 518/474-0841	William G. Rourke, Executive Director Governor's Traffic Safety Committee Swan Street Building - Empire State Plaza Albany, NY 12228 Phone: 518/474-5777
NORTH CAROLINA - Governor James G. Martin	
Edwin C. Guy, Director Highway Safety Program Governor's Highway Safety Representative 215 East Lane Street Raleigh, NC 27601 Phone: 919/733-3083	
NORTH DAKOTA - Governor George A. Sinner	
Walter R. Hjelle, Commissioner State Highway Department 600 E. Boulevard Avenue Bismarck, ND 58505-0178 Phone: 701/224-2581	Errol J. Behm Traffic Safety Program Manager State Highway Department 600 E. Boulevard Avenue Bismarck, ND 58505-0178 Phone: 701/224-2453

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OKLAHOMA - Governor George Nigh
Ralph W. Graves, Governor's Representative
Oklahoma Highway Safety Office
200 N.E. 21st St., ODOT Building
Oklahoma City, OK 73105
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OREGON - Governor Victor G. Atiyeh
Gil W. Bellamy, Administrator
Oregon Traffic Safety Commission
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SAME

PENNSYLVANIA - Governor Dick Thornburgh
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Governor's Highway Safety Representative
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RHODE ISLAND - Governor Edward D. DiPrete
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SOUTH DAKOTA - Governor William J. Janklow

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TENNESSEE - Governor Lamar Alexander

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TEXAS - Governor Mark White

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VERMONT - Governor Madeleine M. Kunin

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VIRGINIA - Governor Charles S. Robb

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WASHINGTON - Governor W. Booth Gardner

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Charles F. Hayes, Assistant Director
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WEST VIRGINIA - Governor Arch A. Moore, Jr.

James M. Albert
Governor's Representative for Highway Safety
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Charleston, WV 25304
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WISCONSIN - Governor Anthony S. Earl

Lowell B. Jackson, Secretary
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Maynard G. Stoehr
Wisconsin Highway Safety Coordinator
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Wisconsin Dept. of Transportation
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WYOMING - Governor Ed Herschler

Richard V. Uthoff
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Highway Safety Branch
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Donald Pruter
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Highway Safety Branch
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AMERICAN SAMOA - Governor A. P. Lutali

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Puni K. Vele
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GUAM - Governor Ricardo J. Bordallo

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Operator Assisted Calls:
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Operator Assisted Calls:
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COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS - Governor Pedro P. Tenorio

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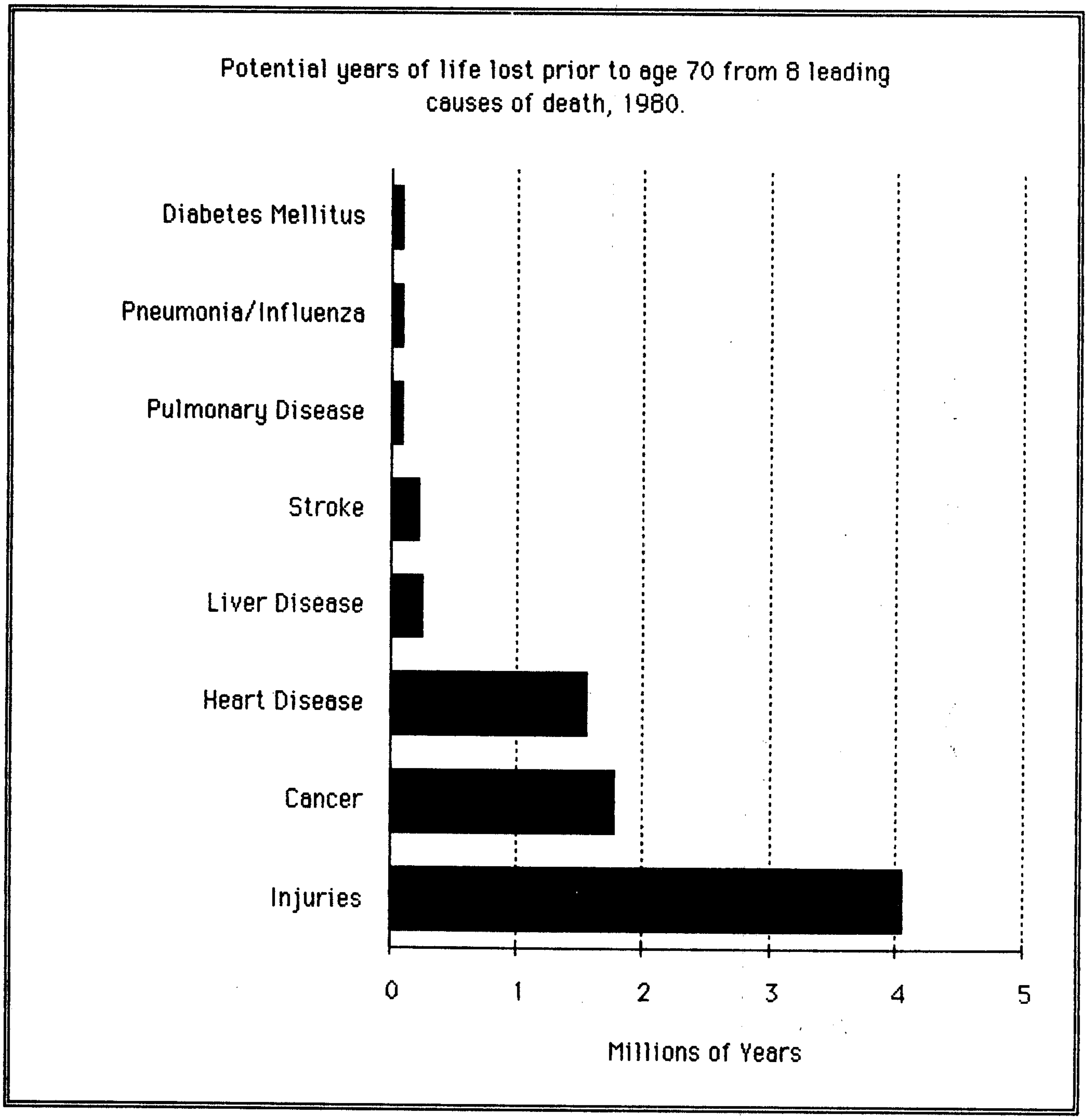
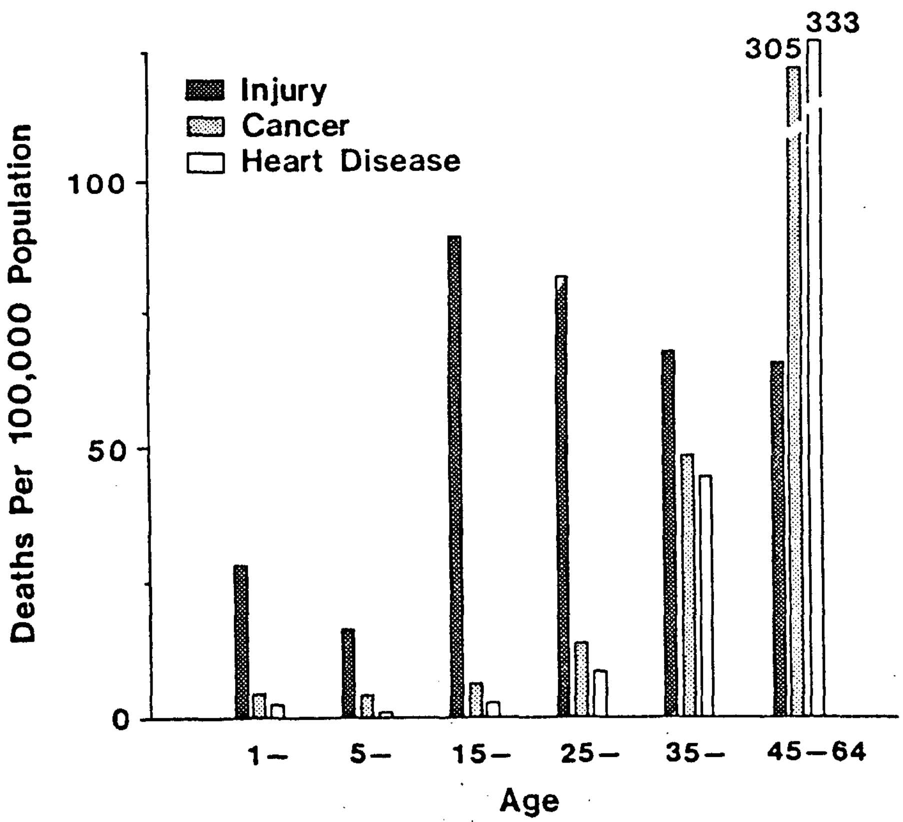
APPENDIX 10: LECTURE VISUALS

The following tables and charts are provided so that overhead transparencies and/or slides could be made from them. They are presented in order of topic as presented in Chapter VII, but several of them could be used in more than one topic area (depending on which information is being stressed). On the bottom right-hand side of each lecture visual is the page number(s) of where in the curriculum the visual belongs.

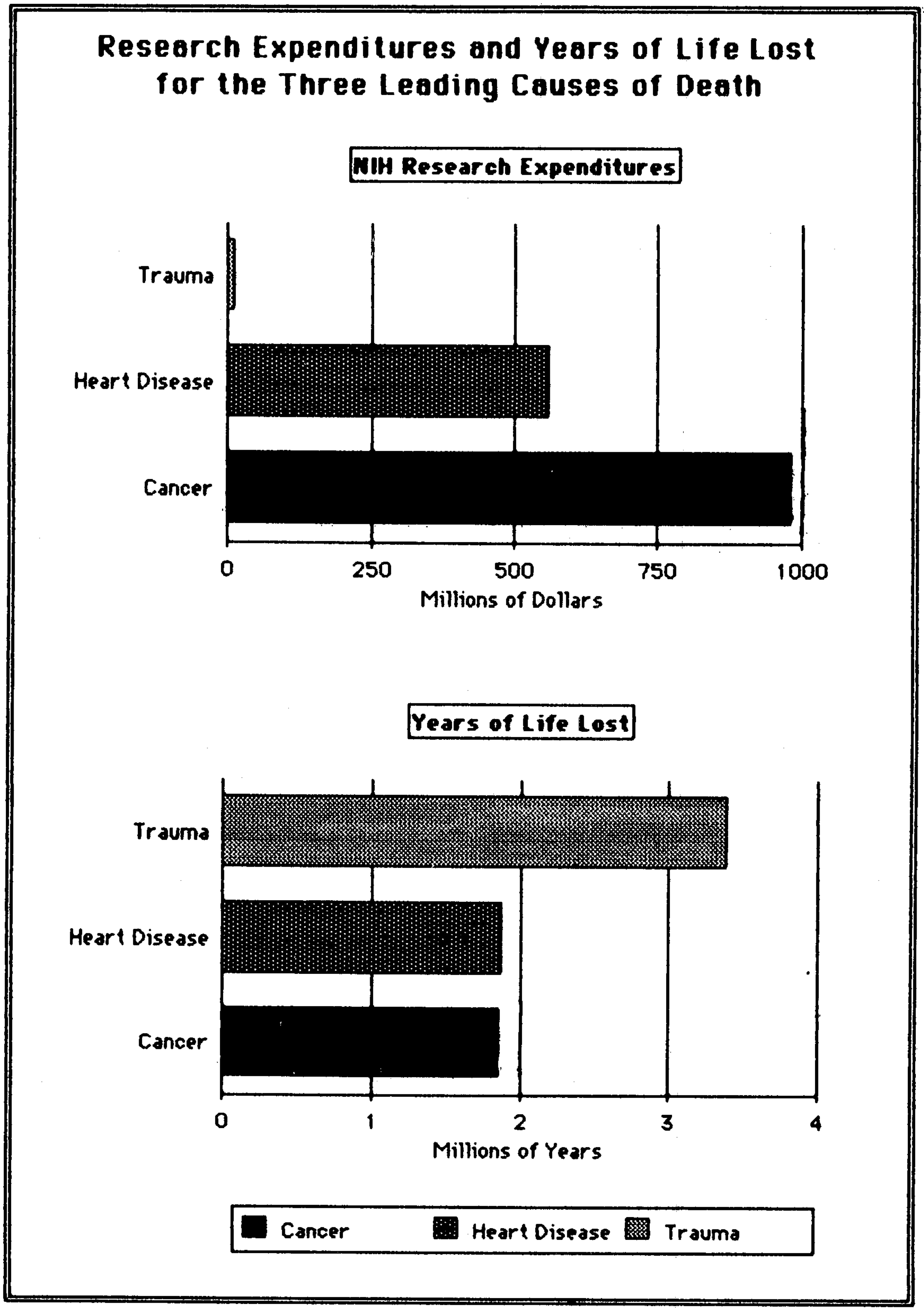
The charts and figures on occupant restraint are from DOT HS-806 142, 1982, unless otherwise noted (see page 79). These charts and figures are from a much larger set maintained by the NHTSA Regional Occupant Restraint Coordinators. Updated materials can be obtained from the NHTSA Occupant Restraint Coordinator for your region.

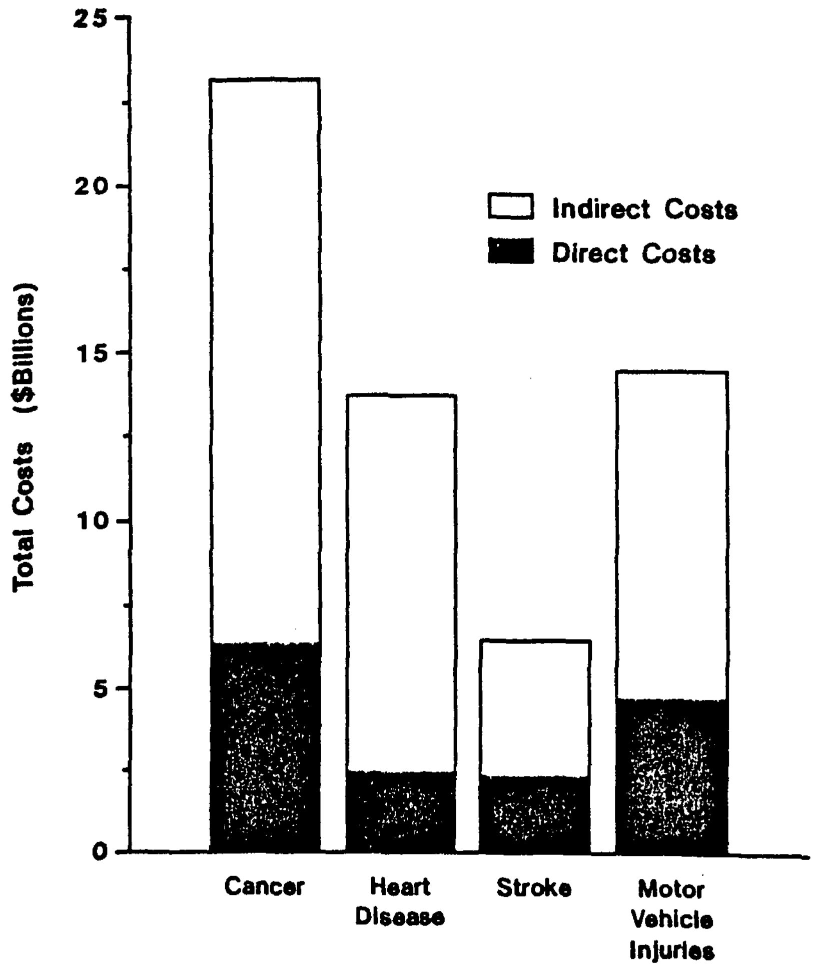

Potential years of life lost prior to age 70 from 8 leading causes of death, 1980.
Diabetes Mellitus
Pneumonia/Influenza
Pulmonary Disease
Stroke
Liver Disease
Heart Disease
Cancer
Injuries
0
1
2
3
4
5
Millions of Years



Death Rates by Cause and Age, 1980

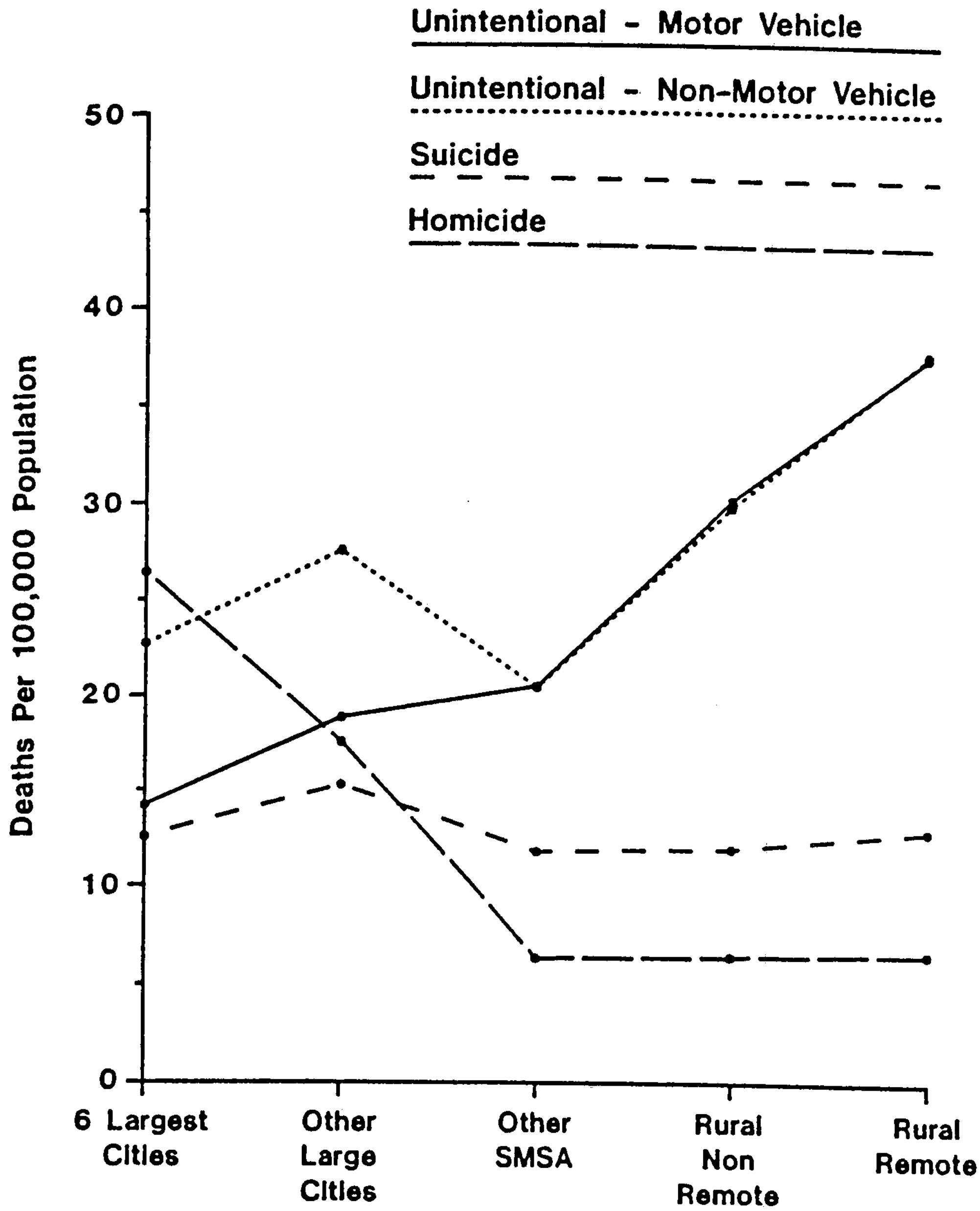
Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company)


Research Expenditures and Years of Life Lost
for the Three Leading Causes of Death
NIH Research Expenditures
Trauma
Heart Disease
Cancer
0
250
500
750
1000
Millions of Dollars
Years of Life Lost
Trauma
Heart Disease
Cancer
0
1
2
3
4
Millions of Years
Cancer
Heart Disease
Trauma



Societal Costs Associated with the Annual Incidence of Cancer, Coronary Heart Disease, Stroke, and Motor Vehicle Injuries, 1975

Source: Reprinted by permission of the publisher, from: The Incidence and Economic Costs of Major Health Impairments by N.S. Hartunian, C.N. Smart, and M.S. Thompson. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1985, D.C. Heath and Company)



Death Rates from Unintentional Injury, Suicide, and Homicide by Place of Residence, 1977-1979

Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company)

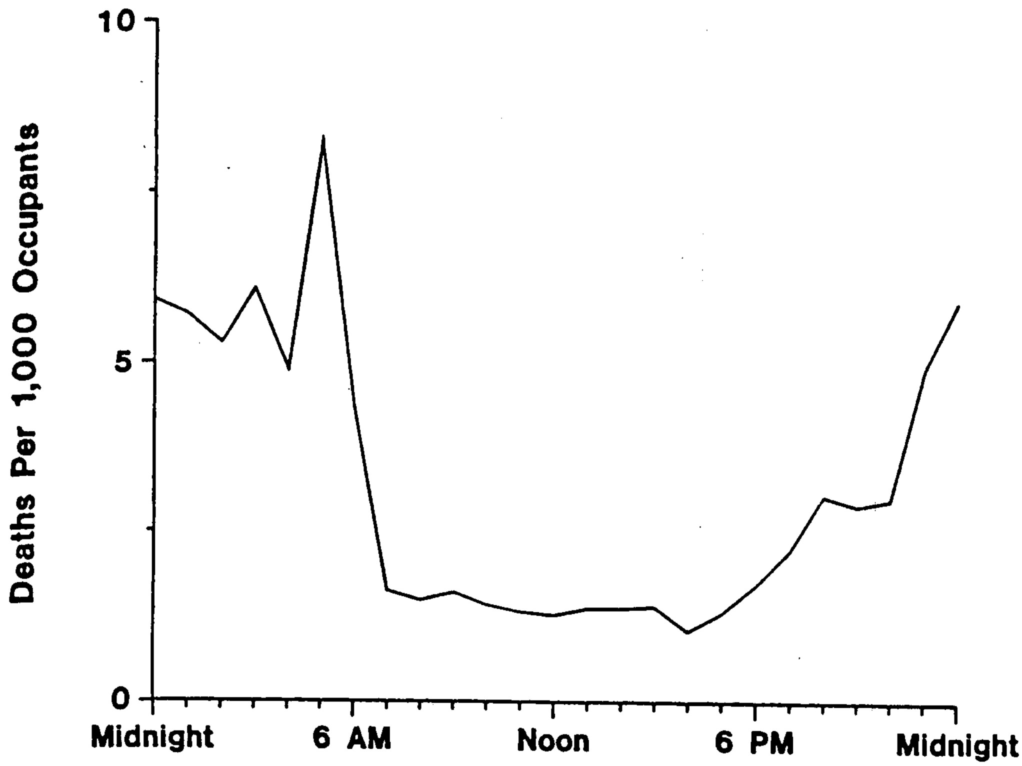
MOTOR VEHICLE INJURIES:

DATA GATHERING PROBLEMS

MEDICAL RECORDS
INACCURATE
INCOMPLETE
ILLEGIBLE
NO CODING SYSTEM

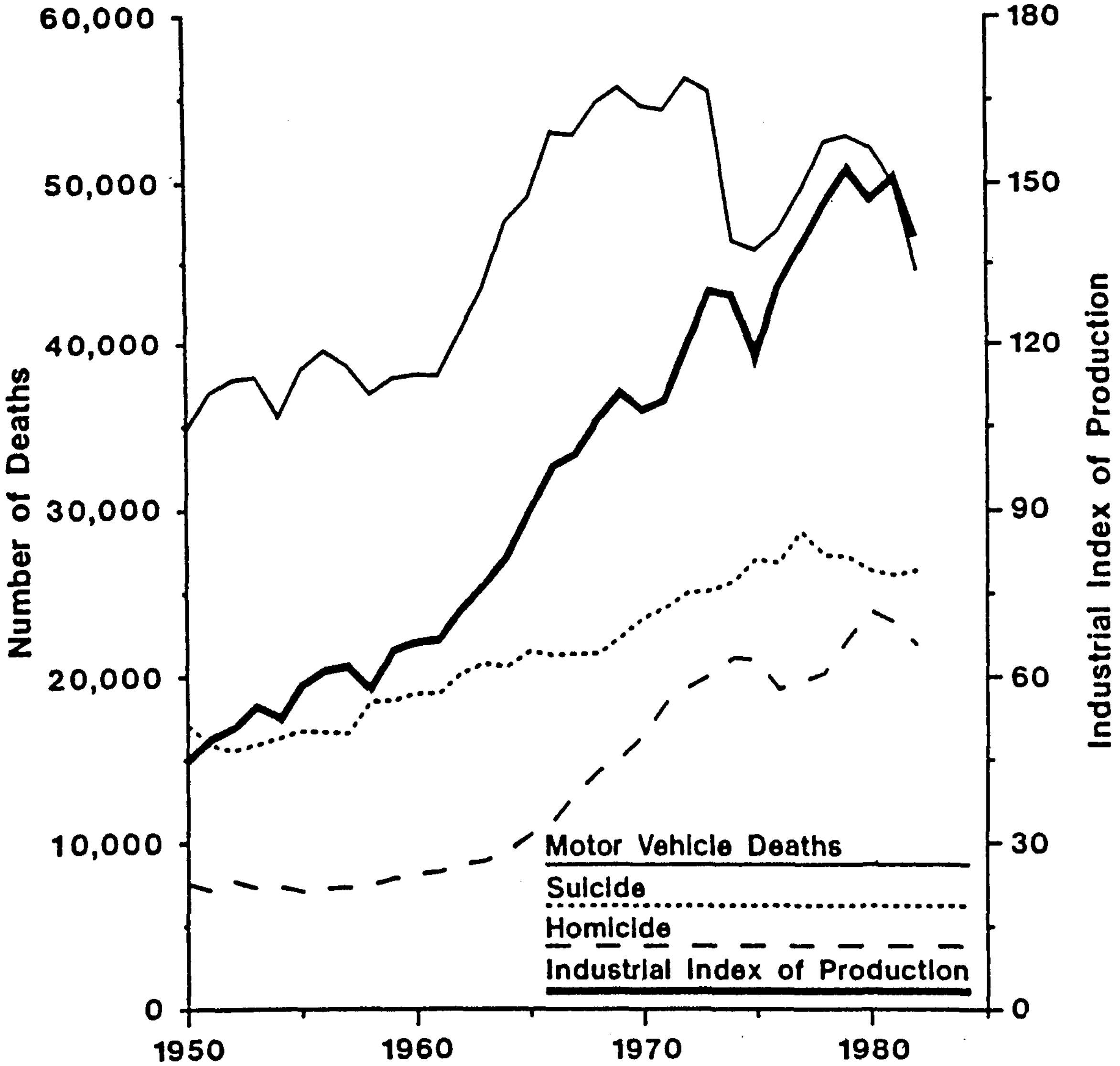
POLICE RECORDS
INACCURATE
INCOMPLETE
INJURY SEVERITY CODING NOT VALIDATED,
PERHAPS ARBITRARY
LAW ENFORCEMENT VS. PREVENTION
BAC, RESTRAINT USAGE INCONSISTENT

LINKAGE OF RECORDS
NONEXISTENT TO DIFFICULT



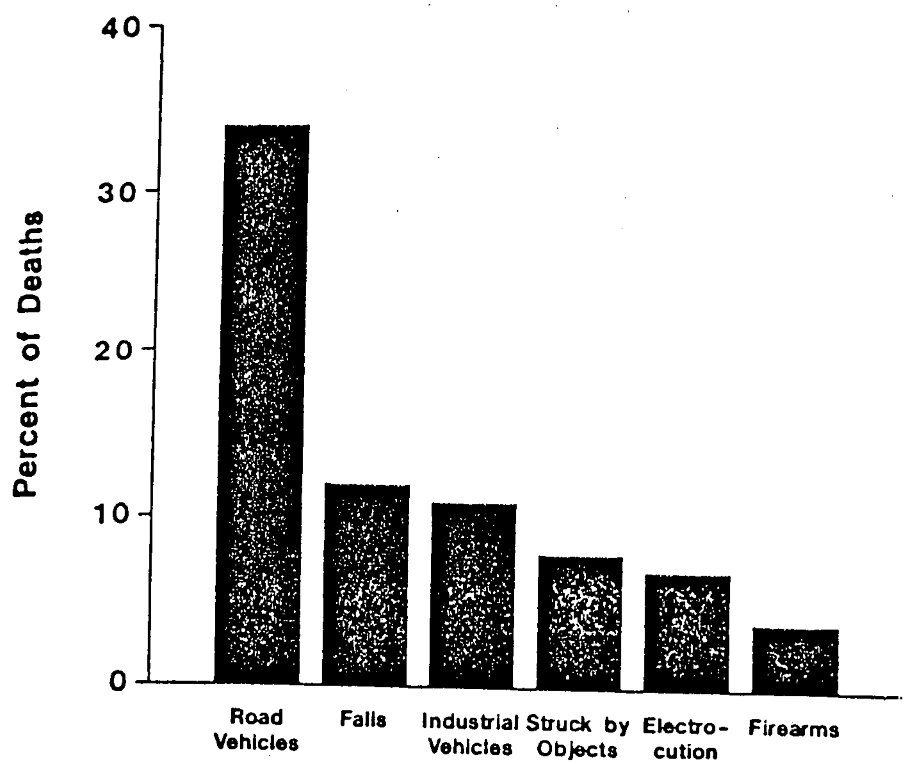
Deaths Per 1,000 Occupants in Crashes by Time of Crash, 1979-1981

Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company)



