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ABSTRACT

In order to determine the effectiveness of improved information dissemination and assessment techniques in reducing highway accidents, a set of seven targeted driver license manuals and tests were developed for the following groups of drivers: new drivers, youthful drivers, renewal applicants, older drivers, traffic violators, accident repeaters, and drinking drivers. The contents of the manuals and tests were based upon an analysis of critical information requirements for each target group and an assessment of existing information deficiencies of drivers relative to these requirements. The manuals and tests were administered to a sample of 30,000 drivers to determine their effectiveness in leading to acquisition, retention, and application of safe driving information. The amount of information acquired showed knowledge gains ranging between 20% and 30% for all target groups except the traffic violator group, which showed an 11% gain. A retention test administered to the new driver and renewal groups after a five-month interval showed a one-half to one-third information loss. The older driver group showed a slight gain. In addition to the manuals, a one-hour audiovisual presentation of the manual's contents was developed and yielded an information gain of 15% and 20% respectively among reading-disabled and mentally retarded high school students. (A bibliography, data tables, and individual test-item statistics are appended. Volume I, a 48-page summary of the 200-page final report, is available separately--CE 014 870.) (Author/JT)

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SAFE DRIVING KNOWLEDGE DISSEMINATION AND TESTING TECHNIQUES
Volume II: Final Report

Contract No. DOT-HS-4-00817

May 1977

Final Report

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
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16. Abstract

In order to determine the effectiveness of improved information dissemination and assessment techniques in reducing highway accidents, a set of seven targeted driver license manuals and tests were developed for the following groups of drivers: New Drivers, Youthful Drivers, Renewal Applicants, Older Drivers, Traffic Violators, Accident Repeaters, and Drinking Drivers. The contents of the manuals and tests were based upon an anlaysis of critical information requirements for each target group and an assessment of existing information deficiencies of drivers relative to these requirements. The manuals and tests were administered to a sample of 30,000 drivers, primarily from the State of Virginia, in order to determine their effectiveness in leading to acquisition, retention, and application of safe driving information. The assessment of information acquisition evidenced knowledge gains ranging between 20% and 33% for all target groups except the Traffic Violator group which showed only an 11% gain. A retention test administered to the New Driver and Renewal group after a five-month interval showed a 1/2 to 1/3 information loss. The Older Driver group showed a slight gain. The accident and violation records of drivers in all groups will be compared with those of a randomly selected control group of equal size over 12, 18 and 24 month intervals. In addition to the manuals, a one-hour audiovisual presentation covering the contents of the New Driver manual was developed and yielded information gain of 15% and 27%, respectively, among reading disabled and mentally retarded high school students.

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METRIC CONVERSION FACTORS

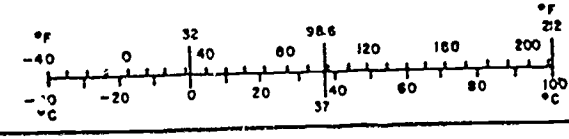
Approximate Conversions to Metric Measures

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



EXECUTIVE SUMMARY

SAFE DRIVING KNOWLEDGE DISSEMINATION AND TESTING TECHNIQUES: FINAL REPORT

Contract No. DOT-HS-4-00817

National Public Services Research Institute (NSPRI)
421 King Street
Alexandria, Virginia 20590

Report Date: June 1976

Abstract

In order to determine the effectiveness of improved information dissemination and assessment techniques in reducing highway accidents, a set of seven targeted driver license manuals and tests were developed for the following groups of drivers: New Drivers, Youthful Drivers, Renewal Applicants, Older Drivers, Traffic Violators, Accident Repeaters, and Drinking Drivers. The contents of the manuals and tests were based upon an analysis of critical information requirements for each target group and an assessment of existing information deficiencies of drivers relative to these requirements. The manuals and tests were administered to a sample of 30,000 drivers, primarily from the State of Virginia, in order to determine their effectiveness in leading to acquisition, retention, and application of safe driving information. The amount of information acquired showed knowledge gains ranging between 20% and 33% for all target groups except the Traffic Violator group which showed only an 11% gain. A retention test administered to the New Driver and Renewal group after a five-month interval showed a 1/2 to 1/3 information loss. The Older Driver group showed a slight gain. The accident and violation records of drivers in all groups will be compared with those of a randomly selected control group of equal size over 12, 18 and 24-month intervals. In addition to the manuals, a one-hour audiovisual presentation covering the contents of the New Driver manual was developed and yielded information gain of 15% and 27%, respectively, among reading-disabled and mentally retarded high school students.

Executive Summary

Purpose and means of accomplishment

The purpose of this effort was to determine the effectiveness of improved information dissemination and assessment techniques in reducing highway accidents. The means of accomplishment was through:

- Identifying the needs of various categories of drivers.
- Meeting those needs through the identification of information to be disseminated to the various driver categories.
- Developing and testing driver information manuals for the target categories.
- Developing and testing audiovisual material for reading disabled and mentally retarded drivers.
- Developing guidelines that others should follow in the development of State driver information manuals for target populations.

Background

A major component of a productive driver improvement program is to disseminate safe driving information to the segments of the population to be effected. The rationale behind this is that although safe driving information cannot be expected to guarantee safe driving behavior in and of itself, it still is a prerequisite to that behavior. Also, the information system to be used must be flexible enough to address not only new drivers or out-of-state transfers, but to address various target groups in the driving population or the entire driving population.

State driver manuals currently in use are largely confined to a presentation of the State's traffic laws or "rules of the road." They would be more informative, and more effective, if extraneous or rarely used information was deleted from them and they were aimed at meeting the specific needs of drivers.

The driving public seems to hold the belief that driver knowledge tests are used to separate the good drivers from the bad drivers. Nothing could be further from the truth. There simply are no tests to our knowledge that will accomplish this most desirable goal. However, tests might be used to serve three basic functions:

1. Assessment: to determine whether an applicant sufficiently meets the knowledge criteria to be granted a license.

2. Diagnosis: to identify specific knowledge deficiencies to be overcome before a license may be granted.

3. Incentive: to motivate the applicant to acquire the necessary information.

The present use of driver tests for assessment and diagnosis is questionable, but their use as an incentive to information acquisition has been receiving increasing attention. It is believed that the primary value of present driver knowledge tests is in their contribution toward forcing drivers to acquire information; that is, to read the manuals or other information sources. For those persons who are reading disabled, other means must be found for providing essential information to them.

Target groups

The target groups identified under this study were: new drivers; experienced drivers; older drivers; youthful drivers; violators; drinking drivers; medically impaired drivers; handicapped drivers; and reading/learning problem drivers. Once target groups were determined, the specific information requirements of each group were identified. A review of knowledge tests conducted in previous studies in Michigan and California failed to identify substantial differences in the information needs of most groups. Only the older drivers were judged to have information requirements that were different from those of the driving population at large.

It was concluded that new and youthful drivers should be combined into one group, because of the commonality of their information requirements. The driver information manual for this combined group was designed to address: licensing procedures; observation; communication; speed control; intervehicle separation; gap judgment; handling emergencies; physical and psychological factors; and vehicle maintenance.

Since some of the information necessary to new and youthful drivers would seem elementary and redundant to experienced drivers, it was determined that the information manual for this group could delete entirely or deal lightly with such information. Some topics in this category are: traffic control signs and signals; right-of-way laws; turn signals; and estimating gaps.

Older drivers, that is, drivers 60 years of age and older, were the only group that was determined to have special information needs. The areas of interest worthy of special treatment included: slow driving; looking to the rear; confusion; seeing and hearing; fatigue; health problems; medicines; traffic signs and signals, and alternatives to driving. The most suitable means of disseminating the information to these older drivers was determined to be through their peers, through a problem-oriented rather than person oriented approach, and through a media delivery system suitable for older persons, recognizing the need for large type, etc.

Information dissemination for traffic violators should concentrate on: exceeding the speed limit; driving too fast for conditions; following too closely; unsafe passing; failure to come to a complete stop at stop signs; running a yellow light; and knowing failure to yield the right-of-way. An approach that makes use of threats or moralizing appears to have little promise.

Information that should be transmitted to accident repeaters should include: scanning ahead, to the side, and behind; communicating the vehicle's presence through use of the lights, horn, etc.; maintaining a safety margin; and use of safety belts. This group should be diplomatically led to the conclusion that all parties of an accident generally share some responsibility for it.

Drinking drivers are worthy of special attention for two reasons. One reason is that they figure so high in serious traffic crashes, and the other is that the behavior that leads to the offense does not involve how one drives, but rather when and how much one drinks. These drivers are usually quite knowledgeable about the traffic laws, and information programs designed for them should include: the magnitude of the drinking-driving problem; effects of alcohol; alcohol content of drinks; separating drinking and driving; controlling drinking; laws and penalties; and the need for a plan by the drinking driver.

Manuals and tests were developed for each of the foregoing target groups. All manuals were pilot tested, revised on the basis of the test results, and then given one final review by consultants and representatives of each pilot group in order to verify their adequacy.

Test development

A set of multiple-choice test items was prepared to accompany each of the manuals. The number of items varied with the size of the manuals, ranging from 10 items for the drinking driver's manual to 140 items in the case of the manuals for new drivers and renewal applicants. All tests were carefully reviewed for comprehensiveness, level of difficulty, and internal consistency.

Other considerations in test construction included alternative responses, wording, and test structure. They were pilot tested and identifiable deficiencies were corrected.

Alternative information presentation and testing systems

Although a printed manual and test are probably the most cost effective means of reaching the general public, there are segments of the population that cannot be addressed in that fashion. These include: illiterates; marginal readers; and foreign-speaking illiterates. A set of test questions was presented to a group of drivers by means of the following informational modes: written; graphic; static audiovisual; and dynamic audiovisual. The results of this test appear to indicate the superiority of the dynamic mode.

An effort was made to determine the relative cost-effectiveness of the following means of achieving the dynamic mode: filmstrip/tape; slide/tape; continuous film; interrupted film, and videotape. The filmstrips and slides were classed as "dynamic" for this purpose since they can be projected in a series to simulate motion. These media were evaluated against the following criteria: image; motion; reliability and durability (hardware and software); ease of operation; maintenance; ease of updating; and cost.

On the basis of this comparison, filmstrips and slides were eliminated due to the failure of their cost advantages to offset their inability to handle motion adequately. Videotape was also eliminated due to the high cost of hardware, low durability of software, and the complexities of operation and maintenance.

Of the remaining media, an interrupted 8 mm presentation appeared to have the greatest long-range potential. However, since the required equipment is not in general use, an interrupted presentation would have a limited market at the present time. For this reason, it seemed best to proceed with development of the standard 16 mm motion picture within the present project. Preparing the presentation in a 16 mm format would allow prints to be prepared in either 16 mm or 8 mm.

Based upon these conclusions, a set of eight film presentations was prepared and tested. Project funds did not permit the preparation of a dynamic audio-visual test to accompany the informational presentation. However, the audiovisual test that was developed for the experimental study of informational modes provided some insight into the requirements of an audiovisual test. These requirements included: automation; simple instructions; increasing difficulty; problem identification; presentation of alternatives; response recording; and test pacing.

Evaluation

An evaluation of the manuals, tests, and audiovisual information presentation was undertaken in the State of Virginia. Evaluation of the manuals and tests involved some 60,000 drivers representing all of the target groups. Within each target group, drivers were randomly divided into experimental and control groups. Drivers in the experimental groups were administered the project developed manuals and test while those in the control groups were subject only to procedures currently employed by the State. The effectiveness of the manuals and tests were evaluated against three objectives: information acquisition; information retention; and information application. The information acquisition and retention test results for all target groups are presented on the last page of this document.

Data collection on these drivers is still underway. At 12, 18 and 24 months following completion of test administration, the records of all drivers in the State of Virginia will be searched and those of drivers in the study will be read into separate files, classified by target group designation and study group assignment (i.e., experimental versus control). The accidents

and violations appearing in the records of drivers in each target group and each treatment group will be tabulated and the following totals obtained:

- o Number of accidents reported
- o Number of convictions for traffic violations
- o Convictions for violations involving an accident
- o Administrative actions

  Advisory letters

  Group interviews

  Personal interviews

  Clinics

  Probation

  Suspensions

Conclusions and recommendations

A list of conclusions was prepared as a result of the activities and findings experienced during this study. Recommendations were presented, addressing both research and development and operational programs.

The conclusions were as follows:

1. A manual providing a comprehensive and exhaustive presentation of critical safe driving information can be prepared for new drivers within the resources available to most driver licensing agencies.

2. Experienced drivers currently present the same general pattern of information deficiencies as do new drivers.

3. Traffic violators, including drinking drivers, are no different from the general driving public with respect to their information deficiencies or needs.

4. Like traffic violators, drivers who have been in accidents present the same general pattern of information strengths and weaknesses as is presented by the general driving public.

5. Older drivers are the only group presenting unique information requirements.

6. Drivers in all groups are capable of realizing significant knowledge gains from manuals designed to meet their information needs.

7. A significant information loss occurs following acquisition of large amounts of safe driving information, such as is provided to new drivers.

8. An audiovisual presentation is capable of leading to significant information gains among reading disabled and learning disabled license applicants.

9. No conclusions as to the effectiveness of the various manuals and tests in preventing accidents can be offered at the present time. These conclusions will be presented in a separate report, at a later date.

ACQUISITION AND RETENTION TEST RESULTS FOR ALL TARGET GROUPS

GROUP	PRETEST		ACQUISITION				RETENTION			
	MEAN	N	MEAN	N	GAIN	SIGNIF-ICANCE	MEAN	N	RESIDUAL GAIN	SIGNIF-ICANCE
New Driver	61.4	100	81.7	100	33.1%	P <..01	72.8	99	18.6%	P < .01
Renewal	62.9	100	79.8	100	26.7%	P < .01	74.8	63	18.9%	P < .01
Older Driver	69.0	100	83.0	100	20.3%	P < .01	88.8	74	28.7	P < .01
Violator	61.8	100	68.6	200	11.0%	P < .05				
Accident Repeater	64.1	100	83.0	100	29.5	P < .01				
Drinking Driver	64.9	100	86.2	100	32.0%	P < .01				
Reading Disabled Unlicensed	58.3	40	67.3	40	15.4%	P < .01				
Licensed	67.0	.35	72.7	35	8.5%	P < .05				
Mentally Retarded	49.7	15	63.3	15	27.4%	P < .05				

PREFACE

This report describes the preparation and evaluation of an information program consisting of driver license manuals, tests, and an audiovisual presentation system. The program was designed to meet the needs of various categories of drivers. The work was performed by the National Public Services Research Institute (NPSRI) under contract to the National Highway Traffic Safety Administration (Contract No. DOT-HS-4-00817). At the time the study began, NPSRI was a division of the School of Public Services, Central Missouri State University. Upon becoming an independent organization in April 1975, NPSRI completed the work under subcontract to Central Missouri State University.

The NPSRI effort was directed by Dr. A. James McKnight, Principal Investigator. Dr. McKnight was assisted by Mrs. Molly A. Green, who has served as Project Administrator. Mr. Gerard Y. Issembert was responsible for development of the audiovisual presentation and test program. Dr. Richard Kaywood, University of California at Long Beach, played a major role in preparation of the manuals.

Other NPSRI staff members and consultants assisting in various phases of the project include the following: Dr. Anthony Pfannkuche, Mr. Stephen Steurer, Dr. Kenard McPherson, Mrs. Elise Brown, Miss Karin Kephart, Miss Valerie Pote, Miss Velva Morgan, Mr. Randy Scott, Mr. Lee Harper, Mr. William J. Coltellero, Mr. William Seals, Mrs. Wanda Dorpfeld, and Ms. Lola Craw.

A major share of the work involved in evaluating the program was performed by representatives of the Driver Services Administration of the Virginia Division of Motor Vehicles. Those contributing heavily to the project were Mr. Richard Spring, Mr. James Parr, Mr. Joseph Augeri, and Mr. Richard Edwards.

The staff wishes to acknowledge the guidance and help provided by the NHTSA Contract Technical Managers, Dr. John Eberhard and Mr. John Matthews.

The following additional reports were prepared as a part of this project:

- Safe Driving Knowledge Dissemination and Testing Techniques: General Findings.
- Safe Driving Knowledge Dissemination and Testing Techniques: Manuals and Tests.
- Handbook For Developing Safe Driving Knowledge Dissemination and Testing Techniques.

A supplement to this report, describing results obtained from a follow up analysis of accident records will be prepared at a later date.

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BACKGROUND

In the recent years there has been an increasing interest in State departments of motor vehicles in moving from a passive program of driver regulation to a more active program of driver improvement. Already, some States, such as California, New Jersey, and Virginia, have considered legislation that would enable the Department of Motor Vehicles to play a larger role in assisting drivers within the State to operate their vehicles more safely and efficiently. These States have begun to make a major commitment to establishing a large-scale driver improvement program.

The major component of a driver improvement program should be a comprehensive safe driving information system. The system would have two, interrelated objectives:

1. To disseminate safe driving information to the general driving population in the State; and

2. To assess the level of safe driving knowledge among individuals holding or applying for licenses.

The rationale for such an information system is an obvious one: safe driving behavior presupposes a knowledge of basic safe driving information. While the possession of a safe driving knowledge will not, in and of itself, guarantee safe driving behavior--since that is a function not only of knowledge, but also of good driving skills, attitudes, and habits--it is a necessary prerequisite. It is the goal of a comprehensive safe driving information system to provide the basic knowledge in an efficient and cost-effective manner, and to assess the possession of that knowledge among the general driving population.

In order to accomplish this goal, the information system would include these elements:

1. A Set of Safe Driving Manuals: Printed materials capable of communicating information critical to safe driving in a highly effective and concise way.

2. A Set of Tests: Printed examinations that interface with the manuals and measure, by sampling from the whole range of critical safe driving information, the applicant's level of knowledge.

3. Alternative Information Dissemination System: Methods other than printed media for communicating safe driving information to drivers throughout the State, especially to that substantial portion of the population which has reading/learning difficulties.

A comprehensive safe driving information system differs from the more traditional DMV licensing program in several important ways. First, it is addressed to the whole driving population, not just to new drivers, out-of-State transfers, or the small percentage of drivers who commit major, persistent traffic violations. Second, it recognizes that the knowledge requirements of all drivers are not identical. Finally, and most significantly, it is intended to present the driving knowledge which is critical to the safe and efficient use of the motor vehicle. It is not limited to legal requirements, regulations, and "rules of the road," as most DMV manuals have been in the past. The design of the information system must take into account these three essential characteristics.

MANUALS

The typical State drivers manual in current use is largely confined in content to "rules of the road," interpretation of signs and signals, basic administrative and licensing information, and a few of the more salient driving practices. A survey of State Manual content by Nuckols (1972) revealed that most manuals contain little task relevant information. It appears that one major objective in preparing State Manuals has been the documentation of State traffic laws, to remove ignorance of the law as an "excuse." There is no contesting the right of the State DMV to inform the citizens of their legal obligations in operating a motor vehicle. However, a distinction should be drawn between the objectives of legality and safety so that items of information can be evaluated for their importance to either objective.

To the extent that traffic laws reflect the needs of safe driving, information concerning these laws represents a potentially effective accident countermeasure. However, highly legalistic orientation often results in:

- The inclusion of information that is of marginal value in promoting safe driving (e.g., scheduling of fees);
- The omission of important safe driving information which does not have regulatory status (e.g., defensive driving practices); and
- A tendency to present safe driving information in terms of legal requirements rather than driver behavior (e.g., alcohol limits in terms of BAC's, rather than number of actual drinks).

When a safety orientation is adopted, different criteria are imposed for the selection of content and method of presentation in the manuals. Some of the information usually contained in State drivers manuals would be excluded, but a great deal more would receive different stress and treatment.

Any effort to develop truly comprehensive manuals, however, must cope with the problem of sheer information volume. A publication that attempted to encompass all of the information that could conceivably be relevant to driving safety would be bigger than the largest existing driver education textbook. Such a publication would be inappropriate to the needs of a State DMV.

The volume of information can be reduced by preparing manuals that are aimed at meeting the critical information needs of individual groups of drivers. Drivers differ in their information needs as a function of differences in age, background, attitudes toward the highway traffic system, driving experience, and other characteristics. Where differential needs can be identified, manuals can be effectively and economically directed toward these needs.

TESTS

The responsibility for determining whether a driver is sufficiently knowledgeable to meet the demands of safe driving falls principally upon State driver licensing agencies. In order to obtain a license, an applicant must demonstrate a certain, predetermined level of knowledge. Typically, this is expressed as a percentage score on a written examination and an on-the-road driving test. All States administer a written and/or oral test of knowledge to new drivers and drivers transferring residence to the State. Some also administer knowledge tests to renewal applicants. These tests serve three basic functions:

> Assessment: to determine whether an applicant sufficiently meets the knowledge criteria to be granted a license.
>
> Diagnosis: to identify specific knowledge deficiencies to be overcome before a license may be granted.
>
> Incentive: to motivate the applicant to acquire the necessary information.

The value of tests for the purposes of assessment and diagnosis is questionable. There is little good empirical evidence to demonstrate a relationship between test results and driving performance because all drivers must ultimately pass a test before they may legally drive and compile an official driving record.

A test intended for diagnosis would have to be extremely lengthy. Since a driver's information deficiencies tend to be quite specific to individual information items, a test would almost have to provide a complete census of the required knowledge--virtually reproduce the manual itself--to have much diagnostic value.

The role of the licensing tests as an incentive to information acquisition has received increasing emphasis in recent years. In this role, the licensing test joins the licensing manual to form a package. The manual helps drivers prepare for the test; the test helps assure that drivers prepare by reading the manual. Throughout the study described in this report, priority was given to the role of tests as an incentive. The view was taken that the primary way in which a knowledge test contributes to driving safety is by forcing drivers to acquire information--that is, to read manuals or consult other information sources.

In order to serve as a proper incentive, tests must be constructed so as to constitute a comprehensive and representative sample of critical information contained in the manual. The following criteria must be met:

1. Well-constructed Items: items should be written and presented so that a knowledgeable applicant will answer correctly, and the unknowledgeable will not.

2. Comprehensive Sampling: items should sample from the full range of critical information in the manual.

3. Representative Sampling: the applicant should not be given advance clues as to which specific information items will be included in the test as such will render the test sample unrepresentative of the applicant's knowledge.

The tests are developed to provide a sufficiently representative sampling of critical information to motivate applicants to learn the information contained in the manual.

ALTERNATIVE INFORMATION DISSEMINATION SYSTEMS

While the conventional printed driving manual is a generally cost-effective way of presenting a large amount of information to a large number of drivers, there is a significant portion of the driving population for which printed media are not effective. It is estimated that as much as 10 to 15 percent of the adult population have reading difficulties that are sufficiently serious to preclude comprehension of conventional DMV materials. Even after an effort is made to lower the reading level of printed manuals, there remains an important segment of the driving population unable to absorb safe driving information in printed form.

Alternative systems of delivering safe driving information are necessary adjuncts to an effective program of information dissemination to the entire general driving population. A highly effective alternative system should meet these criteria:

1. It should be at least in part a dynamic medium in order to convey the dynamic aspects of driving behavior.

2. It should be capable of different modes of presentation, including large and small group, as well as individual.

3. It should be capable of carrying the full range of information available in the printed manuals.

4. In the presentation mode, it should be highly reliable and easy to operate, with a low maintenance requirement.

5. It should rely on present off-the-shelf communication systems that are cost-effectively utilized in the dissemination of safe driving information.

PROJECT OBJECTIVES

The project developed a system of safe driving information dissemination and assessment that assures that drivers acquire, retain, and effectively apply the information needed to drive safely. It achieved this goal through the fulfillment of these objectives.

- The development of manuals capable of communicating critical safe driving information.

- The development of tests that are capable of providing a reliable assessment of an applicant's possession of critical safe driving information.

- The additional development of alternative systems of delivering critical safe driving information to reach those potential drivers unable to use manuals.

- The evaluation of the ability of manuals and tests to lead to the acquisition, retention, and effective application of safe driving information.

CONTENTS OF REPORT

This technical report will describe the development and evaluation of a set of manuals, tests, and an alternative system for delivering information to drivers. Discussion of the development process is divided as follows:

Identification of Target Group

Determination of Information Needs

Specification of Information Requirements

Development of Manuals

Development of Tests

Alternative Information Presentation and Testing Systems

Evaluation

IDENTIFICATION OF TARGET GROUPS

The identification of target groups involved the search for readily identifiable groups of drivers having different information requirements. Information requirements, in this case, means both the nature of information needed and the manner in which it must be presented. The phrase "readily identifiable" means that variables used for target grouping must relate to characteristics of drivers that State departments of motor vehicles would have access to, such as age, driving experience, or driving records.

In an ideal licensing system, the information deficiencies of each driver might be uniquely identified on the basis of some exhaustive test. All drivers could be examined and the diagnosed knowledge deficiencies of each remedied through individually tailored information programs. If such an approach is even feasible, it is certainly a long way from becoming a practical reality. The costs of exhaustive testing, in terms of both examiner and examinee time, would far exceed that which characterizes licensing today. The cost of individually tailored information programs would be close to prohibitive.

The only practical approach is to distinguish information requirements of groups of drivers, groups that are classified on the basis of driver characteristics that may be readily identified by driver licensing agencies (e.g., age, experience, driving record).

In order to identify groups with relatively homogeneous information needs, a panel was assembled under the auspices of the California Traffic Safety Education Task Force. This panel consisted of individuals from the education, licensing and research branches of highway safety. Each of the panelists had specific experience that would provide them access to the information needs of different drivers. The panel met for three days during which the information needs of the various prospective target groups were discussed. A list of the panelists appears in Appendix A.

The results of the panel's deliberations are detailed by Goldstein (1974). The target groups identified as candidates for a targeted information program were as follows:

> New drivers--drivers who have not been previously licensed to drive or who have had a license for less than three years.
>
> Experienced drivers--drivers who have been licensed to drive for three years or more.

Older drivers--experienced drivers over the age of 60.

Youthful drivers--drivers under the age of 21, who are either new drivers or experienced drivers.

Violators--drivers convicted of two or more traffic violations within a relatively short period of time, (e.g., one-three years).

Accident repeaters--drivers who have had two or more accidents within a relatively short period of time, (e.g., one-three years).

Drinking drivers--drivers convicted of a Driving While Intoxicated offense.

Medically impaired drivers--drivers suffering from a health disorder that results in loss of consciousness or loss of ability to control the car.

Handicapped drivers--drivers suffering from a physical handicap that could, in the absence of some compensating mechanism, degrade the driver's ability to operate safely.

Reading/learning problem drivers--drivers who lack the ability to comprehend the existing State licensing manuals, including slow learners, illiterates, and foreign speaking literates.

TARGET GROUP CHARACTERISTICS

The following paragraphs summarize the most salient characteristics of the target groups. A classified bibliography of literature dealing with each target group appears at the end of this technical report. Handicapped and medically impaired drivers were ultimately dropped as target groups for reasons described in the next section. These two groups are, therefore, omitted from the following discussion.

New Drivers

Beginning drivers are usually defined as those drivers holding a license for less than three years. As a group, they are greatly over-involved in traffic violations and accidents. Single vehicle accidents are especially common to this group. Although the specific driver failures which lead to single vehicle accidents are many and complex, they seem to center on a lack of skill resulting from

from inexperience. Beginning drivers get into trouble when they do not recognize the level of risk relating to various driving environments. When an emergency does develop, they lack the experience and the appropriate critical knowledges to deal with it. Their inexperience leads them into situations they don't have the skills to handle.

A prime factor in single vehicle accidents is excessive speed. This is also the most common violation among beginning drivers.

When we speak of excessive speed, we include "driving too fast for conditions." The high incidence of speeding violations is in itself an indication of driver inexperience and shows ignorance of the increased risk associated with speeding when road conditions are deteriorating. Beginning and inexperienced drivers are often unaware of the legal consequences of excessive speed, as well as the danger involved. Some youthful drivers undoubtedly speed because they perceive they are taking an increased risk. However, most inexperienced drivers drive too fast for precisely the opposite reason--they do not recognize the risk they are incurring.

Inexperience, relatively undeveloped basic driving skills, and ignorance of risk factors are all significant contributors to the other common traffic violations which beginning drivers characteristically commit. In addition to speed violations, beginning drivers are also overrepresented in equipment and sign violations, and are more frequently cited for improper passing, turning and use of right-of-way. Moreover, as a group, beginning drivers have more violations associated with fatal and injury accidents. Although male drivers have almost twice the violations and accidents in absolute numbers, the rate of violations and accidents per one hundred thousand miles driven is close to the same for beginning female drivers. Novice female drivers drive less but are not markedly better than beginning male drivers.

Two other driving categories represent problems for beginning drivers: Driving at night, and driving after drinking alcohol. Young drivers are over-involved in nighttime accidents, which appears to reflect a lack of experience in recognizing night driving hazards, such as over-driving headlights, glare problems, etc., and a deficiency in night driving skills. Although beginning drivers as a group drive less and have fewer alcohol-related social problems, they have a rate of involvement in alcohol-related traffic fatalities that is not far different from older drivers. This reflects both inexperience in drinking and in coping with the effects of alcohol on driving skills.

Youthful Drivers

As a group, youthful drivers have about twice the rate of traffic violations and accidents as older drivers. Moreover, they have a much higher ratio of accidents to violations. Beginning drivers are more likely to violate traffic regulations, and they are more likely to have an accident when they do.

There are many complex causes of the characteristic behavior of this group. The years when most people learn to drive--the middle teens to early twenties--are a turbulent period in life. Rebellion against authority, recklessness, and acting-out of immature emotions are common youthful behaviors, and they have a significant negative effect on the driving records of younger drivers. It is, of course, beyond the scope of any driving manual to deal directly with attitudes and motivations. The poor driving record of beginning drivers, however, also reflects their relatively undeveloped perceptual and motor skills. These require actual on-the-road experience, and a manual can, at best, only give low-risk procedures by which these skills may be practiced.

The lack of knowledge of the traffic highway system, and the critical areas of high risk should also be recognized as significant contributing factors in poor driving behavior. For this, age is not nearly so important an element as inexperience and ignorance.

Older Drivers

People over fifty-five make up a growing portion of the driving population. They are not a homogeneous population. Yet, they do tend to have certain common characteristics as a group.