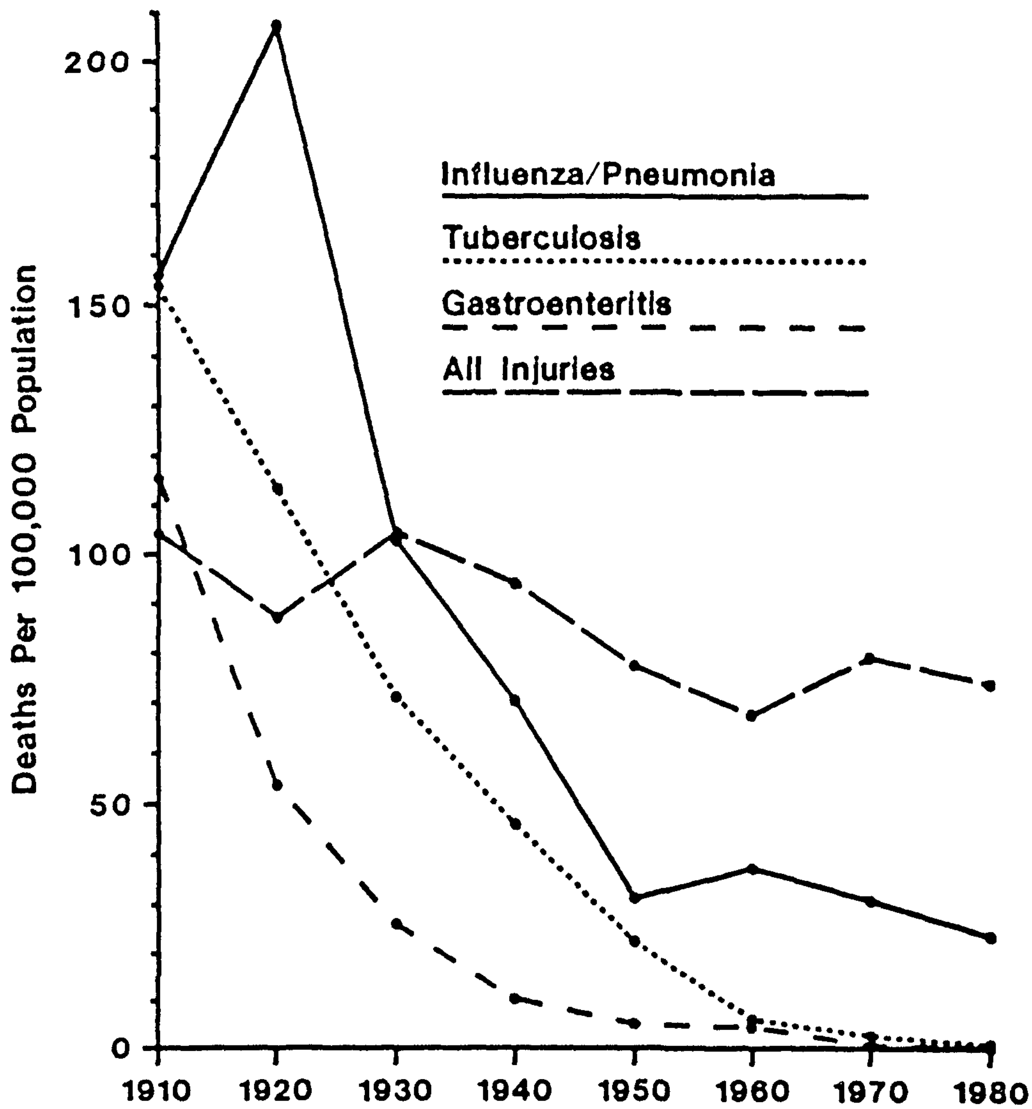
The Federal Reserve Board Industrial Index of Production and Deaths from Motor Vehicle Crashes, Suicide, and Homicide by Year, 1950-1982

Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company)



Percent of Occupational Injury Deaths by Cause, Workplaces with More Than 10 Employees, Bureau of Labor Statistics, 1980-1981

Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company)



Death Rates from Injuries and Infectious Diseases by Year, 1910-1980

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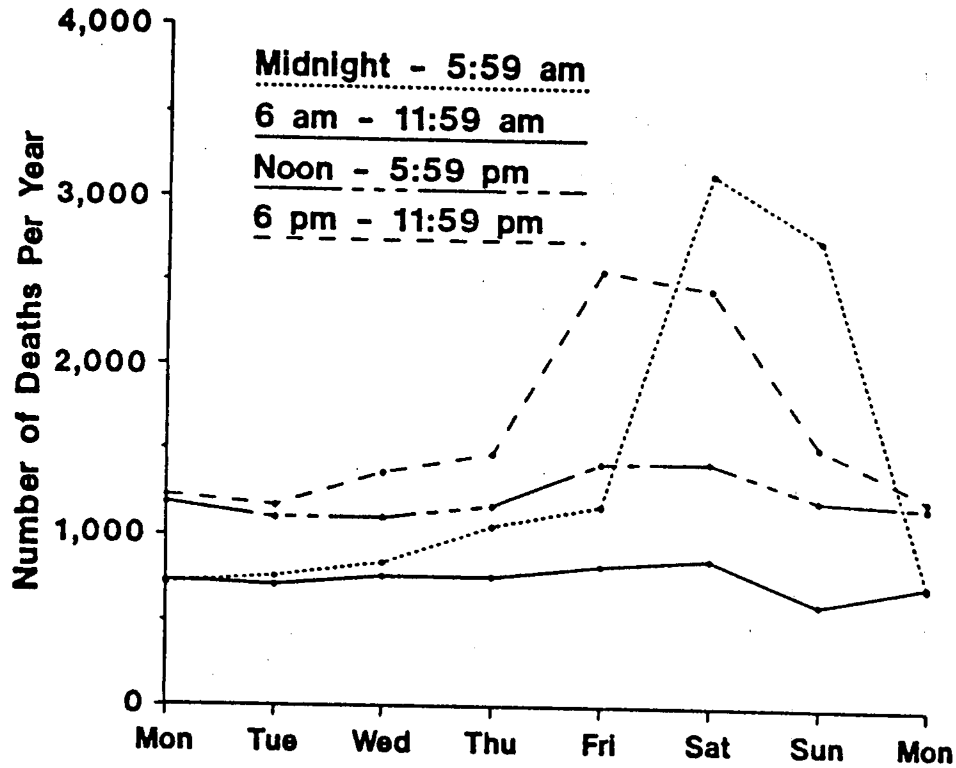
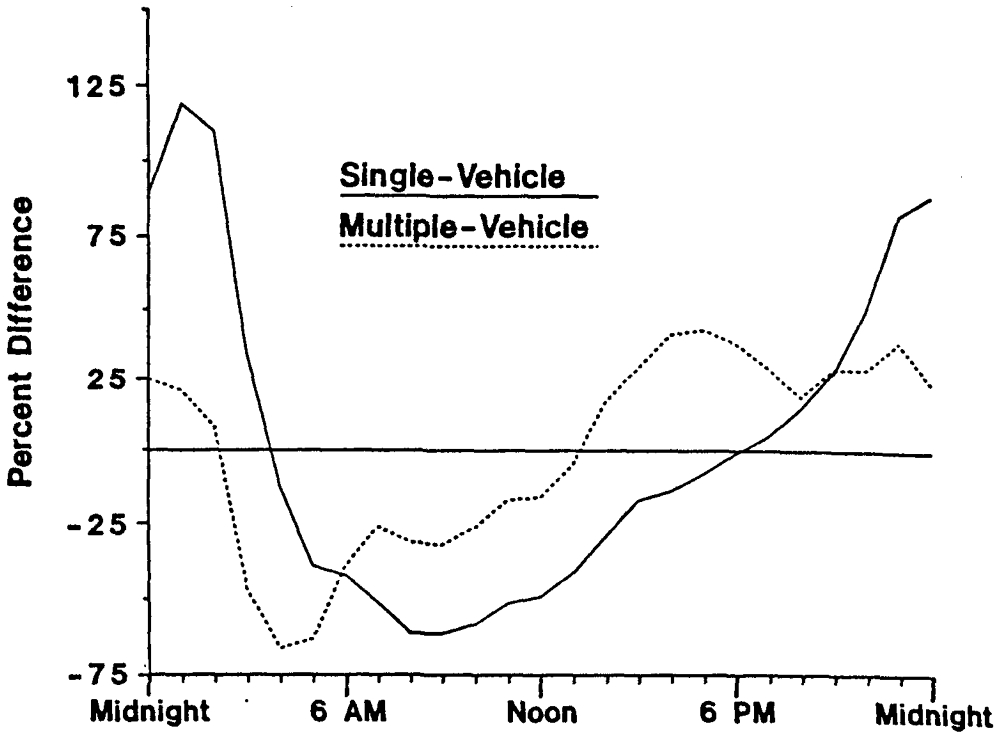


Average Number of Motor Vehicle Occupant Deaths Per Year by Time and Day of Crash, 1979-1981

Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company)



Percent Difference from the Average Number of Single- and Multiple-Vehicle Fatal Crashes by Time of Crash, 1979-1981

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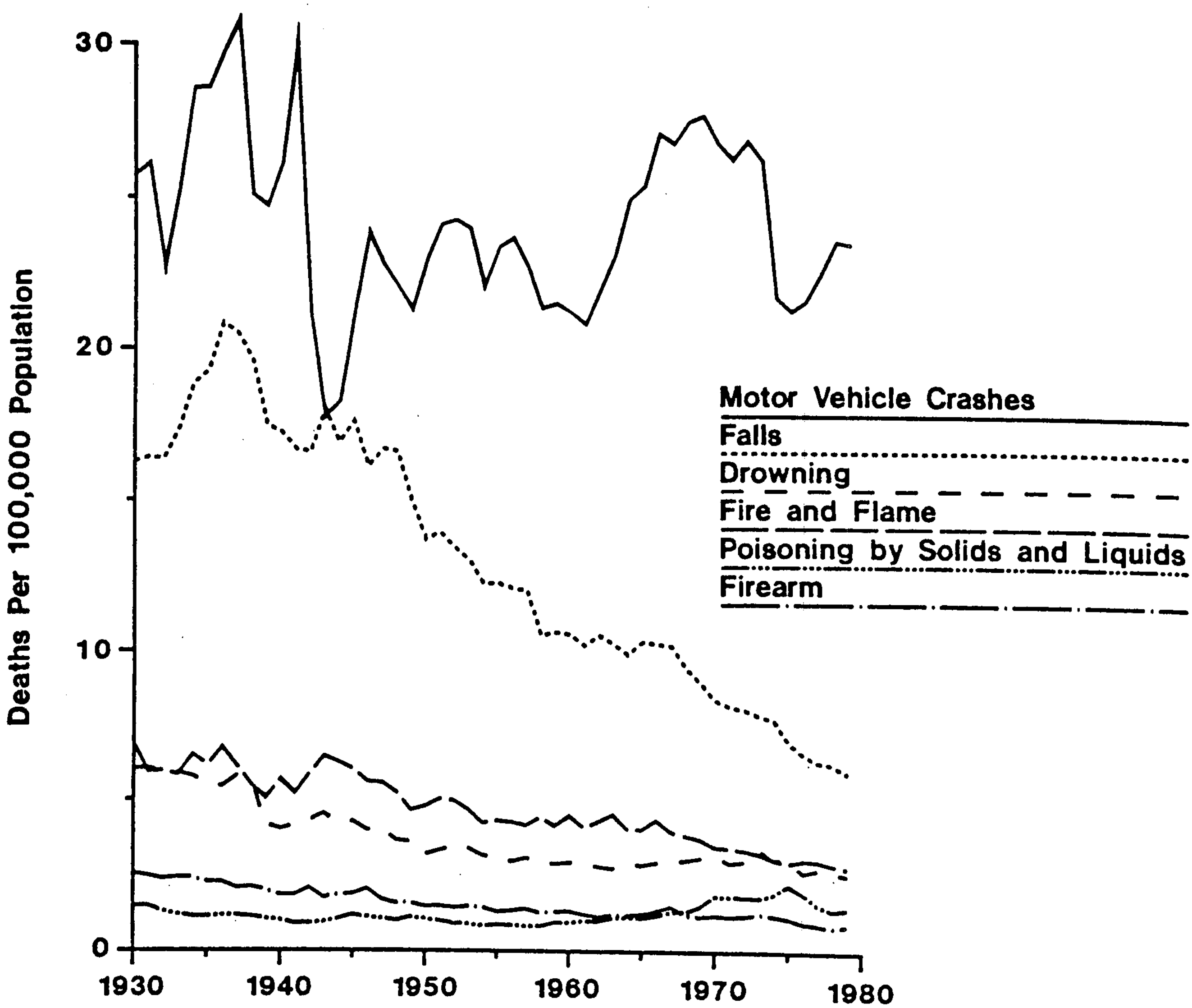
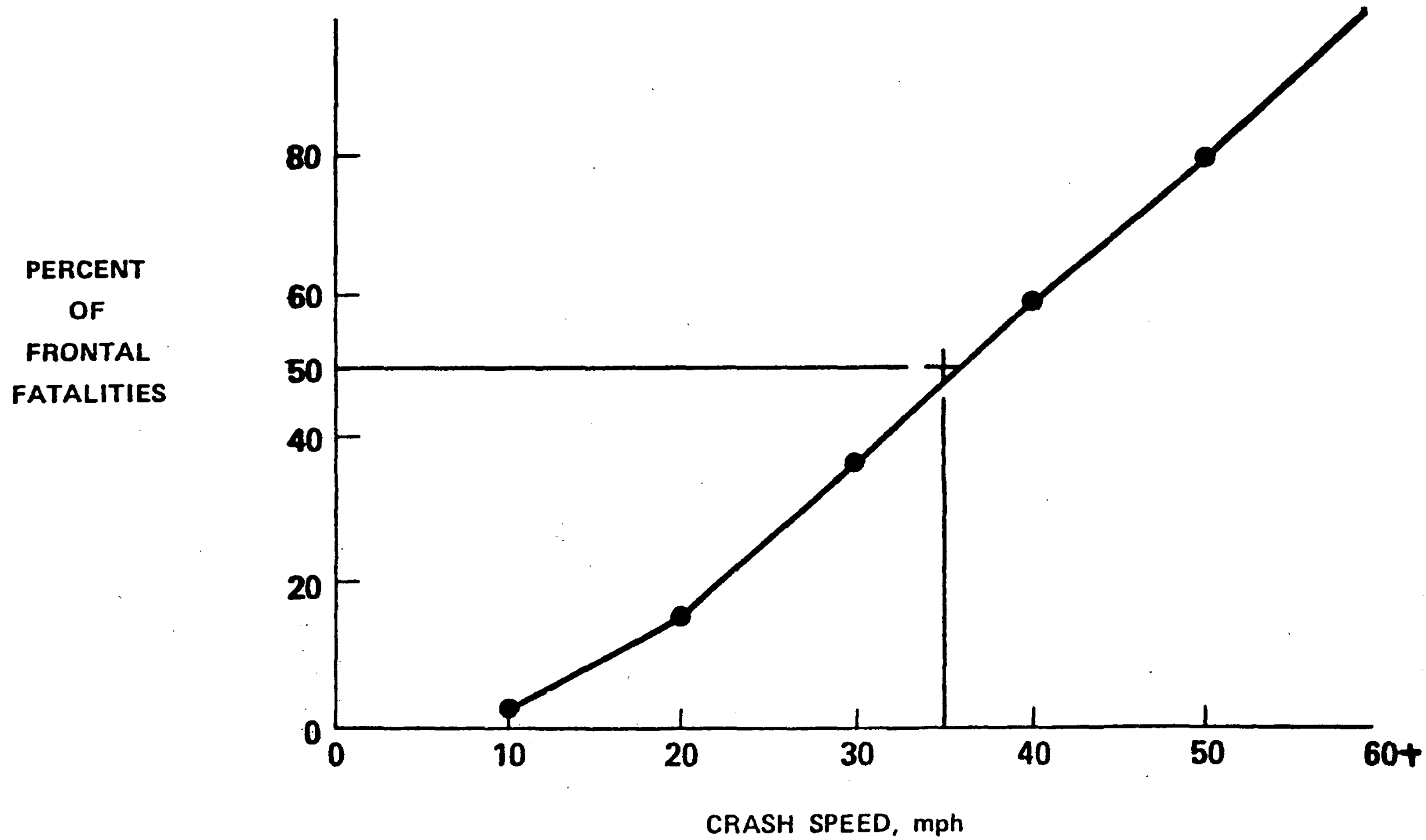


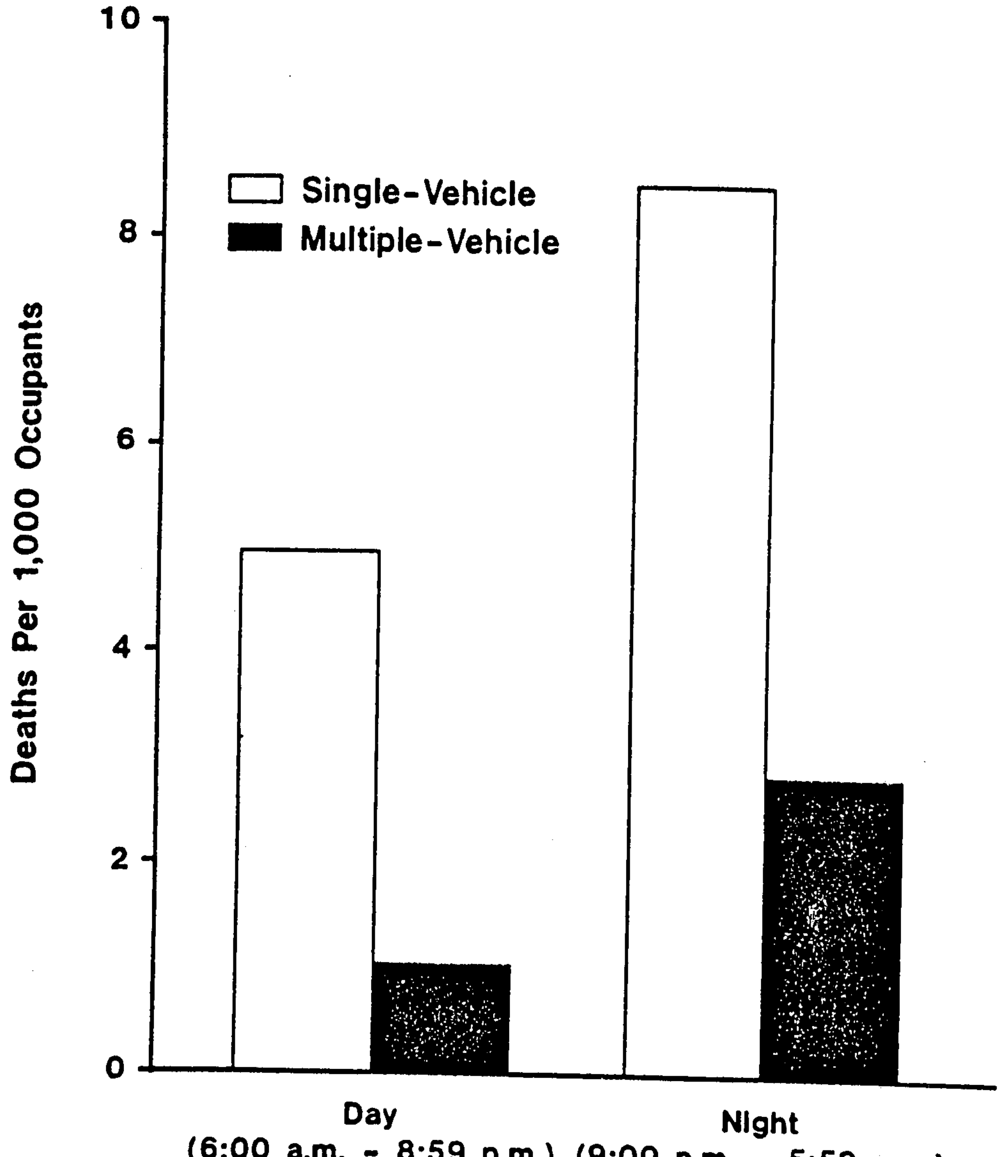
Death Rates from Unintentional Injury by Year and Cause, 1930-1979

Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company)

SPEED OF IMPACT

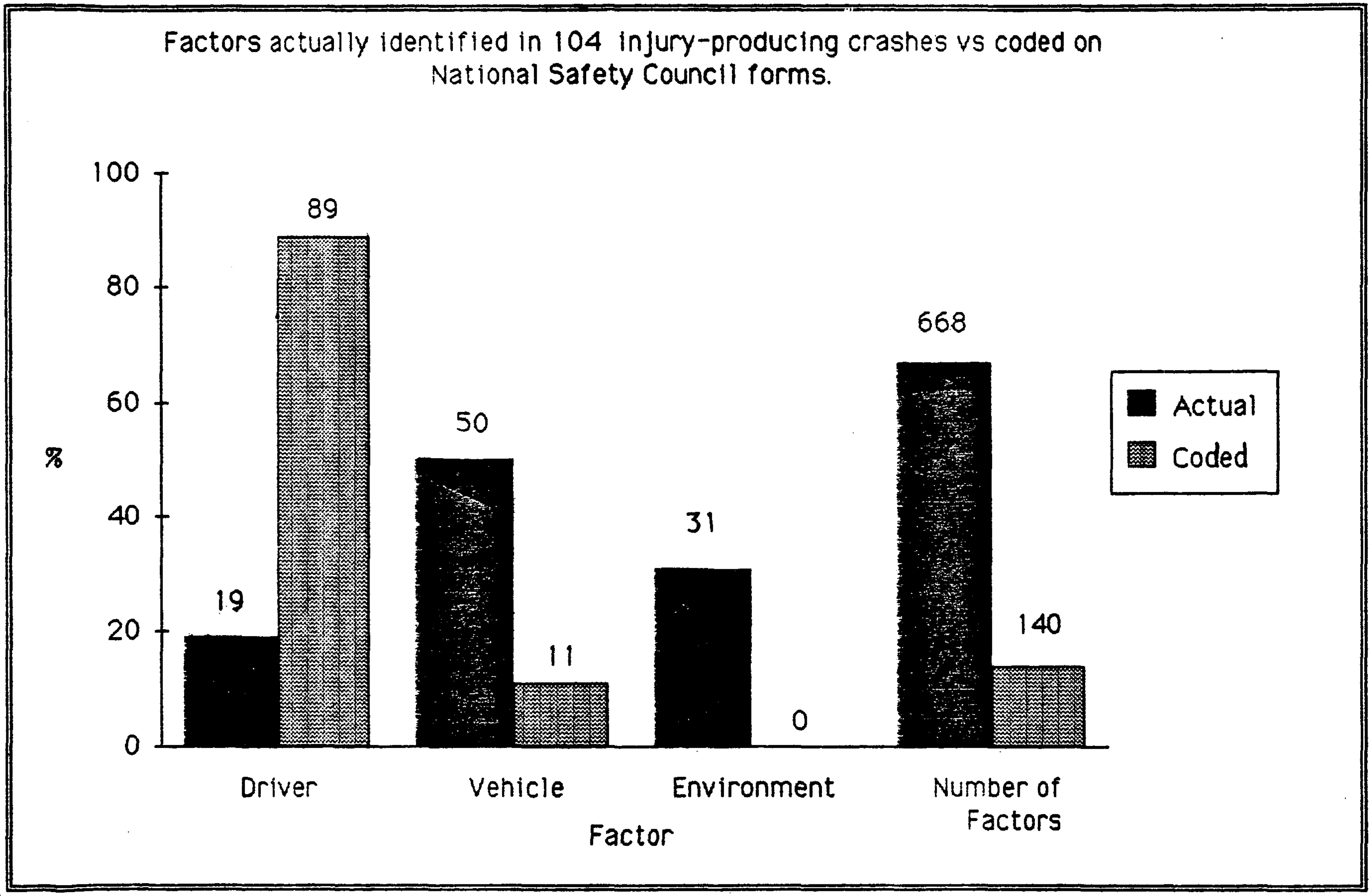
50 Percent of All Frontal Crash Fatalities Result From Vehicle Speeds of 35 MPH or Less



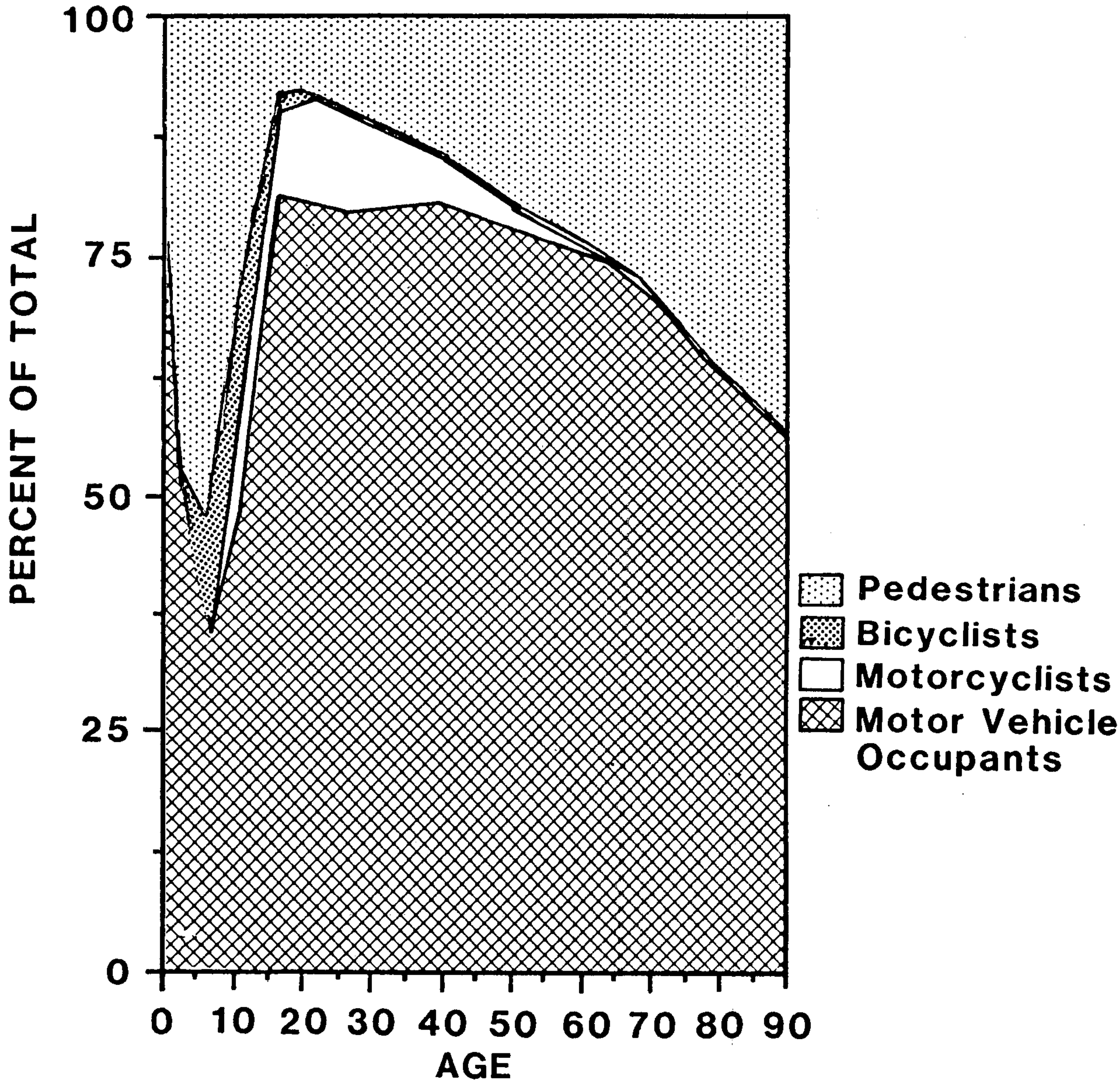


Deaths Per 1,000 Motor Vehicle Occupants in Daytime and Nighttime Single- and Multiple-Vehicle Crashes, 1979-1981

Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company) Page 18

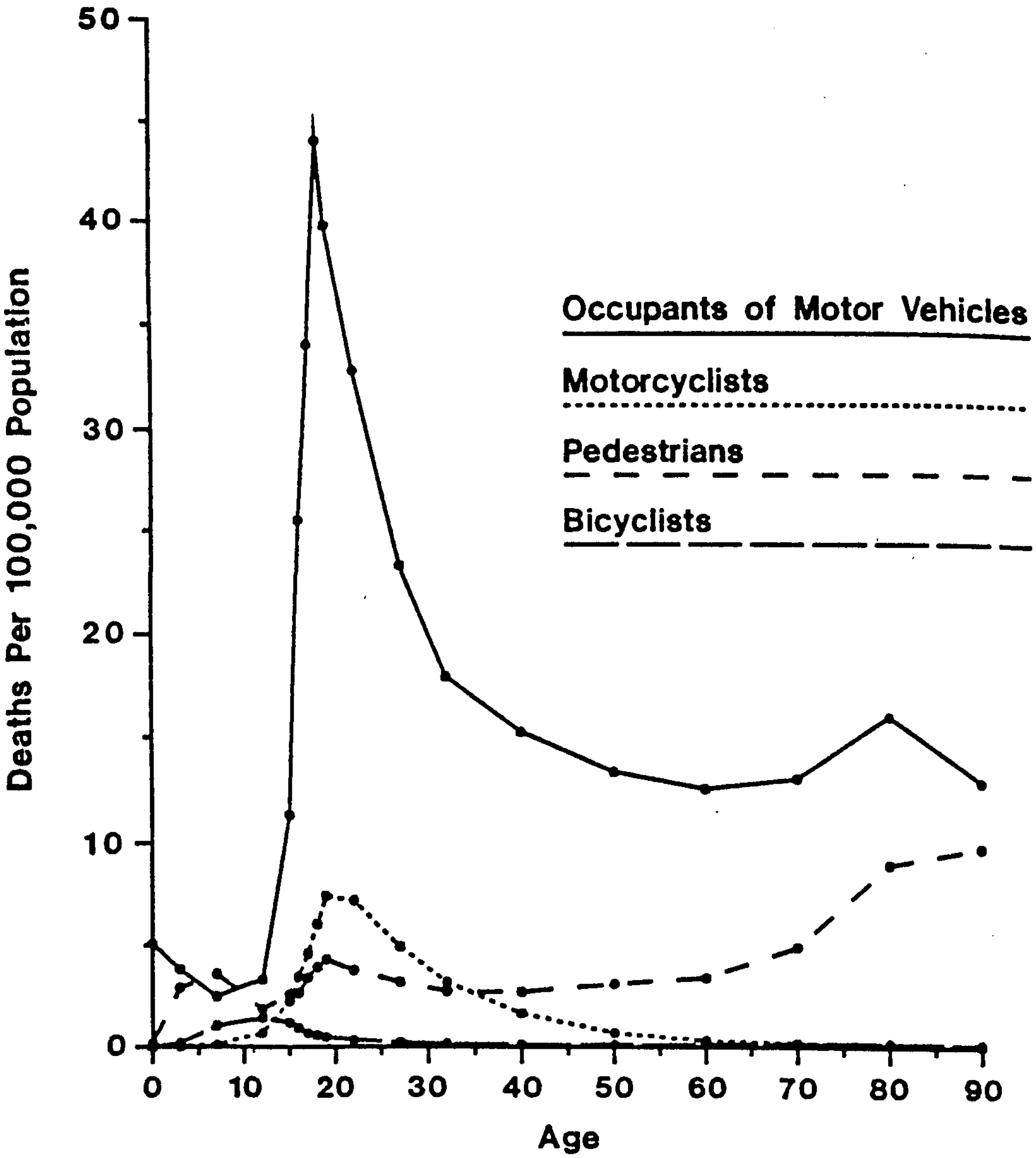


Source: Adapted from Brown, G.W. Analysis of 104 Eastern Iowa Motor Vehicle Casaulty Accidents. Proc. 3rd Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents, New York, 1969.