The aging process varies greatly from individual to individual, so chronological age is at best only a gross indicator of driving competency. In addition, with any one individual, the various physical and perceptual functions may change at quite different rates. A driver might have decreased competency in one aspect of his driving, while remaining thoroughly able to perform all other driving tasks. One driver could drive quite safely during daylight hours, for example, but find it very difficult to drive at night because of reduced night vision. These factors make it hard to generalize about the population of older drivers with great precision.

While there might not be a direct correspondence between increasing age and decreased driving competency, it has been shown nevertheless that drivers over 65 are overrepresented in accident statistics. A very slight increase begins to appear among drivers 55-60, and gets more pronounced among older drivers. Those over 65 have a higher rate

of violations and traffic accidents than drivers aged 45-64, even though they drive fewer miles and less frequently, and are exposed less often to difficult driving conditions. In some places, the per-mile accident rate for drivers over 65 has been almost as high as the rate for drivers under 25.

Aging brings a gradual slowing down of functions in the person's system, due both to physiological and attitudinal changes. What is most relevant to driving performance is the gradual slowing down of the individual's ability to process information, and a reduction in his time-sharing capacity. It becomes more difficult for the individual to select and discriminate among competing stimuli in his perceptual environment. This becomes critical when the aged individual is required to pay attention to several things at once. His reaction time, per se, may be sufficiently quick, but it takes him longer to discriminate among clues and come to a decision.

By far the most common type of traffic accidents among the older driving population occur when the drivers cross or enter the traffic flow. Accidents associated with maintaining the car in the flow of traffic in the lane are much less common. Critical operations include: backing, turning, passing, and lane changes. In addition, older drivers are likely to have problems of inattention, suggestion stimulus overload, and a reduced capacity to rapid reaction. The most frequent violations recorded for older drivers are these: running red lights and stop signs, failure to yield when entering traffic flow, and improper passing.

Older drivers also have problems with the changing traffic system. The highway traffic system has changed very rapidly in the last ten to fifteen years, and many older drivers have not kept up with the changes. There are many drivers still on the road who have never had any formal driver training. Many have never had to take a driving test of any sort, since they received a license before formal exams were required. As a group, older drivers tend to have specific knowledge deficiencies related to recent developments in highway signs and signals, and concerning different kinds of driving behavior required by changing road designs and traffic conditions.

A profile of this target population reveals these general areas of driving deficiency:

1. Decreased capacity to operate a vehicle safely in all types of driving conditions due to physiological or health deficiencies.

2. Inability to react competently when interacting with traffic flow.

3. Deficient awareness of the current rules and regulations of the highway traffic system.

Accident Repeaters

If safety is the prevention of accidents, then drivers who have a high accident rate would, by definition, seem to be "unsafe." The idea that certain drivers were basically unsafe arose some 75 years ago when it was discovered that the majority of accidents could be traced to a minority of drivers. The high accident rate was attributed to inherent "accident proneness" of the individuals involved. However, subsequent studies of accidents, including highway accidents, have revealed that only a small portion of accident repetition can be ascribed to the characteristics of the driver. A greater portion of accident repetition results from chance factors and the differences in exposure.

> Chance--If accidents were handed out at random, a few people would end up with more than one accident by chance alone. It turns out that the number of people who do have more than one accident is not appreciably greater than that which would be expected by chance. Also, when one compares accidents from one period of time to the next, one finds that it is not the same people who are having the accidents.
>
> Exposure--Where people do have an inordinate number of accidents, the accidents are often attributable to the conditions of driving rather than the driver. Accident repeaters tend to be on the road more and often operate under more hazardous circumstances.

It is true that the more accidents a driver has in one period, the more accidents that driver is likely to have in any subsequent period. As the number of accidents in a year increases, the likelihood of future accidents increases very sharply. However, the number of drivers having a large number of accidents is very small. In summary, while there are doubtless drivers who have a predisposition to accidents, the number of such drivers is very small and they account for a very small portion of the total number of accidents occurring on highways. There is no denying that there are certain driver characteristics associated with high accident involvement. As noted previously, youthful drivers have an accident rate of approximately double that of adults. Males show a higher accident rate than females, although this is partially accounted for by differences in exposure. A variety of socioeconomic factors have also been associated with accident experience. However, these findings would lead to a grouping of drivers in terms of the various characteristics themselves rather than in terms of their accident experience.

What is not known is the nature of the information requirements that characterize accident repeaters as a group. While some studies have shown accident repeaters to score lower on tests of driving knowledge than accident-free drivers, none reliably identifies the specific information deficiencies of the high accident group.

One problem that confounds the attempt to identify characteristics of accident repeaters is the question of culpability. One might, in theory, expect to see a relationship between driver characteristics and accidents to appear primarily among those accidents that were actually "caused by"

the drivers whose characteristics are being studied, and not among drivers who are "innocent victims." However, the dividing line is not very clear. First of all, culpability is a legal rather than a behavioral concept. In many instances, the behavior of the "culpable" driver was no more hazardous than that of the "victim." On the other side, few accident victims are entirely free from complicity. In most cases, there were behaviors through which the driver could have rendered himself less vulnerable in accidents "caused by" other drivers.

Until the behavioral correlates of accidents are better identified, the attempt to relate accidents to characteristics of drivers, particularly the informational characteristics, will remain difficult.

At the present time, there are relatively few information programs directed specifically to the needs of accident repeaters. In some states, drivers who are involved in several accidents in a relatively short period of time (e.g., three in one year) are required to take a written examination. In some cases, the requirement involves only culpable accidents, while in others it applies to all accidents (except those that occur to unattended vehicles). However, in none of the programs studied is the accident repeater given any information tailored to his needs. Where any document was provided, it was generally the State drivers manual.

Traffic Law Violators

Most of what has been said about accident repeaters in the previous section applies to traffic violators as well. One would naturally expect the characteristics of the violators to be closely associated with those of accident repeaters. First of all, many accidents involve a traffic violation. However, one would expect an association even beyond this direct administrative connection. If violations truly reflect unsafe acts, then the drivers who have violations are behaving unsafely and, sooner or later, will have an accident. While a true relationship between violations and accidents is generally found, it is a very small relationship. Less than 10% of variability in accidents can be attributed to the factors that lead to violations.

Like the tendency to have accidents, the tendency to be convicted of a violation does not seem to be a stable characteristic of drivers themselves. It is true that the more violations the driver has in one year, the more he is likely to have in the next year. But, the number of drivers having repeated violations in one year or across two years is quite small. The factors of chance and exposure have the same role in repeated violations as they do in repeated accidents. "Chance" in this case refers to the chance of being detected, apprehended, and convicted of a violation. "Exposure" refers to the nature of traffic laws and the intensity of law enforcement.

A great number and variety of programs have been established for traffic violators. They range from individual hearings to courses running for several hours. Some are operated by individual courts for convicted violators, while others are a part of state-wide driver improvement programs for drivers with poor overall records.

The thrust of most programs for violators is improvement in the driver's "attitude." This approach is based upon the reasonably well founded supposition that violation of traffic laws occurs, not so much out of ignorance of the law, as through an unwillingness to accept it. Much of the content of programs for violators focuses upon the hazards of the driving environment and the limitations of both driver and automobile in coping with these hazards.

Some programs of a more informational nature are also provided. The content of such programs covers a broad range of safety-related topics. The National Safety Council's "Defensive Driving Course" is probably the most frequently used of prepared programs.

Drinking Drivers

Drinking and driving is the major cause of serious automobile accidents. Estimates place the percent of fatal accidents attributed to drinking at between 30 and 50%.

Because of the potentially serious consequences of drinking and driving, law enforcement agencies, courts, legislatures, and departments of motor vehicles have slowly begun to take strong action to control the incidence of drinking and driving. Unfortunately, the severity of the penalty imposed upon those convicted of "driving while intoxicated" has encouraged courts to accept guilty pleas for lesser offenses.

Under the impetus provided by the Department of Transportation "Alcohol Safety Action Projects," many communities have launched rehabilitation programs for convicted DWI's. The nature of these programs depends upon the seriousness of the driver's drinking problem. Heavy social drinkers are directed primarily to educational programs. The goal of these programs is to induce the drinking driver to (1) control the amount of alcohol consumed prior to driving, and (2) separate drinking from driving. Drivers who are identified (or identify themselves) as having a true drinking problem, that is, they are dependent upon alcohol, are generally referred to more intensive programs of therapy, including medical programs, individual counseling, or mutual assistance programs such as Alanon.

Despite their large number, rehabilitative programs are not sufficiently widespread to benefit all those convicted of drinking-driving offenses. No doubt convicted offenders learn a great deal merely from the experiences surrounding their conviction. However, they often end up knowing more about the penalties for drinking and driving than they do about practical means of avoiding the offense itself.

CASE STUDY OF TARGET GROUPS[1]

To determine the magnitude of the safety problems created by each of the target groups, a study was made of licensed drivers in the State of Virginia. Driving records were used to determine the number of drivers in each target group licensed to operate in the State of Virginia. It was not possible to determine the actual accident involvement of each target group. However, individuals having contact with the various target groups, within the State of Virginia, were interviewed. As a result of this study, the following three target groups were eliminated: Repeat Violators, Medically Impaired, and Handicapped Drivers.

Repeat Violators

The primary difference between truly "chronic" violators and those who simply have an inordinate number of violations is, in the opinion of driver improvement analysts, more a matter of basic personality patterns than it is of deficiencies in knowledge or in minor attitude problems that might be related to knowledge deficiencies. Moreover, the chronic violator population is not sufficiently large to warrant being treated any differently from other violators.

Medically Impaired

Medically impaired drivers in need of information are not easy for Departments of Motor Vehicles to identify. The only mechanism for identification is the information that drivers volunteer on their applications. It is the opinion of licensing officials and physicians that drivers who are aware of impairments are generally also aware of the hazards associated with them and the measures available for control. The best way of reaching drivers who are not aware of their impairments, or the possible effects of them, was judged to be through the standard manuals for new drivers and renewal applicants. Even here, it was suggested that the coverage of impairments be minimal and that individuals having impairments be referred to their physicians for information specific to their needs.

Handicapped Drivers

The number of drivers with known physical handicaps is relatively small. In Virginia there were approximately 2500 drivers who required special modifications of automobiles in order to be able to operate them. It is the opinion of licensing officials that the controls currently imposed on handicapped drivers are sufficient to assure that those who are granted a license are capable of operating a motor vehicle safely.

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[1]The study of target group drivers in the State of Virginia was performed by H. Christian Nuchols, Jr. The results of the study are contained in an unpublished consultant's report.

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DETERMINATION OF INFORMATION NEEDS

Once the target groups had been determined, the specific information requirements of each group had to be identified. Since the driving tasks that confront each target group are highly similar, one would expect similarity among the information requirements as well. There are two bases upon which relatively unique information requirements can be delineated: information criticality and information deficiencies.

> Information Criticality--While a particular item of information may be needed by drivers in two different target groups, the information may play a more critical role in the safety of drivers in one group than it does to drivers in the other. For example, all drivers should know the importance of good vision and hearing to safe driving. However, the information is more critical to older drivers, among whom vision and hearing defects are more likely to be found. Accordingly, more information concerning vision and hearing might be required in a manual intended for older drivers than in one intended for youthful drivers or drivers in their middle years.
>
> Information Deficiencies--Drivers in different groups may be expected to differ in the extent to which they possess or lack various items of information. For example, new drivers may be expected to know less about common driving errors than more experienced drivers. Older drivers may know less about the nuances of freeway driving than younger drivers.

The extent to which an item of information merits inclusion among information requirements of a particular target group is a joint function of (1) its criticality to drivers in the target group, and (2) the extent to which target group drivers are deficient in possession of that information. An item of information can only be considered "required" when the information is critical to safety and not currently possessed by a significant number of drivers in the target group. The identification of information criticalities and the identification of information deficiencies became parallel activities. An analysis was made of the critical information needs and the information deficiencies of all of the target groups except the Reading/Learning group. The needs of this group are distinguished primarily on the basis of how its drivers acquire and evidence their possession of information, rather than in terms of the information itself.

IDENTIFICATION OF INFORMATION CRITICALITIES

The sources used in identifying information criticality included a survey of specialists in each target group, and a review of literature relating to the target groups' needs.

Survey of Target Group Specialists

The primary source of data concerning the differential criticality of various information items to different target groups was a survey of specialists associated with each group. The questionnaire presented an exhaustive list of information items and required each item to be rated for its criticality by individuals whose experience would acquaint them with the needs of a particular target group.

Two target groups were not covered by the survey--experienced drivers and accident repeaters.

It was not necessary to survey for the needs of experienced drivers since it is the experienced driver population which served as the basis of comparison for other target groups.

No survey was conducted relative to accident repeaters owing to the lack of any source of specialists in the information requirements of that target group. Accident repeaters are not customarily the object of any special educational or regulatory program, except, of course, where the accidents involve violations. Then, it is the violations rather than the accidents that are of concern. Some attempts have, of course, been made to do in-depth studies of people involved in accidents. However, no groups of specialists specifically concerned with "accident repeaters" could be discovered.

Preparation of Criticality Questionnaires

The basic source of questionnaire content was an analysis of driving tasks performed by HumRRO (McKnight and Adams, 1971). This analysis provided a detailed inventory of the performances required of drivers. From this inventory of performances, a list of information requirements was prepared. The information requirements included information that was judged to play an enabling role, that is, it instructed drivers on how to drive safely, as well as that which might be expected to play a motivating role, that is, it fostered favorable attitudes toward safe driving performance.

The results of the task analysis were organized, naturally enough, in terms of specific driving situations. This structure was not a good one for presentation of information requirements. For example, the same or highly similar information requirements could underlie many tasks. Information requirements had to be organized into more efficient content areas. A step in this direction had already been taken in the development of content areas for the Safe Performance Curriculum (SPC), a driver education program developed from the task analysis (McKnight, et al, 1973). However, some further reorganization was necessary in order to:

1. Complete the SPC Organization--Some modification of the SPC took place after the original classification of the knowledge objectives into course topics. These modifications had not been documented in SPC materials.

2. Accommodating needs of target groups--For certain target groups, information requirements had to be expanded beyond those identified in the SPC. For example, information requirements concerned with drinking and driving were far too limited to meet the special needs of a questionnaire concerned with a Driving-While-Intoxicated target group.

The result of this activity was a questionnaire consisting of 227 information items. The questionnaire presented items of information and called for a judgment of the criticality of the information to the safety of drivers comprising the target group. The same five levels of criticality used in the original task analysis to establish criticality for the driving population in general were repeated. These were "very high criticality," "moderately high criticality," "moderate criticality," "moderately low criticality," and "very low criticality."

The questionnaire identified the level of criticality that had been assigned in the task analysis to the performances underlying each of the information requirements. This made it necessary for Target Group Specialists to make entries only when they judged the criticality of an information item to target group drivers to be more critical or less critical than that assigned in the task analysis.

Only eleven of the 227 information items dealt with the subject of alcohol. The remaining items were irrelevant to the needs of the drinking driver target group and were therefore eliminated. The list of alcohol-related information items was then expanded to 68 items in order to provide more comprehensive and detailed coverage of the drinking driving problem.

Target Group Specialists

A panel was assembled to rate the criticality of information requirements for each target group. General sources of target group specialists were as follows:

Youthful Drivers--Driver education teachers and youth safety specialists.

New (Adult) Drivers--Commercial driving school teachers and adult education specialists.

Older Drivers--Physicians, educators, and safety professionals specializing in problems of old age.

Drinking Drivers--Educators and researchers involved in conducting alcohol safety programs.

Violators--Driving improvement analysts, hearing officers, and educators engaged in conducting traffic school courses.

Prospective candidates were contacted and invited to participate. They were offered an honorarium of $25 for completing a questionnaire. Those who accepted were sent the questionnaire along with directions for completing it. The names of target group specialists appear in Appendix A.

Results

The responses of the specialists for each target group were tabulated. Those information items whose criticality was adjusted upwards by a third or more of the Target Group Specialists were tentatively identified as uniquely high criticality information items for that target group. In addition, a listing was made of all "write in" topics.

On the whole, the results of the survey were disappointing. The only group that appeared to yield a truly unique set of information requirements was the older driver group. The disappointment, however, may be traced to the target groups, not the survey. The results of the survey agreed with results obtained from other sources indicating that the differences among the remaining target groups lie in characteristics other than information needs.

Older Driver--The areas deemed to be more highly critical to older drivers than to the driving population at large were the following:

1. Pre-operative Procedures--including checking for objects behind the car, adjustment of mirrors, head supports and seats; use of seat belts and shoulder harnesses.

2. Maintaining Speed--not slowing down unnecessarily or too early.

3. Signalling Properly--Giving a proper signal, signalling at the proper time, and avoiding confusing signals.

4. Protection Against Sunglare--Use of sun visors and sunglasses.

5. Trip Planning--Getting proper rest, limiting mileage, taking frequent rest stops.

6. Limiting Alcohol Consumption--Controlling intake, allowing ample time for alcohol to be eliminated.

7. Urban Driving--Including advanced planning, use of maps, obtaining explicit directions.

8. Route Selection--Selecting routes that are clear of snow, ice, steep hills, and heavy traffic; obtaining assistance in route planning.

9. Visual limitations--The importance of visual acuity, need for eye tests, observing license restrictions.

One set of write-in responses dealt with information requirements that are essentially unique to older drivers. These included the following:

1. Lack of peripheral vision; need to increase the rate of scanning to compensate.

2. Dark adaptation; need to wait for eyes to adjust before driving at night; need to avoid looking directly at bright lights.

3. Hearing limitation; need to keep one window slightly open to improve ability to detect important auditory stimuli.

4. The use of drugs; need to check on the effects of drugs and combinations of drugs; avoid a combination of drugs and alcohol; avoiding the cumulative effects of drugs.

5. Inability to handle high speed highways, rush hours, bad weather; need for assistance in use of public transportation.

An additional number of write-ins dealt with common errors of older drivers. It is impossible to determine whether these errors reflect information deficiencies or just failure of older drivers to apply what they know. In any case, they identify important information requirements for older drivers. Common errors include the following:

1. Failure to make over-the-shoulder checks when changing lanes, pulling into traffic, or backing.

2. A tendency to erratic maneuvers, including sudden lane changes, sudden stops, and U-turns.

3. Straying out of lane on curves or in preparation for sharp turns.

4. Failure to maintain speed when entering or leaving freeways; stopping at the end of entrance ramps or accelerating lanes.

5. Driving too slowly in middle or left lanes of freeways; failure to use right-hand lane.

New Drivers--The critical information requirements for new drivers were far less circumscribed than it was for older drivers. The Target Group Specialists adjusted criticalities for a relatively large number of specific information items. The items that were agreed upon by one-third or more of the specialists appeared to represent simple chance overlap in the judgments rather than true consensus. To obtain a meaningful result, the information items adjusted by each of the specialists were examined and an attempt was made to identify some basic clusters of information requirements. These clusters may be described as follows:

Observation--The need to focus eyes at a distance and scan roadsides.

Speed--The need to adjust speed for curves, slippery surfaces, limited visibility, traffic density, and other factors.

Inter-vehicle Separation--The need to maintain adequate separation from vehicles ahead, to the side, oncoming vehicles and various hazards.

Gap Judgment--Proper gap acceptance when entering or crossing traffic, or passing a vehicle ahead.

Night Driving--Use of headlights, reaction to glare, speed reduction, inter-vehicle separations.

Emergencies--Handling vehicle-related emergencies such as blowouts, headlight failure, stuck accelerator.

Skid Recovery--Use of steering and braking to maintain control in a skid.

Maintenance--Maintaining vehicles in safe operating condition, including tires, brakes, lights, signals, and suspension.

Youthful Drivers--The pattern of information criticalities among youthful drivers closely parallels those of new adult drivers. In fact, no consistent differences between the two groups could be detected. This result suggests that the information needs of youth are more closely associated with lack of experience than with youth itself. This is not to deny the existence of age-related problems. However, these problems, as noted earlier, are more likely motivational than informational.

Violators--The driver improvement analysts and educators who served as Target Group Specialists for violators did not identify a significant number of information items having unusually high criticality to traffic violators. Nor was there any agreement concerning the few items that were identified. The results suggest that the problems of traffic violators involve something other than a uniquely critical set of information needs.

Drinking Drivers--The Target group Specialists for drinking and driving identified the following critical information items:

1. Magnitude of the drinking-driving problem.
2. The effects of drinking on driving ability.
3. The relation between alcohol consumption and impairment.
4. The alcohol content of various drinks.
5. The meaning of BAC and its relation to impairment.
6. Legal limits of BAC.
7. Penalties for second time offenses.
8. Chemical test requirements and penalties for refusal.
9. Methods of controlling BAC.
10. Methods of separating drinking and driving.
11. Need for a personal plan of alcohol control.

One set of information requirements rejected as non-critical concerned problem drinking. The survey had included items concerned with self-identification of problem drinkers and sources of assistance available to problem drinkers. The Target Group Specialists considered this information to be of low criticality. When queried, they gave pretty much the same answer: Most problem drinkers have had extensive exposure to this type of information and have learned to "turn it off." They felt inclusion of this information would simply be a waste of time that could be better devoted to providing practical information for non-problem drinkers.

Literature Review

While the primary source of data concerning critical information requirements was the questionnaire sent to Target Group Specialists,

another valuable source was the literature. An exhaustive review was made of technical highway safety literature relating to each target group. The heart of the review was a search of the computer-maintained "highway safety literature" file of the National Highway Traffic Safety Administration[1]. As noted previously, the existing literature is not particularly enlightening as to specific information needs of various groups of drivers. However, there were a few exceptions. These included the following:

1. Reports of Alcohol Safety Action Projects having strong information and education countermeasure programs.

2. Reports of problems encountered by youthful and older drivers, problems which themselves defined information requirements for the groups involved.

3. Summaries of traffic violations used to define content requirements for the Violators target group.

In addition, the literature was useful in identifying characteristics of target groups which helped to determine the approach to be taken in disseminating information to target group drivers. Examples include literature indicating the failure of "safety" as a concept to appeal to youth, and the need to use other goals to motivate younger drivers, or the tendency of older drivers to be more accepting of information provided by peers than that provided by younger people. A list of reports used, classified by target groups, appears at the end of this report.

Other Sources

A variety of other sources were used to identify critical information requirements of the various target groups. These included (1) attendance at professional meetings, such as a conference on the aging driver held under the auspices of the American Medical Association and the American Association of Motor Vehicle Administrators, (2) interviews and correspondence with individuals knowledgeable in target group needs, and (3) critical reviews of preliminary versions of manuals prepared from initial specification of information requirements.

IDENTIFICATION OF INFORMATION DEFICIENCIES

Research relating to each of the target groups was surveyed for data bearing upon the unique knowledge deficiencies of each group. This

[1]The authors are indebted to Mrs. Virginia Padgett of the National Highway Traffic Safety Administration for assistance in identifying literature pertaining to each target group.

survey was not highly productive. While some studies did report upon the general knowledge level of certain target groups, none attempted to identify the specific nature of knowledge deficiencies, even at the level of broad content areas. An exception was the drinking-driving area, where there existed a few reports which identified specific information deficiencies among drivers in general and among youthful drivers (Preusser, et al, 1974; Grey, 1975; Voas, 1974). Information from these reports identified information deficiencies in the public's understanding of the magnitude of the drinking-driving problem, the relation of alcohol consumption to impairment, the alcohol content of various beverages, and the effectiveness of various methods of controlling intoxication.

Outside of this small oasis, the literature was barren of information bearing upon specific information deficiencies of drivers. It was necessary, therefore, to attempt the identification of target group information deficiencies through recourse to original data. Two sources were utilized: (1) an analysis of test items, and (2) an information survey.

Analysis of Test Items

The project staff was fortunate to have access to several analyses of test items administered to various target groups. The most valuable of these item analyses were the following:

1. An analysis of 1,313 items administered to new drivers, renewal applicants, and problem drivers in the State of Michigan (Pollock and McDole, 1974).

2. An analysis of a 246 item sub-set of the above items, classified by age and the number of violations[1].

3. An analysis of 50 items administered to California drivers about the data consisting of correlations of item scores (i.e., pass/fail) with experience, number of violations, and number of accidents[2].

Other sources of item analysis involved primarily tests that were administered as part of training programs, such as the NHTSA "Safe Performance Curriculum" for high school driver education. These results were too sensitive to the specific characteristics of the training programs under which the tests were administered to be accepted as indices of general information deficiencies of any target group.

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[1]The authors are indebted to Dr. William Pollock, University of Michigan, for providing computer printouts of item statistics of various target groups.

[2]The authors are indebted to Mr. Raymond Peck, California Department of Motor Vehicles, for providing the item correlations reported.

The results obtained through analysis of test items have been incorporated into the final specification of information requirements described in the next section. The following paragraphs summarize the salient findings.

Experienced Drivers--Experienced drivers make up the most populous of the target groups. An analysis of information deficiencies of this group had two objectives. The first was to identify information requirements of experienced drivers as a basis for the development of a manual and a test for experienced drivers, that is, renewals and out-of-State transfers. The second was to provide a basis of comparison for determining the unique information deficiencies of other target groups. Differences in the pattern of information deficiencies between renewal applicants and other target groups would define truly "unique" information requirements.

For the purposes of the analysis, an information deficiency was considered to exist when 25% or more of experienced drivers failed a particular item. The 1,313 Michigan items administered to renewal applicants were examined to identify those items meeting this criterion. The examination excluded the following categories of items:

1. Items relating to performances having "very low" or "moderately low" criticality in the driver education task analysis.

2. Items whose construction failed to meet specifications for test item construction described in a later section.

3. Items dealing with non-safety related information (e.g., parking ordinances).

4. Items dealing with basic vehicle operation (i.e., "how to drive").

This examination process yielded a total of 162 items revealing information deficiencies on the part of experienced drivers. The content covered by each of the deficient items is given in Appendix B. What is most noteworthy about these deficiencies is their specificity. It is simply not possible to characterize the deficiencies in terms of any general categories or topics. Moreover, the deficiencies cut across almost all aspects of driving; there is no concentration in any one area. The implications of this result are further discussed in a later section dealing with the development of a renewal manual and the test.

New Drivers--A correlation of .93 was found between age and number of years of driving experience in the California data. This suggests that new drivers are, by and large, young drivers. The number of miles driven per year was much less dependent upon age (R = .22), although it is not a variable that is readily identifiable by driver licensing agencies. Some sixteen items showed a correlation of .10 or better with number of miles driven per year. Of these, three dealt with rules of the road, while thirteen dealt with more general concepts or principles of safe driving. The total number of items in each category on the test as a whole was approximately equal. The results suggest that inexperienced

drivers are more deficient with respect to safe driving principles and concepts than they are in knowledge of specific rules of the road.

Youthful Drivers--The Michigan data were used in identifying information deficiencies of youthful drivers. The criterion of information deficiency for youthful drivers was a 33% failure rate, and a difference in failure rate from the experienced population of at least 10%. Only five items met this criterion. This meager list of identifiable shortcomings may be attributed to (1) the large proportion of teenage drivers completing formal driver education, and (2) the generally high test taking ability of high school students.

The five items that met the criteria were considered to represent a chance occurrence rather than unique information deficiencies.

Older Drivers--The criterion of information deficiency for older drivers was a 50% failure rate, and a difference in failure rate of 10% from renewals in general. A large number of items met this criterion. However, the majority of them appeared to reflect deficiencies in the construction of the test items rather than deficiencies in the drivers who took them. The specific nature of the test construction deficiencies is further discussed in connection with the development of tests. However, there were 27 items for which the results seemed to indicate a true lack of knowledge on the part of older drivers. These items may be divided into the following categories:

- Signs--Older drivers seem to have difficulty in identifying signs by shape or in interpreting some of the less frequently encountered signs.

- Laws--Older drivers seem to do less well with the letter of the law than with its spirit.

- Defensive Driving--Older drivers seem less well versed in techniques of defending themselves against the unsafe acts of others (e.g., scanning procedures) or against the rigors of the elements (e.g., slippery surfaces), than they did in procedures for safe driving themselves.

- Emergencies--Procedures for dealing with emergencies such as skids or sudden stops were unfamiliar to the majority of older drivers.

- Textbook Information--Older drivers did less well than the general population on textbook type information such as stopping distance.

- Characteristic Older Driver Behaviors--Several deficiencies of older drivers simply reflected their own characteristic behaviors (e.g., using mirrors when backing instead of turning to look out the rear window).

Violators--The selection criterion for violators on the Michigan test results was the same as that for older drivers. On the California results, it was a correlation of .10 or better between test score and number of violations. The number of items meeting these criteria was 9 and 6 for Michigan and California data respectively. This small number of items can be attributed to chance. No consistent pattern appeared in the content of the surviving items.

Accident Repeaters--Six of the fifty items on the California test showed a correlation of .10 or more with number of accidents. Of these six items, five dealt with safe driving concepts and principles while only one dealt with rules of the road. This may simply be a chance finding. However, it is interesting to note that the deficiencies of accident repeaters are similar to those described above for drivers who log relatively few miles per year. Were only chance factors operating, one would expect accident repeaters to evidence more communality with those who drive a lot, since, all things being equal, the more one drives, the more likely one is to have an accident.

Information Survey

In the Identification of Information Criticalities, only one of the target groups, the older driver group, differed substantially from other groups. The older driver group is the only one that appeared to be at all unique with respect to critical information needs.

The analysis of previous test results was not highly informative relative to the older drivers' possession or lack of this critical information. First, the tests which were analyzed did not cover many of the uniquely critical information items. Secondly, because the older drivers are most vulnerable to test construction deficiencies mentioned earlier, it was particularly difficult to distinguish deficiencies in older drivers from deficiencies in the tests they took.

In order to obtain a better estimate of deficiencies relative to the critical information requirements of older drivers, an information survey was conducted. A set of test questions dealing with older driver information requirements was prepared and administered to two groups of individuals over age 65. One was a group of 244 individuals drawn from several local chapters of a national retirement association. This group represented a higher-than-average socioeconomic background. The second group consisted of 56 patients of an urban home for the aged. This group represented a lower than average socioeconomic background. Finally, for comparison purposes, the survey was administered to 97 students of an adult education class program, representing all age levels. The first group (retirees) was used to pilot test several preliminary forms of the information survey, hence its large size.