Percent of Motor Vehicle Deaths by Age and Type of Fatality, 1979-1981

Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company)



Death Rates from Motor Vehicle Crashes by Age and Type of Fatality, 1979-1981

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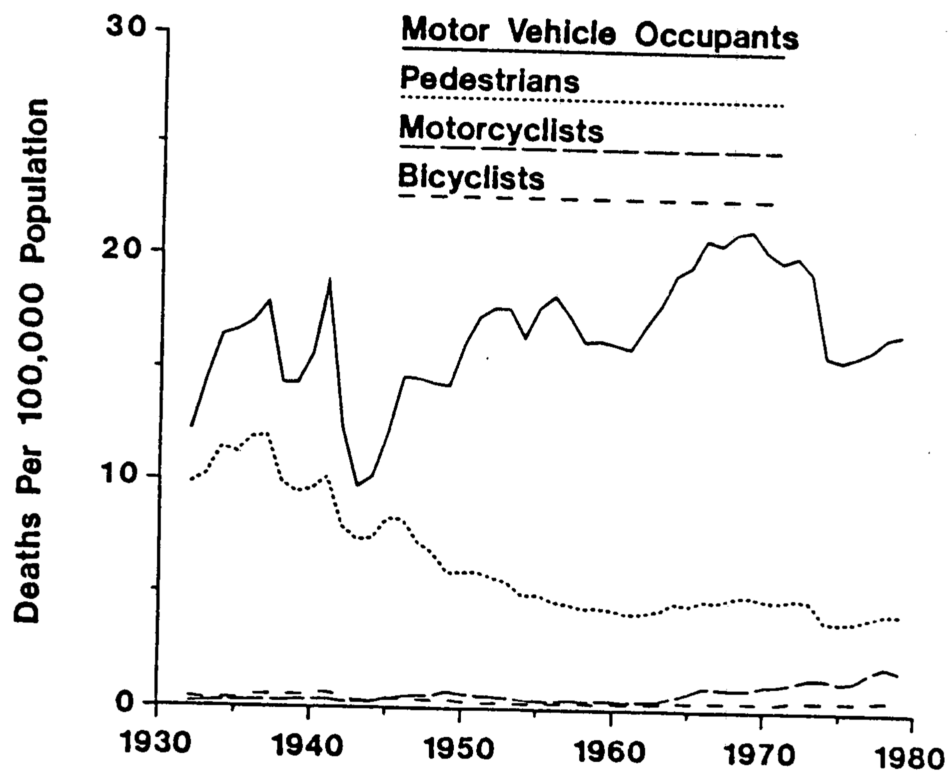

Death Rates from Motor Vehicles Crashes by Year and Type of Fatality, 1932-1979

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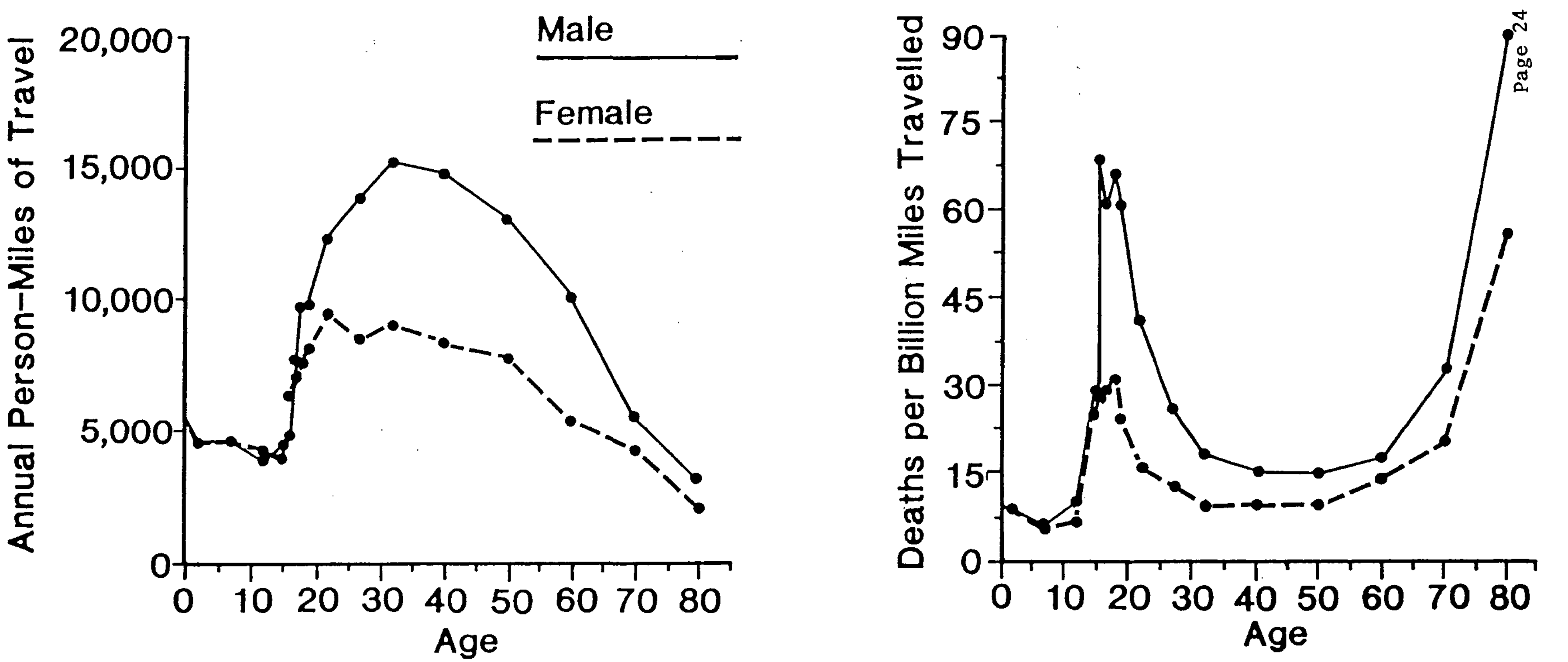
MOTOR VEHICLE OCCUPANTS

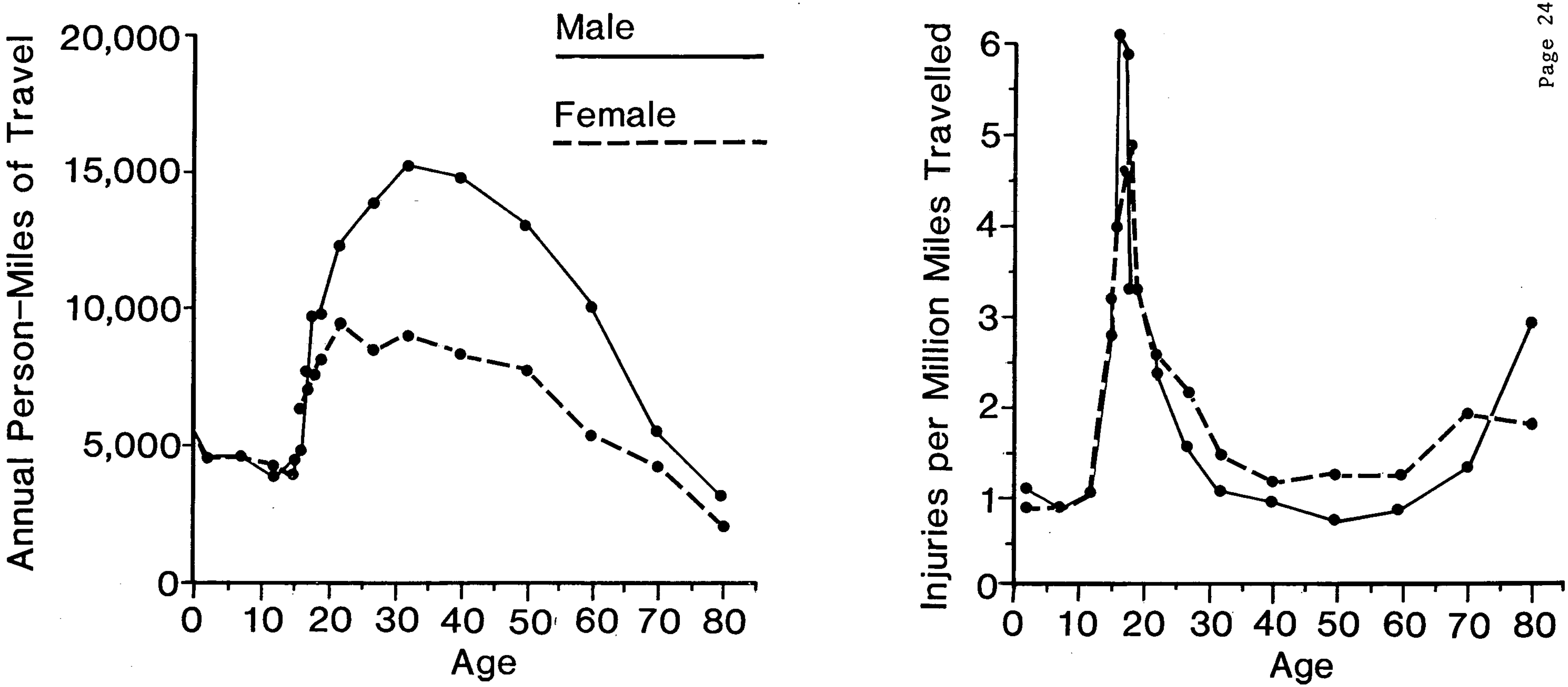


Note: Vertical scales differ

AMOUNT OF TRAVEL (1977) AND DEATH RATES PER PERSON-MILE OF TRAVEL BY AGE AND SEX, 1979-1981

Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company)

MOTOR VEHICLE OCCUPANTS



Note: Vertical scales differ

AMOUNT OF TRAVEL (1977) AND OCCUPANT INJURY PER PERSON-MILE OF TRAVEL BY AGE AND SEX, 1979-1981

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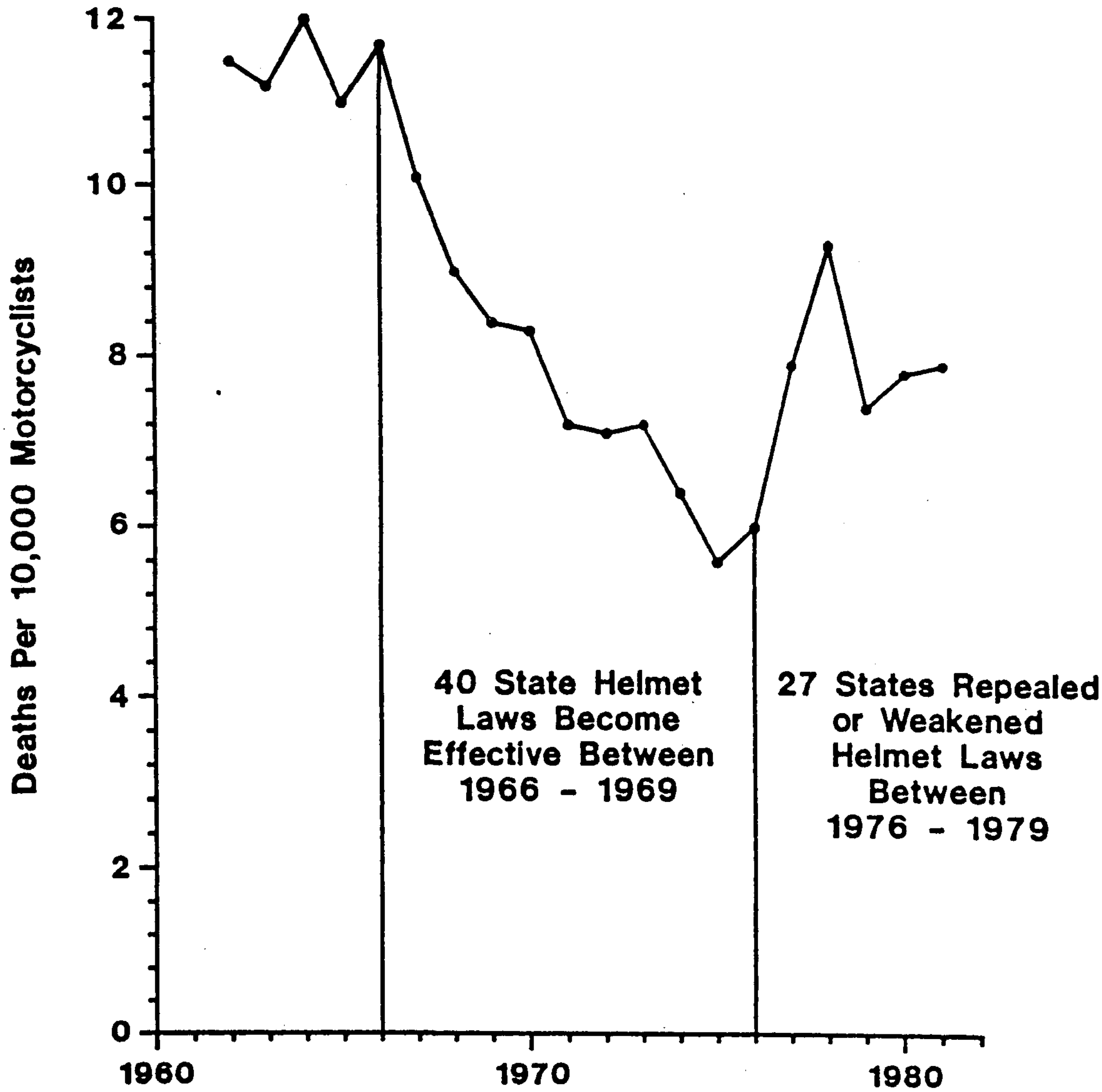


Motorcyclist Deaths Per 10,000 Motorcycles by Year, 1962-1981

Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company)

THE PROBLEM

- WHAT HAPPENS IN A CAR CRASH
- THE SECOND COLLISION
- FORCES INVOLVED IN A CRASH
- DIFFERENT TYPES OF CRASHES
- WHERE PASSENGERS IMPACT
- TYPES OF INJURIES RECEIVED
- OVERVIEW OF INJURIES AND DEATHS

A CRASH IS AN ABRUPT CHANGE IN SPEED (DECELERATION) IT OCCURS IN LESS THAN 1/10 th OF A SECOND

TWO KINDS OF COLLISIONS OCCUR

- **1ST COLLISION** – VEHICLE INTO ANOTHER OBJECT
- **2ND COLLISION** – OCCUPANT INTO THE VEHICLE.*

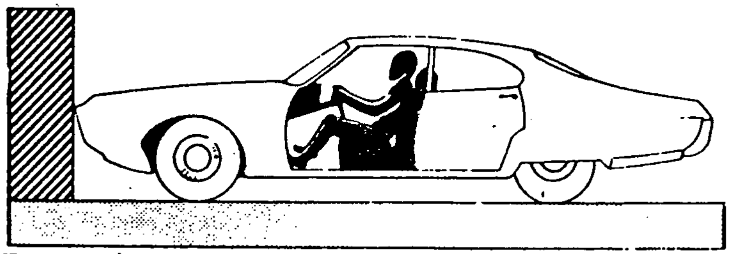
(also, if thrown out, occupant into another object, in which case death is 25 times more likely).

2nd COLLISION

- WHILE VEHICLE IS STOPPING, UNRESTRAINED OCCUPANT MOVES FORWARD AT SAME SPEED UNTIL SHE/HE HITS OBJECT(S) AHEAD.

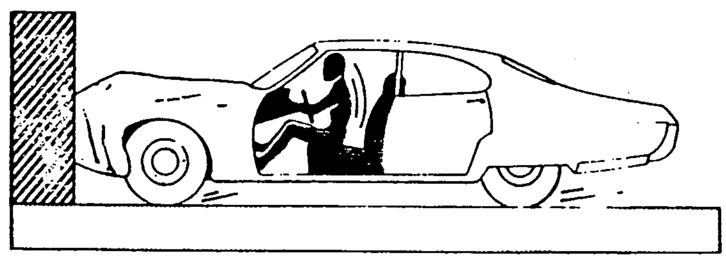
- CHANGE IN SPEED OF OCCUPANT = CHANGE IN SPEED OF VEHICLE.

THE HUMAN COLLISION



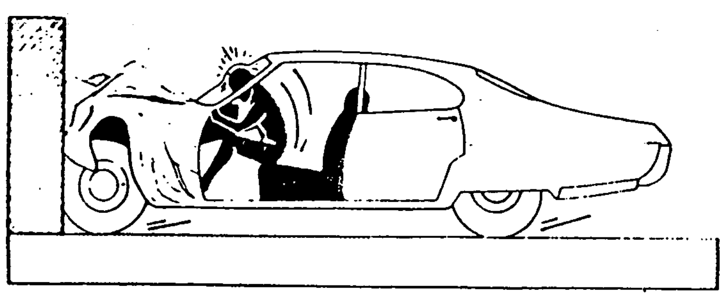
0.000 seconds – car hits barrier

Car begins to crush and slow down. Person inside car continues to move forward at 30 mph.



0.050 seconds – car crushes

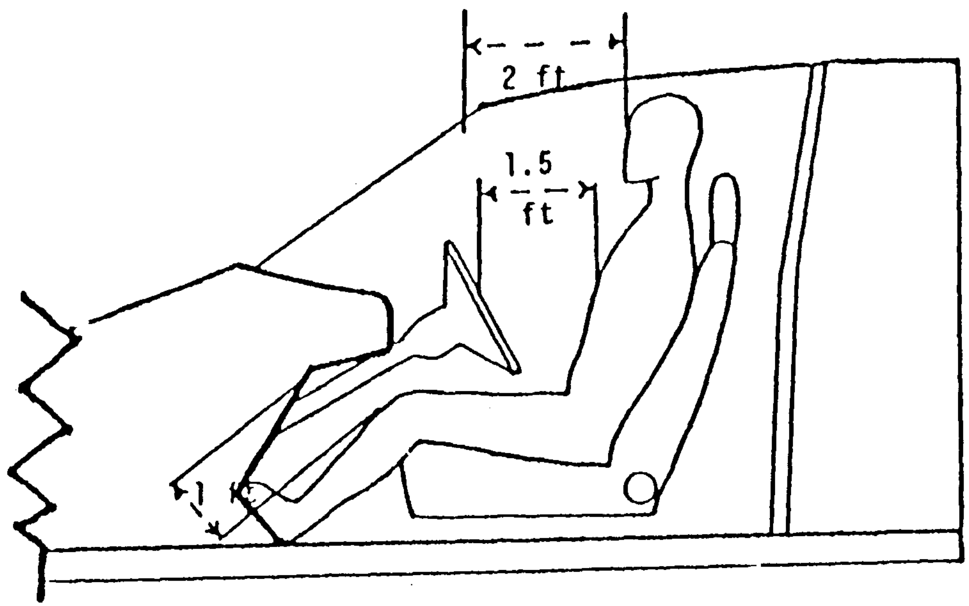
Crushing of the front end absorbs some of force of collision. Person inside still moving forward at 30 mph. Car stops in 1/10th of second.



0.100 seconds – car stops

0.120 seconds – person hits car interior

1/50th of a second after car has stopped, person slams into the dashboard and windshield. This is the human collision. Human collision takes only 1/100 of a second.



Occupant Geometry

OTHER G FORCES FOR COMPARISON

(150 bl. Person)

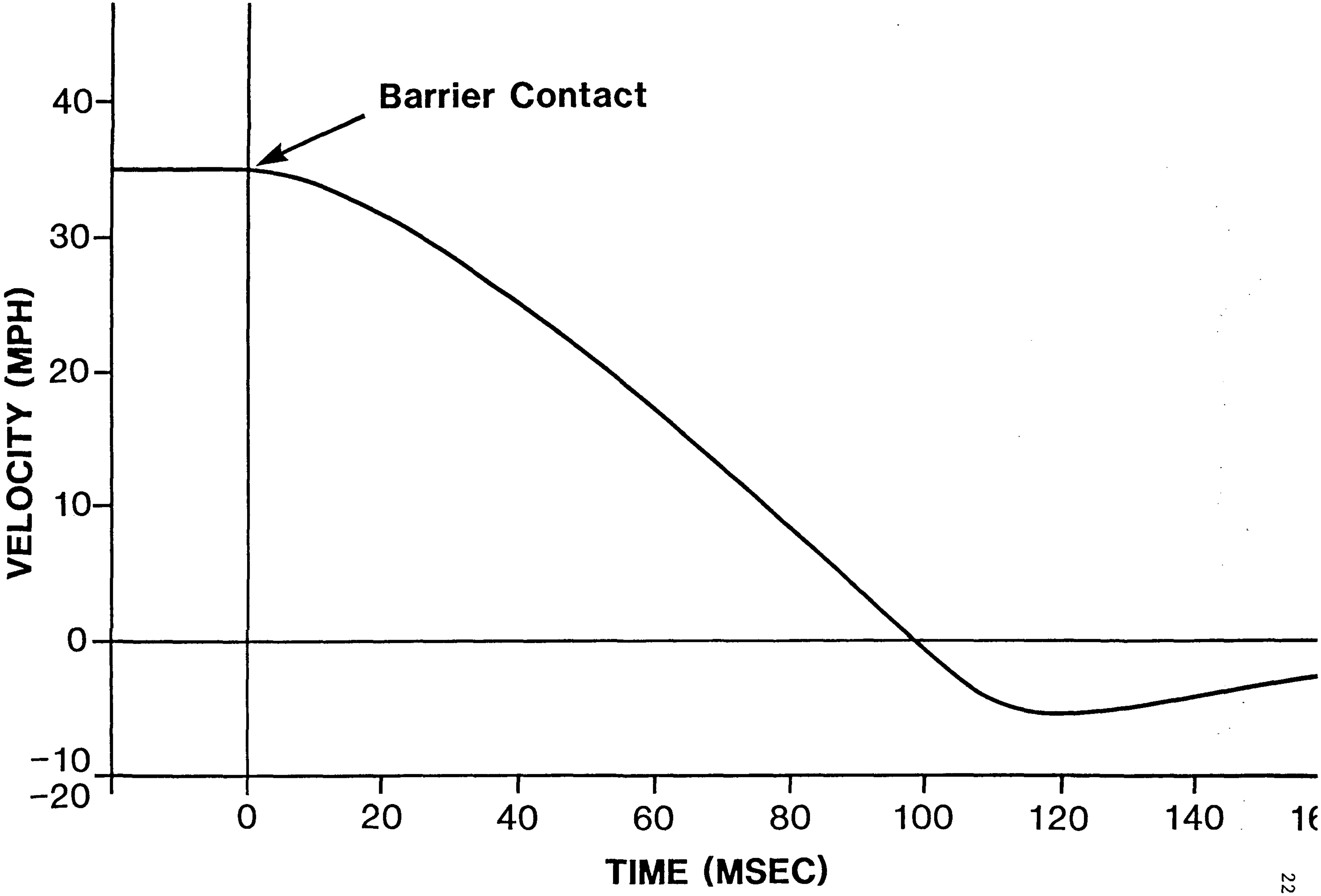
PANIC BRAKING	.8 G	120 LBS.
ROLLER COASTER	.8 G	120 LBS.
ASTRONAUTS	4-11G	1650 LBS.

Page 38,39

HOW SAFETY BELTS WORK : A REVIEW OF CRASH SEQUENCE

- Vehicle hits object and stops (decelerated) in 1/10th second.
- Occupant moves forward at speed of vehicle.
- Occupant hits inside of car and stops in 2/100ths second, (or worse, occupant is ejected).
- Force on occupant = weight x deceleration.
- Force of unrestrained crash may = 80-100 Gs = 15,000 lbs.
- Human body can tolerate more force if:
  - (1) Distributed over wider area of body.
  - (2) Distributed over time.
- Over a large area high G forces can be tolerated (e.g. seat belt 35-40 G's air bag 55-60 G's.)
- Time reduces G-forces exerted.

The following eight overheads are meant to be used as overlays to illustrate the dynamics of a crash as described on pages 37-39.

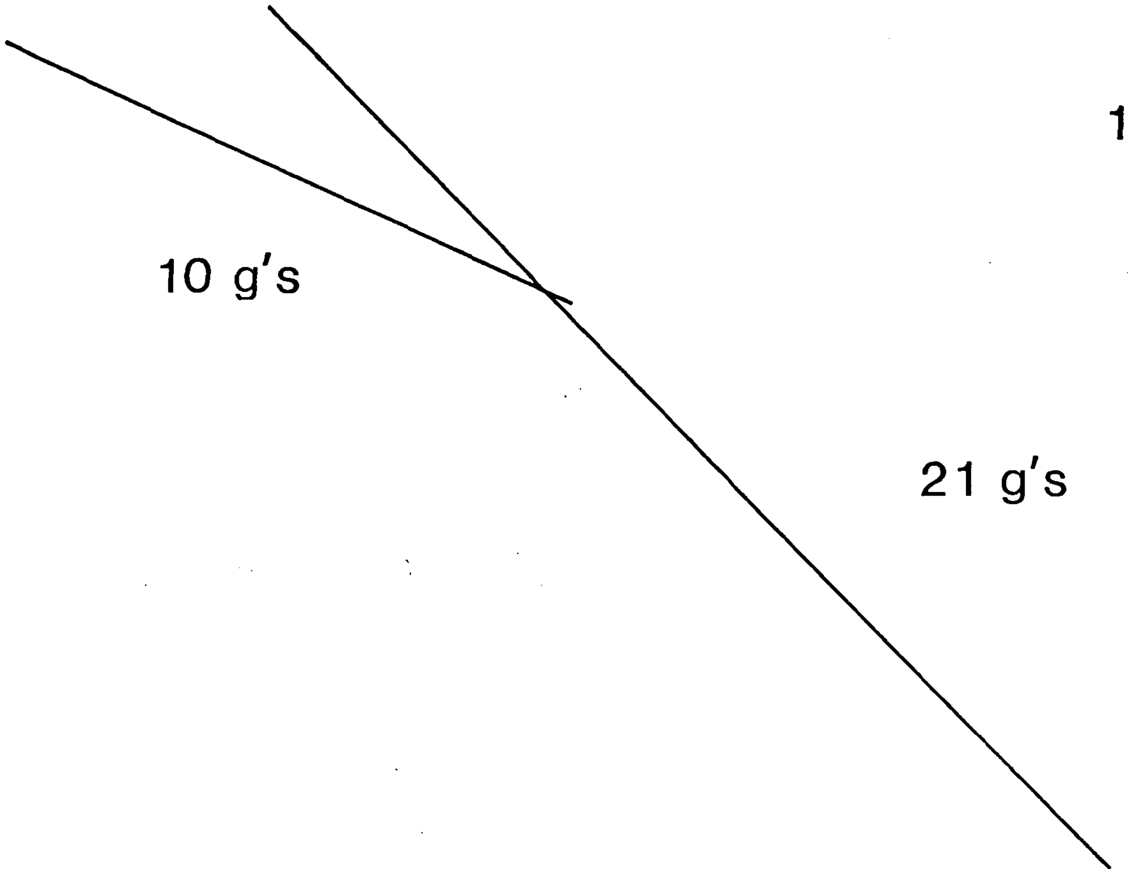


221

1. P. 37, IV. A. 1.a

Vehicle at 35 mph stops 0.01 sec (100 msec) after barrier contact

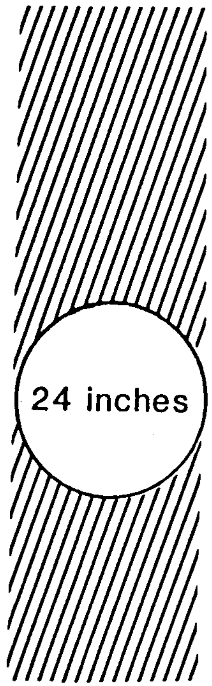
2. p. 37, IV.A.1.a



$$1\ g = \frac{33\ ft}{sec^2}$$

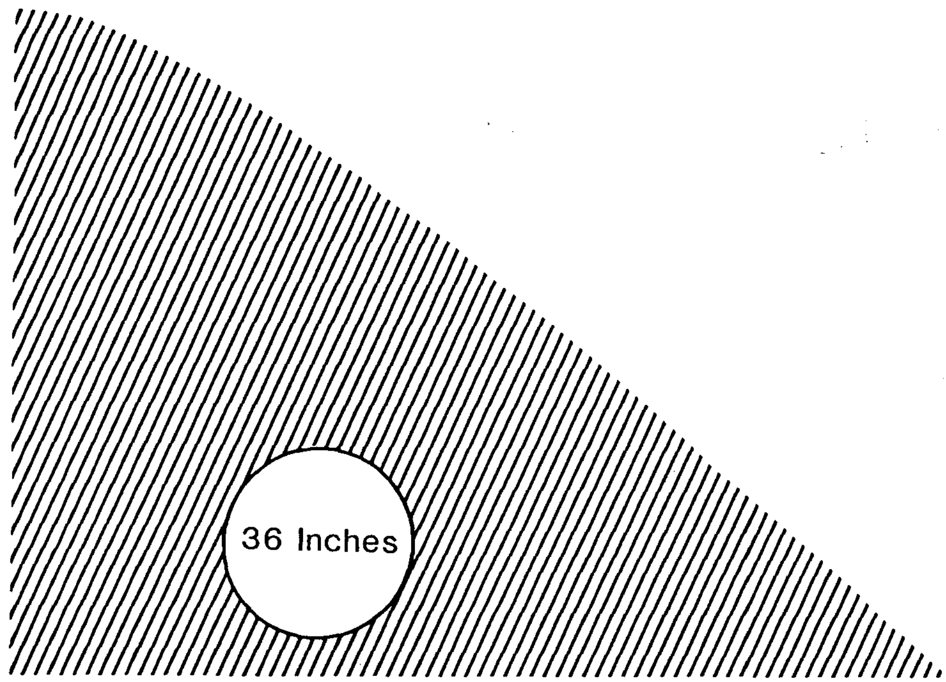
$$\text{Acceleration} = \text{rate of change in speed}$$
$$= \frac{ft}{(sec)\ (sec)} = \frac{ft}{sec^2}$$

3. p.38. IV.A.1.b



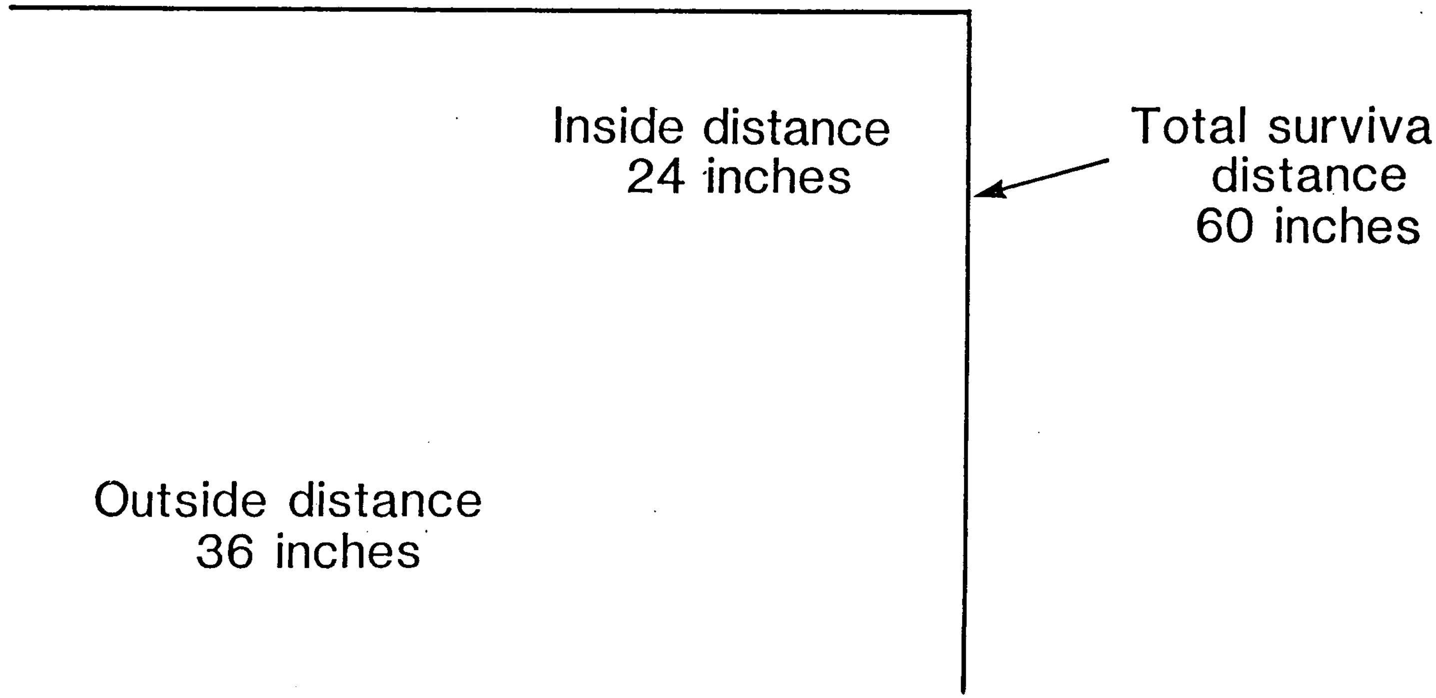
$$\text{Distance} = (\text{speed})\ (\text{time})$$
$$\text{Feet} = \left(\frac{\text{feet}}{\text{second}}\right)(\text{second})$$

4. p.38. IV.A.1.c



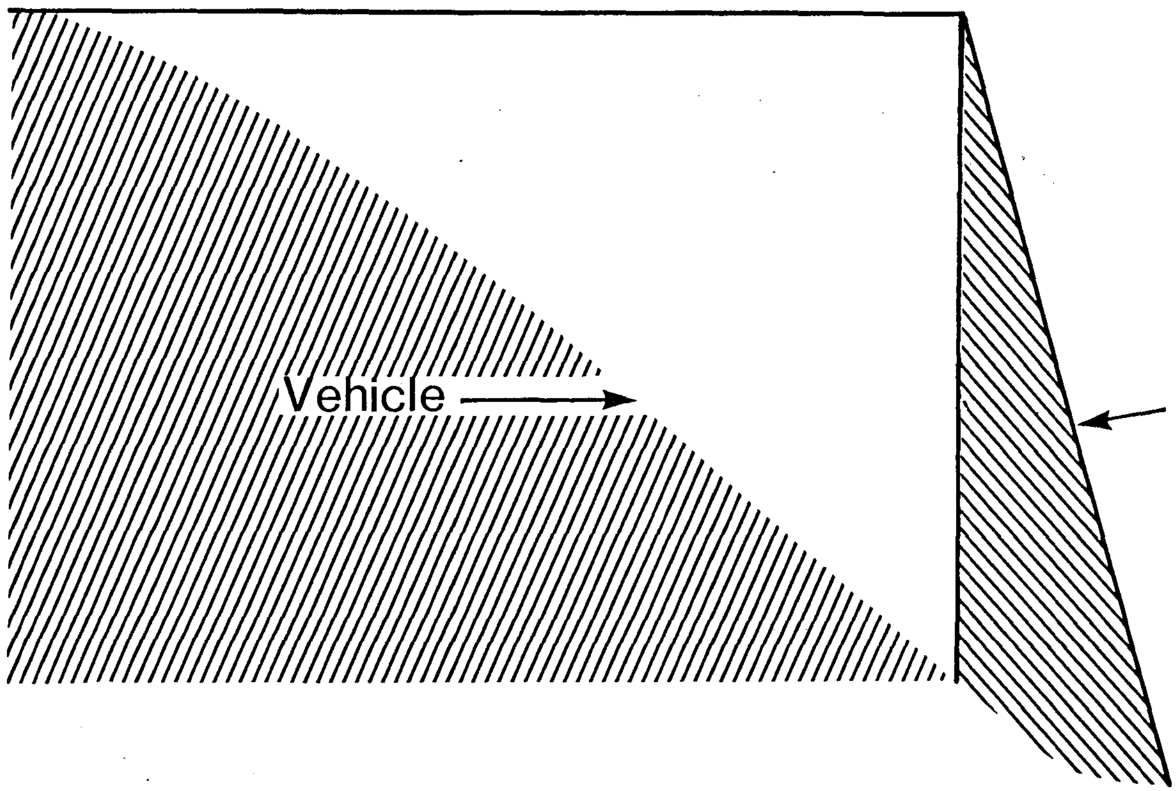
Stopping Distance of Vehicle = (speed) (time)

5.p.38. IV.A.1.d



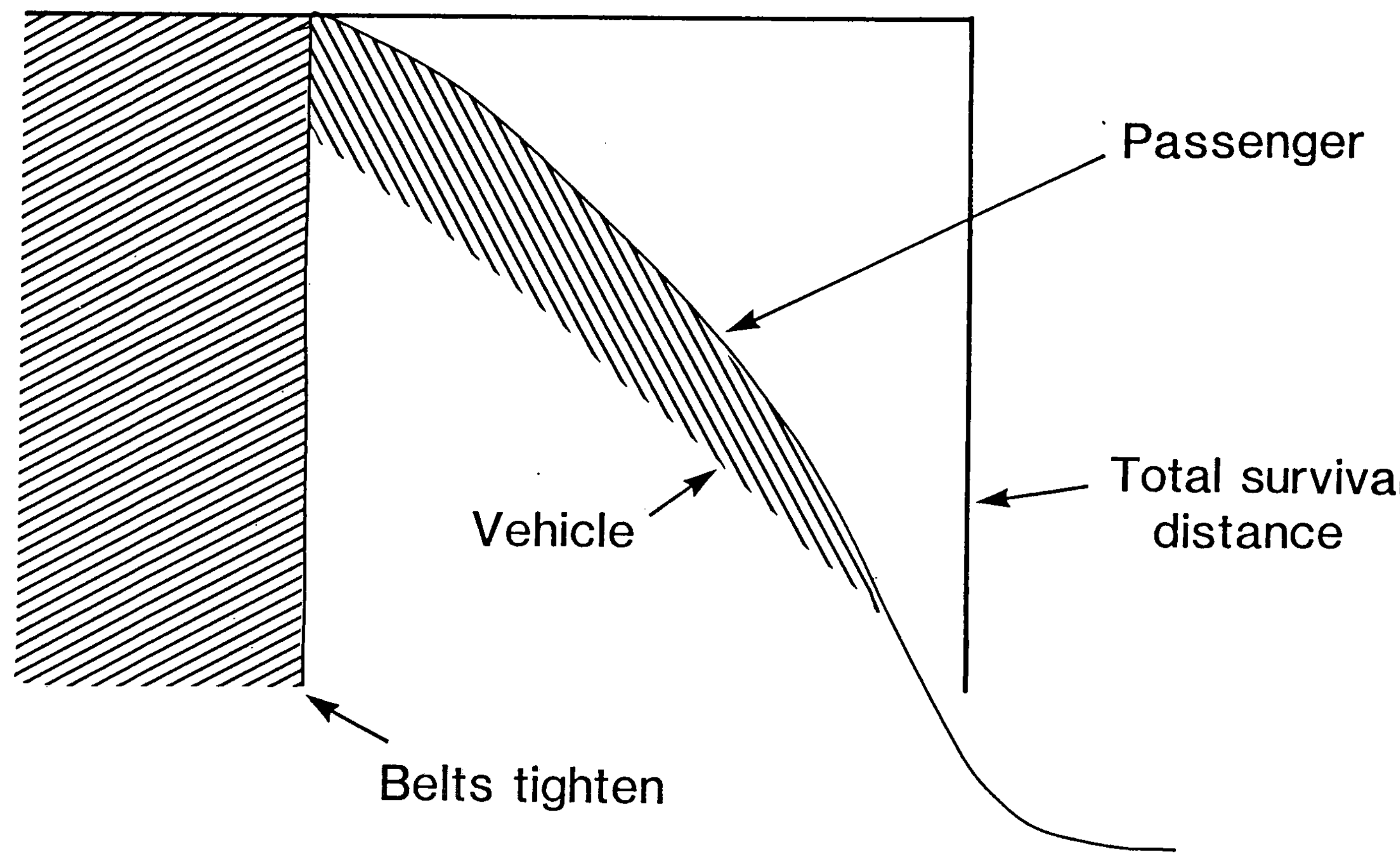
Stopping Distance For Passenger = Inside Distance
Plus Crush of Car

6. p.38. IV.A.1.f



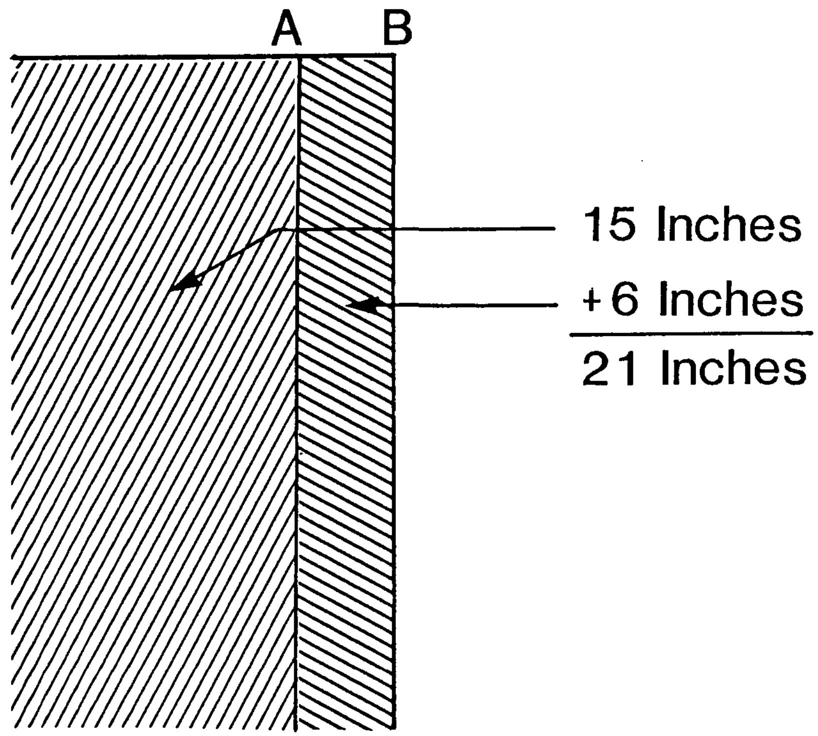
Average Deceleration of Passenger's Whole Body
$$= 2564 \frac{ft}{sec} \approx 78 \text{ g's}$$

7. p.38. IV.A.1.h



Distance Used By Restrained Passenger = Belts Tightening Plus Inside Space Needed With Belts Plus Crush Depth

8. p.39. IV.A.2.

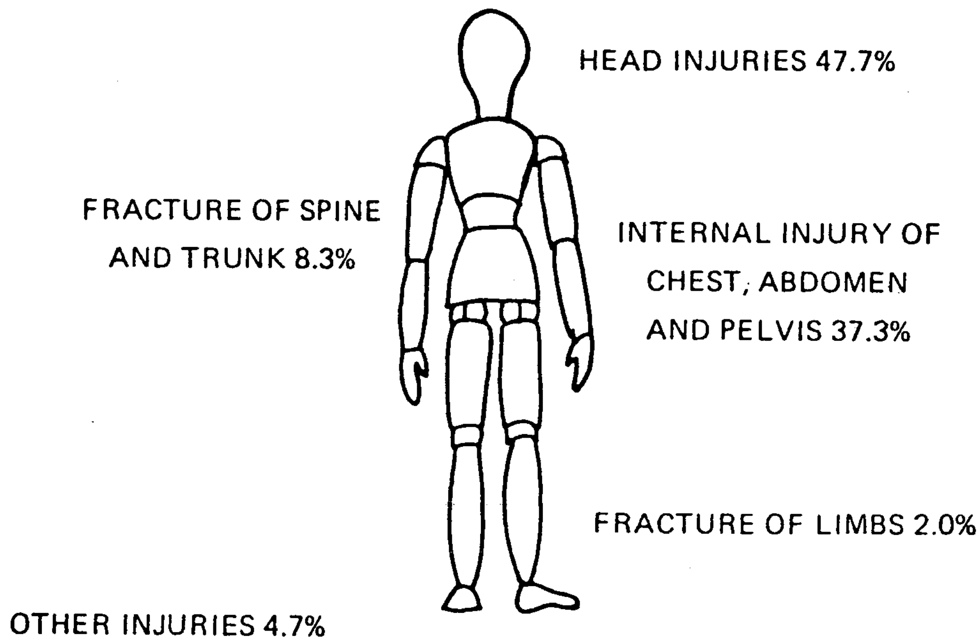


A. Vehicle Sensitive – Lock As Car Decelerates
B. Belt Sensitive–Lock As Passenger Decelerates

9.p.40. IV.A.4.b

TYPES OF INJURIES

Percentages of FATAL Injuries From Vehicle Crashes



INJURIES TO HEAD ARE MOST FREQUENT CAUSE OF FATALITIES

Page 36, 37

SUMMARY OF IMPACT AREAS AND INJURIES

Principal Injury — Producing Areas*

(a) Steering wheel and hub
(b) Windshield and frame
(c) Roof
(d) Instrument panel
(e) Door frame and glass
(f) Hood and car exterior

**Being thrown out of vehicle 25 times more likely to result in death.*

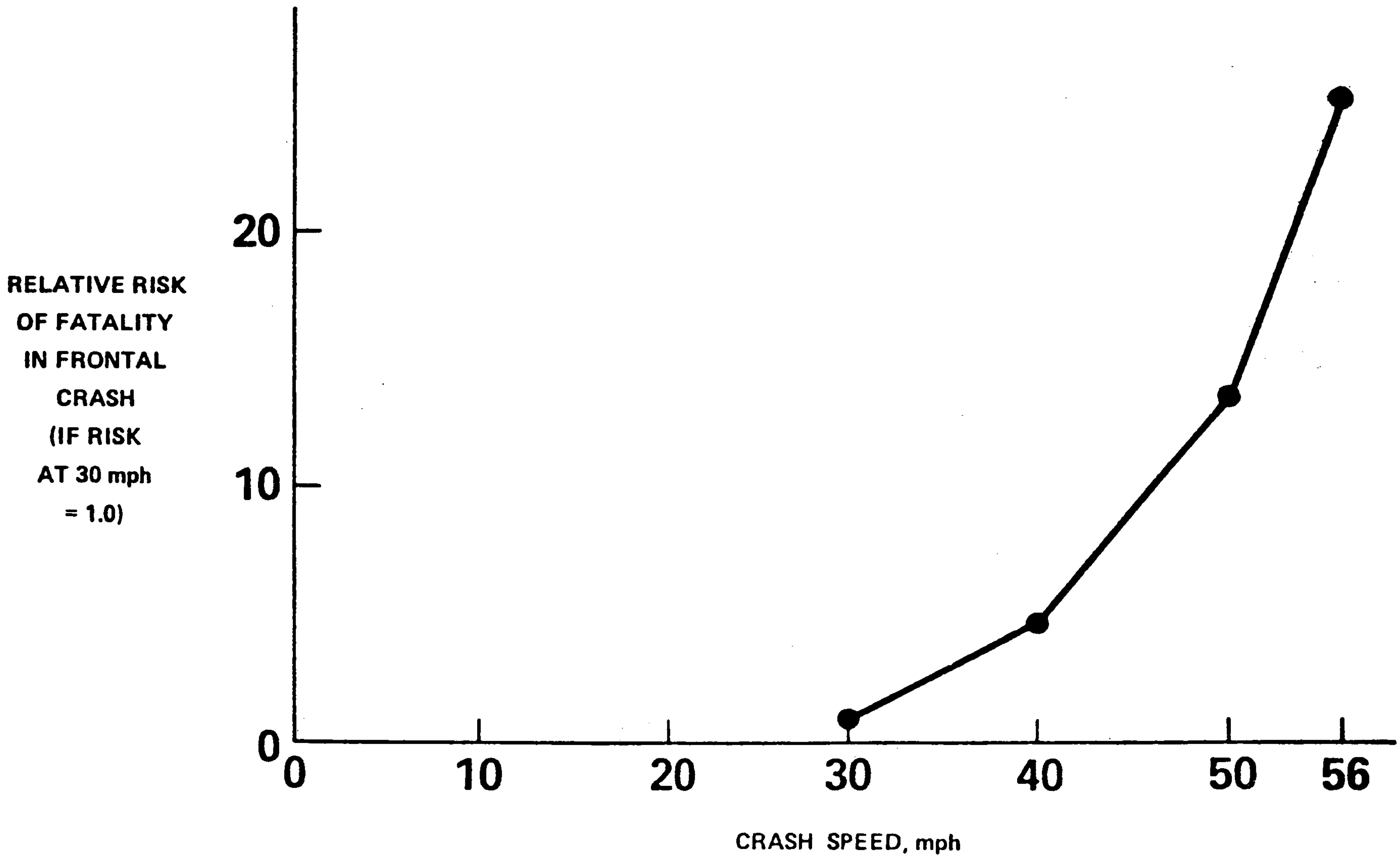
Most Frequent Types of Injuries*

1. Contusions } of face and head
2. Lacerations } of face and head
3. Facial Bone Fractures
4. Skull Fracture
5. Brain Damage

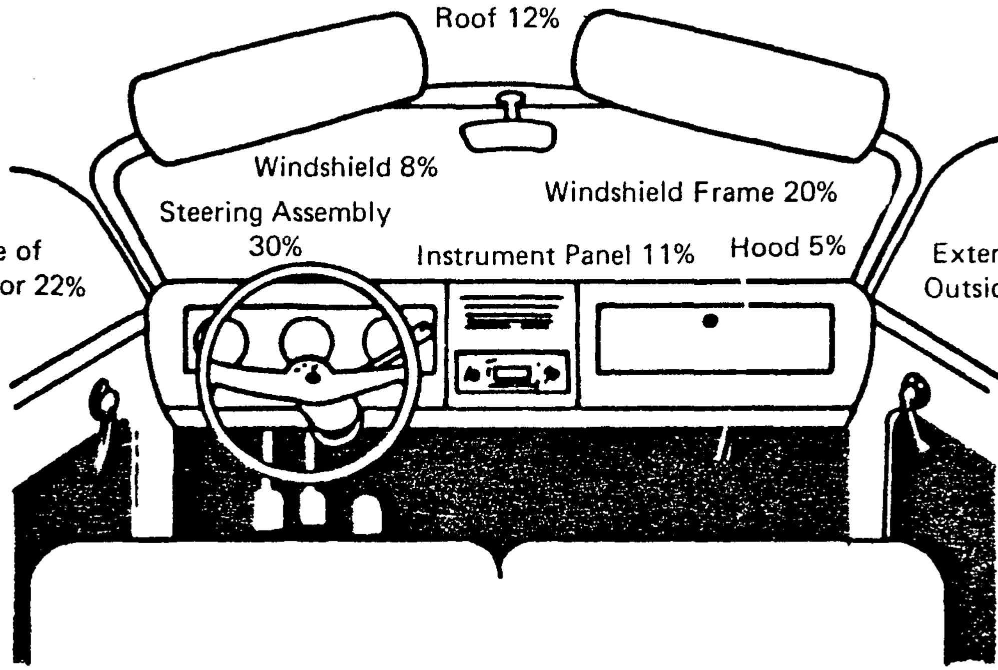
**Most frequent cause of death is head injury.*

SPEED OF IMPACT

AS SPEED OF IMPACT RISES ABOVE 30 MPH RISK OF FATALITY RISES SHARPLY



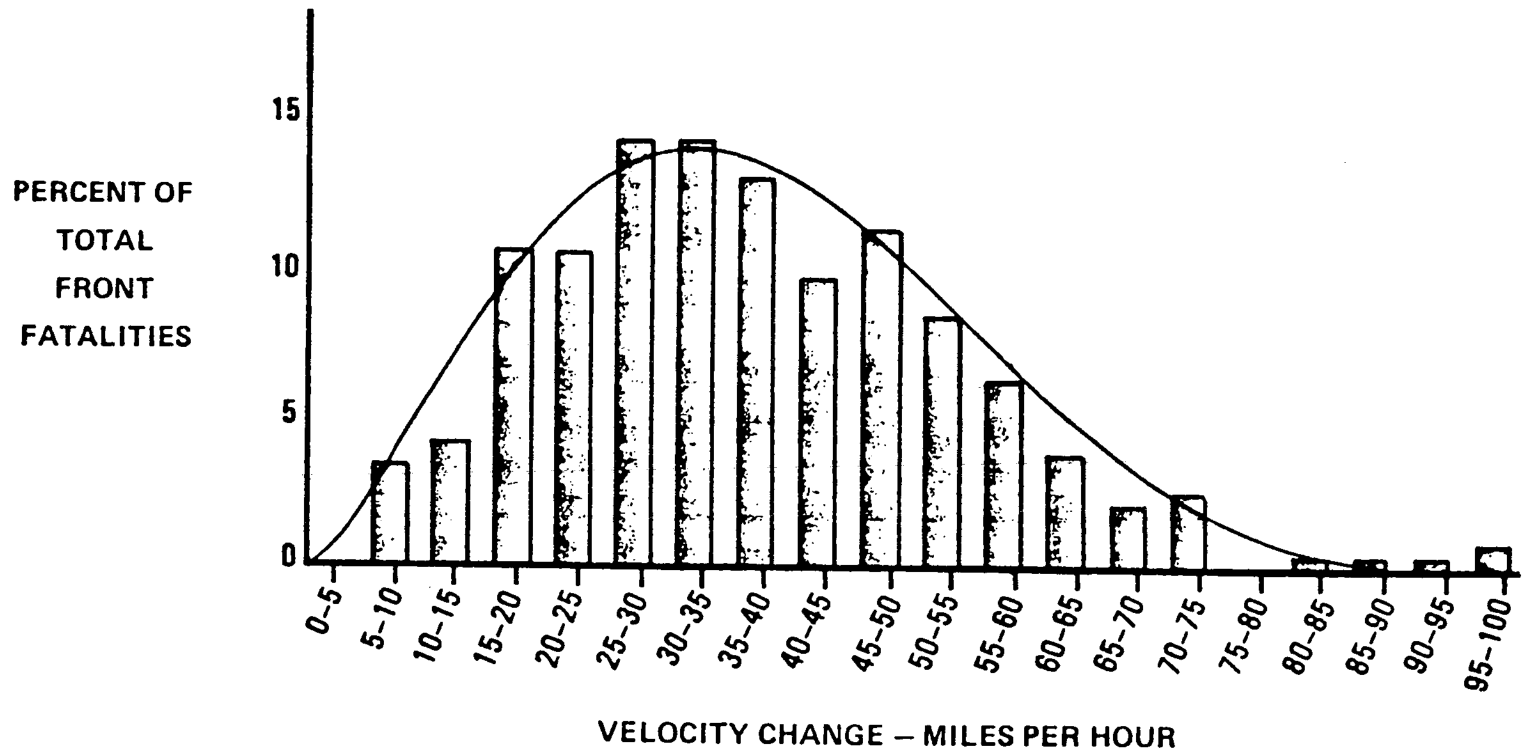
INJURY PRODUCING VEHICLE AREAS

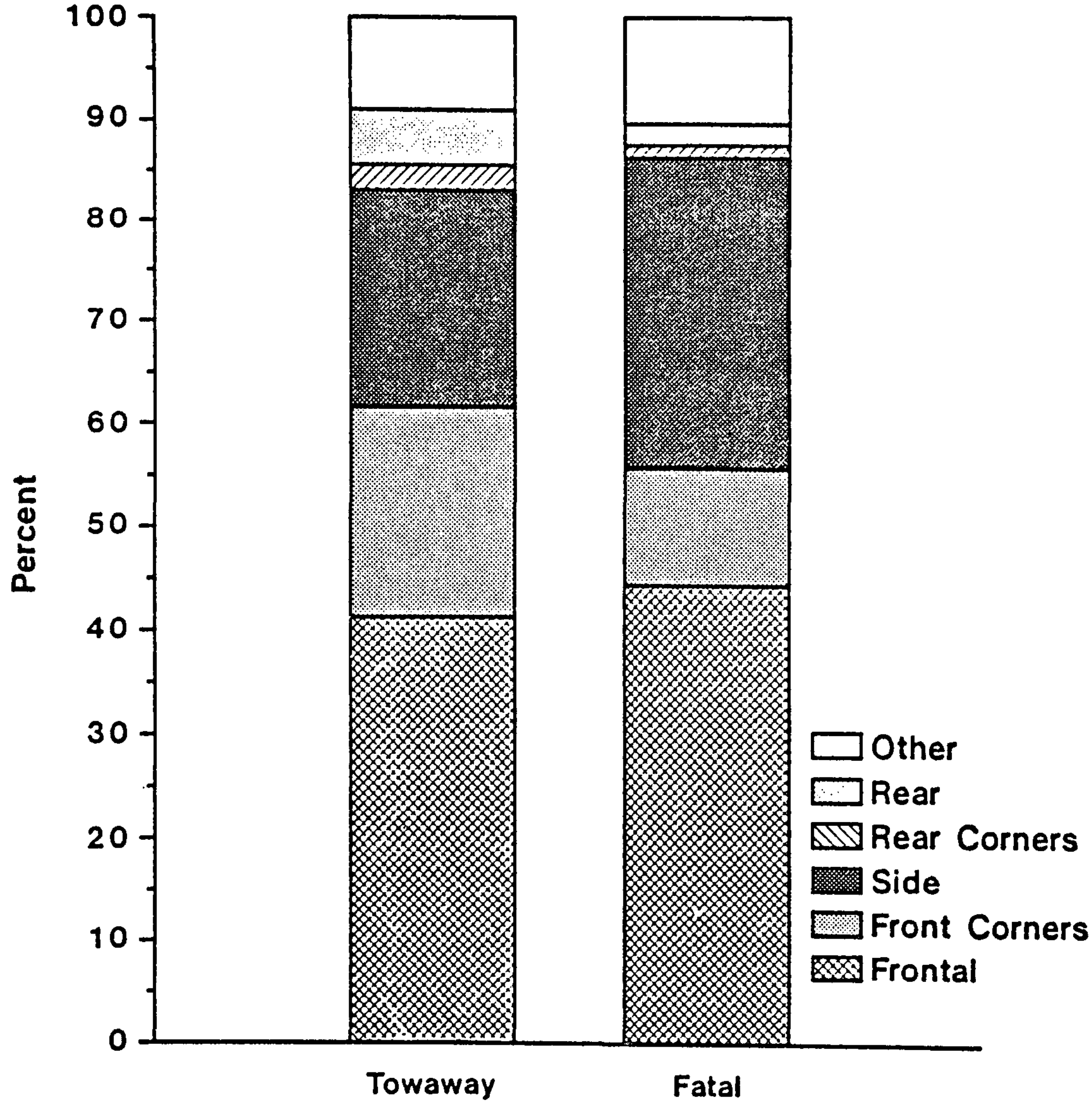


(BEING THROWN OUT OF VEHICLE IS MOST DANGEROUS OF ALL)

SPEED OF IMPACT

Frontal Crash Fatalities by Velocity Change at Impact





Percent Distribution of Passenger Car Occupants in Tow-away and Fatal Crashes by Direction of Impact, 1979-1981

Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company)

CONCLUSION(S)

- FORCES IMPOSED ON HUMAN BODY MUST BE WITHIN TOLERABLE LEVELS.
- TIME (OF DECELERATION) REDUCES LEVEL OF G-FORCE.
- HIGHER G-FORCES ARE TOLERABLE IF THEY ARE DISTRIBUTED OVER A LARGE AREA OF THE BODY.

The Aim of Safety Belts Is To:

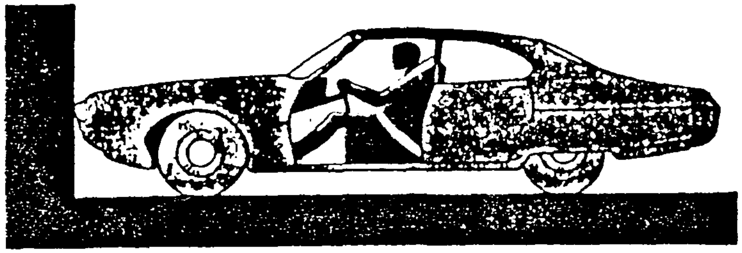
- First, maximize whatever benefits come from the First Collision through "riding down." By making the impact of the first collision work on you sooner, belts give you the benefit of increased stopping distance and dissipation of the forces of impact by the car itself.

- Second, minimize the harm of the Second Collision. By taking the forces of impact quickly (but not too quickly), the belts dissipate those forces through a relatively safe medium (the belt itself) instead of through a dangerous medium (glass or steel).

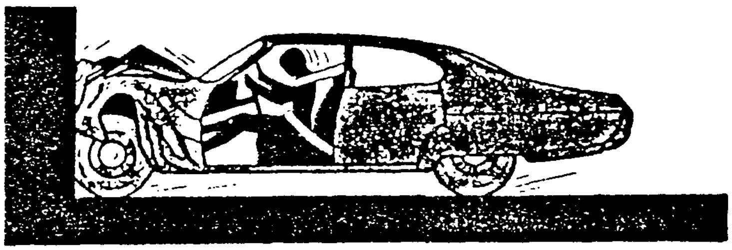
Safety Belts Help Occupants in 5 Ways

1. There is the *"ride down" benefit,* in which the belt begins to stop the wearer as the car is stopping.
2. The belt keeps the *head and face* of the wearer from striking objects like the wheel rim, windshield, interior post, or dashboard.
3. The belt *spreads the stopping force widely across the strong parts of the body.*
4. *Belts prevent vehicle occupants from colliding with each other.*
5. Belts help the driver to *maintain* vehicle control, thus decreasing the possibility of an additional collision.