The survey confirmed the fact that older drivers were deficient with respect to critical information items. The great majority of items showed a clear difference between the two older groups and drivers representing the total age range. As might be expected, those drivers representing low socioeconomic background generally reflected a greater deficiency than those drivers representing a higher socioeconomic background.

Because the older driver group was the only one manifesting unique critical information requirements, it was the only one to benefit from an information survey prior to the specification of information requirements. However, as a part of the development of manuals and tests, representatives of target groups were administered pre-tests prior to the reading of a preliminary manual prepared for that group. The pre-test provided an indication of each target group's general level of knowledge relative to the specified information requirements.

SPECIFICATION OF INFORMATION REQUIREMENTS

From the results of the two preceding activities, the Identification of Information Criticality, and the Identification of Information Deficiencies, a set of information requirements were specified for each target group. Because of the size limitations generally imposed upon driver licensing manuals, the volume of required information had to be curtailed. First, only information having a criticality in the "moderate criticality," "moderately high criticality," or "very high criticality," categories were included. Within these categories, information was further screened on the basis of information deficiencies. Information in the "moderate criticality," or "moderately high criticality" categories were excluded if it did not represent a deficiency of target group drivers. Generally speaking, a failure rate of 25% (i.e., 25% of examinees failing to get the answer correct) represented an information deficiency.

It must be acknowledged that the selection process was ultimately a highly subjective one. While the criteria just described served as guidelines, they did not completely determine the specification of information requirements. Not every item of information had been subject to a criticality or deficiency determination. In passing on a particular candidate information item, it was often necessary to look at results obtained from an item dealing with similar content.

The specification summarizes the content of information required by drivers in the target group and the approach that is considered most effective in communicating the content.

The content requirements were developed from the results of the two preceding activities, that is, the Identification of Information Criticality, and the Identification of Information Deficiencies.

The specification of approach is based primarily upon the information gathered through the review of literature pertaining to target groups, attendance at meetings dealing with the need of target groups, and interviews with various of the Target Group Specialists.

GENERAL REQUIREMENTS

The following set of general requirements applied to each of the target groups.

Criticality to Safety

Only information that is critical to driving safety has been incorporated into the information requirements set forth in this

specification. Such a limitation is not always imposed by States upon their driver licensing manuals. Because the licensing manual generally constitutes the major medium of communication between the State and its drivers, it is often burdened with information that is related to other aspects of driving, such as touring, litter prevention, and pollution control. Exclusion of this information from the specification reflects the safety-oriented goal of the study under which the specifications are prepared. It is not intended to imply that non-safety related information is not worthy of inclusion in a State manual. Licensing officials in any State are, of course, free to delete, change, or add to any of the information requirements contained in the specifications. However, to the extent that assuring the safety of the road using public becomes a goal of the driver licensing process, the specifications will be useful in developing an information dissemination and assessment system capable of meeting this goal cost-effectively.

Generality of Information

Most State driving manuals contain information relevant to the operation of several classes of vehicles, including motorcycles, trucks, and school buses. This certainly simplifies the task of disseminating information. However, it is not highly cost-effective to prepare and distribute to all drivers material that is of concern to but a small minority. The practical consequence of an attempt to meet the requirements of all classes of vehicle operation in a single manual is the need to stint on the information provided to each individual class.

This specification limits the content of the New Driver Manual to information that is relevant to the operation of passenger vehicles. To the extent that this information generalizes across many classes of vehicles, the New Driver Manual constitutes a "core" manual for all vehicle operators. The core manual would be accompanied by supplemental manuals each containing information specific to other classes of vehicles, including motorcycles, trucks, commercial buses, and school buses.

Timeliness of Information

Many State drivers manuals include information that, while relevant to driving safety, is not very critical to drivers at the time they are applying for a driver's license. Major categories of such untimely information include the following:

Vehicle Related Information--Many State licensing manuals provide information concerned with the vehicle registration, titling, insurance requirements and inspection. Including this type of information in the driver licensing manual makes the manual a convenient "one stop" information source for out-of-State transfers who must license themselves and register their vehicles at the same time. However, within the State, drivers who perform the two activities at different times must obtain the entire licensing manual on two different occasions. This approach is hardly economical. It appears more cost-effective to use separate publications for each function. This specification will, therefore, cover only information that is related to the licensing process.

Driver Improvement Information--States frequently provide information in the basic driver license manual that is of relevance to drivers who have been convicted of a traffic offense. Such information includes descriptions of the State "point system," penalties for second time offenders, and license reinstatement procedures. This information only becomes relevant to a driver's needs after he or she has been convicted of at least one traffic offense. It would be more effectively and more economically communicated in a manual issued to convicted offenders.

NEW AND YOUTHFUL DRIVERS

The New and Youthful Driver target groups were combined into a single group owing to the communality of their information requirements. First of all, as mentioned in the discussion of target group information deficiencies, the vast majority of new drivers are youthful drivers. Adults make up a very small portion of the new driver population.

Secondly, even where new drivers differ in age, they tend to manifest the same information deficiencies. This is not to say there are no differences between youthful and adult new drivers. However, the differences are primarily attitudinal rather than cognitive.

Throughout the remainder of this section, both new drivers and youthful drivers will be referred to as "New Drivers."

Content

The following specifications may be used to guide the selection of content for a New Driver Manual.

General Organization of Content--The volume of specific driving information that is critical to new drivers greatly exceeds that which could be cost-effectively included in a manual intended for free distribution to license applicants. One way of compressing a large volume of information is to distill out of this volume specific driving procedures a limited number of principles that are capable of encompassing a large number of specifics. This is what has been done in this specification. An examination of information concerning actual vehicle operation reveals that most of the specific operating procedures could be incorporated under the following principles:

1. Observing--when, where, and how to observe other road users.

2. Communication--informing other road users of a driver's presence and intentions.

3. Speed--adjusting speed to conditions of the roadway, traffic, and visibility.

4. Inter-Vehicle Separation--maintaining sufficient distance from other road users to be able to respond to unexpected actions.

5. Gap Judgment--allowing sufficient space to cross or enter the flow of traffic.

Informational requirements related to safe vehicle operation have been organized in terms of these driving principles. An example of the economy to be secured from this organization may be seen in information relating to turn signals. The simple principle "signal every direction change" makes it unnecessary to cover specifically the signalling of lane changes, turns, entering and leaving freeways, pulling away from the curb, and preparing to park.

Licensing Procedures--Since the applicant's purpose in reading a manual is to obtain guidance in getting a license, it is reasonable to open the manual with an explanation as to how this is done. The explanation should include at least the following:

License Requirements--who does and does not need a license.

License Application--requirements and procedures for obtaining licenses and/or endorsements to operate a:

- automobile
- motorcycle
- vehicle for hire
- truck
- school bus
- other

Locations--places and times at which the license may be obtained.

Documentation--documents required of the applicant (e.g., birth certificate).

Nature of Licensing Exam--a description of:

- vision test
- knowledge test
- road test

Rules of the Road--"Rules of the Road" encompass that information concerned with regulations designed primarily to control the flow of traffic. They are to a certain extent arbitrary; their validity does not stem from the physics of the traffic environment, as do the practices identified under "observation" for example, but rather from a set of accepted conventions.

Except for a few of the newer rules, such as those involving symbolic traffic control signs, new drivers appear to be highly knowledgeable with respect to rules of the road. It is primarily because of its criticality that the rules of the road merits inclusion among information requirements. A driver who does not know what a stop sign means is certainly a hazard. To a great extent, the

criticalities are directly traceable to the high prevailing level of knowledge. Drivers so assume that others know what a stop sign means that they are unprepared to react to someone who does not.

Specific information requirements include the following:

- Intersection control
  - Traffic lights
    - Semaphores (red, yellow, green)
    - Flashing red and yellow lights
  - Traffic signs
    - Stop
    - Yield
    - Do not enter
    - Symbolic (e.g., no left turn, no U-turn)
  - Right-of-way rules
- Use of lanes
  - Thru lanes
  - Passing lanes
  - Turning lanes
  - Lane control lights (reversible lanes)
- Parking
  - Separation from travel lanes
  - Immobilizing car
  - Securing car
  - Leaving car

Observation--New drivers tend to be deficient in knowledge of observational practices. Driver educators have long noted a tendency for novices to focus their attention on the roadway directly in front of the car. This tendency has been confirmed by the results of studies involving recorded eye movements of inexperienced drivers.

Specific information requirements include the following:

- Where to look
  - Ahead
    - Looking far enough down the road
    - Scanning both sides of the road
  - To the sides
    - At intersections
      - Cross streets

Freeway entrances
Driveways and shopping center entrances

Crosswalks

Railroad crossings

Behind

Periodic mirror checks
When changing lanes
When slowing down suddenly
When backing up
On long steep hills

Obtaining a clear view

Keeping windows and mirrors clear
Adjusting seat and mirrors
Seeing well at night

Use of high beams
Dimming lights
For oncoming cars
For cars ahead
Use of low beams in fog, snow, and rain
Reacting to headlight glare

Use of glasses

Communication--Test results indicate that new drivers are familiar with standard requirements for hand signals and use of turn signals. However, they tend to be less familiar with certain information related to the importance of signalling and information concerned with positioning the automobile so that its presence is communicated to other drivers. This section would include the following:

Communicating presence

Daytime use of headlights
Horn
Vehicle position (staying out of the blind spot)
Emergency signals for disabled vehicles

When parked off road
When parked on road

Communicating intentions

Changing direction

Situations

Changing lanes
Turning
Entering or leaving the roadway

Entering or leaving a freeway

Signals

Hand signals
Turn indicators

Timing

Early signaling
Avoiding confusion near intersection

Slowing or stopping suddenly

Hand signals
Brake lights

Speed Control--While control of speed is critical for all drivers, it is particularly critical for new drivers. Research shows that new drivers are overrepresented in single vehicle, out of control, accidents. New drivers are generally relatively well informed concerning legal speed limits. However, they tend to be deficient in knowledge concerning the effect of limitations in visibility and traction, roadway configurations and traffic conditions upon maximum safe operating speed.

Specific information requirements include speed limitations imposed by the following:

Nature of roadway

Curves
Surface traction

Characteristics of various surfaces (i.e., wet, snow, ice)
Detection of slippery conditions

Hydroplaning

Limited sight distance

Darkness
Rain, fog, snow
Intersections
Hills and curves
Parked cars

Traffic conditions (vehicular and pedestrian)

Congested areas
Schools and playgrounds
Areas of heavy pedestrian traffic
Narrow bridges and tunnels
Toll plazas
Construction areas

Intervehicle Separation--The literature suggests that inexperienced drivers tend to place too much trust in other drivers to perform correctly and, as a result, tend not to maintain the intervehicle separations needed to respond to errors on the part of other drivers. Specific information requirements include content related to the magniture of, and rationale for, the following intervehicle separations:

- Following distance
  - The two-second rule
  - Situations requiring additional following distance
    - Slippery surfaces
    - Behind motorcycles
    - Behind oversized vehicles
    - Behind vehicles with restricted rearward vision
    - When being passed
    - When stopped on a hill
- Distance to the side
  - Avoiding adjacent vehicles
  - Separation from oncoming vehicles
  - Changing lanes at freeway entrances
  - Separation from parked vehicles
  - Compromising between lateral hazards
  - Separating lateral hazards
- Dealing with tailgaters
- Separation from hazardous drivers
  - Drivers with obstructed visions
  - Drivers who are distracted
  - Drivers who are confused
- Separation from school buses and emergency vehicles

Gap Judgment--New drivers are notably deficient in their ability to judge intervehicle gaps when merging, crossing or entering traffic, or passing other cars. Since this ability is more dependent upon perceptual skill than it is upon knowledge, it can only be treated obliquely in the manual. This should be done by relating required gaps to known distances such as numbers or fractions of city blocks. These equivalents will serve as an intermediate aid to gap judgment while the driver is acquiring the skill needed to perceive adequacy of gap size directly.

Information requirements include content concerning intervehicle gaps and procedures for the following:

- Merging with traffic

Merge situations

Lane changing
Freeway entrances
Merging onto another road

Required gaps

Single merges
Multiple merges (i.e., crossing several line of traffic)

Crossing and entering traffic

Required gaps
Handling divided highways
Assuring adequate egress
Interpreting turn signals of other drivers

Passing other cars

Required passing distance
Passing restrictions

Oncoming cars
Sight limitations
Intersections
Lane restrictions
Pavement markings and signs
Return to lane

Handling Emergencies--Most new drivers lack the basic skill necessary to apply emergency procedures. However, if the new driver does not obtain the necessary information at the time of licensing, he may not possess it when he is sufficiently skilled to use it.

Content should include the following:

Slippery surfaces

Avoiding skids by proper steering and braking
Skid recovery

Avoiding use of the brake
Corrective steering
Avoiding overshoot

Finding areas of traction

Vehicle related emergencies. Procedures for handling the following:

Brake failure
Blowout
Power steering failure

Headlight failure
Stuck accelerator
Hood latch failure

Avoiding collisions

Emergency stopping
Evasive steering

Hand position
Wheel turning

Self protection

Rear impact (i.e., avoiding whiplash)
Side impacts
Frontal impacts

Value of seat belts

Collision restraint
Improved control
Reduced fatigue

Accident procedures. Requirements for:

Stopping
First aid
Obtaining identifying information
Informing authorities
Written accident report

Physical and Psychological Factors--Because of their relative lack of skill, new drivers are particularly vulnerable to any physical or mental condition that degrades their ability to drive. Among the various conditions of concern, intoxication is probably the most critical to new drivers as a whole. Other conditions, such as visual, hearing or medical problems, tend to be less characteristic of the youth who dominate the new driver group than it is of adult drivers.

Content in this area should include the following:

Alcohol

Magnitude of drinking-driving problem
Effects of alcohol

Processes affected
Insidious effect upon judgment

Drinking limitations

Number of drinks

Simplified system for determining individual limits

Relation of drinks to driving safely (without introducing the concept of blood alcohol concentration)

Equivalence of common drinks (beer, wine, liquor)

Controlling the effects of alcohol

Controlling intake
Effect of food
Knowledge of drink composition

Elimination of alcohol

The effect of time
Popular myths (coffee, shower)

Laws

Penalties
Chemical tests (including implied consent)

Drugs

Effect of common drugs

Depressants
Stimulants

Effects of marijuana

Drugs and alcohol

Determining effect of drugs

Vision

Acuity
Peripheral vision
Depth perception
Night vision
Visual checks

Hearing

Effect of hearing disorders
Need for frequent hearing checks
Improving the ability to hear sounds outside the car

Fatigue

Need for rest
Limitation in driving

Distance
Time

Effect of night driving
Need for rest stops
Fatigue reduction

Health

Effects of the following:

Minor health problems
Epilepsy
Diabetes
Cardiac problems

Emotions

The effects of anger, worry, impatience

Vehicle Maintenance--Information concerning vehicle maintenance is particularly important to new drivers owing to the tendency of teenagers (who represent the major portion of new drivers) to operate old vehicles and vehicles in disrepair. Content should deal with the importance of frequent vehicle checks including what, when, and why to check or have checked. It is unnecessary to cover the nature of repairs. The following safety-related vehicle components should be covered:

Headlights
Brakes
Turn signals
Windows, windshields, and wipers
Tires
Steering
Suspension
Exhaust

The nature of State inspection requirements should also be described.

Approach

A manual prepared for New Drivers should employ the elements approach listed below.

Factual Content

Recent research suggests that the content of a manual intended for drivers should be highly factual (Mackie and Valentine, 1975). It should concentrate upon providing information that a significant proportion of new drivers may be presumed not to know, rather than simply giving emphasis to things already known. General exhortations to drive safely should be avoided regardless of how inspirational, clever, or humorous the approach.

While all manuals should be essentially factual, the requirement is particularly important in manuals intended primarily for teenagers. This is the age at which individuals are likely to be most skeptical of information they are provided.

Explanatory Content

The manuals should provide the "why" as well as the "what" of driving safety. State manuals often tend to bypass explanation in the interests of brevity. Valid and relevant explanatory information represents a potentially effective way of motivating drivers to employ the practices and observe the rules that are presented in the manual. It probably plays a greater role in helping to form positive attitudes towards safe driving than does content that is more directly attitude oriented. Moreover, it tends to give greater meaning to the various principles and rules and thereby help to enhance retention of information.

Like factual content, explanation is important in motivating all categories of driver. However, it is likely to be particularly important to material that is intended for young people owing to the tendency of this age group to resist authority and therefore authoritative statements.

Situational Content

New drivers tend to have difficulty handling general driving principles and concepts owing to their lack of experience with the actual traffic situations to which they relate. Therefore, information should be made as situational as possible. Principles should be tied to their specific application either by listing them or providing illustrative examples. For example, a principle such as "signal any direction change" should be accompanied by a list of examples such as lane changes, turns at intersections and entering highways.

Interactive Learning

Among new drivers, youthful drivers can be distinguished from adults on the basis of their receptivity to written materials. Generally speaking, teenagers are less inclined than adults to acquire and absorb educational materials outside of the formal school system (and sometimes even in it). This disinclination may be at least in part a consequence of the burden of scholastic reading.

It is generally believed that teenagers are more responsive to materials requiring active participating, such as tests, exercises, puzzles and games than they are to straight reading material. This may be a consequence of a competitive urge which characterizes youths, particularly youthful males. One of the major thrusts of present day education is making learning a more active process. This suggests that an information program intended for youthful drivers should make extensive use of materials requiring active participation on the part of the reader.

EXPERIENCED DRIVERS

The term "experienced drivers" includes all drivers who are currently licensed. The major administrative category is that of renewal applicants. However, it also includes transfers from another State. One would, of course, expect out-of-State transfers to be less knowledgeable concerning the unique traffic laws of a particular State than are drivers who have been licensed to drive within the State. However, since the overwhelming mass of safe driving information consists of general safety practices and laws common to most or all States, the effect of this knowledge deficiency should be slight. Outweighing this questionable disadvantage is the fact that out-of-State drivers represent the more mobile and generally better educated elements of society and, therefore, tend to score higher on written tests than do State residents.

From the standpoint of information requirements, out-of-State transfers will be treated the same as renewal applicants.

Content

The information requirements of experienced drivers are almost identical to those of new drivers. The critical information needs of the two groups are the same and both groups show the same general pattern of strengths and deficiencies relative to these critical needs.

The identity of critical information needs for new and experienced drivers is understandable. What people need to know in order to drive safely does not vary as a function of experience. Since the critical

information requirements for new drivers encompass the full range of driving requirements, (that is, no critical information requirements were eliminated just because the drivers were beginners) the new driver information requirements apply equally to experienced drivers.

What is surprising is that new and experienced drivers manifest similar information deficiences. One would expect experienced drivers to know much more about safe driving than novices. Yet, research into actual test results shows the same pattern of information deficiencies to exist among the two groups.

This finding was further supported by the results of activities later described in "Development of Manuals." The failure of experienced drivers to exhibit more knowledge than new drivers is most likely result of (1) the large number of new drivers receiving instruction under formal programs of driver education, (2) the recency of a new driver's exposure to the State driver manual, and (3) the fact that many drivers in the "experienced" category drive relatively little and are exposed to a restricted driving environment.

The lack of a significant difference between the information deficiencies of new drivers and those of experienced drivers merely reflects a present state of affairs, not an immutable fact of life. If a truly comprehensive manual and a test program were administered to all drivers within a State--licensed drivers, previously unlicensed drivers, and out-of-State transfers--the general level of information among experienced drivers would be raised. Then, the information deficiencies of experienced drivers would be limited to that which has been forgotten since the renewal examination was administered.

Just what information drivers would fail to retain cannot be accurately estimated. One might speculate that information which is little used, such as dealing with emergency situations, would be more quickly forgotten than that which relates to everyday occurrences. In any case, it seems reasonable to assume that the amount of information drivers will forget is considerably less than that volume of information which constitutes the information deficiency of experienced drivers at the present time. Should such prove true, it would be possible to prepare a much abbreviated manual for renewal applicants, one that could be cost-effectively mailed out with renewal notices.

It should be noted that a renewal manual derived in the manner just described would be valid only where drivers had previously been subject to a truly comprehensive manual and test program. This would mean instituting the program on a one-time basis for all renewal applicants and instituting it as a permanent program for previously unlicensed drivers (i.e., new drivers and out-of-State drivers). Any requirement to exempt experienced drivers under a "grandfather clause" would limit the effectiveness of the abbreviated renewal manual.

To test the feasibility of this approach, a comprehensive manual and test, such as that identified in the specification of information requirements for new drivers, should be administered to determine what information is forgotten and what is retained. The more perishable information would define a set of information requirements for a renewal manual. This approach to the determination of information requirements for experienced drivers will be mentioned again in the final section "Evaluation."

Approach

While the information requirements of experienced drivers and new drivers do not differ substantially, experienced drivers seem less willing to admit their need for driving information. One source of evidence for this proposition is the complaint from experienced drivers that tends to accompany the introduction of the knowledge reexamination for license renewal.

The difference between new drivers and experienced drivers in their reaction to a examination requirement probably has a great deal to do with expectation; new drivers expect to be given a knowledge test, experienced drivers often do not. Where experienced drivers do expect to be administered a test, i.e., moving into a new State, the complaints are less vocal.

A major share of the experienced drivers' objections to a knowledge examination probably stems from the belief that their knowledge is adequate. This means that an information system intended for experienced drivers must justify itself to the examinee to a far greater extent than one intended for new drivers. Probably the most effective way to provide such justification is through a preliminary self-evaluation that will reveal to experienced drivers the nature and extent of their knowledge deficiencies.

The self-evaluation could be mailed along with renewal notices. Hopefully, renewal applicants would be sufficiently convinced of their need for information that they would obtain the licensing manual. However, should it ultimately prove possible to meet the needs of renewal applicants with an abbreviated manual, one that is inexpensive enough to be mailed out with renewal notices, the self-evaluation could become part of the manual itself.

OLDER DRIVERS

For the purpose of this specification, older drivers are licensed drivers 60 years and older. They represent a special category of experienced drivers. They make up the one target group having clearly differentiated critical information needs and information deficiencies.

Content

The content of the older driver manual should cover the following topics:

Slow Driving

Because of slowed reactions and difficulties in information processing, many older drivers tend to operate at a speed that is too slow for conditions. This tends to invite rear end collisions. Treatment of this topic should cover the following topics:

- Maintaining the pace of traffic
- Using right hand lanes on freeways and high speed highways
- Avoiding the use of high speed highways when the pace cannot be maintained
- Entering freeways at the speed of traffic
- Maintaining speed on freeways prior to entry into exit lanes
- Slowing for sharp turns
    - Giving adequate warning
    - Avoiding excessive slowing or stopping
    - Avoiding a swing to the left before a sharp right turn

Looking to the Rear

Many older drivers experience difficulty in turning their heads and upper bodies due to muscular difficulties, arthritis, etc. As a result, they often fail to look behind them before changing lanes or backing.

Content of the manual should include the following topics:

- The need for over the shoulder checks to observe vehicles in the blind spot.
- The advantage of (1) oversized mirrors, and (2) a side mirror on the right side.
- Proper backing
    - Looking out rear window
    - Checking for objects before entering the car
- Parking so as not to have to back up

Confusion

Difficulties in information processing lead to confusion when operating in unfamiliar areas or difficult traffic conditions. The content of the manual should include the following topics:

Avoiding unfamiliar areas in rush hours

Problems of heavy traffic

Changes in traffic patterns during rush hours

Use of a passenger as navigator

Avoiding dangerous stops when confused

Avoiding backing up for missed turns

Seeing and Hearing

Deficiencies in seeing and hearing are prevalent among older drivers. Because the changes are gradual, they are frequently unnoticed. Content of the manual should include the following topics:

Need for frequent vision checks, including night and peripheral vision.

Night driving procedures

Time to adjust to low illumination

Avoiding glare

Avoiding use of sunglasses or tinted lenses

Use of high beams

Overcoming glare from oncoming cars

Compensating for lack of peripheral vision

Compensating for hearing loss

Keeping window partly open

Use of mirrors and visual checks

Fatigue

Older drivers tend to get fatigued more easily than drivers of earlier years. This is compounded by a reluctance of older drivers to admit that "they aren't quite as young as they used to be."

Content of the Older Driver Manual should include:

Advanced preparation, including sleeping and proper eating

Trip planning, including distance, route, and time

Frequent rest breaks

Sharing the burden of driving

Health Problems

The variety of various health problems become more frequent among older drivers. Among those critical to driving are high blood pressure, arthritis, and heart trouble.

The content of the manual should include the following:

The need for a physical checkup at least once a year

The importance of avoiding strenuous driving when health is not good

Dizzy spells and blackouts

Need for medical control in the case of serious problems

Medicines

The increased use of medicine among older drivers results in increase in the incidence of problems resulting from improper use.

The content of the manual should include:

Importance and means of determining side effects of alcohol

Avoiding taking alcohol in combination with medicines

Limiting the use of alcohol

Traffic Signs and Signals

Many older drivers are unfamiliar with newer symbolic signs and signals. Their lack of vision and information processing limitations often make it impossible for them to read the legend that goes with the signs.

The content of the manual should include the following:

The basic meaning of red as something you cannot do and yellow as a warning sign

No left turn, right turn and U-turn symbols

Wrong way and do not enter signs

Divided highway symbols

Pedestrian crossing symbols

Merge symbol

Slippery when wet symbol

School zone and crossing symbols

Double broken lines

Reversible lane controls (arrow and "x")

Diagrammatic signs

Driving Alternatives

Many older drivers simply cannot drive safely. They need to be encouraged to restrict severely their motor vehicle operation. Content of the manual should include:

The importance of voluntarily reducing or avoiding driving

Alternatives including mass transit, taxis, community transportation services for the elderly

Means by which older drivers can use political pressure to bring about driving alternatives

Lists of local agencies available to help provide transportation to older people

Approach

The most significant requirements of the manner in which the dissemination of information to older drivers is to be approached include the use of peer involvement, a problem orientation, and media that accommodates the special problems associated with age.

Peer Mediation

The old, like the young, tend to be most responsive to their age peers. Gerontologists have advised that information intended for older drivers should be communicated through older drivers. The most efficient way of doing this is by utilizing established organizations, such as retirement associations, old-age assistance groups, senior citizen organizations, retirement communities, and residence facilities provided for older people. By enlisting the cooperation of the leaders of such organizations, information can be presented in such a way that it appears to come from one older person to another.

Problem-Oriented Approach

Older people tend to acknowledge various of the problems associated with age to a greater extent than they do age itself. Information presented to older people should, therefore, address the problems themselves rather than age. The fact that many older drivers are as safe as drivers in their middle years should be granted.

Media

The system of delivering information to older drivers must take account of the visual problems that tend to accompany advancing years. Printed materials should use the largest, boldest, and clearest form of type available. A minimum of 10 point type should be used in preparing manuals and tests. Illustrations should magnify important detail.

Audiovisual presentations are of questionable value in disseminating information to older drivers. In its graphic form, driving information tends to involve considerable detail (e.g., lane markings, traffic signs, distant vehicles or pedestrians). This detail may be very difficult to view on a distant screen. Older people tend to be reluctant to admit their inability to see a screen clearly from the back of the room. Printed materials have the advantage of allowing the viewer to vary distance according to need.

The audio component of an audiovisual system may also encounter difficulties. In order to be heard clearly by the partially deaf, sound levels may have to reach volumes that are offensive to people with normal hearing.

VIOLATORS

Most drivers are convicted of, or forfeit collateral for, a traffic offense at least once during their driving careers. If a driver is to be singled out as a "violator," the number of violations must be great enough, or the period of time during which they occur must be short enough, to exceed some "normal" threshold. A driver subjected to a special program on the basis of a single violation may be legitimately resentful.

On the other hand, the threshold should not be too high. The time to communicate with a violator is before he begins to compile a lengthy violation record. A communication addressed to the truly chronic violator, suffers the disadvantage of (1) being too late to be of maximum benefit, and (2) being addressed to an individual who is more likely to be characterized by basic personal or social problems than simple information deficiencies.

The information deficiencies of violators do not appear to differ substantially from those of other drivers. Nor, can the two groups be differentiated on the basis of what is critical and what is not.

Prior research has shown that violators differ somewhat from non-violators in generally background, education, and a variety of personality factors. However, the differences are small, do not involve driving information, and tend to reflect the influence of a small corps of truly chronic violators. Generally speaking, the weight of scientific evidence supports the conclusion that the principal difference between violators and non-violators is "who got caught."

While violators are not distinguishable from other drivers on the basis of information needs, they can be distinguished in terms of accessibility. The average driver is likely to resist the sudden imposition of an information program that requires taking a test. The violator is generally more amenable to such a program, particularly if it represents an alternative to a more punitive course of action. In short, the violation provides a form of "leverage," that can be applied by courts and departments of motor vehicles to "encourage" participation in information programs that would be of equal benefit to non-violators.

Content

While traffic violators would benefit maximally from a broad program of safe driving information, it would be extremely costly to administer a program to every traffic violator. Moreover, the request to take part in such a program after just one offense may result in a public outcry. The imposition of the requirement to participate in a broad safety program

would generally demand that a driver be guilty of a truly inordinate number of traffic violations. A program that is directed toward the incipient violator--someone who has only had two or three violations--would appear to be, of necessity, somewhat more limited in scope. Moreover, to be acceptable to the violator, it would presumably deal with traffic laws, since it is violation of these laws that caused the individual to be identified in the first place.

There seems to be no need to acquaint violators with the nature of traffic laws. Very few violators break traffic laws through ignorance of the laws themselves. However, there appears to be a sizable number of drivers who break the law through ignorance of the reasons underlying the law.

Most people who are arrested for breaking a traffic law do not believe that they were doing anything really dangerous. And, it must be acknowledged that sometimes they are right. Traffic laws are not infallible; they are designed to cover the general case and frequently are inappropriate to specific circumstances. However, in most cases the drivers involved were indeed performing an unsafe act and simply did not realize the dangers involved. The ideal approach would be to provide each driver with information related to the specific law violated. Such an approach would represent the ultimate in tailored communications. However, tailoring communications too specifically to the driver's past violations limits the ability of a communication to help prevent future transgressions. The fact that a driver has simply violated a traffic law seems to provide sufficient justification for providing information concerned with traffic laws in general.