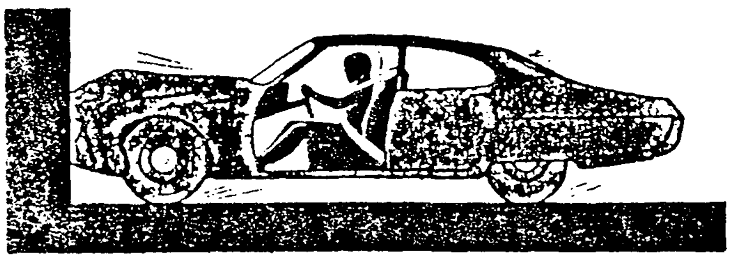
HOW SAFETY BELTS WORK



IMPACT: CAR BEGINS TO DECELERATE (FRONT AND CRUSHES)



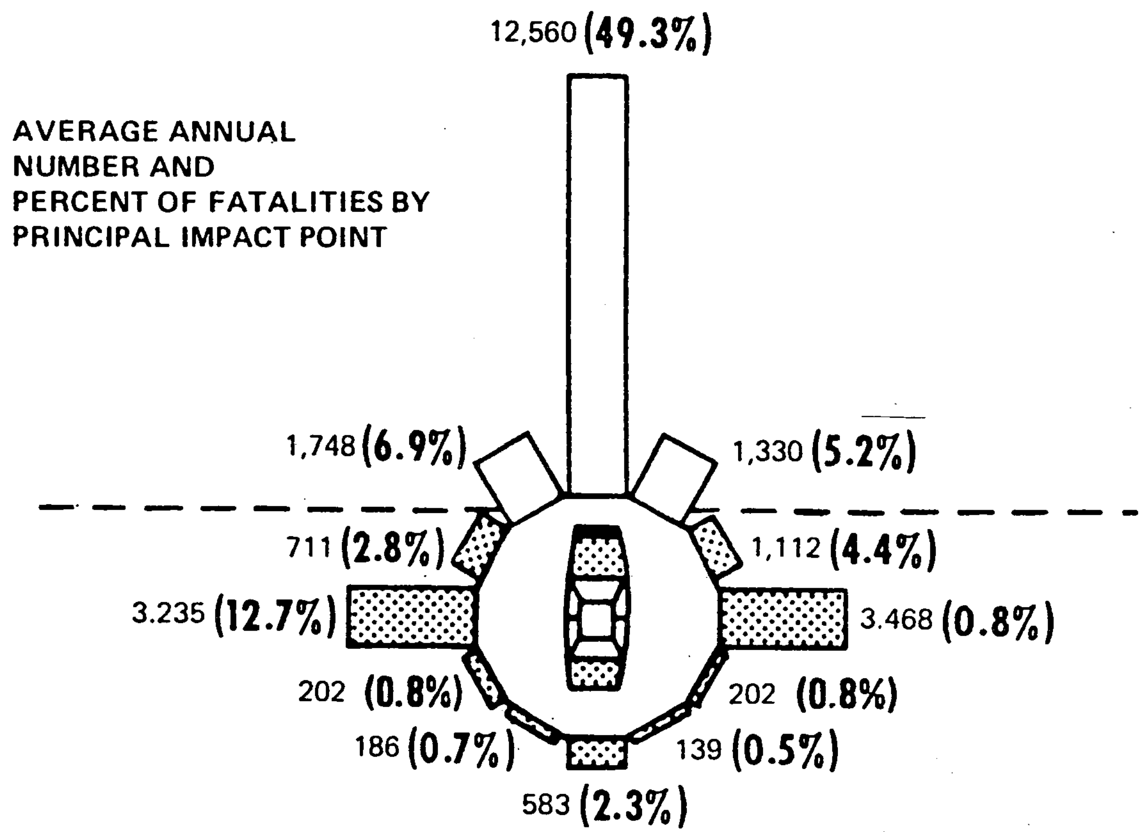
CAR SLOWS: OCCUPANT SLOWS WITH CAR. BELTS KEEP HEAD AND CHEST FROM CAR'S INTERIOR.



CAR STOPS: BELTS STRETCH, DISTRIBUTE FORCE OVER TIME AND OVER OCCUPANT'S BODY.

POINT OF IMPACT

More than 60 percent of FATALITIES result from frontal crash

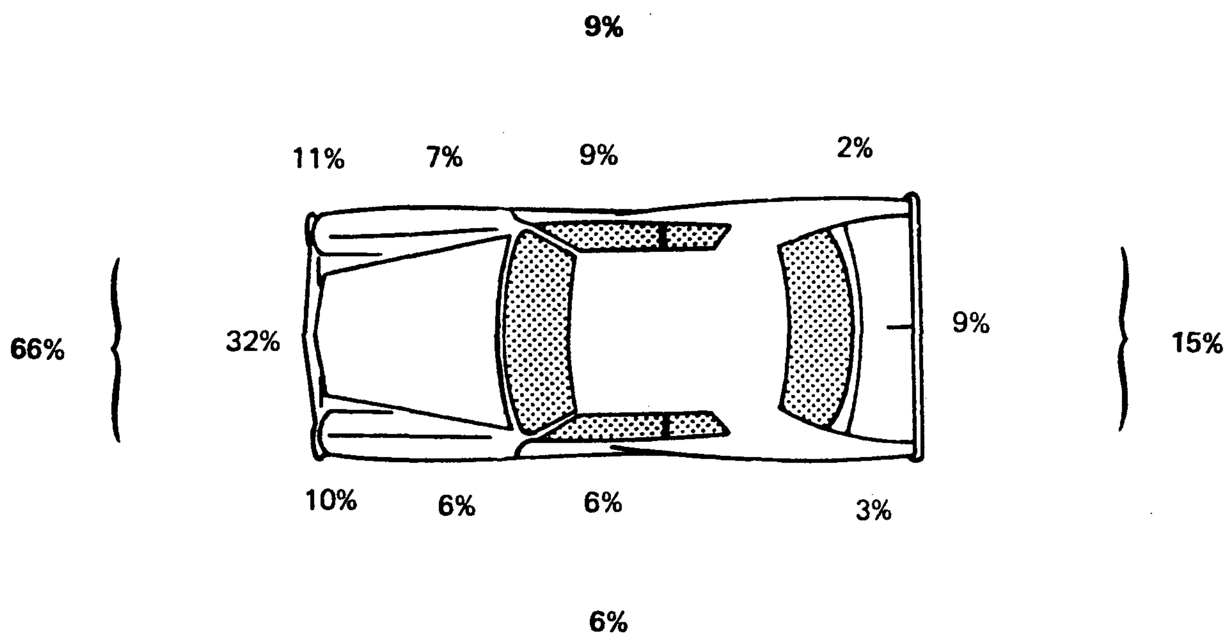


NOTE: *Top (rollover, undercarriage, non-collisions and unknown impact points not included.*

– FARS 1975 through 1978

POINT OF IMPACT

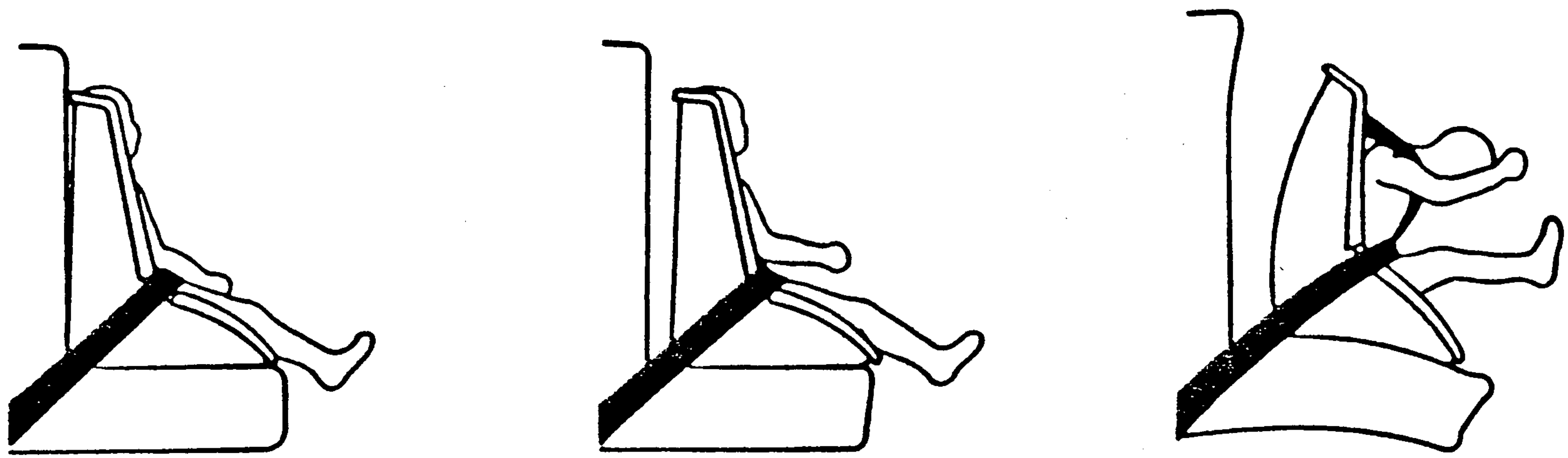
MORE THAN 65 PERCENT OF *URBAN CRASHES*
INVOLVE IMPACT FORWARD OF PASSENGER COMPARTMENT



PERCENTAGES OF PRIMARY IMPACT IN URBAN ACCIDENTS

– MacKay and de Fonseka, 1967
(Canadian Study)

HOW CHILD SAFETY SEATS WORKS

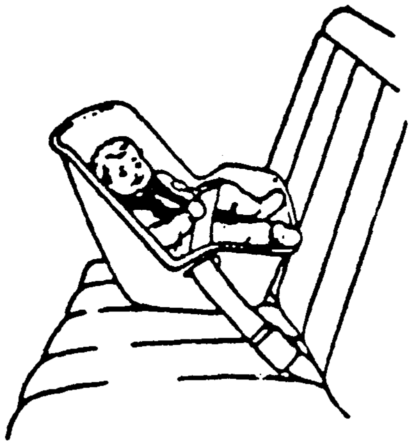


(1) CAR CONTACTS (2) CAR SLOWS (3) CAR STOPS

SAFETY SEATS:

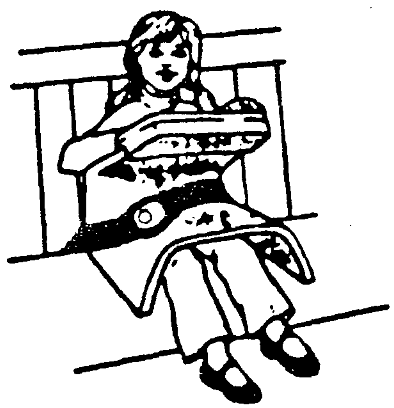
(1) TAKE ADVANTAGE OF "RIDE DOWN" EFFECT;
(2) DISTRIBUTE IMPACT OVER TIME (BY THE BELT STRETCHING);
(3) DISTRIBUTE FORCES OVER CHILD'S BODY;
(4) PREVENT CHILD FROM STRIKING CAR'S INTERIOR;
(5) PREVENT CHILD FROM STRIKING (OR BEING STRUCK BY) ANOTHER PASSENGER.

TYPES OF CHILD SAFETY SEATS



(1) INFANT CARRIER

(2) TODDLER SEAT (WITH HARNESS)



(3) TODDLER SHIELD

(4) SAFETY BELT HARNESS

Forces Applied to the Human Body

G Forces

Panic Braking —	8/10 G	— 120 Lbs
Roller Coaster —	8/10 G	— 120 Lbs
Astronauts —	4 to 11 G	— 1,600 Lbs
Crashes (Unrestrained) —	80 to 100 G	— 15,000 Lbs

Human Tolerance to G Forces

- Steering Column — 25G
- Lap/Shoulder Belt — 35-40G
- Air Bag — 55-60G

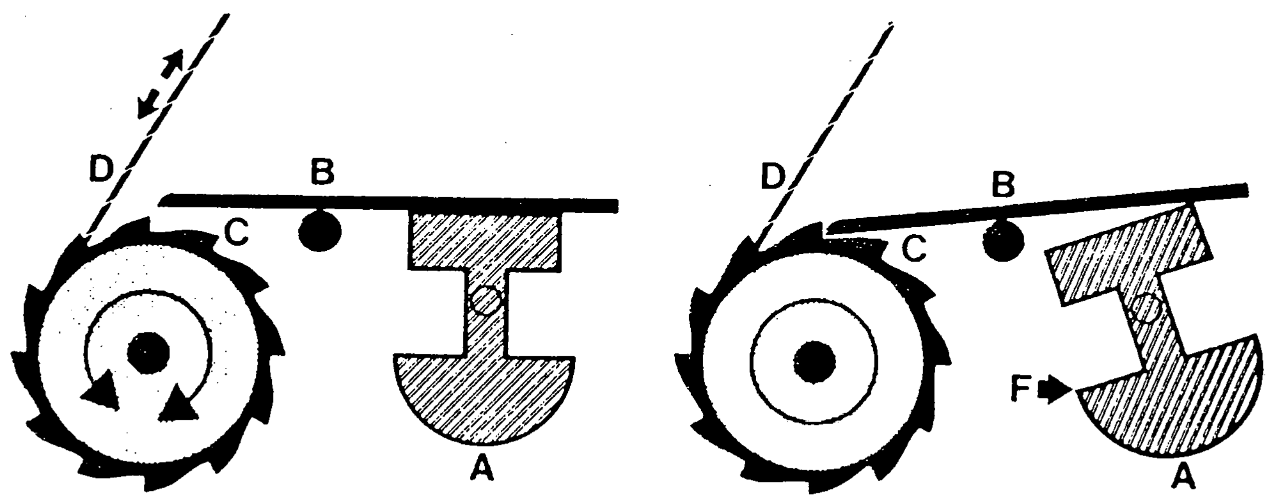
HOW OCCUPANT RESTRAINTS WORK

- MANUAL BELTS
  - LAP ONLY
  - LAP AND SHOULDER (3-POINT)
- AUTOMATIC BELTS
- AIR BAGS
- CHILD SEATS

DOES YOUR MANUAL SAFETY BELT WORK?

- Many people believe their manual (shoulder) belt doesn't work because it doesn't lock-up.
- That's because belt retractors (locks) used to be "belt" sensitive.
- Now these retractors are "vehicle" (acceleration) sensitive.
- That means they lock up when the vehicle changes direction rapidly.
- This is a comfort factor.

HOW CAR-SENSITIVE EMERGENCY LOCKING RETRACTORS OPERATE

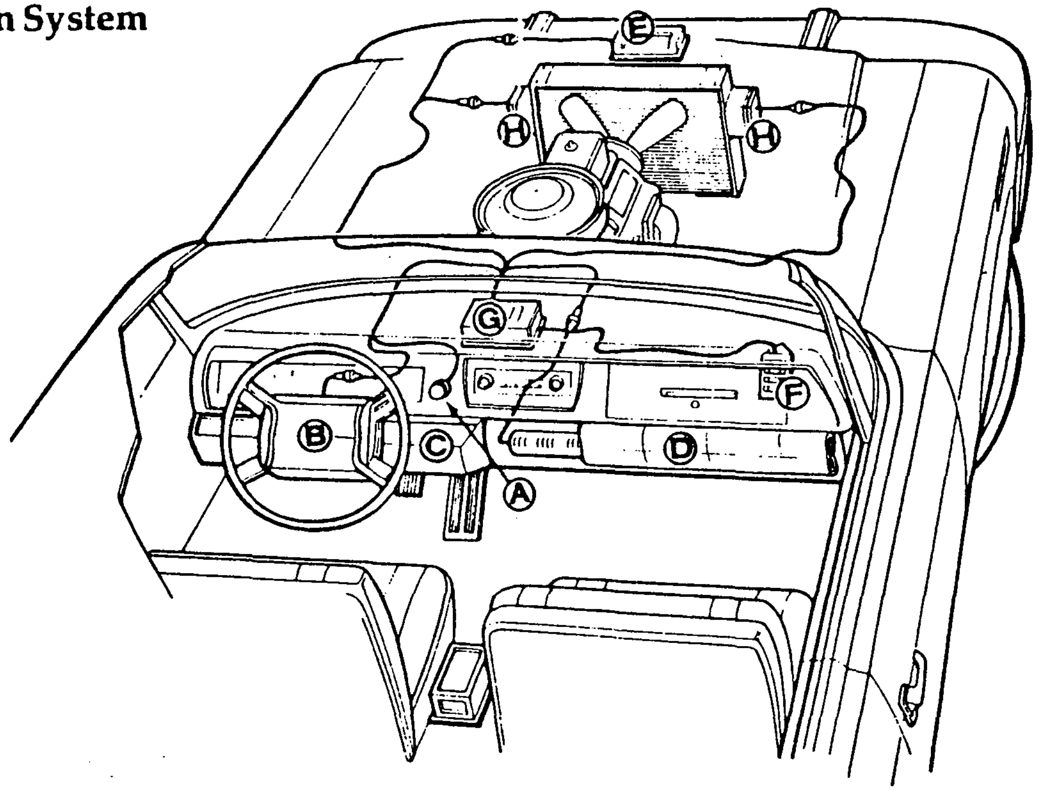


NORMAL CONDITIONS

EMERGENCY CONDITIONS

HOW AIRBAGS WORK

The Air Cushion Protection System



Ⓐ READINESS INDICATOR LIGHT

Ⓑ DRIVER'S AIR CUSHION AND INFLATOR ASSEMBLY

Ⓒ DRIVER'S KNEE RESTRAINT

Ⓓ PASSENGER AIR CUSHION KNEE RESTRAINT AND INFLATOR ASSEMBLY

Ⓔ BUMPER MOUNTED PRIMARY CRASH SENSOR

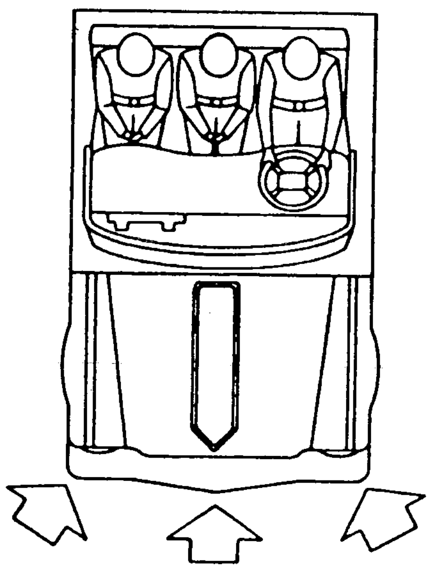
Ⓕ FUSE PANEL

Ⓖ PASSENGER COMPARTMENT CRASH SENSOR AND SECONDARY POWER SUPPLY

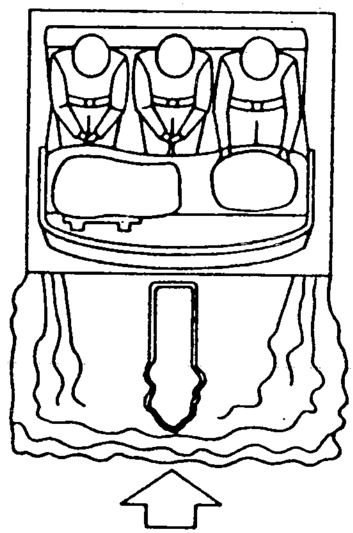
Ⓗ RADIATOR MOUNTED PRIMARY CRASH SENSORS

HOW AIRBAGS WORK

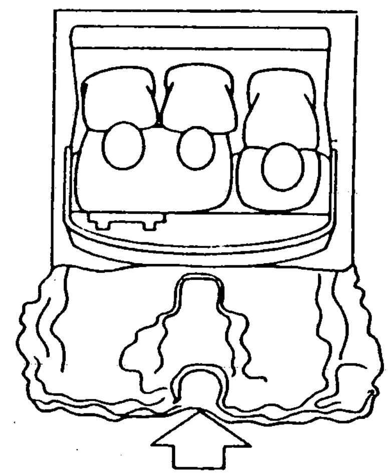
0 SECONDS:
Air bags in dash
and steering wheel



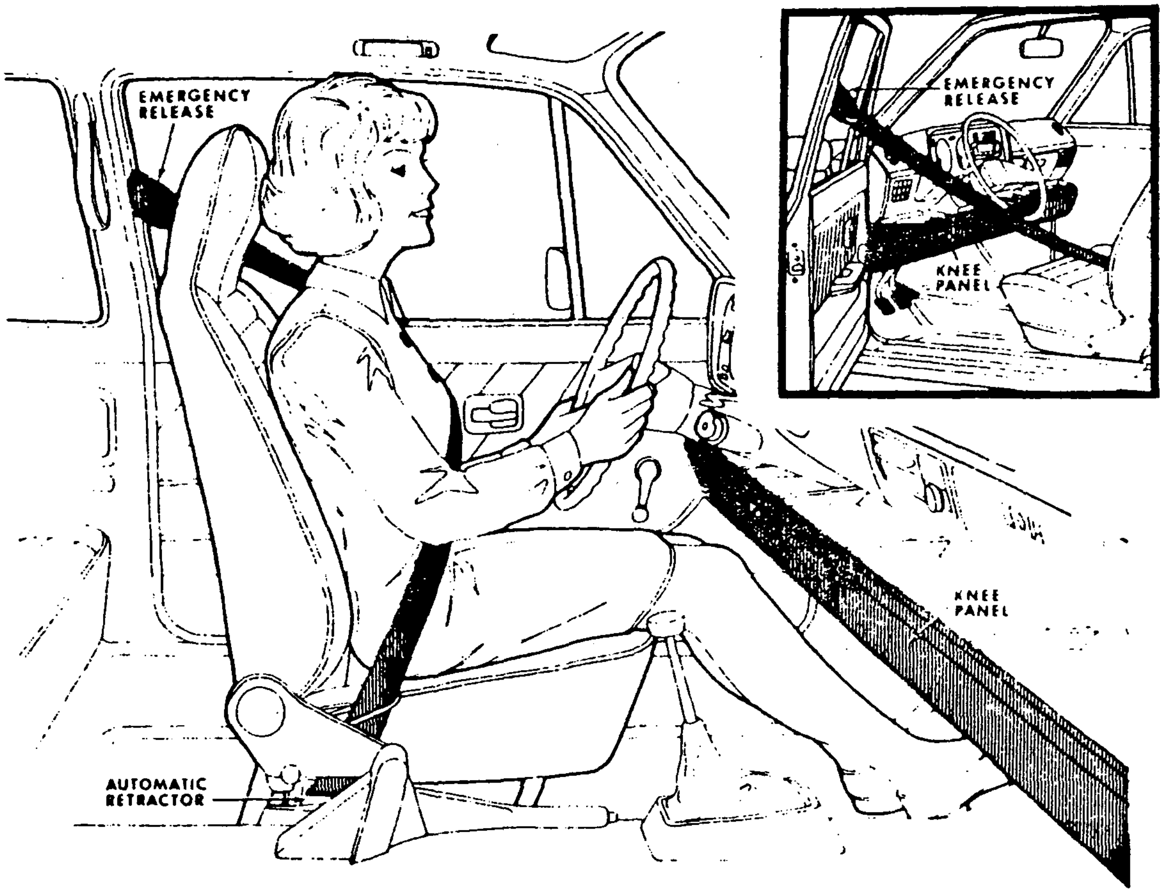
2/100 SECOND:
The air bags inflate,
filling with nitrogen gas.



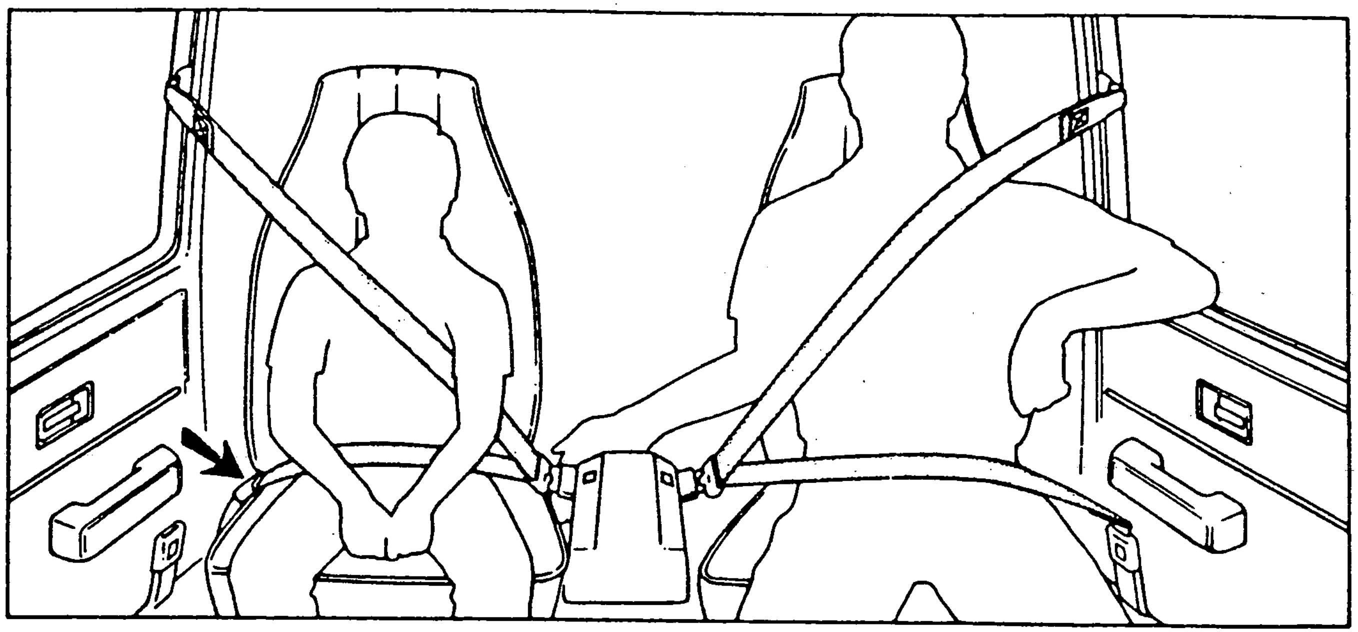
8/100 SECOND:
Cushioning passengers
and deflating to
reduce rebound.



AUTOMATIC SAFETY BELTS :



AUTOMATIC SAFETY BELTS :



TYPE OF CRASH

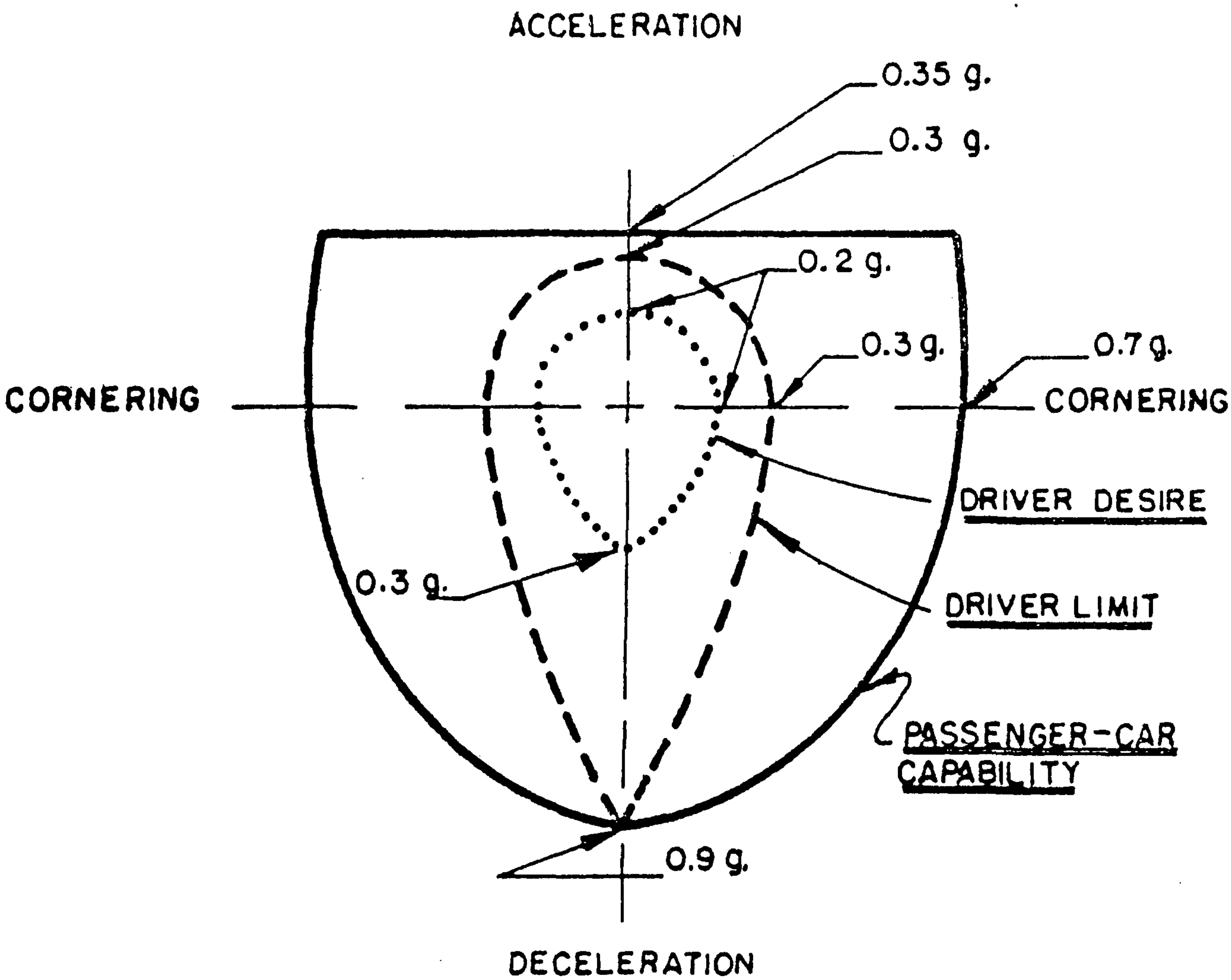
- POINT OF IMPACT
  - — FRONT
  - — SIDE
  - — REAR
  - — (ROLLOVER)

- VEHICLE SPEED
  - — 35 MPH OR UNDER
  - — OVER 35 MPH

TYPICAL ACCIDENT RATES

(Urban Roads)

Facility Type	Accidents per MVM	Fatalities per 100 MVM
2 & 3 Lane	5.08	5.0
≥ 4 Lane, Undivided	6.44	4.0
≥ 4 Lane, Divided	4.97	3.3
Divided Expressway	3.0	3.7
Freeway	1.51	1.5



Source: A Highway Safety and Traffic Study Program. Northwestern University. US DOT. FHWA. March, 1980.