The criteria for selecting traffic laws to be "explained" should include the following:

> Frequency of violation--the frequency with which a particular law is the subject of citations for violation. The more frequently a law is violated, the more is to be gained by seeking reduced violations through the provision of explanatory information.
>
> Behavioral implications--the extent to which citations for a violation reflect a particular type of behavior as opposed to simply serving as an administrative category. For example, "failure to yield the right-of-way" in many cases does not represent a particular behavior, but simply the fact that an accident occurred and a particular driver was legally "at fault."

Willfulness--the extent to which violation of a law represents a conscious decision of the driver, as opposed to a mere lapse of attention, an oversight, etc. Running a red light generally results from failure to notice it. An explanation of the importance of stopping for red lights would presumably accomplish little.

A number of violations that appear to qualify for inclusion in a violator information program, under the above criteria, include the following:

1. Exceeding the speed limit.
2. Driving too fast for conditions.
3. Following too closely.
4. Unsafe passing.
5. Failure to come to a complete stop at a stop sign.
6. Running a yellow light.
7. Knowing failure to yield the right-of-way.

Another category of information that appears appropriate for inclusion in a violators information program is a description of the State's "point system." Information concerning the point system does not become relevant until an individual nears one of the significant milestones within the system. Certainly there is no point in taking up space within the new driver or experienced driver program for information relating to a procedure that will only confront a small minority of drivers. In connection with the point system, it is also desirable to attempt to refute the idea frequently advanced by persistent violators that high mileage drivers should be allocated more points than low mileage drivers.

It has been suggested that information presented to traffic violators be confined to the specific violations of which they were convicted. Drivers convicted of speeding offenses would get information concerned with speeding; drivers convicted of running stop signs would get information pertaining to stop signs. This certainly maximizes the relevance of communications. However, it would mean that frequent violators would not receive information pertaining to a particular violation until after they were convicted of it.

Research indicates that drivers who have two or more violations in any one-year period are very likely to have at least one violation in the following year. (Coppin, McBride, and Peck, 1965). Is it not desirable to use the occasion of the first contact to provide information that might play a part in reducing the likelihood of other violations? And, is not simply having an inordinate number of violations sufficient to establish the relevance of information pertaining to traffic violations in general?

Approach

A convicted traffic violator is likely to react with a certain degree of hostility to any program directed specifically at traffic violators--not because of the nature of the program but simply because he or she has been singled out. In a program of personal contact such as a driver improvement interview, clinic, or training program, the hostility can be neutralized through adroit manipulation of the interaction. A written communication cannot do this. However, research seems to indicate that such communications are most likely to have a beneficial effect if it takes a positive approach. Information should be introduced as being an attempt to help drivers to avoid future convictions. Threats, moralizing, or even dwelling upon the violation is likely to discourage reading of the publication. Information concerning the State "point system," the most threatening of the content categories described above, should be held till the end. This does not mean the threat of future penalties should be played down. It just means that it should become a subtle undertone rather than the dominant theme.

ACCIDENT REPEATERS

Drivers who have accidents are probably closer to the general driving population than any of the three "problem" groups (violators, accident repeaters, and drinking drivers). If those drivers whose accidents also involved violations are removed from the group, it is practically indistinguishable from the driving population at large.

Most accident involved drivers tend to perceive of themselves as victims rather than perpetrators of accidents. Among accident repeaters, this perception is probably valid in the case of at least one of the accidents. An information program that attempts to keep drivers from "causing" accidents is not, therefore, likely to find much acceptance among accident involved drivers. On the other hand, one that purports to help drivers avoid having accidents caused to them--that is, one that conveys "defensive driving" information--may not only prove acceptable but may even be appreciated.

Content

Critical defensive driving principles may be drawn from the content identified previously for New Drivers. Information of an essentially defensive nature includes the following:

- Observation
  - Scanning
    - Looking Far Enough Ahead
    - Scanning the Roadside
  - Checking Cross Traffic at Intersections Regardless of Traffic Controls
  - Checking Traffic Behind When Changing Lanes or Slowing Down Suddenly
- Communication
  - Precautionary Use of the Horn
  - Positioning the Vehicle for Maximum Visibility
    - Avoiding Operation in the Blindspot
    - Moving a Disabled Vehicle Well Off the Roadway
  - Use of Emergency Signals, e.g., flashers and flares
  - Not Trusting Other Driver's Turn Signals
- Speed Control
  - Operating Below Posted Speeds When Visibility is Limited
- Inter-Vehicle Separation
  - Following Distance
    - Two-second Rule
    - Conditions Requiring Increased Following Distance
  - Distance to the Side
    - Separation from Parked Vehicles
    - Not Driving With the Pack
    - Complimentary Lane Changes at Freeway Entrances
    - Compromising and Separating Risks
    - Identifying Potentially Hazardous Drivers
- Collision Avoidance
  - Leaving the Roadway
  - Evasive Steering
- Use of Seatbelts

Approach

A program intended for accident repeaters must approach the issue of accidents sensitively. Many, if not most, of its recipients will tend to view themselves as the aggrieved party. It is important therefore, to move as quickly as possible into the concept of shared culpability. Emphasis should be placed upon the importance of judgment and caution in achieving self-protection, with little or no reference being made to traffic violations or anti-social driving behavior.

DRINKING DRIVERS

Among traffic violators, drinking-driving offenders warrant special attention for two reasons. First, drinking and driving is the single most serious traffic offense. Somewhere between a third and a half of traffic fatalities involve the use of alcohol. Secondly, drinking and driving is distinguished from other traffic offenses by the fact that the behavior that leads to the offense does not involve driving itself, or anything that even has to do with the automobile. Rather, it has to do primarily with when and how much an individual drinks.

A number of communities conduct informational programs for drivers convicted of drinking-driving offenses. However, it appears that the great majority of convicted drinking drivers do not benefit from any formal information program.

Content

In past years, information dispensed to drinking drivers, and to the public at large has echoed one theme---don't drink and drive. This is still the substance of many campaigns. However, in recent years, new programs have taken a more accommodating tack. They have attempted to induce drivers to regulate the amount and timing of their alcohol consumption so as to keep the alcohol in their blood stream below levels that would lead to serious impairment of driving skills.

Convicted drinking-drivers are generally rather familiar with the laws relating to drinking and driving, as well as the penalties that may be levied upon those who violate the law. An information program for convicted drinking-drivers should have two aims: (1) to motivate drivers to control alcohol consumption and (2) to provide practical means for exercising such control short of giving up either drinking or driving. The following topics are appropriate to an information program intended for convicted drinking-drivers.

Magnitude of the Drinking-Driving Problem

The typical convicted drinking-driver has been penalized for engaging in an activity that he has been carrying on for some time without accident. He may not be convinced that the offense is as serious as the law or the court judges it to be. Some information concerning the magnitude of the drinking-driving problem, e.g., the number of alcohol-involved highway fatalities, may be necessary to put the drinking driver in a receptive frame of mind.

Effects of Alcohol

Despite their experience with alcohol, many drinking drivers are not fully aware of the effect that alcohol has on the skills that are critical to safe driving. They need to be informed of the effect which alcohol has upon decision-making, vision, motor coordination, and emotional control.

Experienced drivers, because of their "success" in driving after drinking tend to be skeptical concerning statements as to the debilitating effect of alcohol. They feel they can "handle" alcohol well enough to avoid unsafe behavior. The most convincing evidence to the contrary seems to be a self-demonstration, the so-called "drink in," where drivers are permitted to view records of their performance under various levels of blood alcohol content. While such a demonstration is beyond the scope of a purely informational program, demonstrations of the effect which alcohol has upon the performance of others, particularly drivers of known skill, provide a partial substitute.

Alcohol Content of Drinks

Many drivers are surprisingly ignorant concerning the alcohol content of various drinks. The potency of beer is generally underestimated. While this information deficiency is particularly characteristic of youthful drivers, it also prevails to a surprising degree among experienced drinkers and experienced drivers.

Separating Drinking and Driving

The trauma of a drinking-driving conviction, along with the penalties involved, will encourage separation of drinking and driving for a time. However, such separation involves considerable inconvenience. If it is to endure, the driver must be provided good reasons for putting up with the inconvenience and practical means for minimizing it. Among the latter are drinking at home, riding with others or adopting a rotation system or using public transportation.

Controlling Drinking

Despite the desirability of keeping drinking and driving separate, few people who drink frequently and drive frequently will be able to avoid putting the two together. If one is willing to compromise an ideal for what is attainable, drivers can be provided practical methods for controlling the adverse consequences of drinking and driving. Such methods include limiting the rate of consumption, eating, diluting the alcohol content, engaging in diverting activities, stopping or tapering off early and waiting before driving.

Laws and Penalties

Many convicted drinking drivers are not knowledgeable in drinking-driving laws, despite their brush with it. First time offenders may be unaware of penalties for repeated offenses. Those who benefit from plea bargaining, may not know the extent of their jeopardy. Drivers convicted in part upon the basis of a chemical test may conclude that their mistake was in taking the test. Such misconceptions must be corrected and the actual laws explicated.

Need For a Plan

Control of alcohol, like control of smoking or diet, is facilitated by a well though out plan of action. Drinking-drivers should be encouraged to formulate their own personal plan of action.

Approach

The suggestions offered for approaching traffic violators apply equally to convicted drinking-drivers.

DEVELOPMENT OF MANUALS

A set of manuals was prepared to fulfill the information requirements specified for each of the target groups in the preceding section. The development of manuals was closely coordinated with the test development process to be described in the next section.

DEVELOPMENT PROCEDURE

While the specific activities involved in the development of manuals varied from one target group to another, the same overall process was followed. The key elements of this process were preparation of an initial draft, a pilot test, and a final verification test.

Preparation of Initial Draft

An initial draft was prepared from the information requirements and general manual requirements by a member of the project staff. This draft was reviewed by the following specialists:

Technical Specialist--for accuracy of content.

Communication Specialist--for recommendations as to approach, format, wording and suggested illustrations.

Reading Specialist--for a preliminary determination of reading level and revision, as necessary, to improve readability.

Artist--for preparation of prototype artwork.

Each manual went through several cycles of review prior to the pilot test. It was also recycled at least once after the pilot test and the verification test. The number of reviewed drafts per manual ranged from five to twelve.

Not every item of information in the manual represented a critical information deficiency. Some information of lesser criticality "rode the coattails" of critical information. If a particular item of information represented an example or an application of some critical principle, and could be included in the text with the mere addition of a few words, it was considered appropriate to do so.

Pilot Test

The pilot test procedure called for a draft of the manual to be issued to a group of fifty or more drivers who were roughly representative of the general population for which the manual was intended. A pre-test was administered to all pilot test participants prior to issuance of the manual. Later, a post-test was administered to assess knowledge gains. So that maximum value could be obtained from the pilot test,

drafts were made as complete as possible. Each draft incorporated all required content and utilized a format suitable for a finished product. Illustrations were furnished since they formed an integral part of the content. However, they utilized prototype rather than polished artwork.

Two alternate test forms were used during pilot testing. Half of the drivers received each test form during pre-test. On the post-test, the forms were reversed so that each driver received a different test form. This approach allowed group gains for each test item to be assessed without contamination from prior exposure to the test item.

Individual item gains were examined and the results applied to the revision of the initial draft. Where pre-test scores pointed to an information deficiency, and post-test scores indicated the deficiency had not been overcome, that particular test item was examined to determine whether the problem lay with the item or with the manual. If the test item was clearly at fault, it was revised--as will be discussed in the next section. Where the problem appeared to lie with the manual, the section of the manual dealing with the item was examined to see if its content or format could be improved. Improvements included preparing additional content, using illustrations, lowering reading level, or introducing format changes designed to give greater emphasis.

Where initial performance was high (i.e., few failed the item), it was often possible to reduce somewhat the emphasis that the information received in the manual. Further, if the information were not highly critical or was not one specifically identified as representing an information deficiency in the earlier determination of information requirements, it was possible to eliminate that item of information altogether. This occurred in a few instances.

While the pre/post-test evaluation formed the backbone of the pilot test, qualitative comment was also sought and utilized. Each of the participants in the pilot test was asked to comment directly on the pages of the manual. In addition, a copy of the initial draft manual was sent to each of the Target Group Specialists for their review and comments.

The pilot tests were more valuable in identifying deficiencies in manuals and tests than in providing estimates of information gain from reading manuals. It is not possible to match the incentive of a license test where the test is not being used for active licensing. The information gains obtained during the pilot tests probably underestimate those that may be secured among true license applicants.

The comments received from these two sources helped not only to identify shortcomings of the manuals, but were also useful in charting the course of future revision.

Verification Testing

A final verification test was conducted following completion of revision. Cost considerations prevented the pre/post-test evaluation that characterized the pilot test. The verification test was confined to a review of the manual by (1) Target Group Specialists, and (2) a group of approximately 25 individuals representative of target group drivers. Reviewers were asked to identify specific deficiencies as well as strong points of the manual. In addition, each filled out a questionnaire calling for a general evaluation of the content and format of the various sections of the manual.

SPECIFICATION OF MANUAL REQUIREMENTS

The Specification of Information Requirements established the requirements of an information program for each of the target groups. These requirements were supplemented by additional requirements that were specific to the manuals. Specifications imposed by the manual cover utility of information, organization of content, readability, writing style, illustrations, and State laws.

Information Utility

The information provided to drivers should be given in the most usuable form. The following specifications were applied to development of the manuals in order to improve their utility.

> Distances--Drivers are generally unable to estimate distances in feet with any precision. This process should be given in terms of more meaningful frames of reference, such as portions of city blocks. Where possible, time should replace distance to allow measurement by counting. For example, following distance can be better expressed in terms of seconds than in terms of car lengths.
>
> Relationships--Drivers are unlikely to recall complex relationships such as that between alcohol consumption and blood alcohol level by weight of the person involved. Nor, are they likely to carry the drivers manual around with them as a prompt. The use of some general rule of thumb may lack precision but will make up for it by increasing the likelihood that the information can be recalled.

Concepts--Theoretical concepts would not be introduced unless they have some utility. The concept of centrifugal force does not particularly aid drivers in handling curves. Nor does the concept of blood alcohol concentration aid in understanding the relationship between number of drinks and safe driving.

Alternative Sources--There is little utility in putting information in the manual if the driver has better access to it through alternative sources. If, for example, speed limits for interstate highways are posted on the highways themselves, there is little need for the driver to carry this information around in his head.

Organization of Content

Except where it is used as part of an educational program, a licensing manual is not generally read in a front-to-back sequence. Rather, the reader will tend to open the manual pretty much at random, taking up the various sections in a chance sequence. The reading pattern resembles that of a brochure rather than that of a text. To accommodate a haphazard reading pattern, the manual should be constructed so that each section is relatively independent of the others. Where one section requires recourse to another, the sections should be specifically cross-referenced. Material in later sections cannot assume the knowledge of material in earlier sections, unless the earlier sections are specifically referenced.

Readability

A person cannot be held responsible for acquiring information if he cannot comprehend it. Nor can he be expected to pass a test on the information he possesses if he cannot understand the questions. In recent years, courts and legislatures have begun to place the burden for effective communication upon the governmental and private agencies that prepare information for public consumption.

The reading levels of most State driver license manuals and tests cluster around the twelfth grade. A manual written at this level was comprehensible to the average high school graduate. But, by the same token, it is above the reading level of about half the high school graduates. Many applicants for drivers licenses never got by the eighth grade--or even the sixth grade.

There is a trade-off involved in arriving at the optimum reading level for licensing manuals and tests. Generally speaking, as the reading level of a communication is lowered, the number of people who can read it increases. However, lowering the reading level also increases the amount of verbiage involved, thus increasing the reading time and the risk of losing the good reader.

The optimum reading level appears to lie somewhere in the fifth to sixth grade. Material written at this level will be comprehensible to the great majority of license applicants. Yet, it is sufficiently above the "see spot run" level to avoid turning off the good reader.

Drivers whose ability to read falls below this grade level would have to be accommodated through an alternative information delivery system, such as an audiovisual presentation.

Not all material can be cost-effectively written at the fifth-sixth grade level. Some concepts simply cannot be explained in fifth-sixth grade terms, at least not without greatly inflating the amount of the explanatory content. Some technical terms have no simple equivalents. Such material will simply be incomprehensible to some portion of the applicant population. It is not necessary that everything be capable of being understood by those with a fifth-sixth grade reading level. It should also be noted that some technical words and phrases are sufficiently commonplace as to be readable despite their length or phonetic structure.

Listed on the following pages are some of the major guidelines used in keeping the reading level of manuals and tests low. These guidelines make up a readability specification.

To verify the achievement of prescribed reading levels, ten pages were selected at random from each manual and given a readability analysis using a formula prepared by Fry (1968). The results of this analysis are summarized in Table 1. It is apparent that the goal of the readability effort was generally realized.

TABLE 1

Reading Levels of Manuals by Grade

Target Group	Mean Grade Level (10 samples)	Low Sample	High Sample
New Driver	5.1	2	7
Youthful Driver	4.9	2	6
Renewal Applicant	5.1	2	7
Older Driver	5.8	3	8
Violators	4.7	3	6
Accident Repeaters	6.5	5	8
Drinking Drivers	5	4.5	6

The high reading level of the Accident Repeater Manual is attributable to the unavoidable complexity of the accident descriptions that made up a significant portion of the content. Since each description was accompanied by a diagram, it is likely that the material is more readily comprehended than the reading level would suggest.

Writing Style

The purpose of a driver's license manual is similar to that of the telephone directory, namely to provide people with the specific information they are seeking. The manual should make that information as accessible as possible and communicate it as clearly and economically as possible. It is, of course, desirable that the manual be inherently interesting. If its contents are sufficiently inviting, some drivers may be encouraged to read it without the impetus provided by a licensing examiner. However, high interest value should not be sought at the expense of communication. If efforts to make it interesting result in increasing its length, so that it takes longer to read, and things are harder to find, the manual's utility will have been compromised.

Illustrations

Illustrations are costly of space. Where the size of the manual is constrained by cost considerations, illustrations often tend to displace important content. If the purpose of the manual is primarily to communicate information, then illustrations should be confined to those necessary to afford effective communication of information. Illustrations intended only for eye-appeal are wasteful.

The same considerations apply to the use of color. Extensive use of color in a manual can add to its cost. Where color is an essential part of the information being communicated--the color of traffic lights, signs, and pavement markings--use of color will be cost-effective. Otherwise, it is not.

These comments relate to requirements for the use of illustrations and color in manuals. They are not intended to discourage States from further use of illustrations and color simply to improve the attractiveness of manuals, where such can be done without sacrificing the ability of the manual to fulfill specified requirements.

The following additional points are important to effective communication:

1. Where possible, the driver point of view should be used to minimize the magnitude of the translation from real driving situation to the printed page.

2. Where an external frame of reference is necessary to show relationships between the driver and the driving environment, an illustration is easier to comprehend than an overhead, diagrammatic representation.

3. Details should be confined to that essential to the information being communicated. Extraneous information may be distracting or confusing.

4. In keeping with 3 above, line drawings should be used in preference to photographs in order to control extraneous information, except where detail is essential (e.g., "spot the hazard") or a higher degree of realism is desired.

5. Where directions are important in a driving situation, the scene should be presented from the same perspective as the text. For example, a car "turning left" should be shown from behind so that the car's left and the reader's left are the same.

State Laws

The immediate objective in preparing manuals for each of the target groups was to permit their use by drivers in the State of Virginia. However, the broader goal in preparing them was to evaluate the effectiveness of each manual--its content and its approach--in leading to the acquisition, retention, and application of safe driving information by drivers in any state. In order to achieve this goal, it was necessary to make the content as generally applicable across States as possible.

In preparing manual content, reference to specific State laws and regulations was minimized. While this step was prompted largely by research needs, there are several good reasons for adopting a similar approach even in preparing manuals intended solely for one state.

First, the laws that are promulgated through a driver licensing manual are only a small sample of the laws appearing in the State motor vehicle code. Often there is little discernable logic behind the selection of the sample. They are not necessarily those most critical to safety nor those most frequently violated.

Secondly, the provisions of the law often tend to focus more upon the needs of enforcement than safety. For example laws that prescribe when headlights should be used generally are expressed in terms of hours before and after sunset rather than levels of visibility.

Thirdly, the language in which laws are written is typically very difficult for the driving population at large to comprehend. A law that cannot be understood is not likely to be observed.

It is possible to accommodate most individual State laws through safe driving practices that are broad enough to encompass the specifics of individual laws. For example, the requirement to initiate a turn signal at least three seconds prior to turning a corner would meet the legal signalling requirements, city and rural, of all States. So too would a requirement to dim the headlights when an oncoming car is a block's distance away. Moreover, phrasing driving practices in these terms provide the driver with a more meaningful frame of reference than do the distance measures generally set forth by State laws.

Some recourse to laws is often useful in motivating drivers to adhere to safe driving practices However, such reinforcement can be provided without a verbatim repetition of the law itself.

It was not possible to avoid all reference to Virginia State laws in the project-developed manuals, nor would it be possible in preparing manuals for any other State. For example, license applicants must be informed of the procedures for gaining a license; such procedures are too individualistic to be characterized in general terms. So too are the penalties for second offenses, listed among information requirements of the Violators and Drinking Driver Manuals.

Where possible, State-specific information was consolidated into a limited number of pages in order to limit the amount of revision that would be required if a particular State wished to utilize one of the manuals directly. Some consideration was even given to the use of fly sheets or inserts to remove necessary State-specific material from the body of the manuals. However, it was feared that such an approach might detract from the appearance of the manuals as official State documents and thereby attenuate their effect.

NEW DRIVER MANUAL

A Manual for New Drivers was prepared in accordance with the Specification of Information Requirements, and the manual's specifications. Since the New Driver Manual was the most comprehensive of the manuals, it was one of the first to be prepared.

The New Driver Manual was pilot tested on two groups of high school driver education students. One group of 90 students came from a suburban high school in a highly affluent community. The other group consisted of 80 students from an inter-city high school. Two forms were used to prevent the appearance of spurious knowledge gains from pre- to post-tests.

The students in the suburban high school improved from 75% correct on the pre-test to 87% correct on the post-test--a gain of 12%. This gain, while small, is statistically significant ($.05>p>.01$).

Due to problems in scheduling, it was necessary to conduct the pilot test during the final weeks of the driver education program in which the students were enrolled. This accounts for the relatively high pre-test scores. It is interesting to note that a knowledge gain was possible even among relatively bright students completing a driver education course.

Students in the inter-city school evidenced only a 5% gain, from 51% to 56%. Such a marginal gain may be attributed to the failure of the majority of students to read the manual in its entirety. A few didn't read any of it.

Analysis of individual item results was successful in identifying deficiencies in both tests and manual. Equally informative were the comments offered by both groups.

The majority of the students in the suburban high school considered the manual to be "very easy," while the majority of those in the inter-city school rated it "easy." About a quarter of the students in the inter-city school considered it "a little difficult." No one found it "very difficult."

Of the entire sample, about half of the students felt that class discussion would have helped in using the manual, while the other half felt that no discussion was necessary. Over 80% of the students believed that the manual would help them drive more safely. The most popular sections of the manual are those dealing with emergency procedures, passing and following distance, car care, and alcohol control.

Substantial comment was received from each of the Target Group Specialists. This comment was extremely useful in overcoming deficiencies of the initial draft, particularly those of a technical nature.

YOUTHFUL DRIVER SUPPLEMENT

The earlier Determination of Information Requirements indicated that the information needs of the youthful drivers are largely the result of inexperience and are highly similar to those of adult new drivers. For this reason, one basic manual was prepared to meet the needs of both drivers.

Despite the great overlap in the needs of youthful and adult new drivers, some differences exist. Evidence indicates that youthful drivers tend to drive at higher speeds than adults, particularly at night and under the influence of alcohol and drugs. Youthful drivers tend to be more vulnerable to distractions inside and outside of the car than adults. Finally, youthful drivers are more likely than adults to operate older or poorly maintained cars.

Presentational Supplement

In an attempt to cope with the specific problems of the youthful driver, a short supplement to the New Driver Manual was prepared. It dealt specifically with those information items just mentioned. The initial draft was prepared with the aid of a youth specialist consultant in order that the vocabulary and examples might be more meaningful to youthful readers. A pilot test draft was administered to 100 high school students recently enrolled in a driver education course. A 15 item test was prepared. Since only one form of the test was available, students were randomly divided into two groups. One group took the test as a pre-test, while the other took it as a post-test. Substantial learning was evidenced by a gain in score from 60% on the pre-test to 81% on the post-test. This gain was highly significant ($p<.01$).

The next question was whether the presentational youthful driver supplement would add significantly to whatever learning might occur through reading the New Driver Manual. This question was answered by administering the New Driver Manual to a group of 100 high school students, 50 of which received the youthful driver supplement in addition. The results showed no difference between the two groups. Interviews with

teachers and selected students were undertaken to determine the r. ›n for the failure of a difference to appear. The judgment of the interviewer was that students tended to devote a fixed amount of time to reading of the materials. Those asked to read two documents simply spent proportionally less time on each one.

Interactive Supplement

Literature dealing with the needs of youthful drivers has emphasized the advantage of material with which students can interact over that which merely presents information. This need was previously identified in the new driver information specifications.

The idea of employing a more interactive approach struck a responsive chord in the driver education teachers participating in the pilot test. Noting the volume of information that high school students are already expected to read, they were not surpri›d that the additional material of the presentational supplement did not lead to proportionally greater information acquisition. However, they felt that an approach that called for active involvement might summon forth greater effort. They believed that males would be particularly responsive to materia' that presented a challenge, that capitalized upon the competitive instincts that characterize most youthful males.

A second youthful driver supplement, one employing an interactive approach, was prepared. The interactive supplement had the following salient characteristics:

1. Information Application--The supplement required the application of information from the New Driver Manual to the solution of various problems, puzzles, and exercises. Short of supplying the answers to questions, it did not attempt to furnish information. References were given to those pages of the New Driver Manual identifying the content dealing with a particular problem.

2. Variety of Content--A variety of interactive approaches were used. They include word matching, picture matching, sentence completion, crossword puzzles, word mazes, hidden pictures, and several other devices. Educators have pointed to the importance of variety in maintaining the interest of youthful students.

3. Topical Independence--The supplement adhered tightly to the general manual requirements that each topic be addressed independently and without recourse to other topics. Observation indicates that people are inclined to enter the pages of a puzzle book in even more haphazard fashion than they do a presentational manual. In the supplement, this tendency was accommodated by confining any one problem, puzzle or exercise to two facing pages.

The interactive version of the Youthful Driver Supplement was pilot tested as a part of the same pilot test previously described for the New Driver Manual. The results of the comparison appear in Table 2.

TABLE 2

Scores obtained from administration of the New Driver Manual and the interactive Youthful Driver Supplement at two schools.

	SCHOOL					
Manual	Suburban (N=90)			Inner-City (N=80)		
	Pre-Test	Post-Test	Gain[1]	Pre-Test	Post-Test	Gain[1]
New Driver Manual	75	87	16%	51	56	10%
Youthful Driver Supplement	75	77	3%	53	59	11%
Both	73	84	15%	52	60	15%

Both the New Driver Manual and the Youthful Driver Supplement produced marginal information gains.[1] However, the addition of the Youthful Driver Supplement to the New Driver Manual did not yield any improvement in information gain. It is worth noting that, in the inner-city school, the supplement accomplished as much as the manual. This may be a chance finding. On the other hand, it is in keeping with expectation. One would generally hypothesize that an interactive approach would have a proportionally greater appeal to less able and less highly motivated students.

It is also worth noting that the post-test scores obtained by students in the suburban high school on the New Driver Manual (87), were higher than those obtained by students in the same high school on the earlier version of the Youthful Driver Supplement (81). This occurred despite the fact that the students reading the New Driver Manual were responsible for the larger volume of information. Had the New Driver Manual been issued during the first week of driver education, as was the earlier version of the Youthful Driver Supplement, and the initial scores equally low (60), it is possible the New Driver Manual would have shown an appreciably greater gain.

[1]Gain equals the increase from pre-test to post-test expressed as a percentage of pre-test score.

About a third of the pilot test students worked all of the exercises while a majority of the remainder worked some of them. When asked how helpful the exercises were in learning material from the New Driver Manual, almost half said "very helpful," a third said "helpful," and the rest said "a little helpful." 10% of the students found the directions a "little confusing," while the rest found the "easy to understand." The puzzles themselves were generally considered "easy." A few found them "very easy," and a few found them "hard." Finally, slightly over half of the students considered the exercises "worthwhile," and the rest considered them "all right."

While the results of the pilot test failed to furnish empirical support to the Youthful Driver Supplement, the reaction of teachers and driver licensing officials was very positive. In fact, several representatives of departments of motor vehicles were interested in implementing the manual on a trial basis for a variety of age groups, simply to determine the public reaction.

In view of the time and expense that had already been devoted to preparation of the interactive upplement, a decision was made to incorporate it into the evaluative phase of the study, where the incentive of the driver's license would presumably encourage students to read it. Although the effectiveness of the interactive Supplement in leading to information acquisition had not been demonstrated, the Supplement was included in the Evaluation. This issue will be further addressed in later discussion of the Evaluation.

RENEWAL MANUAL

Evidence obtained from analysis of license test results during the Determination of Information Requirements revealed identical patterns of information deficiencies for renewal applicants and new drivers. However, two doubts clouded the interpretation of these results. First, the tests from which the conclusions were drawn bore a faintly academic aura. Much of the information tested could only come from books. It was possible that a test of a more practical nature would allow renewal applicants to evidence the lessons of experience. Secondly, the wording of even the practically-oriented test items tended to penalize those whose exposure to multiple-choice tests was limited or distant in time.

Renewal Testing

Because of the doubts identified above, a final decision on whether or not a Renewal Manual would be prepared was postponed pending the development of a test based upon the New Driver Manual. It was believed that the New Driver Test would provide a more valid indication of the level of knowledge among renewal applicants than did previous license

tests. This belief was based on both the practical nature of the information requirements and the rigorous nature of the specifications covering construction of test items. If a more practical test were to reveal that many of the tested deficiencies of experienced drivers didn't indicate true knowledge deficiencies, there would be a need for a separate manual. Such a manual would deal only with a relatively small number of information deficiencies characteristic of experienced drivers.