A SAFE HIGHWAY

ONE IN WHICH INTERACTIONS OF THE

DRIVER

VEHICLE

ROADWAY

DO NOT REACH A "CRITICAL THRESHOLD"

DESIGN DRIVER

VISUAL ACUITY	20/40
PERCEPTION/REACTION TIME	3.5 SEC
EYE HEIGHT	3.75 FEET
COLOR BLINDNESS	RED AND GREEN
PERIPHERAL VISION	160

THE DRIVING TASK

THE AVERAGE DRIVER IN HIS DRIVING TASK IS CONFRONTED WITH:

1. TEN OR MORE HIGHWAY AND TRAFFIC EVENTS PER SECOND
2. TWO OR MORE DRIVER OBSERVATIONS PER SECOND
3. ONE TO THREE DRIVER DECISIONS PER SECOND
4. THIRTY TO 120 DRIVER ACTIONS PER MINUTE
5. AT LEAST ONE DRIVER ERROR EVERY 2 MINUTES
6. A HAZARDOUS SITUATION EVERY HOUR OR TWO
7. A NEAR-COLLISION ONCE OR TWICE A MONTH
8. A COLLISION EVERY 6 YEARS OF DRIVING
9. AN INJURY EVERY 40 YEARS OF DRIVING
10. A FATALITY EVERY 1600 YEARS OF DRIVING

THE AVERAGE DRIVER IN HIS LIFETIME WILL:

OVERTAKE AND PASS 15,000 VEHICLES ON 2-LANE RURAL HIGHWAYS

OVERTAKE AND PASS 50,000 VEHICLES ON FREEWAYS

CROSS 1 MILLION INTERSECTIONS

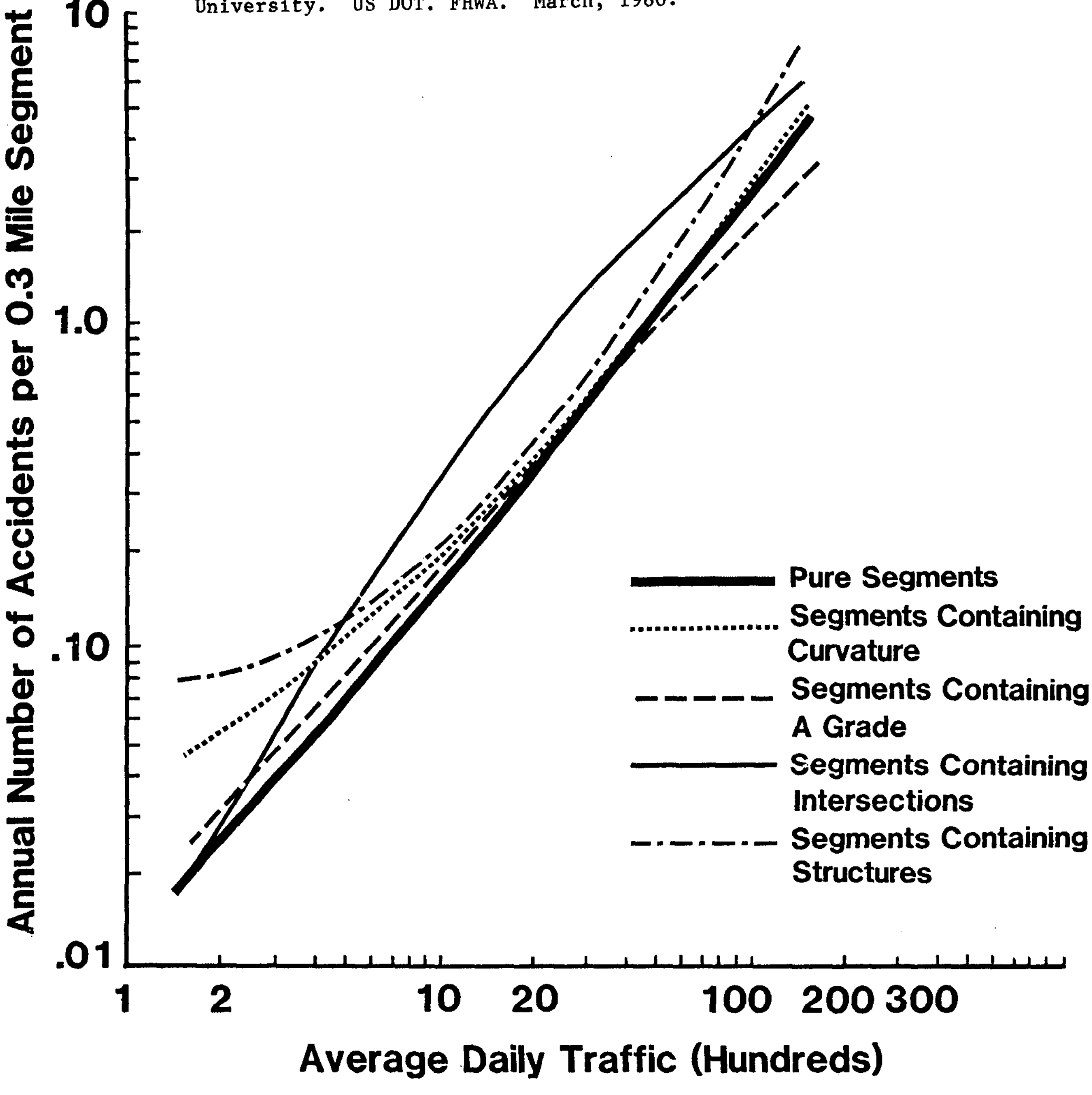
ENVIRONMENTAL HIGHWAY SAFETY FACTORS

	GEOMETRICS AND APPURTENANCES
	ENFORCEMENT SYSTEM
PRE-CRASH	CONTROL SYSTEM
	WEATHER AND LIGHT CONDITIONS
	ROAD SURFACE CONDITIONS
CRASH	GEOMETRICS AND APPURTANCES FOR ENERGY ABSORBTION AND FORGIVING HIGHWAY
POST-CRASH	GEOMETRICS FOR EASE OF EMERGENCY ACCESS
	DEBRIS CONTROL AND CLEAN-UP

ATTRIBUTES OF THE ROADWAY

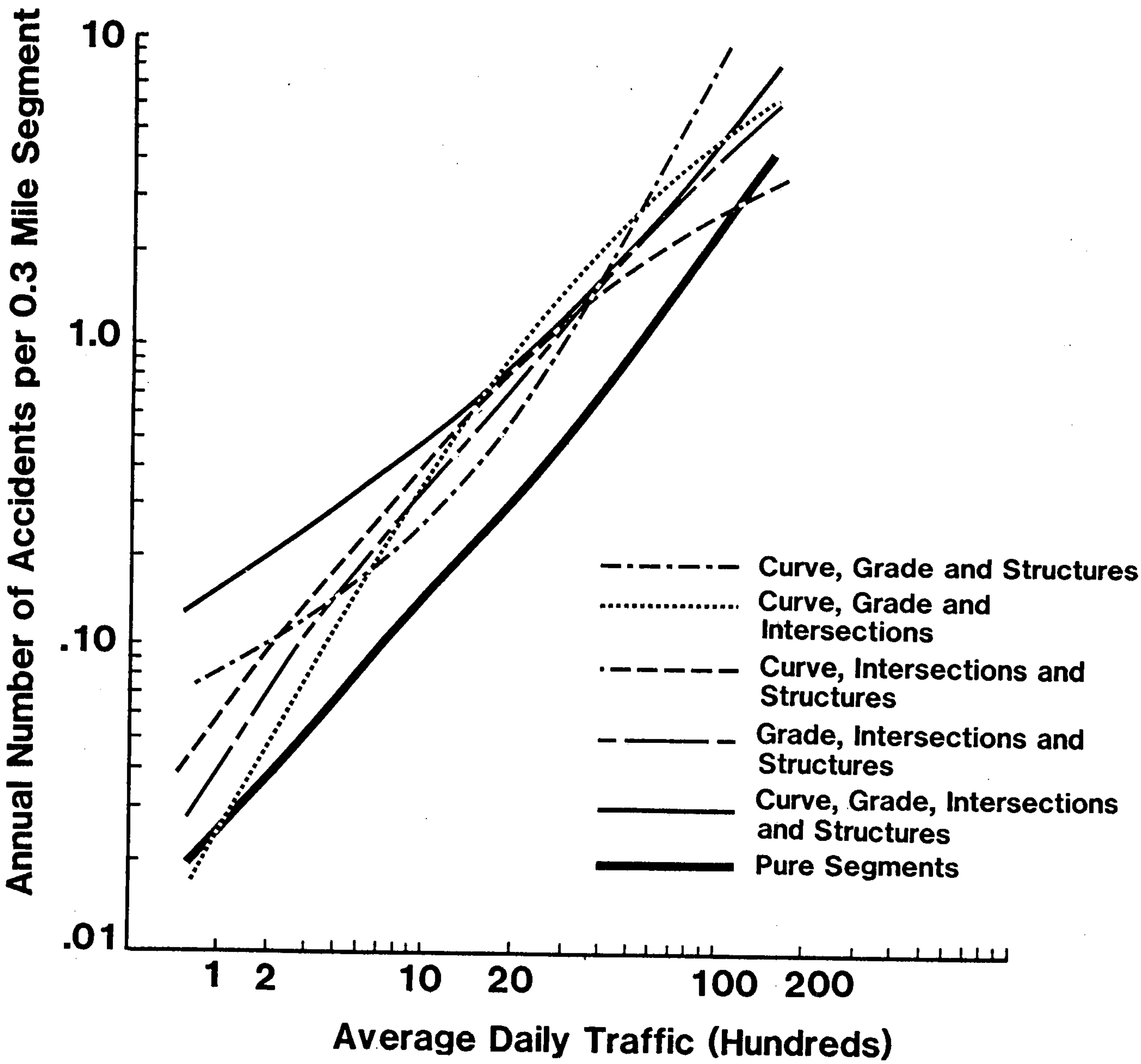
	LIGHT, ILLUMINATION
	VISIBILITY
	VIEW OBSTRUCTIONS
	RECOGNIZABILITY
	RECOGNIZABILITY AIDS
RECOGNITION	DISTRACTION, MONOTONY
	CONFUSION
	STANDARDIZATION
	WARNING SIGNS
	GUIDE SIGNS
	SIGNALS
DECISION	TRAFFIC SIGNAL CONTROL
	REGULATORY SIGNS AND MARKINGS
	ALIGNMENT
	SURFACE CHARACTER
PERFORMANCE	DIMENSIONS
	RESTRAINING DEVICES

Source: A Highway Safety and Traffic Study Program. Northwestern University. US DOT. FHWA. March, 1980.



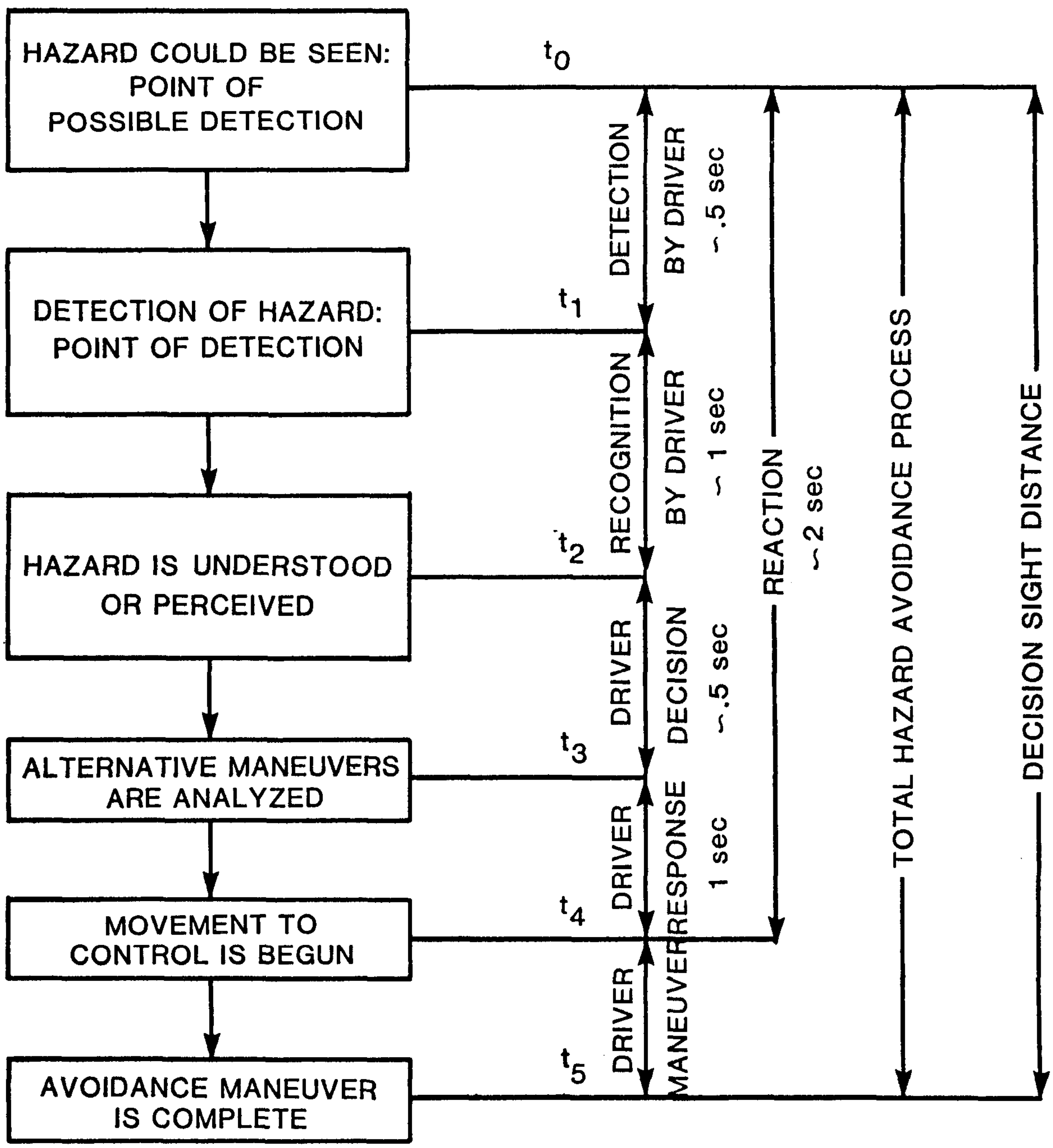
TOTAL ACCIDENT RATES 2-LANE HIGHWAYS WITH ONE GEOMETRIC FEATURE

Source: A Highway Safety and Traffic Study Program. Northwestern University. US DOT. FHWA. March, 1980.



TOTAL ACCIDENT RATES 2-LANE HIGHWAYS WITH THREE OR FOUR GEOMETRIC FEATURES

THE HAZARD AVOIDANCE PROCESS



Source: A Highway Safety and Traffic Study Program. Northwestern University. US DOT. FHWA. March, 1980.

SIGHT DISTANCE CRITERIA

STOPPING SIGHT DISTANCE =

PERCEPTION/RESPONSE DISTANCE + BRAKING DISTANCE

SSD =

$$1.47\,(T_r V) \quad + \quad \frac{V^2}{30\,f}$$

V = DESIGN SPEED, MPH

T_r = RESPONSE TIME, SEC

f = COEFFICIENT OF FRICTION

SIGHT DISTANCE CRITERIA

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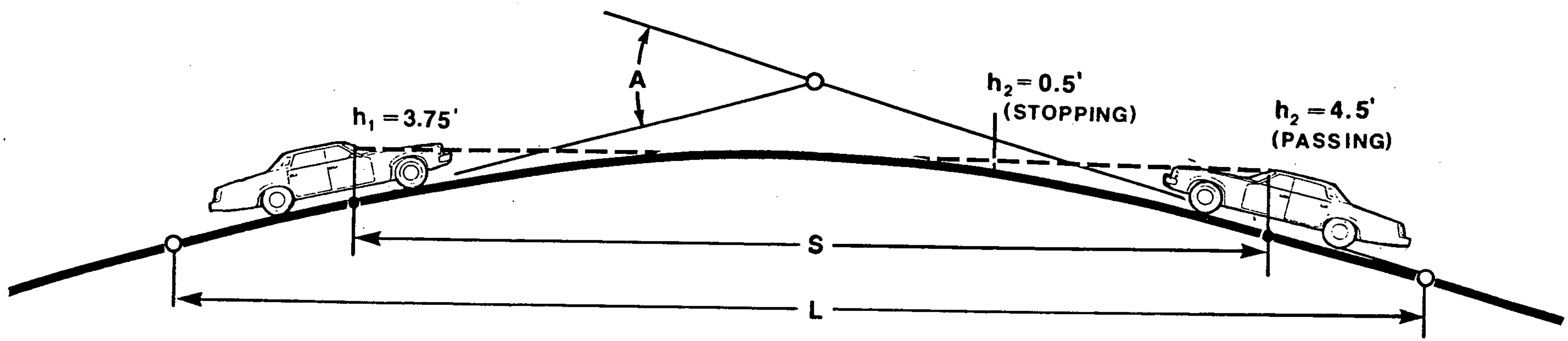


CREST.........$L = AS^2/100\,(\sqrt{2h_1} + \sqrt{2h_2})^2$.................WHEN $S < L$

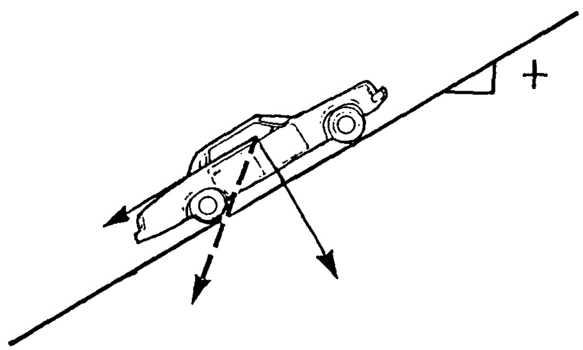
STOPPING SIGHT DISTANCE: $L = AS^2/1398$ or $K = S^2/1398$
PASSING SIGHT DISTANCE: $L = AS^2/3295$ or $K = S^2/3295$

L = LENGTH OF VERTICAL CURVE, FT.
A = ALGEBRAIC DIFFERENCE GRADES, %
S = SIGHT DISTANCE, FT.
K = VERTICAL CURVATURE, L/A

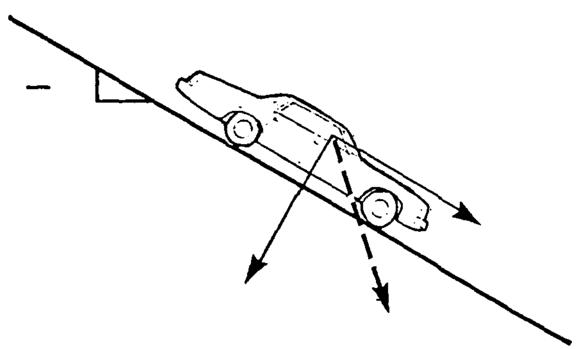
Source: A Highway Safety and Traffic Study Program. Northwestern University. US DOT. FHWA. March, 1980.

SIGHT CRITERIA

GRADE



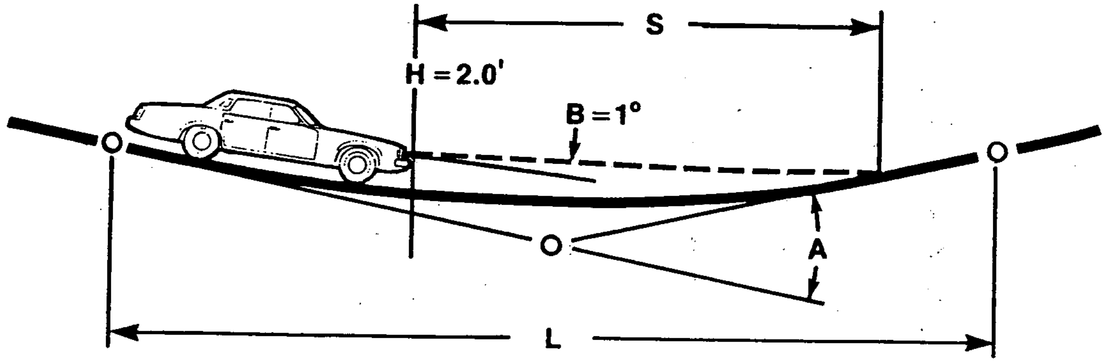
POSITIVE GRADE – Weight Helps Braking, Grade Factor Added To f.



NEGATIVE GRADE – Weight Acts Against Braking, Grade Factor Subtracted From f.

Source: A Highway Safety and Traffic Study Program. Northwestern University. US DOT, FHWA. March, 1980.

SIGHT DISTANCE CRITERIA



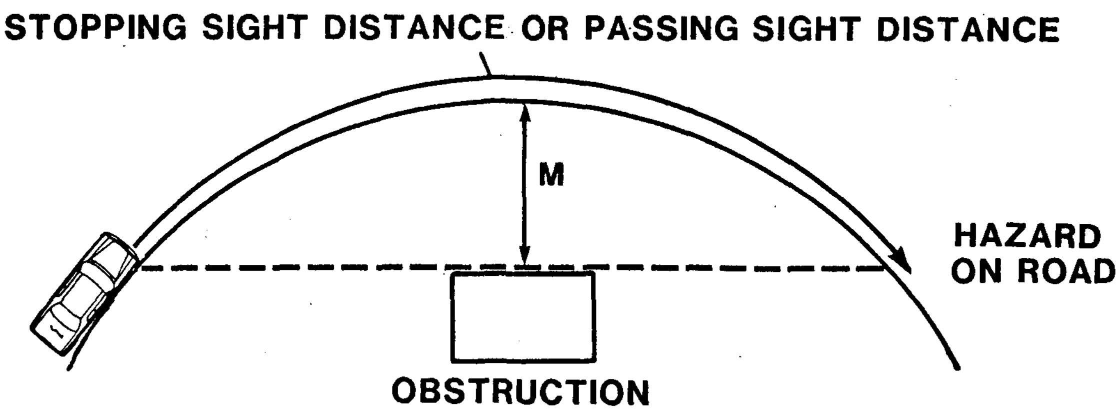
SAG................$L = AS^2/200\ (H + S \tan B)$..............WHEN $S < L$

FOR PASSENGER CARS: $L = AS^2/(400 + 3.5\ S)$ or $K = S^2\ /(400 + 3.5\ S)$

L = LENGTH OF VERTICAL CURVE, FT.
A = ALGEBRAIC DIFFERENCE GRADES,%
S = SIGHT DISTANCE, FT.
K = VERTICAL CURVATURE, L/A
H = HEADLIGHT HEIGHT, FT.
B = UPWARD DIVERGENCE OF LIGHT BEAM, DEGREES

Source: A Highway Safety and Traffic Study Program. Northwestern University. US DOT. FHWA. March, 1980.

SIGHT DISTANCE CRITERIA
HORIZONTAL CURVES



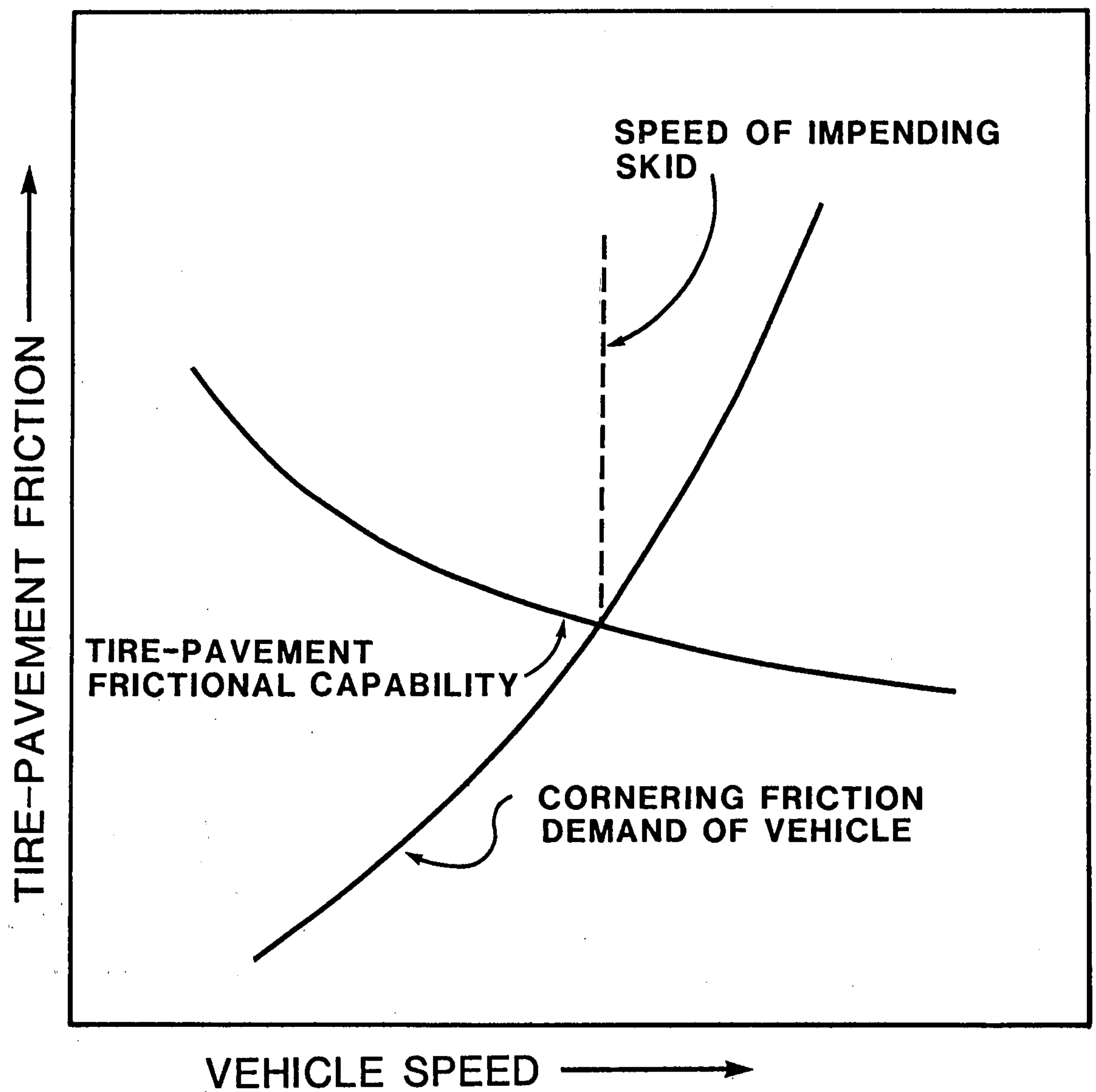
Distance That Obstruction Can Be From Road =

$$M = R\left(1 - \cos \frac{28.65\ \text{SSD}}{R}\right)$$

R = Radius of Curvature

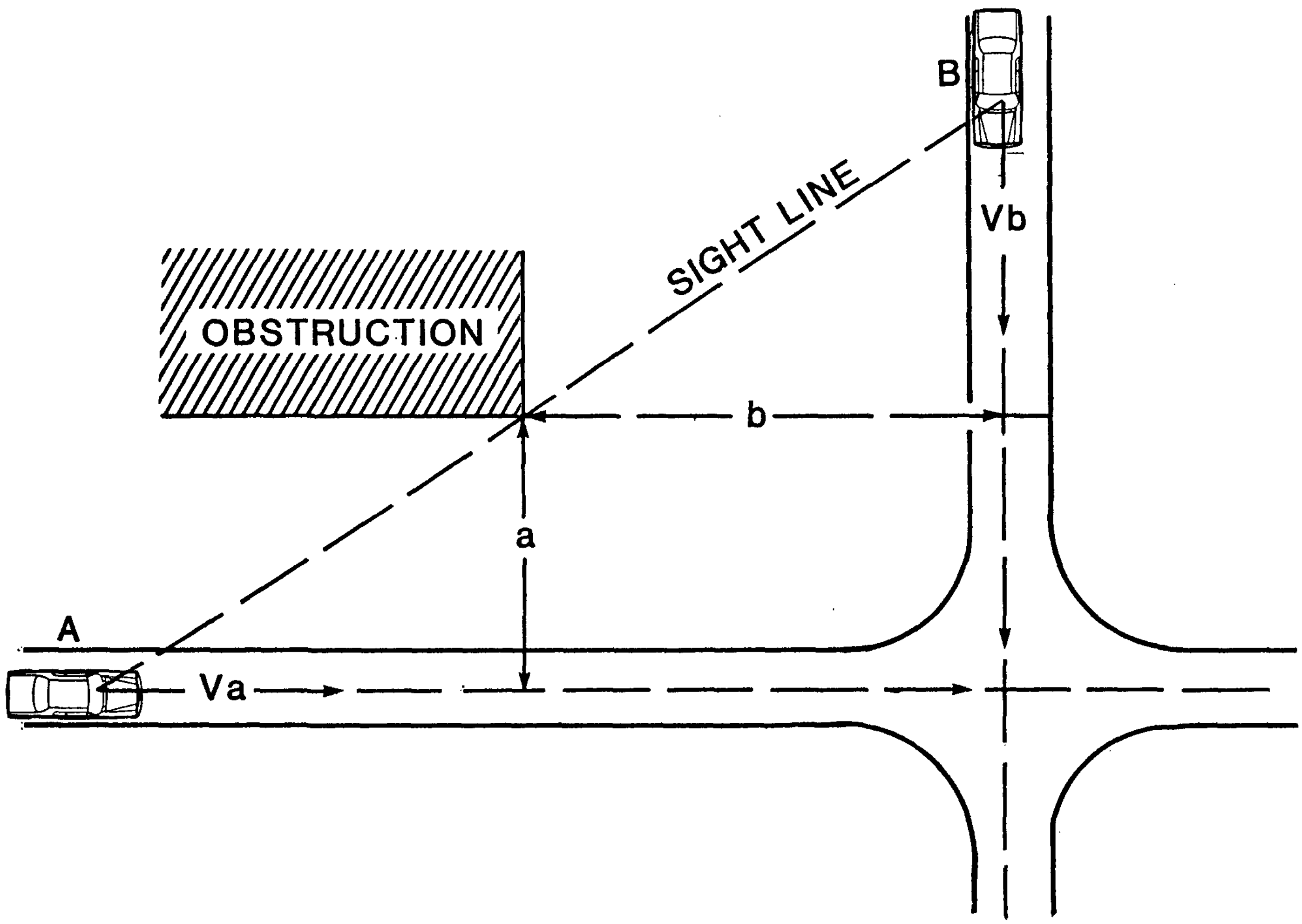
Source: A Highway Safety and Traffic Study Program. Northwestern University. US DOT. FHWA. March, 1980.

FRICTION DEMAND AND CAPABILITY



Source: A Highway Safety and Traffic Study Program. Northwestern University. US DOT. FHWA. March, 1980.

SIGHT DISTANCE CRITERIA
NO STOP OR SIGNAL



VELOCITIES OF VEHICLES (Va and Vb) CAN INCREASE AS a and b INCREASE

Source: A Highway Safety and Traffic Study Program. Northwestern University. US DOT. FHWA. March, 1980.