The development of the New Driver Test is described in the next section "Development of Tests." Upon completion of the test, each item was administered to a sample of 200 license applicants at five Northern Virginia branch offices of the Division of Motor Vehicles. Approximately half of the applicants were previously unlicensed, while the remainder were experienced drivers (out-of-State transfers).

A comparison of scores on each item showed only chance differences between the experienced and new drivers. The results were the same on those items on which experienced drivers would logically be expected to excel (e.g., traffic signals and rules of the road). It is true that the experienced drivers did well on such items; most were passed by more than 90% of the examinees. However, the same was true of new drivers.

Development of Renewal Manual

The similarities in information deficiencies of renewal applicants and new drivers, found in the analysis of earlier tests and replicated in analysis of the New Driver Test, might imply that the two groups could have shared the same manual. However, this did not appear appropriate for two reasons. The first reason was the greater problem in gaining acceptance of the manual among the renewal applicants. The general resistance of experienced drivers to knowledge reexamination was mentioned earlier, as was the desirability of some type of self-evaluation designed to convince renewal applicants of their need for additional information. Fulfilling this need meant including in the Renewal Manual some introductory information which attempted to justify the existence of the manual as well as a short self-test.

A second reason why new drivers and renewal applicants could not share the same manual had to do with the differences between the two groups with respect to their information sources. Much of the knowledge that new drivers evidenced in their tests came from the manual that they read prior to taking the test. This is why critical information cannot be left out of a manual for new drivers simply because most new drivers already know it. However, the situation is somewhat different for renewal applicants. It is unlikely that they owe much of their information to a State driver manual. Therefore, in those instances where the overwhelming majority evidenced possession of a particular item of information, it may be hypothesized with some certainty that they knew the information without reading the manual. For this reason, it is not necessary to include in a Renewal Manual information that the great majority of experienced drivers already possess.

A preliminary version of the Renewal Manual was prepared using a self-test approach and omitting the information that experienced drivers appeared to know already. At the same time, because the information contained was similar to that provided in the New Driver Manual that consideration was given to merely adapting the latter document for use by renewal applicants. Such an adaptation would allow a substantial savings on typesetting and printing costs. To determine the feasibility of adapting the New Driver Manual for use by renewal applicants, two acitivities were undertaken. The first consisted of identifying those information items that were passed by 90% or more of the experienced drivers participating in the renewal test and deleting the corresponding portions of the Manual. The second involved having a group of experienced drivers review the New Driver Driver Manual and striking out those portions of it that they felt were not useful to them. There was a considerable overlap between the information items eliminated by the two processes. However, the experienced drivers tended to confine their deletions to a few sections rather than a large number of specific items. The sections they deleted were the following:

- New driver licensing procedures
- Traffic control signals and markings, except for those recently introduced
- Right-of-way laws
- Hand signals
- Procedures for estimating gaps

The results obtained from the experienced drivers appeared to indicate that the New Driver Manual could be made acceptable to renewal applicants merely by eliminating certain sections. Therefore, the decision was made to adapt the New Driver Manual rather than print an entirely separate manual. The largest change was replacing the section of the New Driver Manual describing licensing procedures with a self-test consisting of ten items. The ostensible purpose of the self-test was to enable renewal applicants to determine whether or not they needed to read Renewal Manual. However, its true purpose was to convince them of the need to read it. Therefore, relatively difficult items were selected for the self-test.

The Renewal Manual prepared from the New Driver Manual contained many items of information that renewal applicants already possessed. However, subsequent reviews of the Manual and its dissemination to large numbers of renewal applicants in the latter Evaluation phase of the project, did not result in objections to the Manual as being too elementary for experienced drivers.

Omission of the section on licensing procedures eliminating most of the information that was specific to the State (Virginia) in which the Manuals would be disseminated during the Evaluation. Eliminating the few remaining references to State-specific information would allow the resulting manual to be employed by other States without any revision of the text. Since this seemed desirable, the Renewal Manual was purged of all State-specific information.

OLDER DRIVER MANUAL

A manual for older drivers was prepared in accordance with the specifications established earlier. The initial draft was pre-tested on a group of 19 members of the senior citizens group in Anaheim, California. Attempts to obtain a larger sample were unsuccessful. Contrary to the belief of some, the majority of older people, at least those who drive, are quite active and not simply sitting around waiting for something to do. Two test forms, each consisting of 15 items taken from the Older Driver Manual, were administered on a pre/post-test basis. The forms were switched across administrations to prevent spurious gain scores.

Scores rose from 69 correct on the pre-test to 82 correct on the post-test, a gain of 19%. Despite the small number of individuals involved, the difference is significant at the .05 level ($p < .05$).

Most of the gain was attributable to seven of the 30 total items. These items dealt with entering freeways, the "blindspot," shape and color of signs, the meaning of diagrammatic signs, and lane markings.

Four items were failed by over half of the drivers on the post-test. These items dealt with peripheral vision, reversible lane markings, sign color and the importance of avoiding rush hour traffic. Since there was nothing to suggest that the test items themselves were deficient, it was assumed that these items were given insufficient emphasis in the manual. The problem of sign color was expected to be overcome through the use of actual color in the manual. The rest of the deficiencies were corrected through rewrite.

The Older Driver Manual was also sent to Target Group Specialists for comment. Of all the target group specialists, those concerned with older drivers were the most responsive. Most of their comments dealt with manner of presentation rather than content. This is not surprising since Target Group Specialists were the basic source of content in the first place. Suggestions offered by the Target Group Specialists included the following:

> Wording--Use of phrases commonly used by older drivers was suggested as a way of striking a responsive chord on the part of readers. Examples include referring to other drivers "driving too fast,"

rather than to older drivers driving too slow. Or, reference to other drivers "coming out of nowhere" rather than to the failure of older drivers to make appropriate visual checks.

Local Assistance Sources--The initial manual noted the existence of local agencies capable of assisting older drivers in finding alternative forms of transportation. The target group specialists suggested furnishing the names, addresses, and telephone numbers of specific local agencies. Such a list was printed on the back cover of the final manual. Putting the information on the back cover made it more accessible for reference purposes.

The specific organizations identified were permanent State or local agencies rather than agencies established as a part of a federal, State or local program. Permanent agencies provided a more enduring reference, even though in many cases inquiries would be referred to other agencies.

Medical Assistance--Conflicting recommendations were obtained from the medical and non-medical Target Group Specialists. The physicians felt that there was too much self-help and too little reference to sources of medical assistance. Non-medical representatives felt just the opposite, that drivers were being asked to "see your doctor" too often. They noted that in this day of specialization, few older drivers had a doctor that could be characterized as their own, and that too frequent reference to medical sources would detract from the credibility of the manual. The response to this comment was no change in the amount of reference to medical sources, but rather a better delineation between where such assistance was and was not needed.

Verification Testing

Following revision, the Older Driver Manual was disseminated for review and comment among the following groups or individuals:

- Target Group Specialists
- Representatives of senior citizens associations
- Representatives of a retirement group
- Representatives of old age assistance groups

Very little of a substantive nature was obtained through this review. The most common "comment" was a request for copies of the manual when it was printed. Evaluative comments were highly favorable. This is probably less a testimony to the value of the manual than it is a reflection of the interest and enthusiasm shown by representatives of older driver groups throughout the development of the manual.

VIOLATORS MANUAL

A draft of the Violators Manual was prepared according to the Specifications of Information Requirements, and the Specifications for Manuals. The Manual explained some of the lesser known reasons behind some of the most frequently violated laws. It also attempted to refute the position, held by many high mileage drivers, that drivers should be "allocated" violations according to the amount of driving they perform.

Pilot Test

The Violators Manual was pilot tested on a group of 36 traffic offenders assigned to a court-sponsored traffic school in Arlington, Virginia. Two six-item test forms were used, the forms being switched from pre-test to post-test. Mean scores improved from 45 on pre-test to 63 on post-test, a gain of 40%. The difference is statistically significant at the .01 level. However, with such a low initial score, there was room for a great deal more improvement that that obtained. Part of the explanation for failure to achieve greater gain scores doubtless lies in the character of the pilot test population. Convicted traffic offenders are not the most highly motivated group. However, part of the problem could be attributed to the ambiguities in both the test and the manual.

Each traffic offender was asked to indicate the extent to which the manual succeeded in convincing them of the validity of laws and regulations. The explanation concerned with stop signs was apparently most effective; 85% of the traffic offenders indicated they were "really convinced." The remaining sections of the manual "really convinced" between a half and two-thirds of the readers. The one exception was the explanation of the Virginia "point system" which netted only a 12% response in the "really convinced" category. Those readers who were not "really convinced" largely checked the "sort of convinced" category. Less than 10% indicated they were not convinced at all. Eighty-eight percent of the readers said that the manual would "make a difference" in their driving habits.

Turning from content to form, about half of the readers felt the manual was "easy" to understand, while 38% considered it "very easy." The rest considered it "a little difficult." About three-quarters of the readers felt the illustrations helped them to understand the manual.

Copies of the manual were also sent to the Target Group Specialists. Not a great deal of comment was forthcoming. Most of the Target Group Specialists were driver improvement analysts whose sole contact with traffic violators was through their own driver improvement programs. Most of these programs were highly attitude-oriented rather than informational. They had nothing to say against the manual; they simply lacked any basis for offering constructive comment.

Verification Testing

The violators manual and test were revised on the basis of pilot test results. In view of the lack of comment from Target Group Specialists during the pilot test, the final draft was not disseminated among the entire panel during the verification test. Rather, it was sent to a group of traffic safety education specialists, including one driver improvement analyst, primarily for technical review. The verification review produced practically no change in form or content.

ACCIDENT REPEATERS MANUAL

A manual for accident repeaters was prepared according to the Specification of Information Requirements and the Manual's Specification. It contained an introduction that aimed at convincing the reader that almost any accident was the "fault" of more than one person. The defensive driving principles which made up the content of the manual were introduced in the discussion of thirteen fictitious accident reports. Each report presented both a diagrammatic and a narrative description

of the accident and asked the reader to decide whose fault it was. Then the mistakes of the drivers were reviewed as a means of introducing defensive driving principles. These principles were summarized at the end of each accident report.

The thought occurred that the accident reports could be rendered more realistic, and hence more interesting, by reference to specific locations throughout the State. Since the accidents themselves never actually occurred, it was necessary to find locations at which highly similar accidents had occured. A search was made of accident reports in the Virginia DMV file, and a set of reports involving conditions similar to the fictitious reports were discovered. The Manual was then revised to include those locations.

While the use of actual locations did improve the realism of the fictitious accident reports somewhat, the slight benefit was offset by the severe limitation this step introduced into the ability of the Manual to be used in other States. Therefore, the idea of using specific locations was abandoned and the references themselves deleted from the Manual.

Pilot Test

No truly suitable pilot test could be run. The major problem was gaining access to groups of accident repeaters. The project staff could neither identify nor contrive a suitable way of getting groups of accident involved drivers together for a pilot test.

Consideration was given to a "mail out" approach. The Virginia DMV was willing to supply the names of drivers within the State meeting the criterion for the Accident Repeater designation. However, the pilot test mechanism would have been a cumbersome one to try to operate through the mail. Participants would have to complete a pre-test and return it, then be sent a manual and return that, and finally be sent a post-test and return it. Moreover, participation would have to be voluntary since the Division of Motor Vehicles has no authority to force compliance. In view of these problems, the idea was rejected.

The only group of immediately available adults who could be required to participate in the pilot test was the court-sponsored traffic school used in pilot testing the Violators Manual. Arrangements were made to pilot test the Accident Repeaters Manual using a later class of twenty-five drivers.

The results of the pilot test showed a gain of only 15% (from 60 to 68). The reasons for such a small gain are unknown. Some part of the problem can be attributed to deficiences that were revealed in the tests and in the manual. Also, the fact that the Manual itself was considerably longer than the Violators Manual may have prevented post-test scores from reaching the level attained with that manual. However, a major part of the meager gain must be attributed to lack of cooperation on the part of the pilot test drivers.

Time and resources did not permit another pilot test to be undertaken. While the pilot test that was conducted failed to provide a good estimate of potential gain scores, it did succeed in identifying deficiencies in the manual and test.

Verification Testing

The revised Accident Repeaters Manual was disseminated to a group of traffic safety experts for review and comment. A number of suggestions for revision to improve both technical accuracy and communication were received and were applied to the final draft.

DRINKING DRIVER MANUAL

The manual for drinking drivers was the last to be initiated and the last to be completed. It was prepared in accordance with specifications identified earlier. With the great amount of material currently available on drinking and driving, it was not difficult to prepare an acceptable draft.

Pilot Test

The Drinking Driver Manual was pilot tested through a group of 30 convicted DWI's participating in a local Alcohol Safety Action Project (ASAP). Pre- and post-tests were switched across administrations to eliminate spurious gain scores.

The pilot test drivers rose from a pre-test average of 72 to a post-test average score of 85, for a gain of 18.6%. This is significant at the .05 level ($.05>p>.01$). The magnitude of possible gain was limited by the rather high pre-test scores. Examination of the response to individual items suggests that the participants were more knowledgeable concerning drinking and driving than the population at large. This result cannot be attributed to the ASAP program, since the pilot test was conducted before the program actually began. Whether this was an outgrowth of their interaction with the enforcement and judicial system, or whether it reflects the results of preparation for the ASAP program, cannot be determined. In any case, the results indicate that the Drinking Driver Manual was capable of producing a significant knowledge gain even among relatively knowledgeable individuals.

Much of the content of the Drinking Driver Manual consisted of practical advice that did not lend itself to testing through multiple-choice questions. It is difficult, for example, to phrase a question that will test whether an individual has learned that a "share-the-ride" program is a good way of separating drinking and driving. As will be

noted in connection with test development, this problem affects all aspects of driver license testing. However, a relatively higher portion of the Drinking Driver Manual was so affected.

The pilot test draft of the Drinking Driver Manual was disseminated among the Target Group Specialists for review and comment. Relatively little comment was received. This is probably a reflection of the high quality of alcohol safety material from which the contents of the Drinking Driver Manual were assembled.

Because of the lack of input from Target Group Specialists during the pilot test, no verification test was conducted.

DEVELOPMENT OF TESTS

The major role of a driver license test, as viewed from the prospective of study objectives, was to provide an incentive for license applicants to acquire information from a licensing manual. The incentive role is paramount.

The role of a test as an assessment instrument--to see if license applicants are sufficiently knowledgeable to be allowed access to the public highways--is secondary. Most applicants will ultimately qualify for a license; therefore, a test rarely keeps anyone off the highway. Rather, it forces the driver to acquire the information before being allowed on the highway. It is the information, rather than the assessment, that makes for driving safety.

The diagnostic function of tests is also considered to be minimal. Each test constitutes but a small sample of information items from the large population of driving information. While it can provide a general estimate of how much the driver knows relative to the population of information items, it cannot identify which specific items within that larger population the driver does or does not know.

The primacy given to the role of tests as an incentive does not mean that assessment and diagnosis are unimportant. A test that does not provide a valid assessment of knowledge may lose its incentive value at least for the drivers who need it. A test that doesn't have some diagnostic value, that does not even provide feedback on incorrect answers, does not give much encouragement to further study. However, the contribution of assessment and diagnosis is primarily through their value in stimulating acquisition of information. It is the actual acquisition of information that makes applicants better drivers.

Defining the role of a test as that of an incentive does not demean the value of tests. Rather, it installs a test as a co-equal partner with manuals in a driver licensing program. The test induces drivers to read the manual; the manual prepares drivers for the test. A manual without a test is not likely to be read; a test without a manual is not likely to be passed.

GENERAL TEST SPECIFICATIONS

In order that the criteria identified in the preceding section might be met, a number of specifications were laid down for development of test items. These specifications deal with content, format, selection of alternative responses, wording, general test structure, and use of illustrations.

Content

If a test is to be an incentive, then to fulfill its primary role, it must have the following characteristics:

1. The test should draw its content entirely from the manual. A test won't encourage people to read the manual unless the manual provides the information needed to pass the test. If both the manual and the test have been developed from the same set of information requirements, then the two will match. Some states go further and specify by law that questions on the test must be taken directly from the manual. Where a test item measures simple recall, it is possible to use the same words and phrases as appear in the manual. However, if the test item is intended to measure the examinee's ability to apply information from the manual, it can only employ the principles and concepts that are presented in the manual.

2. The test must sample comprehensively from the entire manual. If applicants are to read the entire manual, they must also be led to expect that the test will encompass the entire manual. Few existing license tests succeed in this respect. It is not for want of trying. The problem is that a great deal of the information that appears in manuals simply does not lend itself to the multiple-choice test items that characterize most license tests. Much of critical safe driving practice involves information which is not difficult to figure out but may not be readily recalled, at least at the time it is truly needed. It is difficult to test an applicant's recall if the correct answer is presented among alternative responses. To measure recall, a test must provide for a free response. Means of doing this will be explored in connection with Alternative Information Systems.

3, Tests should sample representatively from the content of the manual. If a test is to provide a valid estimate of how much of the manual an applicant knows, the items upon which the estimate is based must consitute a representative sample of information in the manual. To sample representatively, the test should meet the following conditions:

a. All levels of difficulty should be represented. Some test developers avoid use of very easy items---items passed by almost everyone, and very difficult items---items failed by a large number of examinees. The reason for eliminating very easy items is typically that they do not provide much information about examinees. "Why ask a question if everyone gets it right?" The answer is that the few people who answer incorrectly could constitute a serious problem. One does not abandon inspection of aircraft or fire extinguishers simply because most of them pass the inspection.

The reason for eliminating very difficult items is generally the suspicion that there is something wrong with the item. Very often the suspicion proves correct. However, if the item is valid, and the problem is simply that the subject matter is very difficult, eliminating the item from a test may be tantamount to dropping the content from the manual.

It isn't necessary to sample equally across all levels of difficulty. For example, coverage of very easy items might be reduced to those that are most critical. Level of difficulty is only one factor affecting selection of test content. However, items should not be eliminated or selected solely on the basis of their difficulty level.

b. The examinee must not know what items are to be sampled. An examinee who knows what specific items will be included on the test will, in most cases, study that portion of the manual harder than other portions. His test performance will no longer reflect his knowledge of the entire manual. In some states, examinees are purposely or inadvertently allowed to learn which test questions are likely to be included on the test by use of actual test items as sample questions within the manual or by readministration of the same test form on a retest.

c. Eliminating "unreliable" items. Some test developers eliminate items showing a low correlation with total test score. The reasoning is that, if the people who score high on the test

do not do well on a particular item then that item must be unreliable. If such is true, and it often is, an examination of the item's content and construction will generally show the item to be defective. However, an item should not be rejected simply because it has a low item/test correlation. In a knowledge domain as heterogeneous as driving, people who possess one item of information do not necessarily possess another. For example, some drivers may do quite well on items dealing with practical information that can be readily acquired on the street, yet do poorly on "book learning" that is only obtainable from the manual.

Test Format

Years of testing, in and out of licensing agencies, have established the multiple choice test item as the most cost-effective approach to knowledge measurement with a large number of examinees. Some of the limitations of multiple-choice test items in assuring comprehensive measurement have been noted previously. However, until an alternative approach can match its efficiency, the multiple-choice test item will probably remain the principal item format for driver license testing.

The typical multiple-choice test item presents one correct answer and either two or three foils. The more foils there are, the less chance the examinee has of answering correctly by guessing. However, the relationship between number of alternatives and guessing is not clear-cut. The addition of a foil that is totally implausible does nothing to reduce the chance of correct guessing. It only succeeds in adding to testing time and thereby reducing the number of items that can be administered. It is frequently difficult to create three attractive foils for content dealing with driving. For this reason, license tests are making increasing use of two instead of three foils.

"Matching" test items are also used occasionally. For example, the examinee is presented lists of signs and meanings and is asked to match each sign with its meaning. This format essentially assesses many knowledge items with one test item, making it somewhat more difficult to determine what the applicant does and does not know.

Probably the least acceptable format is the "true-false" question. The terms "true" and "false" are highly susceptible to personal interpretation. To some, the word "true" means true without exception, while to others it simply means more true than false. The same differences in interpretation apply to the term "false." Knowledgeable individuals will frequently label an essentially correct statement "false" simply because they know of an exception.

Construction of Alternatives

Alternatives should be constructed so as to differentiate clearly between those who do and those who do not possess specific items of information. The following specifications help to achieve this objective.

1. Alternatives and foils should deal with the same information. A foil is not just an incorrect statement. It should be an incorrect statement concerning the specific information dealt with in the correct alternative. Where alternatives deal with different information, it is not possible to determine just what information the item measures.

2. Only one alternative should be correct. The examinee should be asked to identify the correct answer, not the "best" one. Answers should not have degrees of correctness. This does not prevent using a question that asks the examinee to identify the best course of action, the most serious hazard, etc., where the evaluation of such is an element of the knowledge being tested. In this case the superlative describes the one "correct" answer.

3. Mutually-exclusive alternatives should be avoided. If two alternatives are mutually exclusive, one of them must be correct. This allows any other alternatives to be eliminated on purely logical grounds.

4. Catch-all alternatives, such as "all of the above" or "none of the above" should be avoided. Where the correct answer is "all of the above," it means that each of the other alternatives is also correct. An examinee may select one of the foils before even reaching the "all of the above" answer. An examinee who can identify that the "none of the above" alternatives is correct may not know what the correct answer truly is.

Wording

Fulfillment of the test objectives requires that test items communicate questions clearly without providing any clues as to the correct answer. The following specifications are designed to help in fulfilling that objective.

1. Questions and alternatives should be simply stated. They should be brief, simply constructed, and use short, familiar words. The more complex the wording becomes, the more the test becomes a measure of verbal skill instead of driving knowledge.

2. Use of the negative form should be avoided. A question that uses the negative form, e.g., "which of the following is not...," requires the examinee to search for an incorrect answer. Many examinees, particularly older drivers, lose sight of this fact and often select the first correct answer they see. Giving emphasis to the negative words through underlines and capital letters may help to reduce theis tendency but does not eliminate it.

3. Consistency should prevail across all alternatives. Inconsistencies in wording among alternatives tend to direct attention toward or away from particular alternatives and thereby clouding the measurement of knowledge. The following are examples of inconsistency that should be avoided:

   a. Use of attractive words such as "cautiously."

   b. The mixing of negative and positive forms of expression. This tends to lead to confusion.

   c. The insertion of justification in some alternatives, e.g., "brake gently to avoid locking the wheels." Justification is often used to make the foils look more appealing.

   d. The use of legal or technical phrases in certain alternatives. These tend to make an alternative look more attractive.

   e. Alternatives that are noticeably longer than others. These tend to attract attention.

4. To the extent possible, questions should be expressed in terms of driving application. For example, a question concerning a traffic signal might be better expressed in terms of what you are allowed to do than in terms of what the signal means. This gives an equal chance to a driver whose information is acquired largely through experience rather than through the manual.

5. Key words should be emphasized. Words that are important to interpretation should be underlined and capitalized so that examinees will not miss essential points. For example, in reference to "a flashing red light," underlining the word "flashing" helps prevent confusion with a stop light.

6. Ambiguous words should be avoided. The meaning of each word should be made very clear. A word such as "two lane" road is ambiguous; it might be interpreted to mean either a highway one lane in each direction, or a divided highway with two lanes in each direction.

7. Items should not provide cues to correct answers. To the extent possible, tests should be worded such that examinees who lack the required information cannot attain the correct answer purely on logical grounds. This condition, too, is rarely met with existing examinations. A test-wise or generally intelligent applicant can often identify a correct answer by recognizing key phrases, by eliminating implausible alternatives, or by other processes totally unrelated to the subject matter.

Test Structure

In assembling alternatives and items to form a test, the following specifications should be observed:

1. Alternative responses should be arranged in a logical progression. Any logical sequence among alternatives should be observed. If, for example, the responses involve numbers, the numbers should be arranged in increasing order of magnitude.

2. The position of the correct answer should be decided by chance. The position of the correct response (i.e., "a," "b," or "c") should be decided by some chance process. Failure to use such a process may result in a discernable pattern of correct responses or the excessive use of one position (e.g., one-half of the correct answers falling in the "b" position).

   Where alternatives follow a particular sequence, it will be necessary to select and arrange the foils around the correct answer after position of the correct answer has been selected by chance.

3. Make each item independent of the other. No item should require recourse to another item for a correct answer. Conversely, care should be taken to make sure that one question doesn't contain within it the answer to another question. Items should be arranged on a page such that it is not necessary to turn pages during the response to a question.

4. A sample test question should be provided. The instructions should contain at least one sample item that is answered correctly. The content of the sample item should come from the manual upon which the test is based.

Illustrations

Illustrations should serve the same role in a test as they do in a manual, to communicate. In many instances an illustration will help convey the intent of a question where purely verbal content will not. Illustrations are particularly important in dealing with individuals with reading and learning difficulties. This application of illustrations will be further discussed in connection with Alternative Delivery Systems.

Some States have taken to using illustrations for all test questions. This is particularly true where automated testing equipment is used. Many of the illustrations add nothing to the questions. Use of illustrations that do not communicate simply adds to the size and expense of tests and often to the duration of the test administration. Illustrations may even contain details that serve only to confuse the examinee.

Test Preparation

Tests were developed for each manual in accordance with the specifications just described. Each test consisted of 20 items[1], in keeping with requirements of the State in which the evaluation was to take place.

Seven alternate test forms were prepared for the New Driver Manual and Renewal Manual (since the content of the two manuals were the same, the test items were also the same). Each test form gave equal coverage to the various sections of the manual and all forms were equal in difficulty. One form was prepared for each of the remaining manuals.

Only the New Driver Manual and Renewal Manual were large enough to give rise to seven 20-item forms. It is only for new drivers and renewals that a licensing agency would require alternate forms for retesting purposes. Of course, no agency would require seven forms. The purpose in preparing so many forms was simply to create a large pool of items ($7 \times 20 = 140$) that could be made available to licensing agencies for periodic changes in the forms.

All tests were pre-tested through procedures that were previously described under the Determination of Information Requirements and Development of Manuals. To review, the pre-test groups were as follows:

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[1] The Violators and Drinking Driving Tests were subsequently reduced to ten items each.

Test	Pre-Test Group	Number of Examinees
New Driver Test	Previously unlicensed drivers	100 (approximately)
Renewal Test	Out-of-State Transfers	100 (approximately)
Older Drivers Test	Members of a retired citizens group	244
	Residents of a home for the aged	56
Violators Test	Convicted violators participating in a traffic court program	36
Accident Repeaters	Same as above	25
Drinking Driver Test	Convicted DWIs participating in an ASAP program	30

Items were reviewed on the basis of pilot test results in order to (1) overcome apparent ambiguities in wording, (2) secure a more favorable pattern of responses across alternatives, and (3) improve difficulty level.

ALTERNATIVE INFORMATION PRESENTATION AND TESTING SYSTEMS

A printed manual and written test are probably the most cost-effective media for presenting information to, and assessing possession of information by, the general driving public. However, a significant number of drivers lack the ability to interact effectively with printed manuals and written tests, even when they are written at the sixth grade level. These people can be divided into the following categories:

Illiterates--The number of license applicants who are unable to read or write is not truly known, since applicants are not administered literacy tests. However, between 10% and 20% of drivers in various States request and are administered an oral examination. The number in any State varies depending upon the characteristics of the drivers within the State and the policy governing administration of oral exams. From an administrative point of view, the number of applicants requesting oral exams is probably more significant than the number of true illiterates.

Foreign Speaking Literates--In many States, a large and increasing proportion of the applicant population consists of individuals who are literate only in a foreign language. Where the number representing a particular nationality is large, foreign language editions of manuals and tests can be cost-effectively produced. However, the less densely populated foreign language groups must be accommodated by other means.

Marginal Readers--The reading level of a large number of drivers falls between complete illiteracy and the fifth-sixth grade reading level that characterizes even the most simply written manuals and tests. In many ways, drivers with marginal reading ability pay a greater penalty in test taking than do total illiterates, since many are unwilling to admit their deficiency and therefore attempt to take the test without assistance.

LIMITATIONS OF ORAL TESTING

The oral testing procedures currently used to administer license examinations to applicants with reading deficiencies fall considerably short of dealing with the problem effectively. Some of the major problems are the following:

Cost--Oral examination requires a one-to-one examiner/examinee ratio. This is extremely expensive and can be quite disruptive of flow in a small licensing station.

Lack of Standardization--Despite efforts to standardize oral testing, the "test" that is administered varies considerably from one examiner to another. Some examiners consciously or unconsciously coach examinees in correct responses. Where the test must be administered through an interpreter, there is no assurance that the interpreter is not supplying the answers along with the questions.

Dependence Upon Memory--An applicant taking a written test may review each item several times in selecting an answer. An applicant taking an oral examination, on the other hand, must depend largely upon memory in considering the question and each of the alternative responses. This certainly places the oral examinee at a disadvantage.

Lack of Access to Information--If the role of a test is to induce applicants to acquire information, then a test is of little value if applicants are denied access to information by an inability to read. Some non-readers may be fortunate enough to have available people who are willing to read the contents of the Manual to them. However, even those that have a reader available to them, may not be afforded the same opportunities for review as are available to the literate applicant.

These problems tend to make oral testing an expensive and not highly effective method of assuring that reading-disabled license applicants possess the information needed to drive safely. Some alternative system is needed. To compete effectively with written manuals and tests, such a system must meet the following requirements:

1. It must be capable of leading to the same levels of information acquisition as characterizes written manuals.

2. It must be capable of assessing an applicant's level of knowledge acquisition despite limitations in the applicant's reading ability.

3. It must automate the presentation of questions and the recording of responses so that the administrative requirements imposed upon examiners are no greater than those imposed by written tests.

A study was undertaken to determine the potential feasibility of attempting to meet the needs of reading-disabled drivers through alternative systems for information presentation and testing. The study involved (1) a determination of the relative effectiveness of various presentation and testing modes, (2) an analysis of the relative cost-effectiveness of various media for information presentation and testing through selected modes, (3) preparation of an information presentation system employing the selected mode and medium, and (4) evaluation of the effectiveness of the presentation system in leading to information acquisition. The methods employed in developing a presentation system are described in this section. Evaluation of the system is discussed in the "EVALUATION" section.

DETERMINATION OF PRESENTATION/TESTING MODE

Simply asking questions in an oral rather than written form does not, as noted above, overcome the problems of testing reading-disabled license applicants. The State of North Carolina not too long ago revised its oral testing procedures to use illustrations in depicting each of the alternative responses to orally-delivered questions. The State of California is currently field testing a test similar to that used in North Carolina. However, in the California test, the oral presentation is delivered by means of an audiotape, thereby minimizing the examiner's involvement.

Both the North Carolina and California tests employ static pictorial presentations, i.e., still pictures. The former uses drawings and the latter employs photographs. While a static pictorial may be more readily understood than the written word, such is not necessarily the case where questions deal with the more dynamic aspects of driving. Take for example, a photograph of a car in the middle of a left turn. Most people, including many non-readers, will perceive the pictorial as representing a left turning car, particularly if there is an accompanying narrative. However, many individuals will have difficulty making the translation. A static pictorial is, after all, merely a symbolic representation of a dynamic activity. Research shows that some people have difficulty with any symbol, whether it is written or spoken, verbal or pictorial. Short of going out on the road, it is impossible to avoid completely the use of symbology in dealing with driving information. However, it is possible by the use of dynamic pictorials---motion pictures---to make the symbols closer to the real thing. It seems reasonable to expect that the more closely the form in which information is presented or tested resembles that in which the information will ultimately be used, the more transfer there will be from one situation to the other.

Experimental Study of Information Modes

To assess the effectiveness of a dynamic mode in presenting information to license applicants, a small experiment was conducted. A set of test questions was presented to a group of drivers using several information modes. The results obtained under each mode were compared. Since the level of knowledge of drivers was the same across modes, differences in results were attributable to the differential effectiveness of the modes in communicating the questions.

Selection of Modes--A basic study of communications would have classified informational modes on the basis of some basic underlying dimension of information. In this case, however, the alternate modes selected represented current approaches to license testing. They included the following:

Written--Conventional three-alternative multiple-choice questions.

Graphic--Conventional three-alternative multiple-choice questions accompanied by a diagram or picture illustrating essential points.

Static Audiovisual--An audiovisual format using slides and a taped oral presentation to present the questions and alternative answers.

Dynamic Audiovisual--An audiovisual format using a motion picture to present the questions and alternative answers.

Test Questions--Test questions were based upon 24 items of information drawn from the information requirements of the New Driver Manual. Selection of information items were performed on a random basis to prevent bias in the direction of one particular mode, e.g., selection of information having a dynamic character. Test questions were prepared for each of the 24 items using each of the four modes. The wording of the items was essentially the same in each mode. Only slight variations were introduced to accommodate the special needs of each mode.

Subjects--To permit assessment of the interaction between verbal skill and information mode, individuals representing three levels of verbal skill were selected.

High Verbal Skill--100 college students.

Medium Verbal Skill--100 students in a high school adult education program.

Low Verbal Skill--100 prison inmates having diagnosed reading difficulties.

Administrative Procedures--Subjects at each verbal skill level were divided into four groups with 25 subjects each. The test items were divided into four sets of six items each. Each item set was then administered to each group under each of the four informational modes. The administration scheme is shown below:

	ITEM SET			
Subject Group	A	B	C	D
1	Written	Graphic	Static	Dynamic
2	Graphic	Static	Dynamic	Written
3	Static	Dynamic	Written	Graphic
4	Dynamic	Written	Graphic	Static

Since each informational mode is equally represented by each subject group in each item set, comparisons among modes would be unaffected by any differences among subjects or items. The written and graphic tests were administered orally to those in the low verbal skill group. Otherwise, the administrative procedures were the same across groups.

Results

The results of the comparison appear in Table 3. The entries in each table represent the mean numbers of errors. The top table presents results obtained from the entire 24-item test, while the bottom table presents results obtained from that half of the test consisting of the items that were most dynamic in character. It can be seen that the dynamic test mode yielded the lowest number of errors in all three skill-level groups. No consistent differences among the other three test modes emerged.

TABLE 3

COMPARISON OF TEST MODES AND VERBAL SKILL

ERRORS

(Total Test)

VERBAL SKILL	TEST MODE			
	WRITTEN	GRAPHIC	STATIC	DYNAMIC
Hi (N=100)	4.4	5.3	4.4	3.6
Med (N=100)	6.4	6.8	7.2	5.3
Low (N=100)	7.8	8.0	7.6	7.2

ERRORS

(Dynamic Items Only)

VERBAL SKILL	TEST MODE			
	WRITTEN	GRAPHIC	STATIC	DYNAMIC
Hi (N=100)	2.1	2.9	2.5	1.2
Med (N=100)	3.9	3.8	3.7	3.3
Low (N=100)	4.2	4.5	4.1	3.5

An analysis of variance failed to show significant differences among the four test modes. A comparison of the dynamic mode against the other three modes would have been extremely complicated owing to the nature of the design. However, a simple, non-parametric test is available. The a priori chance probability of the dynamic test mode emerging as superior in all three skill-level groups is .25 x .25 x .25 - .016. This suggests that the apparent superiority of the dynamic test mode is not a chance result.

One would expect that any advantage of the dynamic mode would be traceable to the dynamic items. This was true for the high and low skill-level groups. In the middle group, however, the superiority of the dynamic mode on the entire test exceed that of the dynamic items alone. There is no readily apparent explanation for such a result and it may simply represent a chance fluctuation. One might also have expected the advantage of dynamic mode to become greater at the lower level of verbal skill. Such an interaction between test mode and skill level did not appear.

The results of the experiment doubtless reflect the specific characteristics of the particular sub-groups tested, the information that was selected for the test, and the way in which items were prepared for each test mode. It is possible that with a better way of preparing static pictorials, lower error rates for that mode might have been obtained. However, as far as guiding the selection of modes in the present study of alternative information systems is concerned, the results could be viewed as indicating the desirability of dynamic pictorials in presenting information to, and testing the acquisition by, license applicants who have reading difficulties.

SELECTION OF A PRESENTATION/TESTING MEDIUM

Having determined that a dynamic mode provided the most promising approach to information presentation and testing, a study was made of the relative cost-effectiveness of various media in meeting the needs of a dynamic approach. The study addressed the following media:

Filmstrip/tape--A 35mm filmstrip programmed by a magnetic tape which also provides audio presentation.

Slide/tape--35mm slides programmed by a magnetic tape which also provides an audio presentation.

Continuous film--Standard 16mm and 8mm color film with sound track.

Interrupted film--16mm and 8mm film programmed to stop and start by a magnetic tape which also provides an audio presentation.

Videotape--A color videotaped presentation played back through a videotape recorded (VTR) connected to a television receiver.

Filmstrips and slides are not generally considered "dynamic" presentations, since they involve still images. However, the images may be projected in a series to simulate motion---just like a motion picture film but at slower speeds.

The various media were evaluated against the following criteria:

Presentation

Image--The resolution of the image as it influences ability to communicate essential characteristics of the driving situation.

Motion--The ability of the image to convey situational dynamics.

Reliability and Durability--The general life span of the equipment and freedom from breakdown, evaluated separately for:

Hardware--Projectors, VTRs, audio equipment.

Software--Film filmstrips, slides, videotape.

Ease of Operation--The speed and simplicity with which equipment can be set up for presentation of testing purposes.

Maintenance--The amount of maintenance required in preventing and repairing malfunctions, as well as the speed and simplicity with which maintenance can be performed.

Ease of Updating--The speed and simplicity with which the visual and/or audio components of the presentation can be changed in response to new procedures, laws, or other information.

Cost--The procurement and operating cost, evaluated separately for:

Hardware--Unit cost of hardware equipment as identified above.

Software--Unit cost of audio and visual presentations.

TABLE 4

COMPARISON OF PRESENTATION/TESTING MEDIA

	Continuous Film		Interrupted Film		Filmstrip/Tape	Slide/Tape	Videotape (Color)
	16mm	8mm	16mm	8mm			
Presentation							
Image	Excel	Good	Excel	Good	Excel	Excel	Excel
Motion	Excel	Excel	Excel	Excel	Poor	Poor	Poor
Reliability & Durability							
Hardware	Excel	Good	*	Good	Excel	Good	Good
Software	Excel	Good	Good	Good	Good	Excel	Fair
Ease of Operation	Good	Excel	*	Good	Excel	Excel	Fair
Maintenance	Excel	Excel	*	Good	Excel	Excel	Fair
Ease of Updating	Fair	Fair	Good	Good	Good	Excel	Good
Cost							
Production	High	High	High	High	Low	Low	Med
Hardware	Med	Low	High	Low	Low	Low	High
Software	High	Med	Med	Low	Med	Med	Med

* No production equipment capable of projecting 16mm interrupted presentation could be identified.

The results of the comparison appear in Table 4. On the basis of these results, the use of filmstrips and slides were eliminated due to the difficulties in handling the dynamics of traffic situations. To do a reasonable job of portraying motion, would require a large number of frames. This would substantially increase the software cost and necessitate frequent changing of film cassettes or slide trays, thus complicating operation. Videotape was also eliminated due to the high cost of hardware, the low durability of software, and the complexities of operation and maintenance.

Of the two film media, Super 8 enjoys an advantage over 16mm in costs of hardware and software, as well as in ease of operation. There are on the market a number of highly reliable, durable, and easily operated units that can be used on either a group or individual basis. While the resolution of the Super 8 image is less than that of 16mm, it is generally adequate for information presentation and testing purposes. In fact, the difference is not readily noticeable when Super 8 is used on an individual or small group basis, as would generally be the case in a licensing operation.

A comparison of continuous versus interrupted presentation is confined to Super 8 since no commercially available 16mm equipment capable of interrupted operation could be found. In an interrupted presentation, the film is coded to cause the projector to stop on pre-selected frames. The projector is controlled by a magnetic tape synchronizer which (1) allows the audio presentation to continue while the projector is stopped, and (2) provides a pulse which activates the projector at the appropriate time. The magnetic tape synchronizer is identical to that used with a slide/tape or filmstrip/tape presentation. An interrupted presentation offers the following three potential advantages over a continuous presentation:

1. The projector may be stopped during non-dynamic sequences, thus reducing film footage and its associated production and print cost.

2. The separation of audio and visual components allows the audio presentation to be readily updated without changing the film. It also allows the same film to be shared by several different language groups simply by preparation of individual audio tapes.

3. It is possible to arrange the program such that the presentation is actuated by the viewer rather than the synchronizer. This allows an audiovisual presentation or test to be self-paced.

While the potential advantages of an interrupted presentation are great, they will remain only potential until the necessary equipment becomes more widely available than it is now. Thus far, use of the equipment in the manner described has been largely confined to experimental applications. The fact that the equipment is not widely available inhibits use of the approach in two ways. First, it makes it necessary for licensing agencies to procure the equipment in order to utilize the approach. Given the large number of license offices that would have to be equipped, the procurement would be extensive. Secondly, it has kept manufacturers from investing in the additional development needed to make the equipment easily operated by relatively untrained personnel. Steps involved in setting up and synchronizing the film and audio tape, while not difficult, are somewhat more complex than simply inserting a Super 8 cartridge or cassette.

As far as film preparation is concerned, it really doesn't matter which of the three alternative formats--continuous 16mm, continuous Super 8, interrupted Super 8--will ultimately be used. All original footage would have to be filmed in 16mm (or 35mm later reduced to 16mm). A continuous 16mm master print would then be used to reproduce both 16mm and Super 8. For interrupted presentation, a separate 16mm master print would be prepared with static footage reduced to about five frames. (The use of five frames allows the projector to stop two frames either side of the selected frame.) This second master print would then be reproduced in Super 8 for interrupted presentations. The audiotape would be duplicated from the original sound track tape.

PREPARATION OF AN AUDIOVISUAL PRESENTATION

A motion picture film presentation was prepared to permit an evaluation of the effectiveness of the film medium in leading to acquisition of New Driver Manual content by those license applicants having reading disabilities that prevent them from comprehending written material prepared at the fifth to sixth grade reading level. The following criteria were imposed upon the development of the film presentation.

> Comprehensiveness--The film presentation had to present all of the critical information contained in the New Driver Manual. The volume of this information made preparation of an appropriate presentation a formidable task. Yet, there was no justification for depriving drivers of critical information, or relieving them of the responsibility for demonstrating its mastery on a written test, simply because they cannot read.

Opportunity for Review--The information presentation had to provide an opportunity for review just like a written manual does. This meant building numerous review points into the filmed presentation.

Non-Textual Information--While textual information such as titles and outlines could be included in the presentation, to allow its use by readers as well as non-readers, the success of the presentation in leading to knowledge acquisition could not be dependent upon textual material.

Limited Duration--It is a rare individual who can consume an entire licensing manual in one sitting and fully digest its contents. While a manual can be put aside when the reader has had enough, an audiovisual presentation cannot. Therefore, the total audiovisual presentation had to be divided into several presentations of shorter duration. Dividing the total presentation into short segments also would provide greater flexibility in scheduling. A duration of approximately ten minutes was considered optimum.

A set of eight film presentation was prepared in accordance with the above specifications. The presentations covered the eight major sections of the manual. The duration of each presentation was as follows:

- Rules of the Road..... 7 minutes & 2 seconds
- Observing..... 8 minutes & 47 seconds
- Communication..... 6 minutes & 2 seconds
- Speed Control.....10 minutes & 1 second.
- Inter-vehicle Separation and Gap acceptance..... 8 minutes & 22 seconds
- Emergency Procedures..... 8 minutes & 20 seconds
- Driver Factors..... 8 minutes & 20 seconds
- Vehicle Factors..... 2 minutes & 55 seconds

59 minutes & 49 seconds

All filming was done in 16mm. Most of the footage involving driving scenes was taken from the driver's point of view. A dual-control car was obtained from a driving school to allow filming from the driver's seat. While most of the footage was shot in the Washington, D. C. area, stimuli of an identifiably local nature--local scenery, signs, police cars, etc.,--were avoided where possible in order to maximize the film's acceptability across the country.

Original footage was used exclusively in order to prevent any restrictions from being placed upon distribution of the films. An attempt had been made to use some film prepared under previous NHTSA contracts for scenes that would be too expensive to reproduce--e.g., forces acting upon a body in a crash. However, access to master prints could not be obtained.

Animation was used where necessary to communicate complex information, such as the relation of amount and rate of alcohol consumption to the level of intoxication. It was not used simply to heighten interest or to entertain.

Study of Film Presentation Rate

In preparing an audiovisual presentation for reading disabled drivers, concern arose as to the optimum information presentation rate. It is widely believed that individuals who are deficient in verbal skill cannot absorb information at quite the same rate as those whose verbal skill is in the normal range. The relationship between information presentation rate and verbal skill is believed to be a curvilinear one, that is, there is a minimum rate beyond which, even among the verbally unskilled, slowing the presentation rate results in decreased information acquistion (as well as excessive production cost).

A study of optimum presentation rate was not within the scope of the project. However, an analysis was undertaken to determine whether there was any substantial difference in information acquisition between a presentation that was judged to be optimal for the "normal" population and one in which the presentation rate was made slower than that which characterizes normal audiovisual presentations. The result would have an impact both upon the project and upon development of audiovisual presentations for operational licensing purposes. If slowing the presentation rate produced significant additional knowledge gain, it would seem necessary to prepare separate presentations for verbally skilled and unskilled drivers. This could be done fairly economically in a slide/tape presentation or an interrupted film presentation since only the audio presentation would have to be varied. However, in a continuous motion picture, two separate films would have to be prepared.

To test the effect of film speed upon knowledge acquisition, two of the audiovisual presentation were shown to a group of 24 reading disabled high school students. The total group was divided into two subgroups. Each subgroup saw one of the films at normal speed and one film at a reduced speed. Two separate five-item orally administered tests were administered prior to and following each presentation. The two forms were switched across the two groups so that each form was administered both as a pre-test and post-test. Under the design as carried out, comparisons of information gain between the "regular" and "slow" presentation were uncontaminated by any small differences between presentations, test forms, or student subgroups.

Both films yielded statistically significant increased in knowledge. The slow presentation rate produced 56% greater information gain than the regular presentation rate on one film, and 35% greater information gain on the other film. The overall superiority of the slower rate on the two films was 41%. With only 12 participants per film none of these advantages for the slow presentation rate emerged as significant. Since no conclusions could be reached as to the effect of presentation rate, and because significant learning was produced at the regular presentation rate, the expense of preparing a separate presentation for reading disabled drivers was not considered justified. Further study of the effect that presentation rate has upon acquisition of information among individuals with reading disabilities seems warranted.

Delivery of Audiovisual Presentations

The effectiveness of an audiovisual presentation depends greatly upon the system through which the presentation is delivered to those needing it. The preparation of an audiovisual presentation did not include any attempt to design a delivery system. However, some consideration was given to various prospective means of delivering an audiovisual presentation. The delivery system may be divided into three categories: individual, group, and mass.

Individual Delivery Systems

Only a small fraction of driver license applicants would have available the equipment needed to view an audiovisual presentation. If audiovisual presentations cannot be effectively brought to applicants, then the applicants must go to the presentation. In some areas it

might be possible to offer audiovisual presentations at the licensing station on an individual basis. However, space in a licensing station is typically at a premium. A more likely source of individual presentation would be public libraries, school libraries, school learning centers, and other public agencies whose mission includes an educational function. Where such agencies are equipped with individual carrel-type audiovisual equipment, presentations such as the eight films prepared as part of this project, could be maintained as part of the basic audiovisual library. The presentations themselves might be made available through the State department of motor vehicle or purchased under the budget of the host agency.

Group Presentations

In larger cities, the numbers of reading disabled license applicants may be sufficient to warrant group presentation. Such presentations could be offered under the auspices of the local license offices, either on the premises or in some other public building. A schedule of presentations would be publicized and applicants could view all or some part of the total presentation at each session. Group presentations might also be offered under the auspices of such community organizations as high schools (e.g., special education programs), local safety councils, or service organizations.

One advantage of group presentation is that it affords the opportunity for group administration of an oral or audiovisual testing. An on-the-spot group administration would not only be a convenience to applicants, but could help to economize on examiner personnel time.

Mass Presentation Systems

Television provides a potential means for reaching large numbers of reading-disabled applicants with an audiovisual presentation. The most formidable problem would be assuring that the information actually gets delivered and that prospective license applicants are aware of it. Unscheduled public service programming is not sufficiently reliable to constitute an acceptable avenue for delivery of information that is required for licensing purposes. What is needed is a regularly scheduled set of presentations that is well publicized in advance. Probably the most promising outlet would be educational TV. Another would be commercial television during those hours reserved for educational programming (e.g., early morning). The key to success of such a program would be the publicity it receives through licensing agencies, organizations catering to the reading disabled, or the mass media themselves.

DESIGN OF AN AUDIOVISUAL TEST

Project funds did not permit the preparation of a dynamic audiovisual test to accompany the informational presentation described in the preceding section. Moreover, preliminary reports emanating from the study of audiovisual testing conducted in the State of California were such as to challenge the generality of the results obtained from the study of informational testing modes described earlier. For these two reasons, no dynamic informational test was developed. However, the essential requirements of such a test were studied. Those requirements of greatest concern involve giving of administrative instructions, the presentation of alternative responses, individual response recording and pacing of test administration.

Administrative Instruction

The clarity of administrative instructions is particularly important in testing reading disabled license applicants. In order to avoid imposing inordinate time requirements upon license station personnel, administration of the test must be automated. This means that the examiner will not be present to sense when instructions are not being understood. To assure that the instructions are clear and that the test is measuring driving knowledge rather than test-taking ability, the following guidelines should be observed:

1. Simple instructions--Instructions must provide a simple step-by-step procedure. Each step should be made as small as possible to minimize short term memory requirements. If possible, no more than one sentence should precede the performance of each step in the administrative procedure.

2. Increasing difficulty--The question should be given in a progression of increasing difficulty so that administrative procedures are completely mastered before difficult questions are asked. If this progression cannot prevail over the entire test, at least the first several questions should be simple ones. This requirement largely rules out a "random access" testing approach where questions are administered on a continuous basis and applicants enter the sequence at any time.

3. Problem identification--The test must provide a mechanism for identifying applicants who do not understand the administrative instructions. One approach is to precede the test by two or three questions of a "Who's buried in Grant's tomb?" type, where an incorrect answer signals misunderstanding rather than lack of knowledge. The appearance of an error could either summon an examiner automatically or provide instructions to the applicant to do so.

Presentation of Alternatives

When still pictures are used in conjunction with an oral test, the pictures corresponding to each of the alternative responses are displayed at the same time while the examinee chooses the correct one. This is not practical in a dynamic audiovisual test since it would require the applicant to observe several motion picture sequences simultaneously. Rather, the various alternative responses must be presented successively. To aid the applicant in selecting alternatives, key frames from each sequence could be presented in a single montage after the dynamic presentation. In practice this was found to be unsatisfactory due to the loss of resolution that occurs when three or four separate pictures are presented in a single 16mm or 8mm frame. It also requires split-frame processing which is very expensive. A more practical approach is to present the entire sequence of alternative responses twice, once to communicate the question and a second time to allow the examinee to select a response. This approach was used in the comparison of information testing modes described earlier and found to be satisfactory so long as there were no more than three alternative responses. Later, an experiment was conducted to see if results would be improved by presenting the alternative responses three times, allowing the applicant to review the question twice before selecting an answer. The third presentation was found to be superfluous. All examinees had responded by the second presentation and objected to having to sit through a third.

Response Recording

The system by which examinees register the selection of a response must be very simple in order to accommodate those non-readers whose difficulty arises out of basic intellectual limitations. The simplest system would be a mechanical or electrical response recorder with which the examinee may indicate selection of a response merely by pushing a button. The buttons would be coded with numbers or other symbols which would be specifically associated with the various responses in the visual and/or aural presentation of the test question.

A need for electrical and mechanical response recorders would impose a hardware requirement which might limit the utility of a dynamic

audiovisual test. Therefore, use of an electrical response recorder was compared with a simple paper and pencil format. A series of dynamic audiovisual test questions was presented to a group of non-readers and slow learners. Half of the questions were answered using the response recorder and the other half using a paper-pencil format. The paper-pencil format resembled the typical multiple choice answer sheet except that the numbers, letters, and spaces for indicating a response were made considerably larger and there were only ten answers per page. The examinees experienced no difficulty in using either format. Results indicate that, while an electro-mechanical response recorder may be advantageous in providing for automated scoring, it is not a necessary adjunct to the dynamic audiovisual test.

Test Pacing

A written examination is self-paced. An examinee can take as much time to answer the question as desired, subject only to whatever limits may be imposed upon total test time. To provide this same opportunity in a dynamic audiovisual test would mean allowing the examinee to stop the presentation of test questions. This is not hard to do with existing equipment. However, there are several arguments against doing it.

First, allowing the examinee to stop the presentation is of no particular advantage in a audiovisual test unless the examinee is afforded an opportunity to review the question. Without such a review, all that is accomplished by stopping the test is to allow the examinee to forget what the question was. Secondly, there is anecdotal evidence to the effect that a self-paced test, when administered to some categories of slow learners, will simply grind to a halt.

If a test question is well presented, it should be possible to call for an immediate response. Where a test question deals with traffic situations, the need to supply an immediate response becomes a form of content validity in that the real world of driving generally demands an immediate response. In the audiovisual testing that has been described, the film ran continuously and the examinees were allowed approximately five minutes for each answer. In almost all cases, examinees made their election of a response immediately upon presentation of the question. Available response time was not a factor in test administration. Self-pacing does not appear to be a necessary feature of audiovisual testing.

OTHER ALTERNATIVE APPROACHES TO INFORMATION PRESENTATION

The study of alternative methods for information presentation and testing has thus far focused upon techniques for accommodating drivers who have language difficulties, drivers whose needs cannot be met through conventional manuals and tests. This focus reflects a belief that, among drivers who can read, a manual represents the most cost-effective means of presenting information. Manuals can be sent directly to drivers who can be identified as having specific information needs; otherwise, they can be made generally available through licensing stations. The other alternative approaches discussed--slides, film-strips, audio cassettes, films, videotape--represent an expensive means of communicating information owing to their cost and the need for special equipment.

About the only way in which audiovisual presentations could be provided economically to drivers in general is through the use of existing delivery systems. The two major existing systems of information delivery, amenable to audiovisual presentations, are ongoing educational programs and mass media.

- Educational Programs--By making audiovisual programs available to schools, government and community agencies, and employers conducting various educational programs, licensing agencies could reach large numbers of individuals with valuable driving information.

- Mass Media--Providing presentation materials to mass media might succeed in reaching even larger numbers of people.

There is, however, reason for questioning whether the support of educational and mass media programs is an appropriate activity for licensing agencies. This question concerns the dubious relevance of conducting broad information dissemination programs to the mission of licensing agencies. What makes a licensing agency unique among sources of driving information is its ability to make acquisition of information a condition for issuance or rejection of a drivers license. Schools can give support to educational programs. Mass media programs can be supported by a variety of organizations including automobile companies, oil companies, safety-related organizations, and various governmental agencies. There seems little point in encouraging license agencies to duplicate the activities of these other organizations. Only where the licensing authority can be exercised to provide incentives to information acquisition does it seem appropriate to involve licensing agencies. It is questionable whether issuance or retention of a license could be made contingent upon information acquired through mass media or educational programs outside the control of the licensing agency.

The one activity of an educational nature that could legitimately be brought under the licensing authority would be the driver improvement programs administered by licensing agencies and courts to convicted traffic violators. Here is an existing channel through which information in an audiovisual form may be used to supplement written information, with the incentive of license retention to enhance information acquisition. At the present time, there is no lack of audiovisual material to support driver improvement programs. The National Safety Council's "Defensive Driving Course" is the most commonly used presentation. Other available presentations include the U. S. Air Force Multi-Media Series, prepared in cooperation with the National Highway Traffic Safety Administration, as well as a variety of slides, filmstrips, and films prepared by commercial media house, the American Automobile Association, colleges and universities, and various governmental agencies. These materials, on the whole, appear designed primarily to alter attitude rather than broaden knowledge. Whether attitudes can be effectively modified through existing materials, indeed whether they can be modified at all, is an unanswered question. Whether they can or not, a need also exists for audiovisual materials that may be used as a supplement to written materials and instructor presentations in improving the knowledge of safe driving by those assigned to driver improvement programs.

EVALUATION

An evaluation of the manuals, tests, and audiovisual information presentation was undertaken in the State of Virginia. Evaluation of the manuals and tests involved some 60,000 drivers representing all of the target groups. Within each target group, drivers were randomly divided into EXPERIMENTAL and CONTROL groups. Drivers in the EXPERIMENTAL groups were administered the project developed manuals and test while those in the CONTROL groups were subject only to procedures currently employed by the State. The effectiveness of the manuals and tests were evaluated against three objectives:

- Information acquisition--Effectiveness of the manuals and tests in leading to acquisition of required information.
- Information retention--Effectiveness of the manuals and tests in leading to retention of information originally acquired.
- Information application--Effectiveness of the manuals and tests in leading to changes in driving behavior as reflected in lower accident and violation records.

Evaluation of the audiovisual presentation involved assessment of information acquisition among limited numbers of drivers representing various categories of reading disability. The project did not call for an evaluation of the audiovisual presentation in terms of accident and violation records.

SELECTION OF EVALUATION SITE

The major requirement a State had to meet to serve as an evaluation site was the ability to require tests of drivers in the various target groups. Without the test, there would be little incentive for drivers to acquire the information contained in the manual for that target group.

Of the various target groups, that consisting of renewal applicants was the most critical. First, it was the most highly populated target group. Secondly, it is with respect to this group that the whole question of testing is the most controversial. There is no real opposition to the testing of new drivers. Few would oppose the compulsory testing of traffic violators and DWIs or the voluntary testing of accident repeaters. However, many States have opposed renewal testing, to the point of failing to comply with those provisions of the NHTSA safety program standards that required periodic knowledge testing of renewal applicants.

After negotiations with the Virginia Division of Motor Vehicles, the State of Virginia was selected, and agreed, to serve as an evaluation site. Provisions of the Virginia Motor Vehicle Code allowed testing of drivers in all target groups, except that consisting of Accident Repeaters (very few States require testing of drivers in accidents unless the accidents involve violations).

One apparent advantage Virginia offered as an evaluation site is the fact that the provision which allows testing of Renewals was enacted less than a year prior to the scheduled evaluation. This assured that Renewals had not been subject to a prior renewal test and allowed for a clearer identification of the effects of renewal testing. As it turned out, this "advantage" was less than a total blessing. The problems encountered in attempting to administer renewal testing under provisions of Virginia law will be discussed later.

DETERMINATION OF SAMPLE SIZE

The criterion of sample size is that the sample must be sufficiently large to establish the significance of any cost-effective result.

For any result, that is, any difference between an EXPERIMENTAL and CONTROL group, there is a sample size that will allow the significance of that result to be established. If the sample is too small, the result may not appear. If it does appear, its significance may not be statistically supportable. On the other hand, a sample that is too large will establish the significance of a cost-effective result but at unnecessarily great expense.

The task in establishing sample size is to determine the smallest difference between EXPERIMENTAL and CONTROL groups that represents a cost-effective accident reduction. A cost-effective accident reduction is one in which the per-driver cost of the licensing program equals the per-driver savings in accidents. A minimally cost-effective difference becomes the ratio between the two costs, i.e., program costs ÷ accident costs.

The difficulty involved in using this approach to determining sample size requirements lies in the estimation of program costs and accident costs. Program costs include the following:

- Manuals--The additional cost involved in preparing, printing, and disseminating manuals.
- Tests--The additional cost involved in developing and printing tests.
- Examiner Time--The additional cost involved in administering and scoring tests, including reexamination for those who fail.

- Examinee Time--The cost to the examinee of time spent in testing, as well as in travel to and from the test site.

These costs are obviously difficult to estimate. However, for determination of sample size in the present project, a figure of $10.00 per driver was assumed.

The cost of the average accident is even more difficult to estimate than the cost of a manual and test program. The elements of cost include the following:

- Property Damage--The cost to repair the vehicle or other structures involved in the accident.
- Personal Injury--Medical and hospital bills, cost of drugs, cost of transportation, etc.
- Lost Work Time--Cost resulting from work time lost, whether compensated for or not.
- Lost Earnings--Lost earnings due to disability or death of the primary breadwinner.
- Loss of Vehicle--Cost of transportation while the vehicle is unavailable.