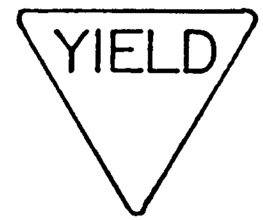
NEED FOR INTERSECTION CONTROL

0 vpd

- NO CONTROL

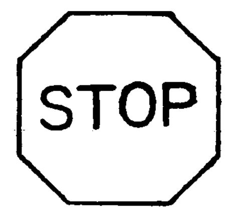
1000 vpd

- YIELD



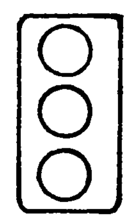
3000 vpd

- STOP

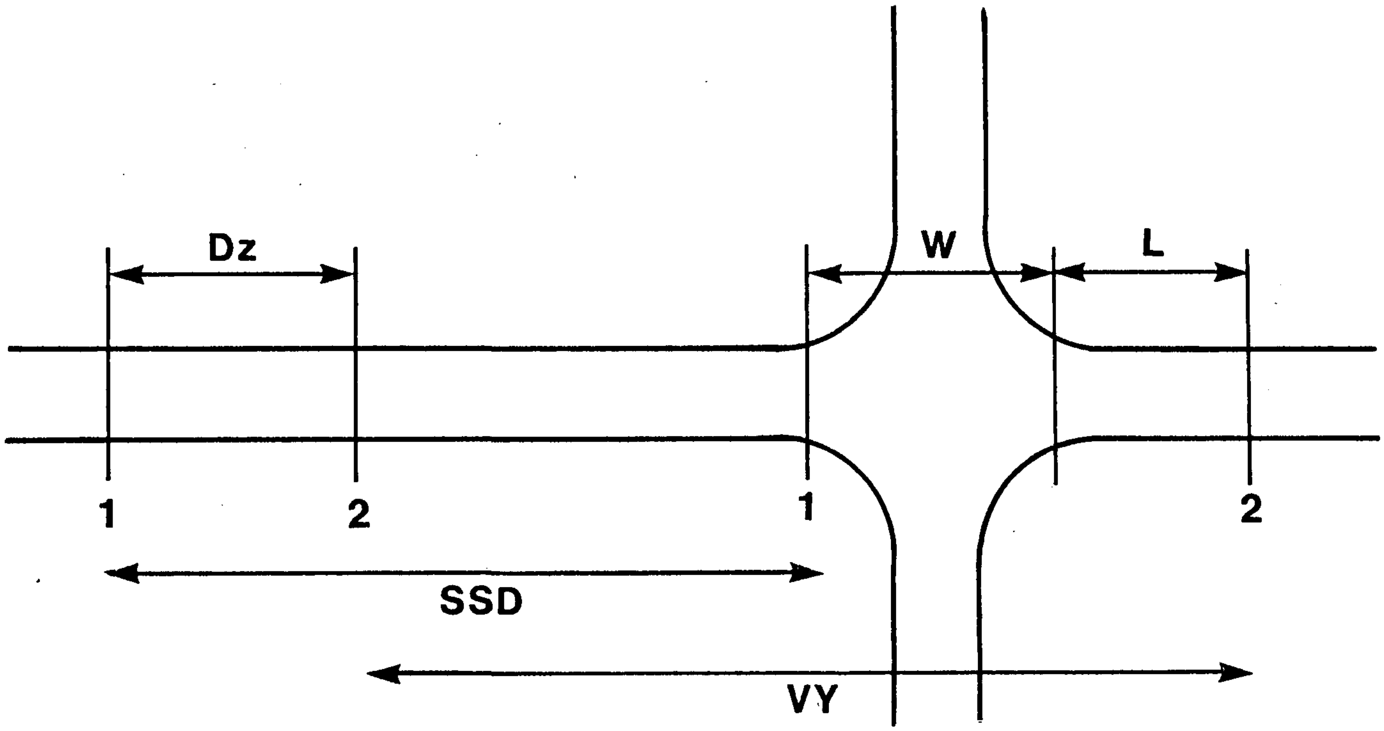


15,000 vpd

- SIGNAL



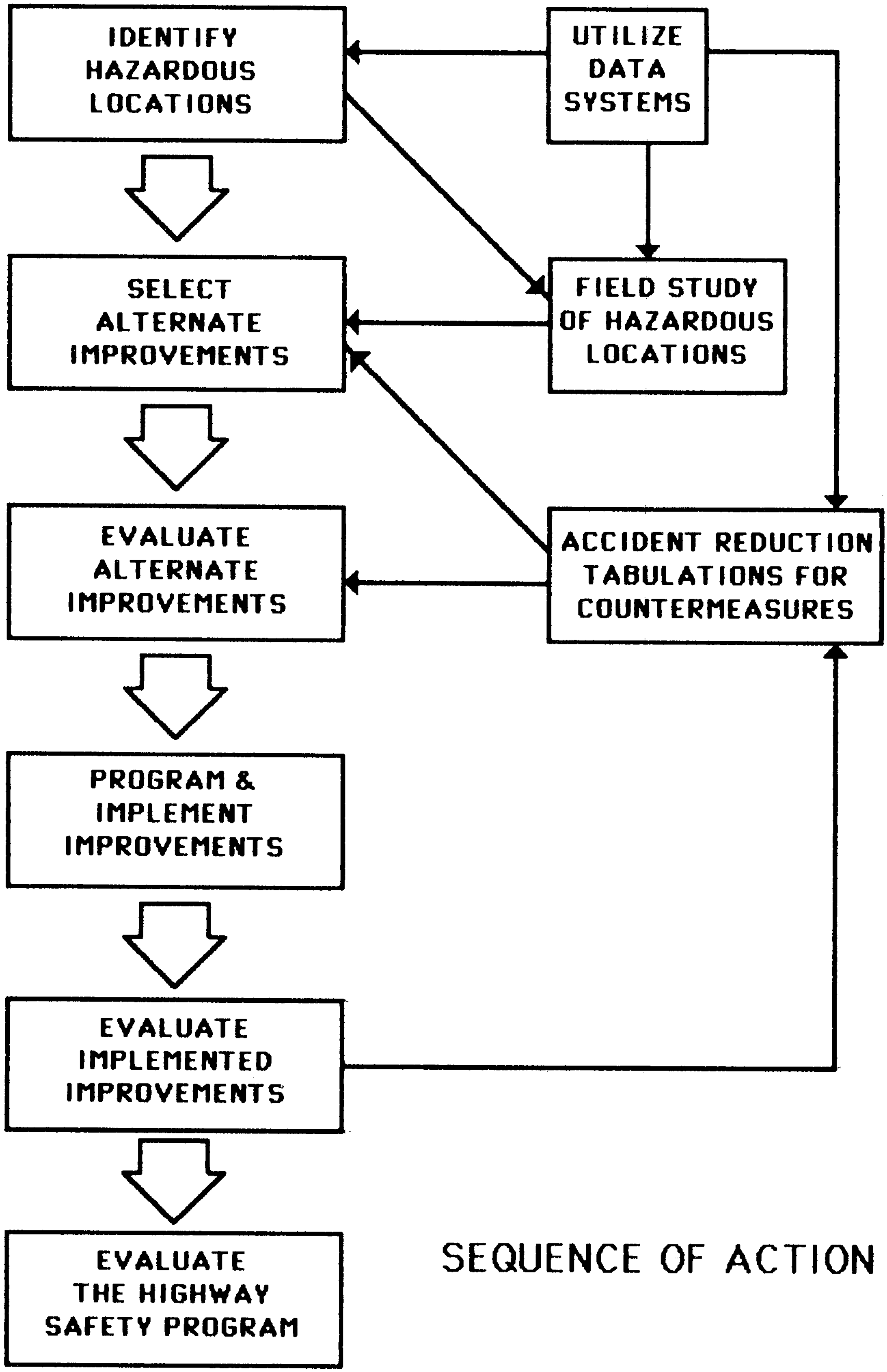
SIGHT DISTANCE CRITERIA
SIGNALIZED INTERSECTIONS



Dz = Dilemma Zone
Dz = SSD + W + L − VY

SSD = Stopping Sight Distance
W = Width of Intersection
L = Length of Vehicle
V = Velocity
Y = Duration of Yellow Light

Source: A Highway Safety and Traffic Study Program. Northwestern University. US DOT. FHWA. March, 1980.



SEQUENCE OF ACTION

INTERSECTION PROBLEM IDENTIFICATION AND IMPROVEMENTS

PROBLEM IDENTIFICATION

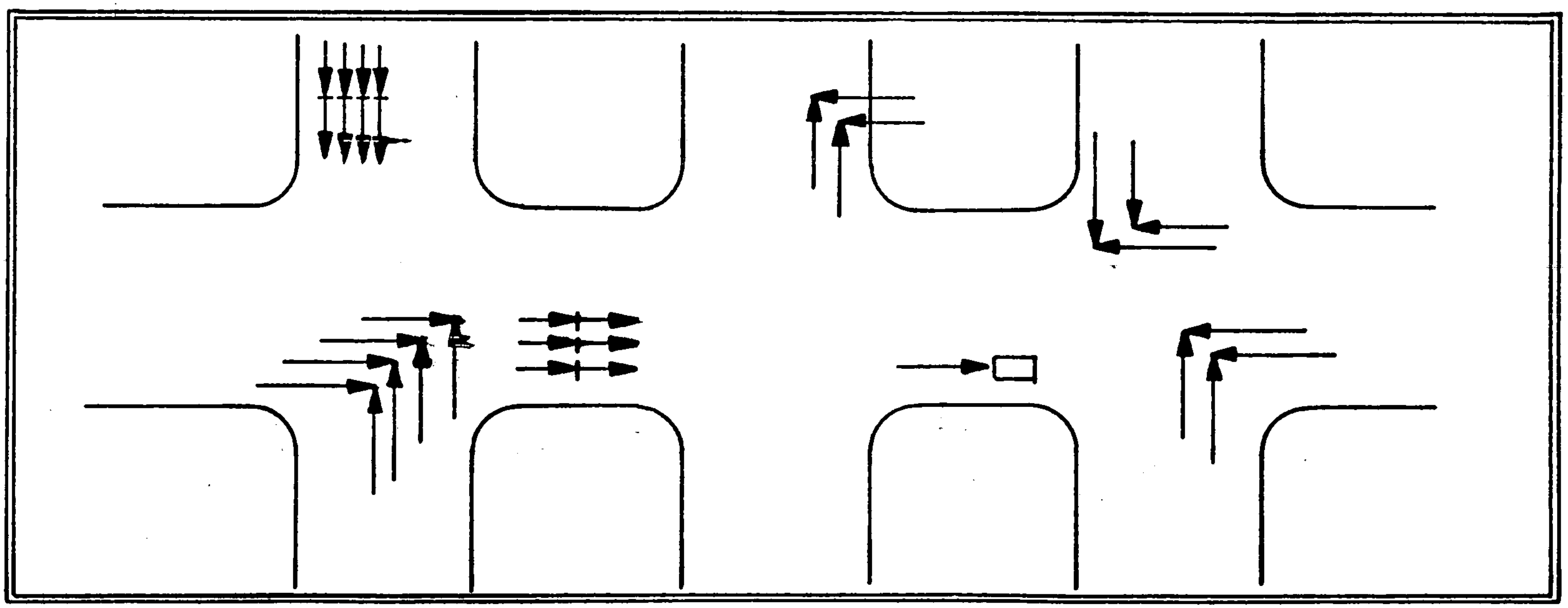
- SAFETY STUDIES
- DELAY STUDIES
- FIELD OBSERVATIONS

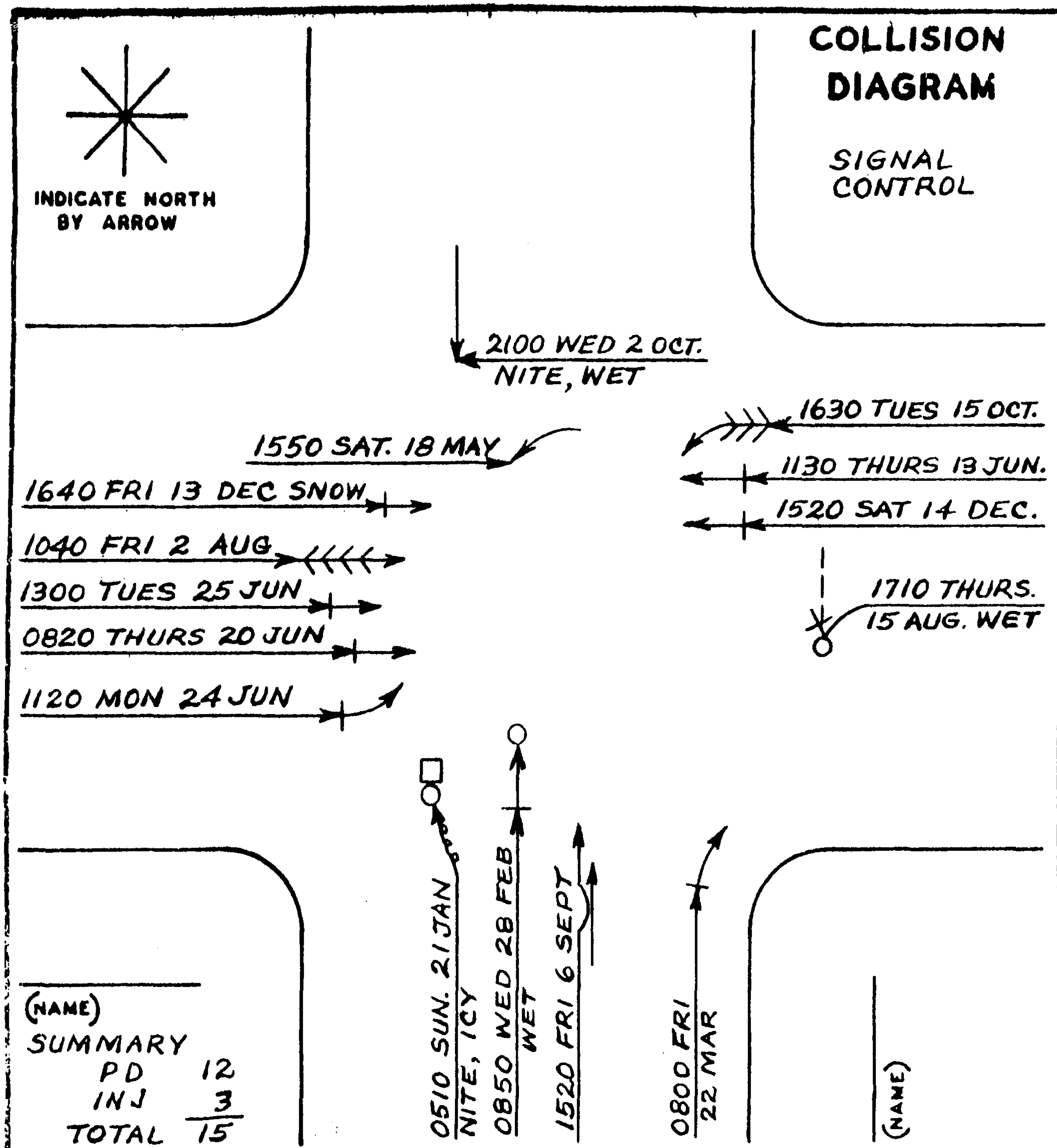
IMPROVEMENT TECHNIQUES

- REMOVAL OF PROBLEM
- SIGNING AND STRIPING
- CHANGE IN CONTROL TYPE
- CHANNELIZATION

ACCIDENT STUDIES

- TYPICAL ACCIDENT RATES
- ACCIDENT RECORD SYSTEMS
- ACCIDENT PATTERN ANALYSIS





SYMBOLS	TYPES OF COLLISIONS	SHOW FOR EACH ACCIDENT
MOVING VEHICLE	REAR END	1. DAY, DATE AND TIME.
BACKING VEHICLE	HEAD ON	2. WEATHER AND ROAD SURFACE – IF UNUSUAL CONDITION EXISTED.
NON-INVOLVED VEHICLE	SIDE SWIPE	3. NITE – IF BETWEEN DUSK AND DAWN
PEDESTRIAN	OUT OF CONTROL	
PARKED VEHICLE	LEFT TURN	
FIXED OBJECT	RIGHT ANGLE	
FATAL ACCIDENT		
INJURY ACCIDENT		

INTERSECTION ____________ AND ____________

PERIOD 1968 : FROM 1 JAN TO 31 DEC

Highway Safety Program
Documentation Record
FORM 101

Location Identification Code 5099-1.45
Date 5/10/74
Prepared by DRC

HAZARDOUS LOCATION IDENTIFICATION WORKSHEET
(One for each hazardous location)

LOCATION: State Highway 99 from milepost 1.40 to 1.50

Intersection ☐ Spot ☒ Section ☐ Section length ______

CATEGORY: Rural ☒ Urban ☐ 2-lane ☒ 4-lane Undivided ☐ Divided ☐ Freeway ☐

DESCRIPTION: Sketch on back of sheet ☐ See collision diagram ☐
No sketch or collision diagram drawn ☒

ACCIDENT EXPERIENCE:

Year	1971	'72	'73			Total
From (date)	1/1	1/1	1/1			1/1/71
To (date)	12/31	12/31	12/31			12/31/73
AADT	750	750	750			Ave= 750 veh.
Exposure	273,750	273,750	273,750			821.25
Total accidents	2	2	1			5
Fatal accidents	0	0	1			1
No. fatalities	0	0	1			1
Injury accidents	1	1	0			2
PDO accidents	1	1	0			2
Accident rate	7.3	7.3	3.6			6.09 acc/mv

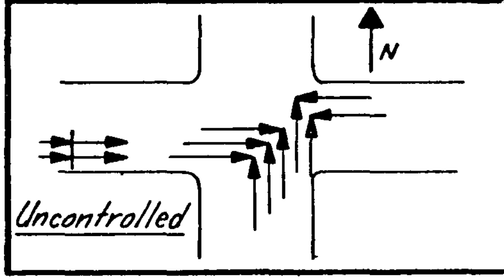
SYSTEMWIDE AVE. RATE FOR CATEGORY: 2.0 Acc/MV

CRITICAL RATE FOR LOCATION: 3.732 Acc/MV

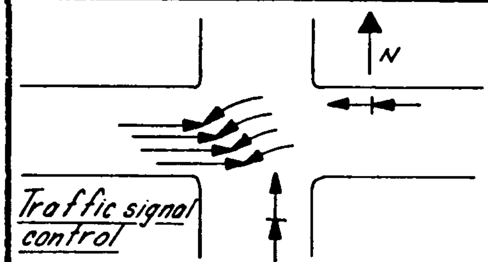
INDEX OF SEVERITY: ______

COMMENTS: ______

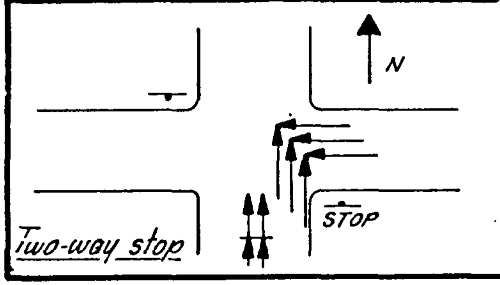
INTERSECTION ACCIDENT PATTERNS

ACCIDENT PATTERN	POSSIBLE EXPLANATION
	• Poor corner visibility at SE and/or SW • Excessive approach speeds, especially for northbound

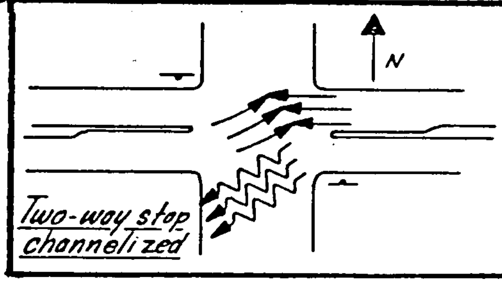
INTERSECTION ACCIDENT PATTERNS

ACCIDENT PATTERN	POSSIBLE EXPLANATION
	• Visibility for left turning drivers, east to south, is poor • Approach speeds from the west are too high

INTERSECTION ACCIDENT PATTERNS

ACCIDENT PATTERN	POSSIBLE EXPLANATION
	• Poor visibility of stop sign at SE corner • Corner visibility and location of stopline at SW corner not compatable • Excessive westbound approach speed

INTERSECTION ACCIDENT PATTERNS

ACCIDENT PATTERN	POSSIBLE EXPLANATION
	• High approach speed and stopping sight distance inadequate for westbound • Edge of pavement delineation and width inadequate at SW corner • Visibility for left-turning drivers, west to north, is poor

HUMAN + VEHICLE + ENVIRONMENTAL CAUSAL CHAINS = CRASH

c = cause   e = effect   C = last cause   E = last effect

HUMAN CAUSAL CHAIN

c: Alarm clock doesn't go off

e: Late departure for work

c: Late departure for work

e: Aggressive driving

c: Aggressive driving

e: Driver speed too fast for conditions

C: Driver speed too fast for conditions

E: Driver did not immediately comprehend danger of slower vehicle ahead around curve

VEHICLE CAUSAL CHAIN

c: Faulty inspection

e: Worn brakes not detected

C: Worn brakes

E: Increased Stopping Distance

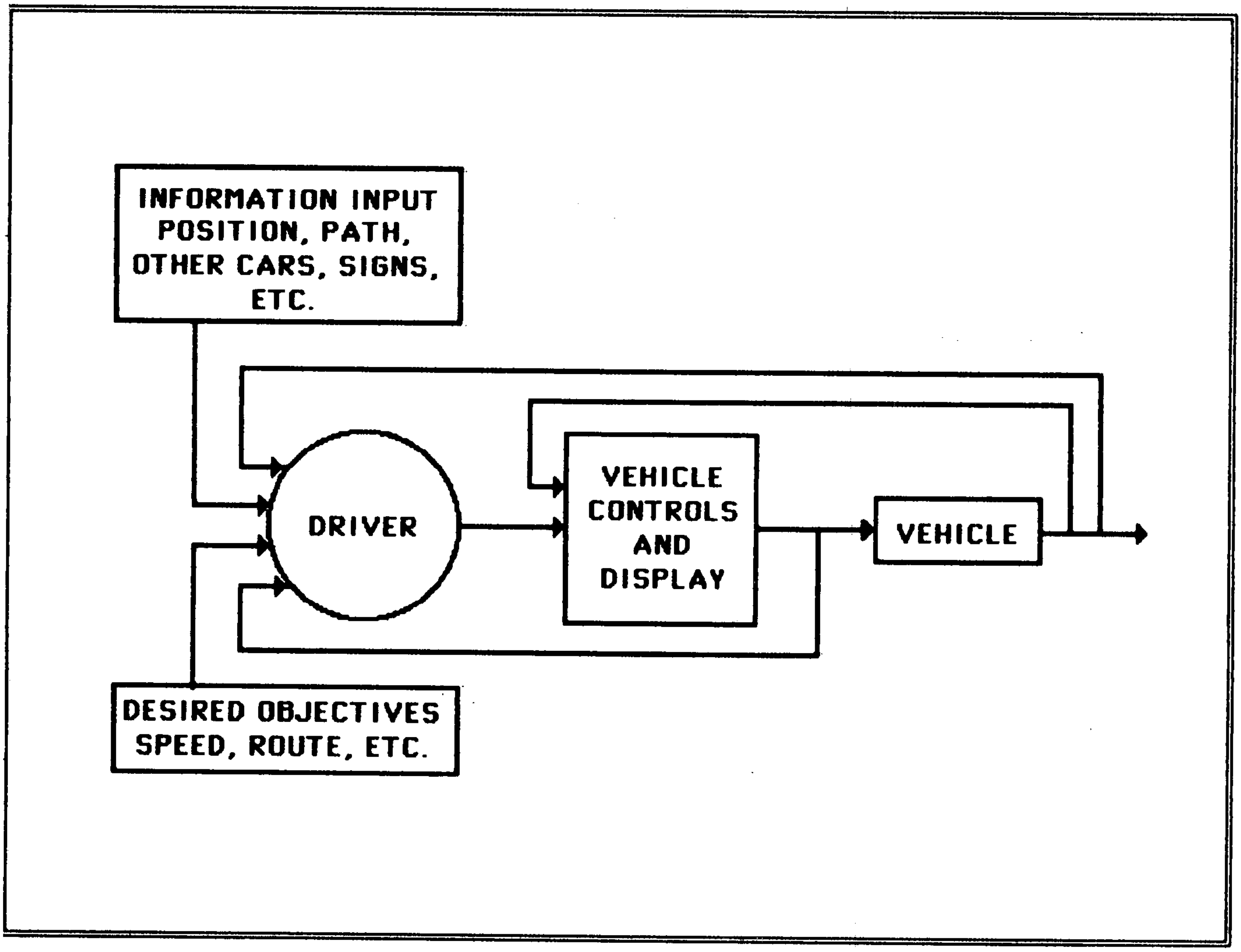
ENVIRONMENTAL CAUSAL CHAIN

c: It was raining

e: Wet roadway

C: Wet roadway

E: Lower coefficient of friction on roadway


INFORMATION INPUT
POSITION, PATH,
OTHER CARS, SIGNS,
ETC.
DRIVER
VEHICLE
CONTROLS
AND
DISPLAY
VEHICLE
DESIRED OBJECTIVES
SPEED, ROUTE, ETC.

VEHICLE HIGHWAY SAFETY FACTORS

PRE-CRASH	CONTROL SYSTEM DESIGN
	COMFORT SYSTEM DESIGN
	INFORMATION SYSTEMS DESIGN
	LAWS AND ENFORCEMENT
CRASH	OCCUPANT PROTECTION SYSTEM
	CONTROL SYSTEM DESIGN
POST-CRASH	FIRE/FUME CONTROL
	DESIGN FOR EASE OF EMERGENCY ACCESS
	REPAIR CAPABILITIES

ATTRIBUTES OF THE VEHICLE

	RECOGNIZABILITY
	RECOGNIZABILITY AIDS
	HEADLIGHTS
	SENSORY AIDS
RECOGNITION	VIEW OBSTRUCTIONS
	DISTRACTIONS
	INSTRUMENTS
	SIGNALLING DEVICES
	CONTROL FEEDBACK
	COMFORT
DECISION	SYMBOLISM
	AUTOMATIC CONTROLS
	CONTROL ARRANGEMENT, FUNCTION
	OPERATING SPACE
PERFORMANCE	DIMENSIONS, WEIGHT
	PERFORMANCE
	STABILITY

METHODS FOR CODING LIGHT SIGNALS

NUMBER

LOCATION

INTENSITY

COLOR

FLASH RATE

SHAPE

AREA

CRITERIA FOR DESIGN OF SIGNAL SYSTEMS

1. EASILY UNDERSTOOD
2. FAIL - SAFE
3. AUTOMATIC
4. COMPATIBLE WITH PRESENT SYSTEMS
5. COST EFFECTIVE

CRITERIA FOR DESIGN OF SIGNAL SYSTEMS

1. EASILY UNDERSTOOD
2. FAIL - SAFE
3. AUTOMATIC
4. COMPATIBLE WITH PRESENT SYSTEMS
5. COST EFFECTIVE

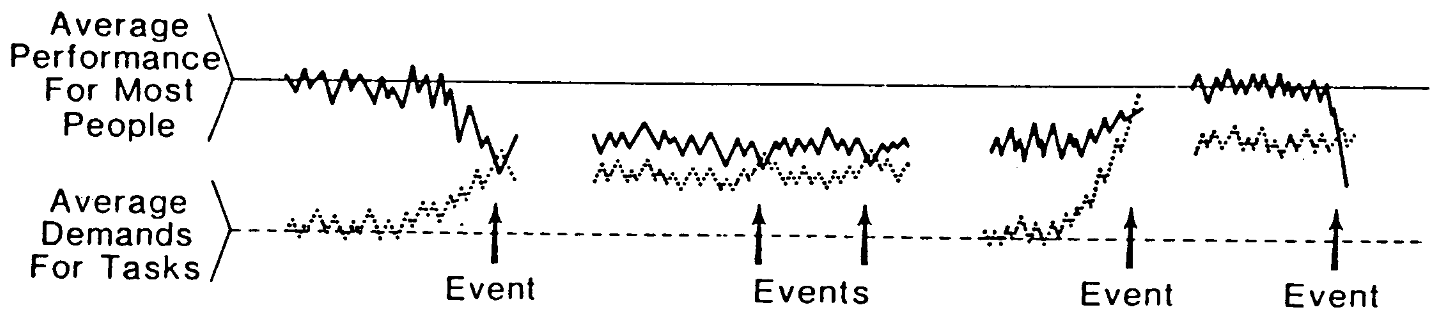
MESSAGES CURRENTLY BEING TRANSMITTED

1. PRESENCE (FRONT, TAIL, SIDEMARKER)
2. BRAKE
3. TURN
4. BACK-UP
5. DISTRESS

ATTRIBUTES OF DRIVERS

RECOGNITION	KNOWLEDGE OBSERVING HABITS SENSORY ABILITIES SIGNALING HABITS RECOGNIZABILITY (MAINLY PEDESTRIANS)
DECISION	INTELLIGENCE, JUDGEMENT ATTITUDES EMOTIONAL STABILITY ALERTNESS, CONCENTRATION
PERFORMANCE	OPERATING SKILL, HABITS SIZE,WEIGHT,STRENGTH FREEDOM OF MOVEMENT

Page 62,63



A. Performance decreases suddenly as demands increase suddenly.

B. Performance and task demands both differ consistantly from average.

C. Performance or task demand suddenly differs from average while it's correspondent consistantly differs from average.

Pre-Injury Events Attributable Both to Low Human Performance and to High Task Demand.