Since the evaluative criterion in the current project is to be officially reported accidents, estimates of accident costs would not include those below reporting thresholds (generally personal injury or property damage in excess of $200).

Estimates of current accident costs are not available through the literature. However, estimates used in accident studies place the figure at somewhere between $2,000 and $4,000 per accident. (NHTSA 1972, NSC 1975). Dividing program costs by accident cost, a minimally cost-effective difference would be .005 accidents per driver for an assumed cost of $2,000 per accident, and .0025 accidents per driver for an assumed cost of $4,000 per accident.

The sample size needed to establish the statistical significance of a difference may be estimated by using the standard formula for significance of a difference in proportion, and solving for N. The formula becomes:

$$N = \frac{(Z^2)\ (2PQ)}{d^2}$$

Where: Z = the standard score corresponding to the selected confidence level. A confidence level of .95 corresponds to a Z of 1.96.

P, Q = estimated population proportions of accident-involved and accident-free drivers. For sample setting purposes, P is set at .11 for the 2-year period during which accident data will be collected.

d = the difference in accident rate between EXPERIMENTAL and CONTROL groups. As noted above, this is set at .005 and .0025.

Applying this formula yields sample size requirements of 30,000 per treatment group for an assumed accident cost of $2,000 and 122,000 drivers per treatment group for an assumed accident cost of $4,000.

A sample of 122,000 drivers per treatment group was clearly beyond the financial resources of the project. Indeed, it seems unlikely that any research project could afford such a large sample. Only where new manuals are part of an operational program, where the costs of printing and disseminating the manuals could be borne of an operational budget, would it seem feasible to send them to so many drivers.

For purposes of research, an assumed accident cost of $2,000 is the more "conservative" of the two figures in that it requires the higher payoff. Any program that could pay for itself through a savings of $2,000 per accident would also pay for itself if the savings are actually $4,000 per accident. For this reason, an assumed accident cost of $2,000 and a sample size of 30,000 per treatment group were considered adequate for the present study.

TARGET GROUP SAMPLE SIZE

To provide a valid determination of the effects of a manual and test program, the sample to which the program is applied should be approximately representative of the actual driving population to which the program would ultimately be applied. This means that each target group should be represented roughly in proportion to its numbers within the general driving population. An additional advantage of proportional representation is that it allows the study to reach the requisite numbers in each target group within the same approximate period of time. If a large sample were required from some sparsely populated group, it could take a long time to obtain it.

Strict proportionality must be tempered by the need to include in each target group a sufficient sample to obtain a meaningful result. An acceptable minimum in each target group was believed to be one-tenth of the total sample size, or 6,000.

Applying these considerations to the total sample yielded the following target groups sample sizes:

Target Group	Total Target Group Sample	Experimental Group Sample	Control Group Sample
Renewals	26,000	13,000	13,000
New Drivers	8,000	4,000	4,000
Older Drivers	8,000	4,000	4,000
Violators	6,000	3,000	3,000
Accident Repeaters	6,000	3,000	3,000
Drinking Drivers	6,000	3,000	3,000
TOTALS	60,000	30,000	30,000

The number of drivers in any one target group is not sufficient to establish the significance of the minimally cost-effective result in that target group alone. It is only when results are combined across target groups that there are enough drivers to establish statistical significance. Of course, it is possible that the accident reduction in one target group might actually turn out to be so large--that is, so much greater than that which is minimally cost-effective--that statistical significance would be achieved with a relatively small number of drivers. Such an outcome doesn't represent a very realistic expectation.

It would take the same 60,000 drivers to establish the significance of a minimally cost-effective accident reduction in any one target group. Across all six target groups, this adds up to over one-third of a million drivers. The cost of an evaluation involving so many drivers would be prohibitive.

An efficient strategy would appear to be to start with an initial evaluation of the entire program without regard to the effectiveness of the individual components of the program. If the results evidence the value of the total program, then the funds needed to determine which target groups are primarily responsible for the result could be sought. There is always the danger, of course, that the success of certain components may be obliterated by the failure of others, with the result that the overall program shows no beneficial effect, despite the effectiveness of some of its components. However, such a result is very unlikely unless the unsuccessful components were to cancel out the successful ones by producing an actual increase in accidents.

EXPERIMENTAL PROCEDURES

This discussion will describe the procedures that were used to (1) assign drivers to EXPERIMENTAL and CONTROL groups, (2) disseminate appropriate manuals to drivers in each group, and (3) administer tests to assist the acquisition of information from manuals. Since the procedures differed from one group to another, each target group will be discussed separately.

Renewal Applicants

Applicants for license renewal made the largest target group and the group of greatest interest. For the purposes of the study, the Renewals are defined as drivers under the age of 60 whose licenses were due to expire.

Selection and Assignment

Toward the end of any month, the records of all drivers in the State of Virginia are searched to identify those whose licenses are due to expire by the end of the following month. It was during this record search that drivers were selected and classified into EXPERIMENTAL and CONTROL groups. To create the target group sample, the computer program identified drivers having the following characteristics:

1. License due to expire during the following month.
2. A residence address in the Northern Virginia area.
3. Not included in any other research study.
4. Not meeting the criteria of any other target group.

The elimination of drivers in other target group was considered necessary to prevent the effects of one informational program from being confounded with the effects of another.

Drivers meeting the above criteria were then sorted on an every-other-name basis into EXPERIMENTAL and CONTROL groups. The driver's target and study group assignment was then entered into the driver's record within a special field provided for that purpose. This was intended to facilitate the retrieval and classification of accident and violation records during the later follow-up evaluation.

Dissemination of Manuals

CONTROLS received a standard renewal card and were told to report to the most convenient DMV field office to take a vision test and have their license renewed. EXPERIMENTALS received a renewal application card with a special red border and a letter advising them of the following:

1. They were part of a research study and would be given a twenty-item renewal test.
2. They would receive a special renewal manual in a separate envelope and would have to read the manual in order to pass the test.

3. They should report to one of the Northern Virginia field offices identified in the letter.

4. They should remember to bring their renewal application card with them to assure that they are given the test for which they are prepared.

The color coded application card was intended to assist field office personnel in identifying drivers by target group. Each target group was assigned a color code. In addition to appearing on application cards, the color was used as paper stock for tests and covers of manuals. Color coding helped to prevent mistakes in disseminating manuals and administering tests.

Manuals were mailed separately. The cost involved in sending them first-class along with renewal notices and renewal application cards would have been prohibitive. EXPERIMENTALS were informed that they could obtain a copy of the manual at any field office should it not arrive in the mail. However, in most cases manuals arrived within a few days of the renewal notice. Drivers not receiving manuals through the mail were primarily those who had moved without notifying the DMV. These drivers obtained their manuals directly from a field office.

Administration of Tests

CONTROLS, as previously noted, were not required to take a written examination. EXPERIMENTALS, upon producing the color coded renewal evaluation card, were administered one of the seven forms of the Renewal Test. If an applicant arrived without a renewal application card, that driver's record was accessed through a computer terminal located in the field office. If the driver was identified as being an EXPERIMENTAL in the Renewal target group, the Renewal Test was administered.

The examiner scored each applicant's test and reviewed it with the applicant. The item numbers of those items failed were recorded on the renewal application card.

Processing Results

A Data Entry Operator at each field office entered the following items into the driver's record through the remote terminal access:

1. Score

2. Test Form

3. Item numbers of items answered incorrectly.

The application form cards were then forwarded to DMV headquarters in Richmond, Virginia, where entries were verified.

Test Refusals

The authority under which renewal applicants were required to take a written test derived from an act passed by the Virginia General Assembly. This act authorized the Commissioner of Motor Vehicles to require a test of any renewal applicant. The law had been recently enacted to allow another research study concerned with renewal testing to take place. It was not intended to initiate a permanent renewal testing program for all drivers.

A number of objections were received by law makers and DMV personnel when provisions of the law were applied approximately two months prior to the scheduled initiation of the procedures described above. Because the law applied unequally to drivers, its constitutionality was unclear. The decision was therefore reached that drivers should not be compelled to take the renewal test. The letter that accompanied the renewal notice notified the EXPERIMENTALS that a test would be administered and neither stated nor implied that any relief from the test was possible. Nor, did examiners give any indication that the test was not compulsory. However, if an applicant refused to take the test, notice of the refusal was noted into the driver's record but their license was renewed. No one "failed" the test.

Throughout the first three months of this study, the refusal rate among renewal applicants was approximately 17%. However, during the third month, a newspaper article appeared announcing that the test was not compulsory. The refusal rate increased to between 25 and 30% throughout the remainder of the study. Overall, the rate averaged 25%. The refusal of an applicant to take the Renewal Test does not necessarily mean failure to benefit from the Renewal Manual. Many of those applicants refusing to take the test claimed to have read the manual. Many further supported the idea of compulsory renewal testing despite their own refusal to take the test. The most common reason for declining to take the test was simply being in a hurry.

Sample Exclusions

The only drivers excluded from the project sample were those who failed to renew their license. Exclusion was automatic in the sense that any search of driving records for accidents and violations would turn up no record of the individual involved. Non-renewals have been found to be equally distributed across EXPERIMENTAL and CONTROL groups and, therefore, will not bias the results. Since those refusing to take the test are likely to differ from those agreeing to take it, relative to variables associated with accident causation, the elimination of test refusals from the sample would have introduced a bias between EXPERIMENTAL and CONTROL groups.

Senior Drivers

The procedures applied to Senior Drivers were largely the same as those described in the preceding section. The only notable differences were:

1. Selection of drivers 60 and over, instead of drivers under 60.

2. Use of a green color code for renewal application card, test, and cover of manual.

3. Dissemination of the Older Driver Manual rather than the Renewal Manual.

4. Administration of the Older Driver Test rather than the Renewal Test.

The problem of test refusals prevailed among Older Drivers as it did among Renewals. The Older Drivers were somewhat more cooperative, the refusal rate averaging 18% instead of the 25% reported for Renewals.

New Drivers

The New Driver Manual and the Youthful Driver Supplement were evaluated using a sample of high school driver education students drawn from 28 schools in the Northern Virginia area.

Selection and Assignment

Driver education teachers in each of the participating schools were asked to divide their driver education classes equally into EXPERIMENTAL and CONTROL classes. Basic characteristics of each class (hour of the day, number of students, proportion of males and females) were reviewed by the project staff to assure that the process was essentially random.

Dissemination of Manuals

Students in CONTROL classes were administered the standard Virginia Driver's Manual. Students in EXPERIMENTAL classes were given the New Driver Manual. The first set of classes in each semester (i.e., first six weeks) received only the Renewal Manual; the second set of classes (i.e., last six weeks) received both the Renewal Manual and the Youthful Driver Supplement. Both CONTROL and EXPERIMENTAL classes used their assigned manuals as part of their driver education program.

On purely statistical grounds, it would have been preferable to assign individual students rather than entire classes to the two study groups. Such an approach, however, would have been almost impossible to administer in the classroom. Moreover, it is likely to have produced a "cross-fertilization" that would have obscured the effects of each manual.

Administration of Tests

Tests were administered to drivers in the New Driver group as part of their application for a learner's permit. Most of the examinations were administered in the school by a DMV Field Examiner. CONTROLS were administered the standard Virginia State license examination. EXPERIMENTALS were administered the New Driver Test.

To aid the Field Examiner in distinguishing between groups, applicants were given color coded application cards by their teachers. CONTROLS were given a card coded with a black stripe; EXPERIMENTALS were issued a card color coded with a yellow stripe (yellow was the color code for the New Driver Manual and the New Driver Test).

Applicants who passed their test were issued a learner's permit. Those who failed the test were told to restudy their assigned manual and report to the field office for retesting. They were required to present their color coded application card to be sure that they received the proper test. Those reporting to the field office were administered the appropriate test by a field office Examiner.

Processing

The color coded application cards were delivered by the Field Examiner or Field Office Examiner to the Data Entry Operator for processing. The Data Entry Operator prepared a record for each individual driver using the remote computer terminal located in the field office. With the aid of the color code, the Data Entry Operator entered the applicant's target group and study group assignment into the record. Also entered into the record were the same items of information identified earlier in discussion of the Renewal group (score, test form, etc.). Application cards were then sent to DMV headquarters where the entries in the driver's records were verified.

Use of High School Students

The use of high school students for evaluating the New Driver Manual was dictated by the need for control. It would have been very difficult to control the dissemination of manuals in a way that would assure random assignment had manuals simply been handed out to all age groups at a licensing station. It would have been equally difficult to assure that each driver received the appropriate test. By placing the dissemination of manuals and the designation of tests in the hands of teachers, somewhat greater control was achieved.

Two questions may be raised concerning the use of a high school population. The first question concerns the representativeness of high school students to the new driver population in general. The basic answer to this question is simply that the overwhelming majority of new drivers are high school students. Whatever differences may exist between youthful and adult new drivers in their reaction to knowledge manuals and tests (and there is little reason to believe that a significant difference exists) would not be likely to have much effect.

A second question concerns the ability of a driver manual to exert an appreciable influence over drivers who are enrolled in driver education. There are several points to be raised in response to this question. First, since the great majority of new drivers these days have completed driver education, a test of the effectiveness of any manual for new drivers must superimpose the manual upon driver education. Secondly, a State driver manual is generally an integral part of a driver education program and, therefore, may be expected to influence the effectiveness of the program. This is particularly true in communities where driver education students do not have a textbook for their individual use. Finally, even where a textbook is provided each student, it is likely that the student is more highly motivated to read the manual since it represents a key to gaining a driver's license. Therefore, the effect of an improved manual might appear even where textbooks are supplied on an individual basis.

Violators

In Virginia, drivers who compile eight or more "points" under the State Driver Improvement Program are required to report to a Driver Improvement Analyst for a group interview. The group interview provides a mechanism for administration of the test that is needed as an incentive to reading the manual.

Selection and Assignment

As drivers in a particular locale accrue eight points, their names are placed upon a roster. Once the roster contains 12 names, a group interview is scheduled and the offending drivers are notified as to when and where it will take place. For the duration of the project, classes were randomly assigned to the EXPERIMENTAL or CONTROL group. An entry containing the target group and study group assignments was then made in each driver's record.

Dissemination of Manuals

Drivers in the CONTROL group received only the letter notifying them to report for the group interview. Drivers in the EXPERIMENTAL group received a copy of the Violators Manual along with the letter. They were

told that they would be administered a test on the contents of the manual. Both groups were informed that failure to comply with requirements would result in a suspension of their license.

Test Administration

Drivers in the CONTROL group were not administered any test. Those in the EXPERIMENTAL group were administered the Violators Test at the time they reported for the group interview. The test was scored by the Driver Improvement Analyst and the results used in the group interview in whatever manner the Driver Improvement Analyst saw fit. No administrative action was taken directly as a result of the violator's failure to pass the test.

Accident Repeaters

There is no provision within the Virginia Motor Vehicle Code that permits tests to be required of Accident Repeaters, except to the extent that the same drivers might also qualify as Violators. Virginia is fairly typical; few States require drivers to be tested simply because of involvement in accidents.

If an information program were to be directed toward accident repeaters, it would have to depend upon the voluntary participation of targeted drivers. It was not believed very likely that voluntary participation would extend as far as a trip to a licensing station to take a test. Therefore, a mailback test approach was selected.

Selection and Assignment

The designated target group consisted of drivers who had recently reported an accident and had a previous accident sometime during the prior three-year period. Ordinarly, such drivers would be identified when accident reports were received. A clerk would check the driver's record to determine if a previous report had been filed during the prior three years. Owing to the procedure by which accident reports are filed in the State of Virginia, this approach was not feasible. Therefore, an alternative procedure was followed. Records of all licensed drivers were searched to identify drivers who had filed two or more accident reports during the previous three years including one within the previous six months. Drivers meeting this criterion were classified on an every-other-name basis into CONTROL and EXPERIMENTAL groups.

Dissemination of Manuals and Tests

No action was taken with respect to drivers in the CONTROL group.

Drivers in the EXPERIMENTAL group received a letter accompanied by a copy of the Accident Repeater Manual and the Accident Repeater test. The letter explained that the State had undertaken a research project intended to assist drivers who had been in accidents by providing information concerned with accident prevention. The theme followed that of the manual itself, namely that of helping drivers to defend themselves against accidents caused by others. Drivers were asked to participate by reading the manual and taking the mailback test. They were informed that drivers who completed the test and returned it would be apprised of their score and their specific errors by return mail. A stamped return envelope was provided for return of the test.

Processing

All tests that were returned were scored and the score entered into the driver's record. Each test was photocopied for item analysis purposes and the original was returned to the driver. Two months after the original letter was sent, non-respondents were identified and sent a follow-up letter containing a copy of the examination and urging them to complete it. Anyone who had misplaced the Accident Repeaters Manual was invited to call the nearest DMV branch office to request a duplicate. The response rate is discussed in the "Results" Section. Drivers remained in the EXPERIMENTAL sample whether they returned their test or not.

Drinking Drivers

Evaluation of the Drinking Driver Manual and Test was to have taken place in Virginia among drivers whose licenses had been suspended for conviction of Driving While Intoxicated. However, subsequent to initiation of the project, Virginia launched a State-wide Virginia Alcohol Safety Action Project, under which drivers convicted of drinking-driving offenses might be assigned to educational or rehabilitative programs rather than having their licenses suspended. Drivers permitted this option would never have come to the attention of Virginia DMV and, therefore, could not be included in the study. A projection of the actual number of license suspensions for Driving While Intoxicated indicated that it might take several years to compile the required sample of 6,000 drivers.

Discussions with representatives of the California Department of Motor Vehicles revealed that a project was about to be undertaken in which the effect of various informational materials upon convicted DWIs would be evaluated. The project would involve a comparison among three groups. One group would receive the informational materials, while a second group merely received a warning letter and the third group received no communication at all. The project plan called for a total of 10,000 drivers in each group. Arrangements were completed for inclusion of the Drinking Driver Manual as one of the categories of informational material.

Selection and Assignment

Thirty thousand first-time offenders among drivers convicted of Driving While Intoxicated would be identified and randomly assigned into the three treatment groups: information, warning, and control. Those in the Information Group would be subdivided into three approximately equal groups, one of which would receive the Drinking Driver Manual. The other two subgroups would receive other information materials concerned with drinking and driving.

Administration

Drivers in the Information and Warning groups would be sent the appropriate materials directly. In addition, one-half of the drivers in each subgroup of the Information group would be sent tests which they would have to complete and return to the DMV. Completion and return of the test would be compulsory.

ASSESSMENT OF INFORMATION ACQUISITION

An assessment was made of the extent to which the manuals provided each group were successful in leading target group drivers to acquire the information they contained. The assessment of information acquisition involved the selection of an "Acquisition Test" sample of 100 drivers from each EXPERIMENTAL group and a comparison of results with those obtained by a "Pretest" group of 100 drivers who had not received the manual. The Pretest group was selected so as to be as much like the Acquisition test group as possible. The results obtained from this group could be taken as representing the level of knowledge among the Acquisition test group prior to receiving the manual. A comparison of test scores from this Pretest group with those obtained by the Acquisition test group provided a measure of knowledge gain resulting from reading the manual.

Since the specific procedures used to obtain samples differed somewhat from one target group to another, each target group will be discussed separately.

Renewals

The test given to renewal applicants involved some seven forms of 20 items each, a total of 140 items. It was neither necessary nor practical to assess information acquisition across all these items. Instead, 20 items were selected according to the following criteria:

1. All levels of difficulty were represented. Specifically, a quarter of the items were drawn from each of the following difficulty levels: up to 69, 70-79, 80-89, 90-100. The item statistics upon which difficulty levels were estimated were those compiled during an earlier administration of the test.

2. Item content was distributed evenly across all sections of the manual.

3. Approximately half of the items represented content that drivers could be expected to know without reading the manual (e.g., meaning of road signs), while one-half represented content that drivers could not be expected to know without reading the manual (e.g., following distance in seconds).

The items selected in this manner will be referred to as the "Acquisition Test" from this point on. Results for the EXPERIMENTAL sample on the Acquisition test items were obtained by drawing random samples of 100 drivers from those taking each of the test forms as a part of the renewal process. The percent answering each item correctly was determined and a mean Acquisition Test score generated from the item statistics.

A Pretest group was obtained by asking a sample of renewal applicants who were not in the EXPERIMENTAL group to take the 20-item Acquisition Test. Given the problem of test refusals among the EXPERIMENTAL group, it was feared that similar refusals might be experienced among the Pretest sample. Therefore, the 20-item Acquisition Test was divided into four forms of five items each. This reduced the number of test items each participant would answer to a mere five items. There were practically no refusals among the 100 drivers in the Pretest sample completing each form.

The results of the Acquisition Test appear below:

Pretest Mean	Acquisition Test Mean	Percent Gain[1]	Significance
62.9	79.8	26.7%	$P < .01$

Except where otherwise noted, simple one-tail t tests were used to determine statistical significance. A gain of 26.7%, in addition to being statistically significant, is fairly substantial for a group of experienced drivers. A Pretest mean of 62.9% indicates t over a third of the content of the Acquisition Test was unknown to the average licensed driver.

[1] In this comparison, and all those that follow, the "gain" is the difference between Acquisition Test and Pretest results expressed as a percent of the Pretest results, that is: $\frac{\text{Acquisition Test - Pretest}}{\text{Acquisition Test}}$

Older Drivers

To test the effectiveness of the Senior Driver Manual in leading to knowledge acquisition, a sample of 100 Senior Driver tests was drawn at random from the EXPERIMENTAL sample. Obtaining a Pretest sample was something of a problem in that it would have been very difficult to identify the ages of drivers outside of the EXPERIMENTAL sample. However, because of the thorough pretesting that had been given the Senior Driver Manual and test, results on the Senior Driver test were available from a sample of over 100 older drivers. The results from this Pretest sample and the Acquisition Test sample appear below.

Pretest Mean	Acquisition Test Mean	Percent Gain	Significance
69.0	83.0	20.3%	$P < .01$

Again, a substantial and statistically significant information gain resulted from reading the Senior Driver Manual. It is worth recalling that the Older Driver group was the only one having information requirements that were different from the public at large. The Manual and Test dealt solely with this information. Administration of the Renewal Manual and Renewal Test to the Older Driver group is lik ly to have produced results similar to those obtained in the Renewal group.

New Drivers

The special 20-item test was used for assessment of information by New Drivers. To determine levels, a sample of 100 responses to each item was drawn from the results of the EXPERIMENTAL sample, in the same manner as described for Renewals. A Pretest sample was drawn by selecting 100 high school students at random from the CONTROL group. Each student took the entire test. A comparison of the Acquisition and Pretest groups yield the following results:

Pretest Mean	Acquisition Test Mean	Percent Gain	Significance
61.4	81.7	33.1%	$P < .01$

The gain for the New Driver group is somewhat greater than that of Renewals, owing primarily to higher Acquisition Test scores. Whatever advantage Renewals might have owing to their experience is apparently offset by additional study given to the New Driver Manual in the school setting, coupled with whatever test-taking advantage high school students possess.

The gain produced by the New Driver Manual represents information that is acquired over and above that which students had received through driver education. To determine the gain produced by the Manual among drivers who

had not completed driver education, the 20-item Acquisition Test was also administered to a group of high school students just entering driver education. The Pretest mean of this group was 56.7%, confirming that high school students know a great deal about driving before they enter formal driver education.

Approximately half of the New Driver sample received the New Driver Supplement in addition to the Manual. This was not due to any intent to assess the contribution of the Supplement, but rather came about as a result of delays in printing of the Supplement. However, a comparison of Acquisition Test scores attained by those who received the Supplement with the scores obtained by those who received only the Manual might be informative. Such a comparison could not be conducted at the time this report was prepared owing to the small numbers of Supplement recipients completing their license tests. The results of a comparison will be provided in a later report.

Violators

Acquisition of information from the Violators Manual was assessed by comparing scores on the Violators Test obtained by a randomly selected group of 100 drivers drawn from the EXPERIMENTAL sample, with scores obtained by administering the same test to a randomly selected group of 100 drivers from the CONTROL sample. The results appear below.

Pretest Mean	Acquisition Test Mean	Percent Gain	Significance
61.8	68.6	11.0%	$P < .01$

It is readily apparent that the drivers in the EXPERIMENTAL group gained little from the Violators Manual. This failure is most readily attributable to the uncooperative attitude that characterized the Violator group in general. Those experienced in administering driver improvement programs for convicted traffic offenders are familiar with the hostility that typically pervades the initial sessions. One of the first objectives in a driver improvement program is to neutralize the hostility through group interactive processes. No manual can duplicate this.

It is quite possible that the Violator Manual would have been accepted more favorably had it been offered as an alternative to participation in a driver improvement activity rather than as an addition to it. In any further attempt to evaluate informational communications to convicted traffic offenders, this prospect should be considered. If a manual is to be used in conjunction with a compulsory driver improvement program, it should be introduced only in later sessions of the program after the initial hostility has had an opportunity to subside.

Accident Repeaters

The use of a voluntary, mailback testing approach did not produce the results that had been hoped for. Even with a follow-up letter to non-respondents, only a 41% response was obtained. To obtain an assessment of knowledge gain, a sample of 100 tests was drawn at random from those who did respond. For several reasons, it was not possible to use the CONTROL group for comparison purposes. However, there is no reason to expect Pretest results from the Accident Repeater group to differ appreciably from that of the public at large. Therefore, the Accident Repeater test items were administered to a sample of 100 drivers reporting to a branch office of the Division of Motor Vehicles for license renewal. The 20 test items were divided into four forms of five items each in order to ease the test burden upon examinees and thus minimize test refusals.

A comparison of Acquisition Test and Pretest yields the following results:

Pretest Mean	Acquisition Test Mean	Percent Gain	Significance
64.1	83.0	29.5%	$P < .01$

It is apparent that those who did read the Accident Repeater Manual gained a great deal from it. To what extent the result reflects true knowledge gain cannot be determined since respondents were free to look up answers in the book. However, given the inconvenience involved in looking up answers, and the fact that there was nothing to be gained by doing so (test score did not affect the status of their licenses), it is likely that most respondents attempted to answer from memory.

The rather substantial gain among respondents is offset by the rather small response rate. There is little doubt that many of the drivers who failed to complete and return the test did read all or part of the manual. The low response rate does not appear to be symptomatic of a generally unfavorable reception. On the contrary, judging from the volume of favorable comment received from those returning tests, the manual was well received. However, there being no deadline for return of the tests, or any real requirement to do so at all, most of the recipients probably laid the test aside and never got around to completing it.

Whatever the reasons for the low response rate, it is apparent that a voluntary mailback test approach is not very productive. Only two alternatives seem open, one being to make return of the test compulsory, the other being to give up the test entirely. A compulsory test would be possible only where the licensing agency has the legislative authority to require tests of drivers who have been in accidents, without being charged with violations. Such authority is rare. At least one State has used an approach in which an obligation to return the test was implied although not specifically stated. Such an approach might succeed on a short term basis but would not be practical in a permanent program.

The second alternative is that of simply mailing out the manual without requiring a test. Certainly there is precedent for such an approach; the great majority of safety oriented communications reaching drivers are unaccompanied by tests. The question is whether a simple mailout is appropriate to a licensing agency. As has been emphasized previously, what makes a licensing agency unique is its ability to accompany a manual with a test and require that the test is passed as a condition for retaining a license. Where the authority to require a test cannot be invoked, a licensing agency has no advantage over any other organization. Insurance companies might offer a better avenue of communication with Accident Repeaters if no return communication is to be required.

Drinking Drivers

A Pretest measure of knowledge was obtained by administering the Drinking Driver Test to convicted DWIs reporting to the Fairfax County (Virginia) Alcohol Safety Action Project (ASAP). The test was given before any activity took place so that test results would not be influenced by the program itself.

A measure of information Acquisition was not obtainable from the EXPERIMENTAL sample owing to the timing of the Drinking Driver evaluation effort in California. The administration of the test to the Pretest group after their reading of the Manual would have produced spurious knowledge gains owing to their prior exposure to the test items. No other convicted DWI groups were available. However, the use of DWIs was not as important for Acquisition Testing as it was for the Pretest. In the Pretest it was necessary in order that initial knowledge levels reflect the information about drinking and driving that DWIs pick up through the enforcement and adjudication process. However, the Acquisition Test measures primarily knowledge absorbed from the Drinking Driver Manual. Any group of individuals who could be induced to read the manual should have the same Acquisition as convicted DWIs. To obtain an interim assessment of information acquisition, the Drinking Driver Manual was administered to a group of 100 students taking adult education. Only those who acknowledge use of alcoholic beverages were involved. Reading the Manual was a class assignment. All were administered the Drinking Driver Test following reading of the Manual. Results obtained from this interim evaluation of acquisition appear below:

Pretest Mean	Acquisition Mean	Percent Gain	Significance
64.9	86.2	32.8%	$p < .01\%$

It is apparent that the Drinking Driver Manual is capable of producing a substantial information gain even over the Pretest knowledge levels of

convicted DWIs, whose recent brush with drunk driving laws might be presumed to have left them fairly knowledgeable on the subject of drinking and driving. A later supplement to this report will report a measure of information gain obtained from the actual California EXPERIMENTAL sample.

Analysis of Individual Items

Analysis of Acquisition Test results included an analysis of individual item responses for all tests. The individual item response patterns appear in Appendix C. The purpose of analyzing individual items was primarily to provide a means by which States desiring to incorporate individual items into their tests might obtain a preliminary estimate of item difficulty for use in setting passing scores and constructing equivalent test forms. In addition, items that were answered correctly by less than 70% of the drivers taking them were studied to see if they revealed some deficiency in the corresponding Manual. Technically speaking, any instance of a high error rate represents a deficiency in the Manual in that test performance could always be improved by giving additional emphasis to the information in the Manual. Such emphasis would take the form of additional content, use of pictures, or format changes. However, given a fixed level of reader effort, any additional emphasis given to one information item is achieved only at the expense of some other item. The best solution is to require applicants to devote the additional time needed to lower the error rate on the items in question without raising it for other items, thus raising the overall level of information acquisition. Therefore, efforts to revise Manuals were confined to those needed to correct what were clear deficiencies. The deficiencies identified were primarily (1) words or pictures that, while technically correct, were misleading, and (2) general principles whose implications were not made sufficiently clear.