Source: Reprinted by permission of the publisher from: Injury Control: A Guide to the Causes and Prevention of Trauma, by Julian A Waller (Lexington, Mass.: Lexington Books, DC Heath and Co., 1985, D.C. Heath and Company)

HUMAN HIGHWAY SAFETY FACTORS

PRE-CRASH	KNOWLEDGE
	BASIC ABILITIES
	SKILL
	MOTIVES AND ATTITUDES
CRASH	TRAINING
POST CRASH	EMERGENCY MEDICAL SERVICES
	INCIDENT DETECTION AND ASSISTANCE

PARTS OF THE DRIVER PERSONALITY

NATURAL ABILITIES - WHAT THE DRIVER HAS TO START WITH

LEARNED CAPABILITIES - ACQUIRED BY STUDY AND PRACTICE

MOTIVES AND ATTITUDES - WHY THE DRIVER BEHAVES IN A PARTICULAR WAY

CIRCUMSTANCES THAT MAY AFFECT THE DRIVER

POISONS

ALCOHOL NARCOTICS CARBON MONOXIDE

PERSCRIPTION MEDICINE

INSULIN BARBITURATES ANTIHISTAMINES

ILLNESS

HEART AILMENTS EPILEPSY DIABETES

DROWSINESS

EXHAUSTION TENSION MONOTONY FATIQUE

COMFORT

TEMPERATURE NOISE HUNGER

NATIONAL PRIORITY PROGRAM AREAS

ALCOHOL COUNTERMEASURES

POLICE TRAFFIC SERVICES

OCCUPANT PROTECTION

TRAFFIC RECORDS

EMERGENCY MEDICAL SERVICES

SAFETY CONSTRUCTION AND OPERATIONAL IMPROVEMENTS

FEDERAL HIGHWAY SAFETY PROGRAM STANDARDS

1. Periodic motor vehicle inspection
2. Motor vehicle registration
3. Motorcycle safety
4. Driver education
5. Driver licensing
6. Codes and laws
7. Traffic courts
8. Alcohol in relation to highway safety
9. Identification & surveillance of accident locations
10. Traffic records
11. Emergency medical services
12. Highway design, construction & maintenance
13. Traffic control devices
14. Pedestrian safety
15. Police traffic services
16. Debris hazard control and cleanup
17. Pupil transportation safety
18. Accident investigation and reporting

ESTIMATES OF RESTRAINT SYSTEM EFFECTIVENESS
ALL ACCIDENT DIRECTIONS
PERCENTS

	FATAL	MODERATE TO CRITICAL	MINOR
MANUAL LAP BELTS	30 - 40	25 - 35	10
MANUAL LAP AND SHOULDER	40 - 50	45 - 55	10
AUTOMATIC BELTS	35 - 50	40 - 55	10
AIRBAGS ALONE	20 - 40	25 - 45	10
AIRBAGS AND LAP BELTS	40 - 50	45 - 55	10
AIRBAGS AND LAP/SHOULDER	45 - 55	50 - 60	10

FEDERAL REGISTER, 49(138):28985, JULY 17, 1984

Effectiveness

Percent Reduction in a Specific Injury Level, Due to a Countermeasure

REAL WORLD EFFECTIVENESS	=	100 PERCENT USE EFFECTIVENESS	X	USAGE RATE

SAFETY BELT EFFECTIVENESS :
3 KINDS OF EVIDENCE

- LABORTORY CRASH TESTS
- REAL WORLD CRASH COMPARISONS
  (Users vs. Non-Users)
- CRASH EXPERIENCE OF FOREIGN COUNTRIES
  (With Belt Laws)

CITIES IN 19-CITY SURVEY (USAGE RATES)

(1981 - 82)

New England

Boston (12.1%)
Providence (9.3%)

Mid-Atlantic

New York (8.9%)
Baltimore (11.8%)
Pittsburg (10.4%)

Southeast

Atlanta (12.6%)
Miami (7.9%)
Birmingham (8.4%)
New Orleans (6.5%)

Southwest

Houston (9.1%)
Dallas (6.7%)

North Central

Minneapolis (16.1%)
Chicago (7.3%)
Fargo (5.9%)

West

Seattle (21.0%)
San Francisco (15.2%)
San Diego (15.2%)
Phoenix (13.9%)
Los Angeles (12.2%)

Some Factors Associated With Usage Rates

- Education Level
- Driver Education
- Socio Economic Level
- Perception of Danger
- Comfort and Convenience
- Request to Wear Belts
- Health Orientation

Reasons Given For Non-Use

- Inconvenience
- Discomfort
- Laziness
- Fear of Entrapment
- Forgetfulness

Likely Major Reasons for Non-Use

- Perceived Low Probability of Crash
- Lack of Understanding of Dynamics of Crash
- Failure of Acquire Habit Early in Life

19 CITY SAFETY BELT AND CHILD SAFETY SEAT OBSERVED USAGE

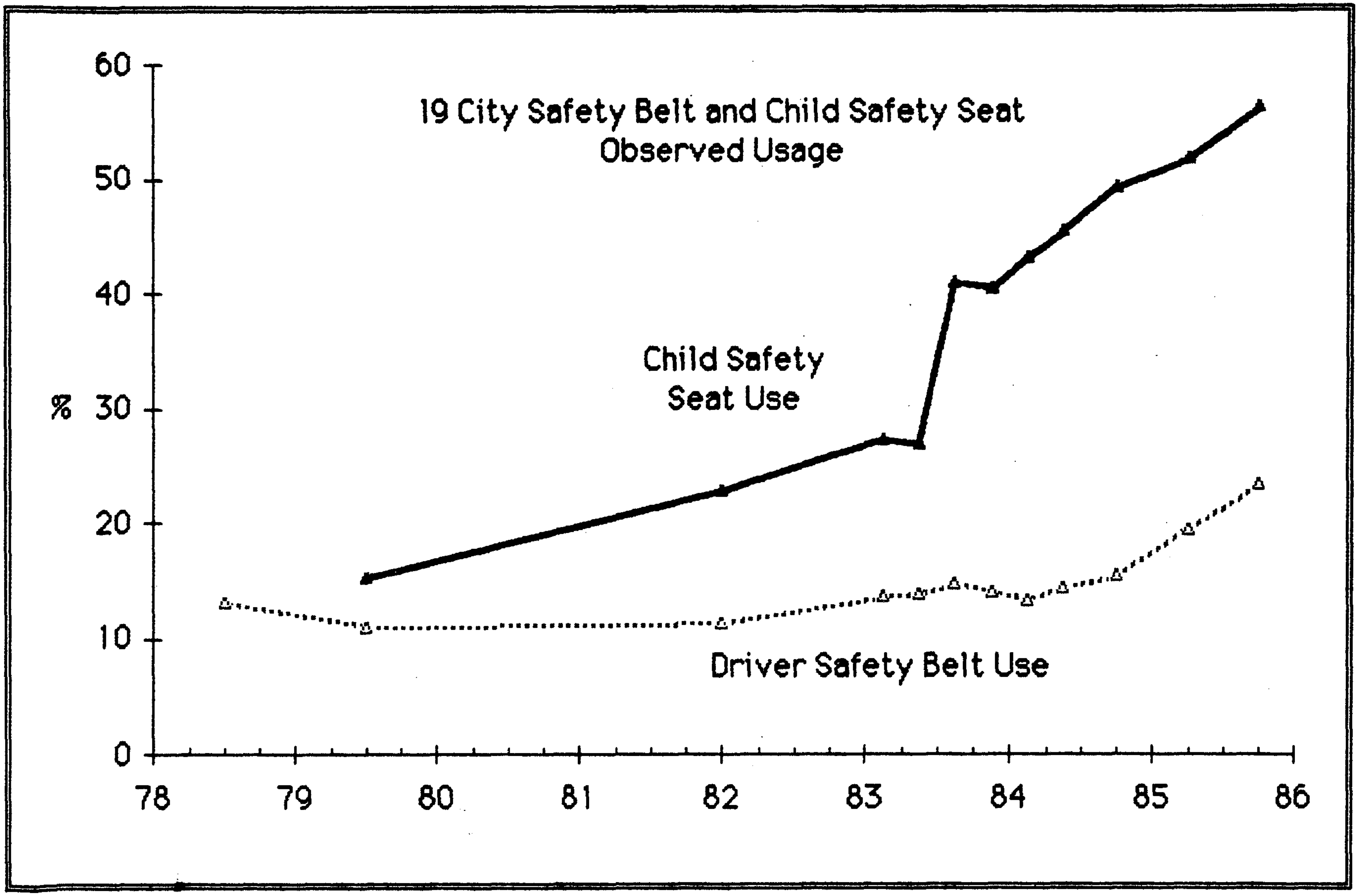
NO DATA COLLECTED IN 1980

CHILDREN AGE 4 AND UNDER

FOR THE DATA COLLECTED DURING THE LAST 6 MONTHS OF 1985:

DRIVER SAFETY BELT USAGE	23.3%
EXCLUDING NEW YORK AND CHICAGO (MANDATORY USAGE)	
DRIVER SAFETY BELT USAGE	21.6%
CHILD SAFETY SEAT USAGE	56.2%
UNDER 1 YEAR OF AGE	65.9%
1 TO 4 YEARS OF AGE	55.1%

NHTSA, 19 CITY SURVEY OF RESTRAINT USAGE, JANUARY 1986


19 City Safety Belt and Child Safety Seat
Observed Usage
Child Safety
Seat Use
Driver Safety Belt Use
%
60
50
40
30
20
10
0
78
79
80
81
82
83
84
85
86

PERCENT OF CHILDREN IN	1979	1982	1984
CHILD SEATS	15	32	46
LAP BELT ONLY	3	6	14
CHILD SEATS OR LAP BELTS	18	38	60
NUMBER OF STATES WITH SEAT BELT LAWS IN EFFECT AT END OF THE YEAR	1	13	46

Source: Kahane, DOT HS 806 889, 1986

PERCENT OF ALL CHILD PASSENGERS IN	1979	1982	1984
CORRECTLY USED SAFETY SEATS	3	8	18
PARTIALLY MISUSED SEATS	5	14	18
GROSSLY MISUSED SEATS/ HOME CARRIERS	7	10	10
(NOT IN SAFETY SEAT)	85	68	54

Source: Kahane, DOT HS 806 889, 1986

AGE OF CHILD	PERCENT USING SAFETY SEATS IN 1984
0	68
1	62
2	51
3	27
4	17

Source: Kahane, DOT HS 806 889, 1986

OBSERVED MISUSE, 1984

INFANT SAFETY SEATS	59.3%
CONVERTIBLE SEATS	66.3%
BOOSTER SEATS	61.5%

Source: Cynecki and Goryl, DOT HS 806 676, 1984

OVERALL AVERAGE EFFECTIVENESS OF SAFETY SEATS AND OTHER SAFETY MEASURES FOR CHILD PASSENGERS AGED 0-4, 1984, BASED ON OBSERVED USAGE

PERCENTAGE REDUCTION OF:	FATALITIES	HOSPITAL-IZATIONS	NONSERIOUS INJURIES
SAFETY SEATS	46	46	37
LAP BELT ONLY	33	50	30
UNRESTRAINED: BACKSEAT VERSUS FRONTSEAT	27	27	25
SEAT USERS: BACKSEAT VERSUS FRONTSEAT	20	20	20

Source: Kahane, DOT HS 806 889, 1986

PRE–LEGISLATION USAGE RATES IN FOREIGN NATIONS

– Usage Rates In The 24-40 Percent Range

AUSTRALIA	28%	NETHERLANDS	26%
CANADA	24%	NEW ZEALAND	33%
DENMARK	25%	NORWAY	36%
FINLAND	40%	SWEDEN	36%
FRANCE	24%	SWITZERLAND	32%
GREAT BRITAN	33%	WEST GERMANY	34%

TRB REPORT RECOMMENDATIONS (1980)

(1) ENACT CHILD RESTRAINT LAWS

(2) ISSUE GOVERNMENT BELT USE REQUIREMENTS

(3) DEVELOP MORE EFFECTIVE STATE 402 PROGRAMS

(4) IDENTIFY ECONOMIC COSTS OF BELT NON-USE

(5) ENCOURAGE EMPLOYER BELT USE POLICIES

(6) INDENTIFY CRASH DEATHS AND INJURIES AS PUBLIC HEALTH PROBLEM

NHTSA REPORT RECOMMENDATIONS (1981)

- AIM AT THE "MALLEABLE MIDDLE"
- AVOID STATISTICAL THEMES
- INCREASE FEELINGS OF DRIVER RESPONSIBILITY
- EMPHASIZE ECONOMIC BENEFITS
- EMPHASIZE AVOIDANCE OF:
    - INJURY AND HOSPITALIZATION
    - DEATH
    - SECOND (HUMAN) COLLISION
- TARGET MANY DEMOGRAPHIC GROUPS
- DISPELL "FEAR OF ENTRAPMENT" (WITHOUT IMPLANTING IT UPON THOSE WHO DO NOT HAVE IT.)

SUMMARY OF RECOMMENDATIONS : (1982)
(EFFECTIVENESS AND EFFICIENCY REPORT)

(1) MANY GROUPS AND ORGANIZATIONS MUST BE INVOLVED (NETWORKED)

(2) CRASH DEATHS AND INJURIES MUST BE MADE A PUBLIC HEALTH ISSUE

(3) CHILD PASSENGER PROTECTION MUST BE SUPPORTED

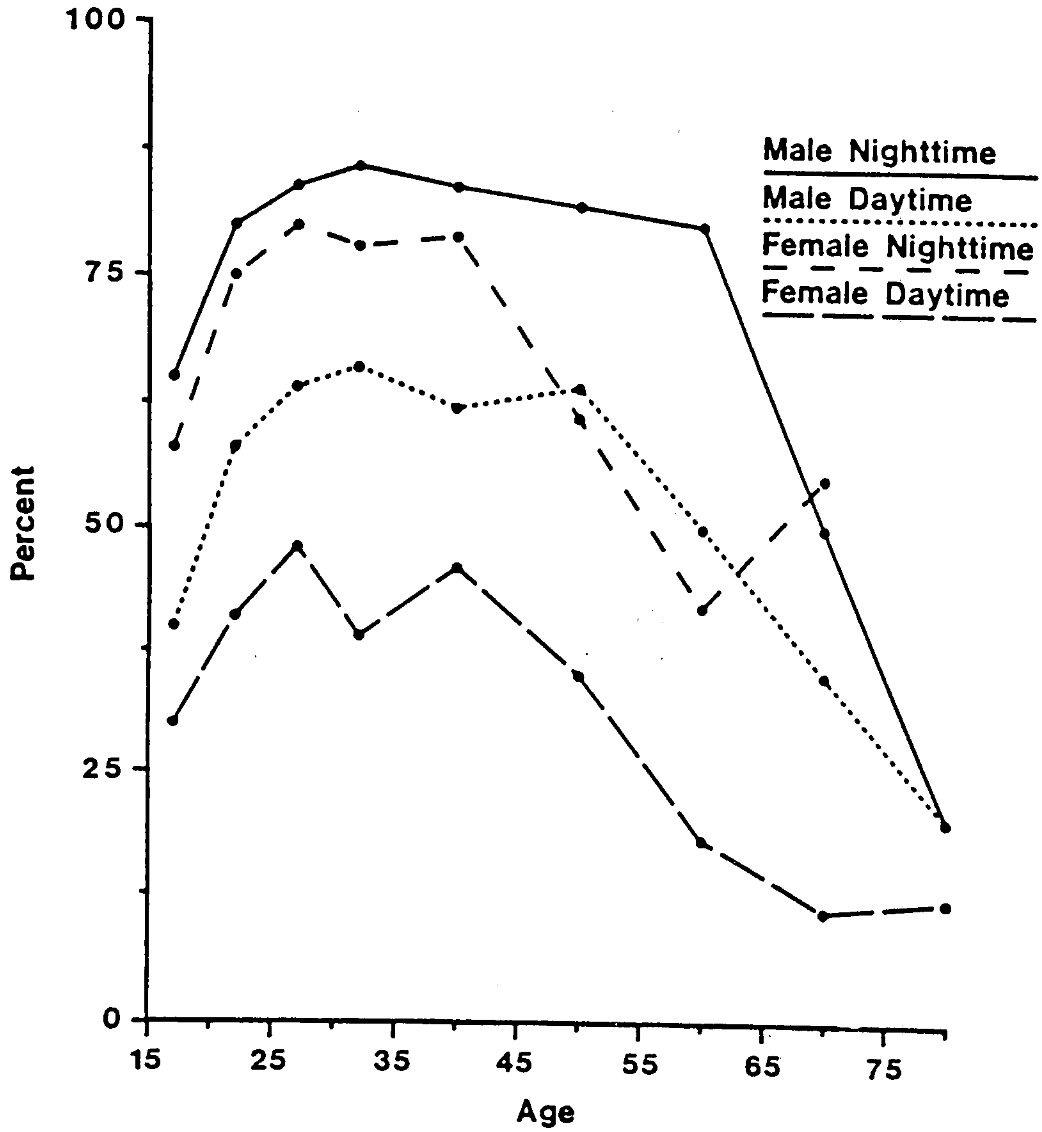
(4) ECONOMIC COST OF NON-BELT USE MUST BE PRESENTED

(5) INCENTIVES SHOULD BE MADE GREATER USE OF

(6) COMPREHENSIVE PROGRAMS ARE NEEDED

(7) MANY TARGET GROUPS MUST BE REACHED

(8) A VOLUNTARY USE PROGRAM MUST PRECEED LEGISLATION



Percent of Fatally Injured Passenger Vehicle Drivers in Single-Vehicle Crashes with Blood Alcohol Concentrations At or Above 0.10 Percent by Age, Sex, and Time of Crash, 1979-1981

Source: Reprinted by permission of the publisher, from: The Injury Fact Book by Susan P. Baker, Brian O'Neill, Ronald S. Karpf. (Lexington, Mass.: Lexington Books, D.C. Heath and Co., 1984, D.C. Heath and Company)

ALCOHOL NEEDED TO REACH CERTAIN BACs

0.05%	A 160 LB DRINKER DRINKING 1 OUNCE OF 86 PROOF ALCOHOL PER DRINK NEEDS	4 DRINKS IN 2 HOURS
0.01%	NEEDS	7 DRINKS IN 2 HOURS
0.15%	NEEDS	9 - 10 DRINKS IN 2 HOURS

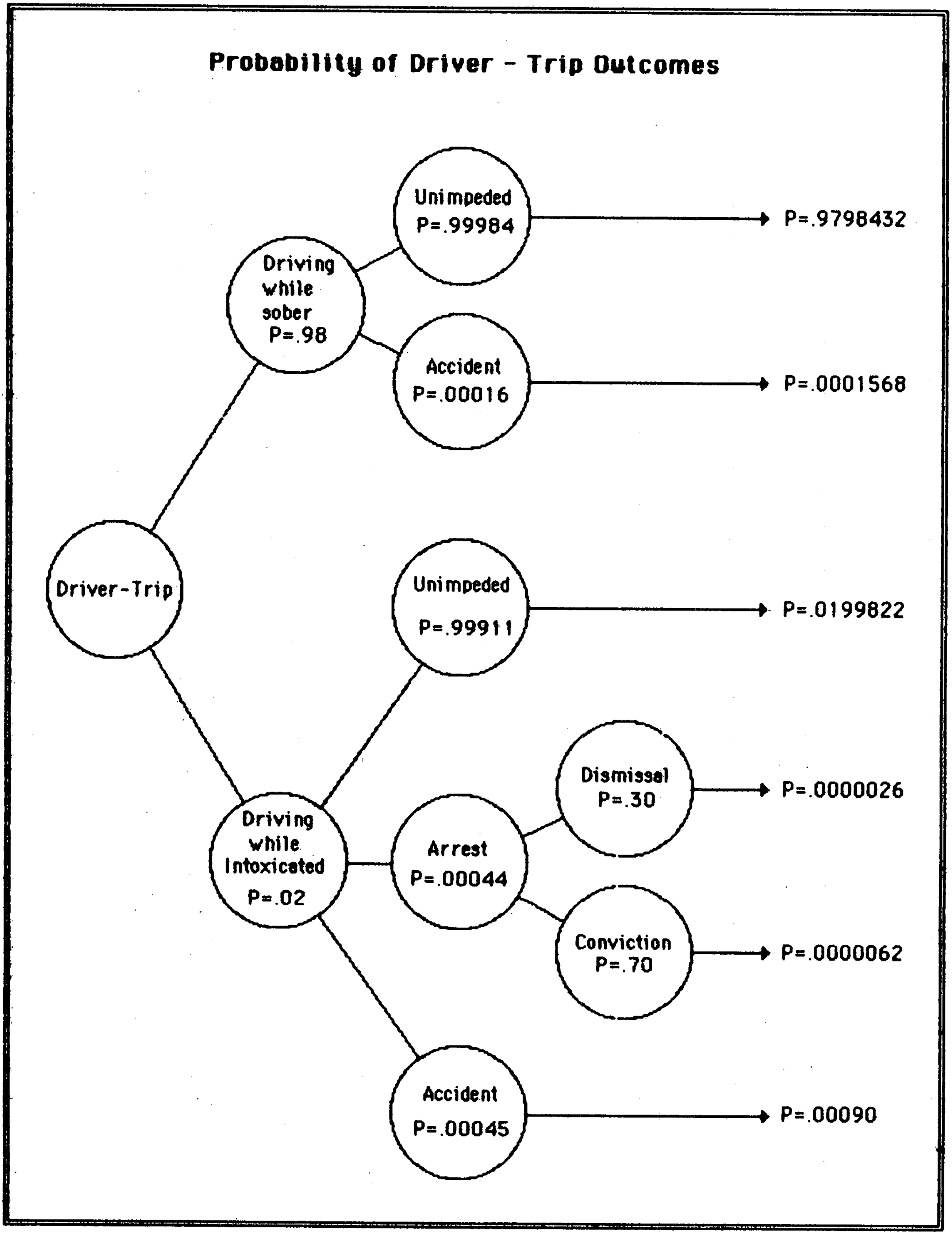
KINDS OF IMPAIRMENT PREDICTED AT SPECIFIC BACs

0.00 - 0.04%	IMPAIRMENT - NOT SEVERE
.005 - .009%	ABILITY AND JUDGEMENT IMPAIRED
0.10 - 0.14%	ABILITY AND JUDGEMENT NOTABLY IMPAIRED IN EVERYONE
0.15% +	ABILITY AND JUDGEMENT SERIOUSLY IMPAIRED IN EVERYONE

ALCOHOL NEEDED TO REACH CERTAIN BACs

THE NUMBER OF DRINKS IN A 2 HOUR PERIOD NEEDED BY A 160 LB DRINKER DRINKING 1 OUNCE OF 86 PROOF ALCOHOL PER DRINK TO REACH THE FOLLOWING BAC LEVELS:

0.05%	4 DRINKS
0.10%	7 DRINKS
0.15%	9 - 10 DRINKS



Source: Summers, L. and Harris, D. DOT HS 803 582. 1978, p. 10.

DEFICIENCIES IN THE PRESENT METHODS OF CONTROLLING THE PROBLEM DRINKING DRIVER

INADEQUATE IDENTIFICATION OF DRINKING DRIVERS

LIMITED AVAILABILITY OF CHEMICAL TESTS

RESTRICTIONS ON USE OF CHEMICAL TEST

FAILURES TO PROSECUTE DWI DRIVERS

INEFFECTIVE PENALITIES FOR DWI

INADEQUATE TREATMENT PROGRAMS FOR PROBLEM DRINKERS

LAX ENFORCEMENT OF DRIVING SUSPENSIONS

LITTLE IS KNOWN ABOUT THE EFFECTIVENESS OF TRAFFIC-LAW SANCTIONS

SANCTIONS	IMPACT	RESEARCH FINDINGS
EFFECT OF GRADUATING SANCTION SEVERITY BY NUMBER OF PRIOR CONVIC-TIONS	UNKNOWN	THERE IS NO INFORMATION ON THE EFFECTIVENESS OF THIS PROCEDURE.
ALTERNATIVE SERVICE	UNKNOWN	THERE IS NO INFORMATION ON THE EFFECTIVENESS OF THIS PROCEDURE IN REDUCING SUBSEQUENT CRASHES. IT IS A POSITIVE SANCTION FOR THE INDIVIDUAL AND COMMUNITY.

SOURCE: JOINT DEPARTMENT OF DEFENSE/DEPARTMENT OF TRANSPORTATION WORKSHOP ON ALCOHOL, OCCUPANT PROTECTION AND MOTORCYCLE SAFETY, 1983.

LITTLE IS KNOWN ABOUT THE EFFECTIVENESS OF TRAFFIC-LAW SANCTIONS

SANCTIONS	IMPACT	RESEARCH FINDINGS
COURT APPEARANCE ONLY	UNCERTAIN	A LIMITED STUDY DEMONSTRATED THAT FACE TO FACE CONTACT WITH A JUDGE DOES NOT NECESSARILY RESULT IN LOWER RECIVIDISM THAN FOR NON APPEARING OFFENDERS.
MONETARY FINE	UNCERTAIN	THERE ARE NO REPORTED STUDIES IN WHICH THE AMOUNT OF FINE WAS MANIPULATED EXPERIMENTALLY. THE FEW EX-POST FACTO STUDIES ARE NOT VERY INFORMATIVE. THERE IS SOME EVIDENCE, HOWEVER, THAT HEAVY FINES (IN EXCESS OF S12Ø) ARE ASSOCIATED WITH SUBSEQUENT DECREASES IN ACCIDENT FREQUENCY.

SOURCE: JOINT DEPARTMENT OF DEFENSE/DEPARTMENT OF TRANSPORTATION WORKSHOP ON ALCOHOL, OCCUPANT PROTECTION AND MOTORCYCLE SAFETY, 1983.

LITTLE IS KNOWN ABOUT THE EFFECTIVENESS OF TRAFFIC-LAW SANCTIONS

SANCTIONS	IMPACT	RESEARCH FINDINGS
COURT PROBATION AND SUSPENDED SENTENCE	UNKNOWN	LITTLE/NO EVIDENCE HAS BEEN GATHERED ON THE EFFECTIVENESS OF JUDICIAL PROBATION AND SENTENCE SUSPENSION.
DRINKING-DRIVER TREATMENT PROGRAMS	UNCERTAIN	BASED ON EARLY ASAP RESULTS (1973), REHABILITATIVE EFFORTS FOR DRINKING DRIVERS HAVE NOT BEEN PROVEN EFFECTIVE. HOWEVER, POOR EVALUATION DESIGN IN MANY OF THE ASAP'S PRECLUDED VALID SCIENTIFIC CONCLUSIONS BEING MADE ON THE INITIAL DATA.

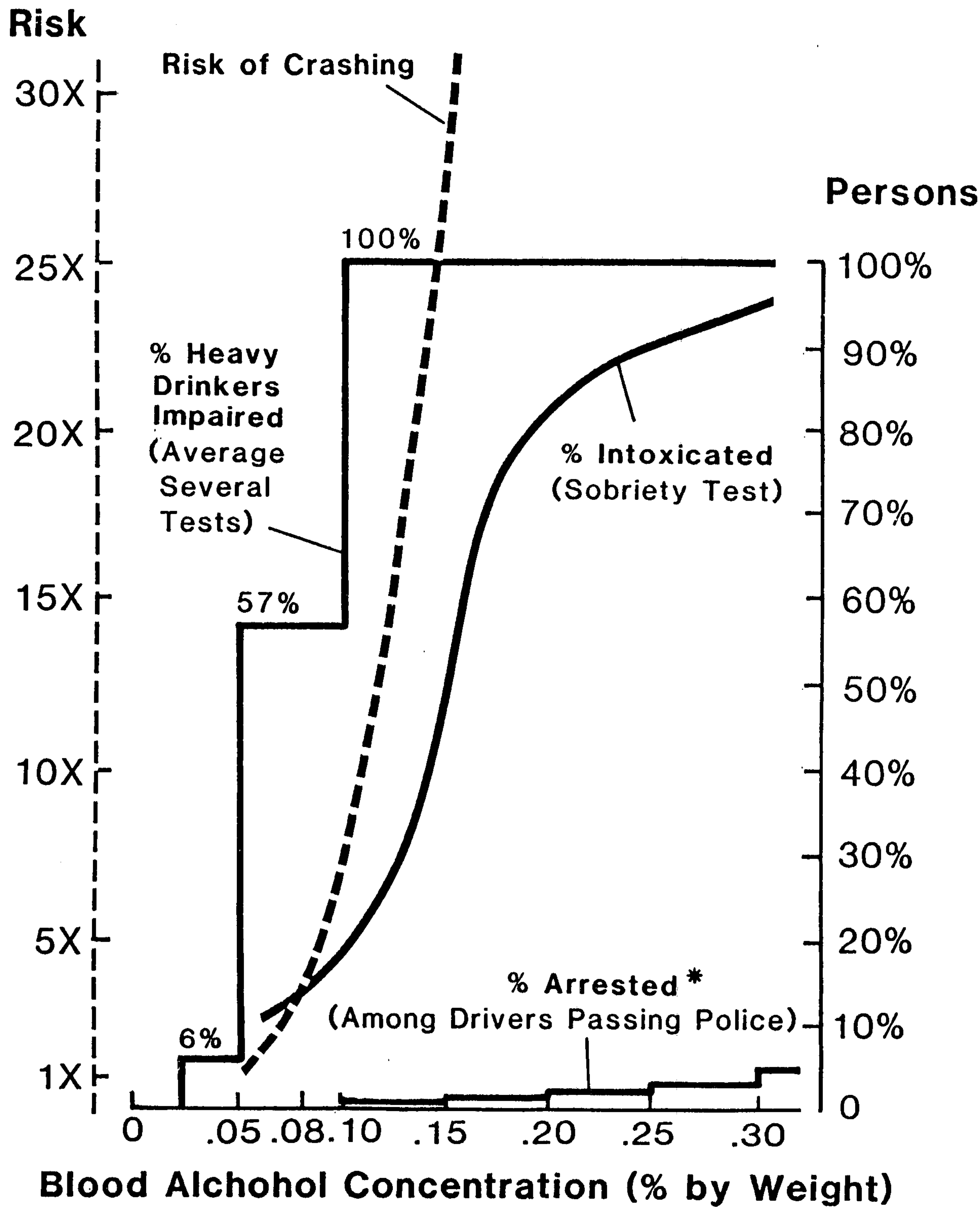
SOURCE: JOINT DEPARTMENT OF DEFENSE/DEPARTMENT OF TRANSPORTATION WORKSHOP ON ALCOHOL, OCCUPANT PROTECTION AND MOTORCYCLE SAFETY, 1983.

LITTLE IS KNOWN ABOUT THE EFFECTIVENESS OF TRAFFIC-LAW SANCTIONS

SANCTIONS	IMPACT	RESEARCH FINDINGS
RESTRICTED OCCUPATION-LICENSE	UNCERTAIN	FINDINGS OF THE LIMITED RESEARCH HAVE NOT BEEN ENTIRELY CONSISTENT. THE RESTRICTED LICENSE IS VIOLATED PROBABLY AS OFTEN AS LICENSE SUSPENSION. RESTRICTED DRINKING, DRIVING OFFENDERS HAVE BEEN FOUND TO HAVE MORE SUBSEQUENT ACCIDENTS THAN REVOKED DRINKING DRIVERS, BUT NOT MORE THAN THE GENERAL DRIVING POPULATION.
TRAFFIC SCHOOLS AND GROUP DRIVER IMPROVEMENT MEETINGS	UNCERTAIN	THERE IS REASONABLY PERSUASIVE EVIDENCE THAT SOME GROUP TRAFFIC SAFETY MEETINGS ARE EFFECTIVE IN REDUCING ACCIDENTS AND VIOLATIONS, ALTHOUGH NOT ALL AUTHORITIES AGREE.

SOURCE: JOINT DEPARTMENT OF DEFENSE/DEPARTMENT OF TRANSPORATATION WORKSHOP ON ALCOHOL, OCCUPANT PROTECTION AND MOTORCYCLE SAFETY, 1983.

DISCREPANCY BETWEEN DRIVER IMPAIRMENT ANI CRASH RISK AND THE ABILITY OF POLICE TO IDENTIFY IMPAIRED DRIVERS



* Special training can increase this by only 12% of values

Source: compiled by Julian Waller, University of Vermont, College of Medicine

REQUEST FOR FEEDBACK TO
The DOT Program Of University Research

Report No. DOT/OST/P-34/86-050 **Report Title:** A Course on Motor Vehicle Trauma: Instructor's Guide - Final Report Users Manual

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