The individual item statistics reported in Appendix C represent results obtained by particular groups of drivers who were issued particular manuals under particular circumstances. They should not be viewed as representing inherent difficulty levels of the items themselves. Future results obtained in administering these items will vary as a function of the following:

> Manual Content--Any changes in manuals made to accommodate the laws, policies, driving conditions or desired emphases of various States will influence individual item statistics. Should a particular item of information be eliminated from a manual, it would be necessary, of course, to drop the corresponding item from any test.

Pass/Fail Standards--The pass/fail standards employed by different States will affect item statistics in two ways. First, an applicant's knowledge of what the standards are will generally influence the amount of time devoted to reading the manual. Applicants will study harder for a test on which 90% is passing than for one on which 70% is passing. This should be reflected in item and test statistics. Secondly, those applicants who do not pass the test the first time must retake it. Eventually, they will have to attain a passing score. The higher that score is, the higher will be the overall performance on test and item statistics compiled on the applicant population at large.

Population Characteristics--Characteristics of target group populations from State to State may influence the level of information acquisition that takes place and the extent to which it is revealed on written tests. Item statistics will probably be less sensitive to differences among the drivers themselves than to differences in the way different States define particular target groups. For example, results obtained from a program for "traffic violators" that is confined to chronic offenders will produce results that differ from those obtained from a program that is directed toward first-time offenders.

Presentation/Testing System--Any differences in the system under which information is presented or assessed will be reflected in test results. Variables capable of having an effect include (1) whether the testing program is voluntary or compulsory, (2) whether the test is administered by an examiner or self-administered, and (3) whether the presentation and assessment process is a part of, or alternative to, some broader program (e.g., driver improvement).

Because of the potential effect of these factors upon individual item results, no attempt has been made in the present report to package items into individual tests or alternate forms of tests. Nor has an attempt been made to generate stable item statistics by analyzing large numbers of tests. The item statistics have been provided solely to allow anyone contemplating use of the items to obtain a preliminary estimate of what they might expect of a test constituted of various items. There is probably more stability to an estimate of overall test score generated from item statistics than there would be to the item statistics themselves. For example, administration of the entire 140 Renewal/New Driver test item pool to a group of experienced drivers, under conditions less well controlled than those that prevailed in the assessment of information Acquisition, yielded Pretest and Acquisition Test means of 66.2 and 82.5 for a total information gain of 24.6%. These results are quite close to those reported in the Acquisition Test, despite the differences in the driver population from which the sample was drawn and the items that were administered.

In view of the number of factors capable of influencing individual item statistics, one should be advised against attempting to compare the results of New Drivers and Renewals on an individual item basis. Small differences are readily attributable to chance.[1] Only items showing 15 points or more separation should be viewed as representing potential information differences.

Audiovisual Presentation

The audiovisual presentation was evaluated through administration to a group of 75 high school students having diagnosed reading difficulties serious enough to render them incapable of comprehending materials written at the fifth or sixth grade reading level. Of these students, 40 were unlicensed and 35 held drivers licenses. In addition to students with reading difficulties, 15 unlicensed students diagnosed as being "educably mentally retarded" were also administered the presentation.

The audiovisual presentation was administered to the reading disabled students in four one-hour presentations, during each of which two of the eight films were shown. Each class consisted of approximately ten students. Except for those already licensed, participants were in the program in order to pass the written license test. Arrangements had been made for oral administration of the project-developed New Driver test by a State driver license examiner following completion of Acquisition Testing. The educably mentally retarded students were given the presentation in eight one-hour classes, during each of which only one film was shown. The remaining time was devoted to a review of the film and a question-answer period.

All students were given Pretest and an Acquisition Test using two equivalent forms of the New Driver test. The questions were given orally by a representative of the project staff. Those who were seeking to obtain a license were orally administered a third form by the license examiner following the administration of the Posttest.

The following results were obtained:

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[1] The average item is passed by approximately 80% of each group. The standard error of a proportion with samples of 100 = $\sqrt{\frac{PQ}{N}}$ = .04. One would predict that on two-thirds of the 140 items, or 93 items, differences between New Drivers and Renewals would fall within a range of ± .04 or 8 percentage points. Interestingly enough, a count of items in Appendix C shows exactly 93 items falling in this range, suggesting that the differences are following a chance distribution.

	Pretest Mean	Acquisition Test Mean	Gain	Significance
Reading Disabled				
Unlicensed	58.3	67.3	15.4%	$P < .01$
Licensed	67.0	72.7	8.5%	$.05 > P < .01$
Mentally Retarded	49.7	63.3	27.4%	$P < .01$

The audiovisual presentation managed to produce significant knowledge gain in all three groups. In the case of the reading disabled groups, the gain was small. Failure to obtain a large gain is attributed to deficiencies in the students rather than the audiovisual presentation. Many of the students simply did not pay much attention. This is understandable in the case of the Licensed group; there was no real incentive to learn. However, those in the Unlicensed group were ostensibly attending the presentation to prepare for the license examination. Several of these students presented severe behavior problems and clearly were unprepared to profit from any instruction. Another large segment of the Unlicensed group lacked access to automobiles and would have benefited little from passing the license examination. What gain was achieved came from a small group--a quarter to a third of the class--that appeared genuinely interested in preparing for the test.

The information gain among the Mentally Retarded students resembled that obtained from New Drivers and Renewals. Because of their intellectural deficiencies they entered and emerged from the presentation with lower absolute knowledge levels. In fact, the Acquisition Test scores for the Mentally Retarded group resembled the Pretest scores of the New Driver group. It is possible that use of an audiovisual test format would have resulted in higher Acquisition scores than were obtained through oral administration of the standard written test. It was the belief of the teachers involved, as well as that of the project staff representative, that students reflected greater levels of knowledge in the discussion which accompanied each presentation than they did on the test.

ASSESSMENT OF INFORMATION RETENTION

The reason given for renewal testing is the existence of knowledge deficiencies among renewal applicants as a result of the following:

1. Inadequacies in the knowledge tests and manuals under which they were originally licensed.

2. Changes in traffic laws and driving conditions that have arisen since they were originally tested.

3. The possibility that substantial forgetting of important safe driving information has occurred since they were last tested.

The magnitude of information deficiency attributable to inadequacies of current tests and changes in laws would be difficult to assess. However, the effects of forgetting can be directly measured. Unfortunately, because of the termination date of the project, the period of time over which the retention of information by drivers couldcbe assessed was limited to a five month period following initial information acquisition. This is a relatively short period. However, since the curve of retention drops most sharply during the first few weeks after information has been acquired, and tends to become asymptotic at the end of a few months, it was expected to provide a reasonably good estimate of the extent to which information was being retained. The assessment of retention was confined to the New Driver, Renewal and Older Driver groups, since the question of periodic reexamination applies only to these groups.

The retention of information among renewals was assessed by administering the 20-item composite "Acquisition Test" to 150 drivers selected from those taking the renewal test five months earlier. The sample was chosen such that each of the original seven test forms was represented approximately equally. The tests were mailed to those in the sample along with a covering letter, a brief questionnaire, and a return envelope. The letter requested participation and assured the drivers that their scores on the retention test would not affect the status of their license. The questionnaire which asked their opinions concerning the value of the renewal program, helped to reinforce the idea that the test would not be used in any official capacity. Retention testing among Older Drivers paralleled that of Renewals. The only difference was the fact that the original Acquisition Test was re-administered, there being no alternate forms available.

Selection of a retention sample from among the New Driver group took a somewhat different form. Because the rate at which acquisition testing was preceding among New Drivers was far slower than that which characterized the Renewal and Older Driver groups, it was necessary to select the first 100 New Drivers completing Acquisition Tests in order to have a five month retention interval. Retention tests were administered to the New Driver retention sample during school hours by representatives of the project staff in order to obtain close to a 100% response.

A total of 47% and 49% of the Renewal and Older Driver retention samples returned completed tests. As had been anticipated, the initial acquisition levels of those who responded were somewhat higher than the samples as a whole. Among the Renewals, the retention sample averaged 83.6 as compared with 79.8 for the overall acquisition mean reported earlier. For the Older Drivers, it was 86.3 as compared with 83.0 for the acquisition sample as a whole. The New Driver retention group also scored somewhat higher on initial acquisition tests than did the New Driver group as a whole, 82.5 versus 80.3. This may be attributed to the fact that the retention sample was not selected at random but consisted of the first 100 students completing the Acquisition Test.

In order to compare Retention test results with initial Pretest levels, it was necessary to adjust scores of the retention sample to remove the effect of their higher Acquisition levels. This was done simply be taking the difference between the Acquisition scores obtained by the retention sample and those reported earlier for the acquisition sample and substracting this difference from the Retention test score. The results obtained through this process appear below:

Group	Pretest	Acquistion	Retention	Residual Gain[1]
New Driver	61.4	81.7	72.8	18.6%
Renewal	62.9	79.8	74.8	18.9%
Older Driver	69.0	83.0	88.8	28.7%

The most striking aspect of the Retention test is the fact that the scores compiled by the Older Driver group improved from Acquisition to Retention testing. It is very likely that many of those in the Older Driver sample reread the manual prior to the Retention test despite being asked not to. It is also likely that, having more time on their hands than drivers in other groups, many reread the manual during the five month interval between the two tests' administration. In either case, it is significant that the Older Drivers had retained the manual and had it available for study.

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[1]Residual Gain equals the gain from pretest to retention expressed as the percentage of pretest results, i.e., $\frac{\text{Retention-Pretest}}{\text{Pretest}}$.

The New Driver and Renewal groups showed the expected decline from Acquisition to Retention testing. The knowledge gain of the New Driver group had shrunk from the 33% reported earlier to 18.6% while the gain realized by the Renewal group had dropped from 26.7% to 18.9%. In other words, the groups had lost 1/3 to 1/2 of their original information gain. As might be expected, individual items differed in their vulnerability to forgetting. The differential effects of forgetting cannot be characterized in general terms. The number of items administered and the percent of the retention sample responding to the test are both too low to permit generalization. It is quite likely that the effects of forgetting will prove quite specific to individual items of information. What is needed is administration of the entire 140 item pool to a sample of those drivers involved in the original information acquisition. Each item should be taken by at least 100 drivers. There should be strong incentive, such as payment of a fee, to assure close to a 100% response.

It may be concluded that, while most of the information acquired from a license manual is retained, a substantial number of specific information items tend to be forgotten. These items, along with information pertaining to changes in traffic situations and driving laws, could profitably be made the subject of a Renewal Manual and periodic renewal testing. Such a circumscribed program of information dissemination and testing assumes that all licensed drivers within the State have acquired a comprehensive knowledge of safe driving either through an appropriate initial licensing manual and test, or through a "one time" renewal testing program involving a comprehensive manual such as that used in the present study.

ASSESSMENT OF INFORMATION APPLICATION

The ultimate test of an information presentation and testing program is not whether the information is learned or remembered, but whether it is applied. If the objective of an information program is to foster highway safety, the effects of the program should eventually be revealed by a reduction in the number and severity of automobile accidents. After all, what does "safety" mean other than the absence of accidents?

The major limitation of accidents as the ultimate criterion of effectiveness for a safety program is their extreme rarity. A driver may operate his car in a way that is manifestly unsafe, in a way that is sure to lead to an accident sometime. Yet, due to good fortune he manages to avoid having an accident during the limited period during which his performance is observed in a research study. This inequity does not necessarily undermine the status of accidents as a criterion

of safety. However, if the effects of a safety program are to be detected through accident reduction, the number of drivers observed and the period of time over which the observation takes place must be large enough to compensate for the small number of accidents that occur and the large number of factors that influence that occurrence.

While accident reduction forms the primary criterion of the extent to which information is being applied to improvement in driving safety, traffic violation will provide an informative secondary criterion. If traffic laws truly prescribe safe driving behavior, then the violation of these laws represents unsafe behavior. Like accidents, traffic violations as recorded over a short period of time do not provide a highly reliable index of normal driving behavior. Very few of a driver's actual violations are ever detected, and fewer still end up as convictions on a driver's record. Yet, because violations are more frequent than accidents, and because they provide a little different form of information, they warrant consideration as a measure of information application.

Length of Follow-Up

The longer a driver's performance is observed, the more likely it is that unsafe behavior will show up in an accident. Therefore, in an effort intended to detect the difference between safe and unsafe driving behavior, the longer the follow-up period is, the better. However, the urgency of the research question imposes a time limitation. The researcher cannot afford to wait for a lifetime of driving to occur in order to see if his treatment is taking. The maximum amount of time that could be reasonably allotted to the follow-up period during the present study was two years. It was on the basis of a two year follow-up period that need for a sample of 60,000 was based.

It is, of course, possible that the information program will be so effective as to become evident in a shorter period of time. To allow for this possibility, follow-ups were also scheduled at periods of one year and one and a half years following completion of the information acquisition phase of the project. Even the shortest of these periods extends well beyond the termination of this project. Therefore, the results of the follow-up are not provided by this report. The follow-up study will be performed by the Virginia Division of Motor Vehicles and will be reported separately.

Follow-Up Procedures

The follow-up procedures to be employed by the Virginia Division of Motor Vehicles are identical to those involved in a separate study of renewal testing being conducted by the Virginia Highway and Transportation Research Council. They are described in detail in a separate report (Stoke, 1975). The procedures to be employed in evaluating the

Drinking Driver Manual in California have not as yet been detailed. They are expected to parallel those employed in Virginia fairly closely. Any significant departures are noted:

1. Records Search--At approximately 12, 18 and 24 months following completion of test administration, the records of all drivers in the State of Virginia will be searched and those of drivers in the study will be read into separate files, classified by target group designation and study group assignment (i.e., EXPERIMENTAL versus CONTROL). The search will address all target groups at the same time. Therefore, the actual follow-up intervals for some target groups will extend a few months beyond the stated intervals, depending upon the date upon which testing terminated for that target group. California will employ one follow-up conducted 14 months following completion of information dissemination.

2. Eliminations--The files for each target group, both EXPERIMENTALS and CONTROLS, will be purged of drivers who don't maintain active licenses. These include the following:

   - Renewals and Older Drivers--Drivers who fail to renew their licenses during the follow-up period.
   - New Drivers--Drivers who fail to obtain licenses during the follow-up period.
   - Problem Drivers--Drivers whose licenses expire without renewal during the follow-up period.

Since failure to maintain an active license is the result of factors outside of the study (moving out of state, death), it should affect EXPERIMENTALS and CONTROLS equally, and therefore introduce no bias in the comparison.

No drivers will be eliminated from the EXPERIMENTAL sample where similar eliminations cannot be made from the CONTROL sample. The following categories of drivers will remain in the EXPERIMENTAL sample:

- Renewals and Older Drivers who refused to be tested.
- Accident Repeaters who failed to receive materials or who failed to return completed tests.
- Violators who fail to report to group interviews and who, therefore, do not receive tests.

Drivers in these categories may well differ from the remaining drivers in the EXPERIMENTAL groups in ways that relate to accident involvement. Their exclusion from the EXPERIMENTALS sample would, therefore, make them no long comparable to the CONTROL sample.

Accident and Violation Totals

The accidents and violations appearing in the records of drivers in each target group and each treatment group will be tabulated and the following totals obtained:

Number of accidents reported

Number of convictions for traffic violations

Convictions for violations involving an accident

Administrative actions

- Advisory Letters
- Group Interviews
- Personal Interviews
- Clinics
- Probation
- Suspensions

The accident totals will include both culpable and non-culpable accidents; the Virginia accident file makes no distinction. The goal of the safe driving information program is to reduce all accidents. The content of the various manuals deals as much with prevention of non-culpable accidents, that is, defending against accident situations created by the unsafe acts of others, as it does with prevention of culpable accidents.

No analysis concerning the nature of accidents themselves is comtemplated. Such information does not appear in the computerized driver records. It would be possible to review the hard copy reports of accidents identified through the computer records. However, if predicted accident rates prevail, as many as 20% of the total sample could be involved in reported accidents. This would necessitate massaging some 12,000 accident records to obtain qualitative data. If any worthy hypothesis concerning accident characteristics were formulated, the cost of the necessary analysis might be justified. At the present time, no such hypotheses have been put forth.

TABLE 5

ACQUISITION AND RETENTION TEST RESULTS FOR ALL TARGET GROUPS

GROUP	PRETEST		ACQUISITION				RETENTION			
	MEAN	N	MEAN	N	GAIN	SIGNIF-ICANCE	MEAN	N	RESIDUAL GAIN	SIGNIF-ICANCE
New Driver	61.4	100	81.7	100	33.1%	P < .01	72.8	99	18.6%	P < .01
Renewal	62.9	100	79.8	100	26.7%	P < .01	74.8	63	18.9%	P < .01
Older Driver	69.0	100	83.0	100	20.3%	P < .01	88.8	74	28.7	P < .01
Violator	61.8	100	68.6	200	11.0%	P < .05				
Accident Repeater	64.1	100	83.0	100	29.5	P < .01				
Drinking Driver	64.9	100	86.2	100	32.0%	P < .01				
Reading Disabled Unlicensed	58.3	40	67.3	40	15.4%	P < .01				
Licensed	67.0	35	72.7	35	8.5%	P < .05				
Mentally Retarded	49.7	15	63.3	15	27.4%	P < .05				

Evaluation Summary

Results obtained from the assessment of information acquisition and retention are summarized in Table 5. Statistically significant knowledge acquisition occurred across all target groups. The gains were fairly substantial, over 20%, in the New Driver, Renewal, Older Driver, Accident Repeater, Drinking Driver, and Mentally Retarded groups. The small gains obtained from the Violator and Reading Disabled groups are attributed to low motivation. Retention tests administered some five months after Acquisition tests showed a 1/2 to 1/3 loss among New Drivers and Renewals, and a slight gain among Older Drivers.

Evaluation of the manuals and tests in reducing accidents among drivers in the various target groups will be described in future supplements to this report. The first report is scheduled to appear approximately one year from the publication date of the present report. It will provide an evaluation of information application based upon a one year follow-up of accident and violation records for all target groups except Drinking Drivers and Reading/Learning Disabled drivers. It will also report upon the results of (1) Acquisition testing among convicted DWI's receiving the Drinking Driver Manual, and (2) a compairson of Acquisition test results between those New Drivers who received the Manual and Supplement and those who received the Manual without the Supplement.

CONCLUSIONS

Following is a list of conclusions reached as a result of the activities and findings described in the preceding pages.

1. A manual providing a comprehensive and exhaustive presentation of critical safe driving information can be prepared for new drivers within the resources available to most driver licensing agencies.

2. Experienced drivers currently present the same general pattern of information deficiencies as do new drivers. Except for basic rules of the road, which they already know, and information relating to the licensing process and skill development, which they don't need, experienced drivers can generally benefit from the same general types of information as is needed by new drivers.

3. Traffic violators, including drinking drivers, are no different from the general driving public with respect to their information deficiencies or needs. However, their record of violations provide both a legal and social justification for requiring the acquisition of safe driving information. To be effective, this information should be generally related to the subject of traffic violations. A manual for traffic violators is likely to experience a hostile reception unless it is introduced in conjunction with, or as an alternative to, a driver improvement program involving direct contact.

4. Like traffic violators, drivers who have been in accidents present the same general pattern of information strengths and weaknesses as is presented by the general driving public. Unlike traffic violators, however, most cannot be required to participate in an information program. While some will do so on a voluntary basis, many--if not most--will not.

5. Older drivers are the only group presenting unique information requirements. Their information needs largely involve methods of identifying, ameliorating, or compensating for age-related driving disabilities.

6. Drivers in all groups are capable of realizing significant knowledge gains from manuals designed to meet their information needs. The gains range from approximately one-tenth to one-third of initial knowledge levels.

7. A significant information loss occurs following acquisition of large amounts of safe driving information, such as is provided new drivers and renewals. The magnitude of the loss ranges from one-third to one-half of the information originally acquired. The loss is specific to certain items of information, indicating the value of periodic reinforcement relative to individual items. In some cases, drivers may evidence an information gain during the months following initial acquisition, indicating continued recourse to the manual.

8. An audiovisual presentation is capable of leading to a significant information gain among reading disabled and learning disabled license applicants. The gain is sufficient to allow a sizeable proportion of such drivers to qualify for a license.

9. No conclusions as to the effectiveness of the various manuals and tests in preventing accidents can be offered at the present time. Such conclusions will be presented in a separate report, following a comparison of driving records compiled by those receiving the manuals and an equivalent group of drivers who were given neither the manuals nor tests.

RECOMMENDATIONS

Recommendations for future activity may be divided into two categories, those relating to research and development activities and those related to operational licensing programs.

RESEARCH AND DEVELOPMENT

Based upon the experiences gained in the present study, the following recommendations for continued research and development are offered:

1. The content of a driver information system should be expanded beyond a program for drivers of four-wheeled passenger vehicles to include the following categories of vehicles:

   - Motorcycles
   - Recreational vehicles (e.g., campers, trailers, motor homes)
   - Commercial trucks and buses
   - School buses
   - Emergency vehicles

2. The mechanisms employed in a driver information system should be expanded to encompass all those involved in driver control including, in addition to licensing, those involved in enforcement, adjudication, and driver improvement. Particular attention should be directed toward means of obtaining a greater acceptance of an information program on the part of convicted traffic violators. The development of a broader driver information system should address the interface of control mechanisms with public information and education mechanisms, such as schools, community organizations, the private sector, and public media. However, the system itself should not duplicate the functions served by these mechanisms but should confine itself to the functions involving driver control.

3. Means of fulfilling specific needs identified during this project should be studied. These needs include the following:

   - A method of obtaining the participations of accident repeaters in an information program, either on a compulsory or voluntary basis.

- Making available a dynamic audiovisual information presentation and test, suitable for use by driver licensing agencies in extending to reading disabled drivers the same benefits that are afforded the driving public at large.

- Identification of specific information items that drivers tend to forget over time, and the development of a Renewal Manual and test containing this information.

OPERATIONAL PROGRAMS

Until the cost-effectiveness of a driver information system has been established through an examination of driver accident experience, recommendations for changes in operational licensing programs must be confined to those that can be put into effect without substantial cost or the need for enabling legislation. In consideration of this limitation, it is recommended that States consider the following actions:

1. Expanding the scope of State driver manuals to encompass the broad array of critical driver information contained in the New Driver Manual. By following guidance concerning exclusion of unessential information, avoidance of unnecessarily elaborate format, and better organization of content, most States could accommodate a broader information program without an appreciable increase in cost.

2. Accompanying expansion of the New Driver Manual with development of a manual patterned after the Renewal Manual and administering it to all licensed drivers on a one-time basis as part of the license renewal process.

3. Preparing an orally administered knowledge test based upon items that are dealt with in the audiovisual presentation. This action would allow schools and other agencies to use the audiovisual presentation in preparing reading disabled drivers for the knowledge test.

4. Consider the suitability of certain of the individual manuals and associated tests to ongoing programs of licensing and driver improvement.

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Each of the above reports provides an extensive bibliography of literature pertaining to the particular subject area identified.

APPENDIX A

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APPENDIX B

INFORMATION DEFICIENCIES OF EXPERIENCED DRIVERS

The following is a list of information items representing knowledge deficiencies of experienced drivers, as revealed through the results obtained from administration of the University of Michigan Knowledge Item Bank[1]. Items listed as those failed by 25 percent or more of applicants, excluding the following types of items:

1. Items that failed to meet the NPSRI specification for knowledge test item construction.
2. Items that are of low criticality.
3. Items dealing with non-safety related information (e.g., administration, parking ordinances, etc.).
4. Items dealing with basic vehicle operation, i.e., "how to drive," rather than safety.

Item Number	Item Content
5	Clear windows of ice
21	Limiting driving per day
22	Avoiding driving weekends and holidays
31	Lane usage
47	Watch the path of car ahead signalling turn
51	Expect cars ahead to slow down at freeway entrances
55	Watch vehicles making sudden moves near exits
56	Expecting vehicles to slow down at forks in the road
67	Encourage passing by allowing room in front
79	Look well down the road
82	Checking path ahead in a turn
83	Check blind spot
85	Shift before starting turn

[1]Pollack, W. P. and McDole, T.L. HANDBOOK FOR DRIVING KNOWLEDGE TESTING, Highway Safety Research Institute, University of Michigan, August 1974.

Item Number	Item Content
99	Set speed according to speed of traffic
114	Allow more room when stopping behind a car uphill
120	Avoiding braking skids
121	Speed versus stopping distance
124	Emergency braking
126	Longer stopping distances required when backing
129	Looking ahead in urban driving
130	Looking ahead in country driving
132	Keeping the radio down
136	Watching adjacent vehicles
153	Making sure people respond to your turn signals
156	Using a hand signal when slowing on a slippery road
157	If giving a hand signal, do so before stopping
166	Permitted to cross a double line into driveway
167	Don't stop when entering a driveway
170	Don't come to a sudden stop after entering a shopping center
175	Slow down for intersections
179	Signal at least 100 feet before an intersection
182	Watch for sudden left turns by oncoming vehicles
187	If view of intersection is blocked, edge forward
193	Don't enter path of vehicle until it begins to turn
194	Look left-right-left at intersections
198 199	Complete turn if signalled
202	Watch oncoming vehicles turning left (same as 182)
205	Turn away from intersecting vehicles to reduce impact
206	Accelerate across path of intersecting vehicle
207	Check cross traffic when turning at an intersection

Item Number	Item Content
209	Check traffic in path ahead at intersection
211, 212	Don't slow down excessively on a right turn
218	Give way to oncoming traffic when turning left
221	Wait for oncoming vehicles to begin left turn before turning left
223	Two left turning vehicles can turn in front of one another
224	Wait for left turning vehicles to clear so that you can see before turning left
228	Yield to vehicles in a traffic circle
229	Watch vehicles entering the circle before you start toward the outside
244	Slow down before starting down a steep hill
247	Check traffic behind while going down a hill
253	Look over the shoulder for cars in the blind spot
263	Travel at the speed of other cars
272, 4	Importance of knowing the accelerative capacity of car when passing
281	At highway speeds it takes longer to pass than you think
292	Use the middle lane on a three lane road for passing only
293	Use right lane to pass left-turning vehicles
296	Flick headlights or toot horn before passing vehicle
300	Don't exceed speed limit when passing
301	Emergency acceleration
324, 5	Turning wheels when parking on hill
354	Avoid quick turns on slippery roads.
358	Pavement is most slippery right after rain starts
361	Relation of tire tread to hydroplaning
365-7	Effect of water on brake linings

Item Number	Item Content
370	Ice is most slippery near freezing temperatures
378	Stopping on snow or ice
382	Avoiding using brakes when crossing ice
383	Make steering corrections without brake when on ice
387	Downshift when going down a steep or icy hill
393, 6	Off road recovery
403	Open window to clear condensation
407	Use low beams in fog
416-19	Stuck accelerator
422	Brake failure
432	Blowouts
440	Wheel lock
442	Avoid braking in a skid
444	Depress clutch in skid
447	Countersteering in skid
449	Braking after skid recovery
450, 1	Braking techniques
473	Do not enter "wrong way" ramp
485	Comparing mirror with over the shoulder view
487	Watching cars in front while monitoring side mirror
500	Slowing down at freeway entrance
507	Traveling at the speed of other traffic
519	Watching for speed reductions of vehicles ahead
520	Watching exiting vehicles turning back on the freeway
523	Preparing for an exit by getting into the correct lane
526	Use of deceleration lane

Item Number	Item Content
535	Watching for changing lanes at forks or exits
539	Watching out for people in car with hood up
555	Speeding up to allow car that started to pass and then dropped back to return to lane
560	Dealing with tailgaters
563	Check behind when stopping
568	Watch for car to cross center line when traffic is stopped
590	Emergency braking when leaving roadway
591	Watch for buses and trucks to stop at railroad crossings
592	Watch left turning vehicles ahead for signs of slowing or stopping
597	Watch for vehicles stopped in roadway to turn suddenly
603	Watch for pedestrians at bus stops
604	Trolley tracks tend to be slippery
607	Watch for pedestrians crossing the street when the sidewalks are crowded
615	Swerve around pedestrians
638	Dim lights and slow down for pedestrians
642	Slow down at railroad crossings
651	Check speedometer in tunnels
669	50% of fatal highway accidents involve the drinking driver
670	Alcohol and intoxication
671	Alcohol and its effects
674	Food versus coffee
676	Rate at which alcohol leaves the bloodstream
688	Need for regular visual checkups
694	Need to know the effects of various medicines
695	Avoid driving with various ailments

Item Number	Item Content
713	Symptom of bad brakes (pulling to one side)
719	Removing injured after an accident
785, 6	Meaning of implied consent
819	Liability of drinking driver for injury to passengers
855	Passing distance
859, 60	Passing on right
861	Prolonged passing maneuver
864	Keeping right except to pass
870	Right turn in traffic circle
878	Crossing the median
896	Meaning of pedestrian safety zone
915	School and passenger buses stopping at railroad crossing
919	School buses across divided highway
937	Drugs and driving
938	Fines for drinking and driving
947	Moving car that blocks the road
955	Parking near driveway
957	Parking, distance from curb
959	Turning off the engine on an unattended vehicle
961	Backing, areas permitted
964	Number allowed in front seat
969	Coasting downhill
970	Following fire engines
981	Stopping behind a streetcar
1063	Color of stop, do not enter, yield signs
1163	Merge sign

Item Number	Item Content
1200	Obstruction sign
1229	Yellow arrow
1231	Red arrow
1242-44	Reversable lane controls
1267	Meaning of cross hatched sign
1304	Shape of school crossing sign

160 items

APPENDIX C

INDIVIDUAL ITEM STATISTICS

The following pages present item statistics obtained from a sample of 100 responses to each item of each test. Tests were selected at random from those completed by drivers during acquisition testing. Where numbers do not total 100 it means that some drivers failed to answer the question.

APPENDIX C

NEW DRIVERS AND RENEWAL APPLICANTS

	NEW Percent	RENEWAL Percent
1. You see a traffic signal with a flashing red light. You should: a. Slow down and look both ways b. Come to a full stop and go when the way is clear. c. Stop and wait until the light turns green	a 2 b * 93 c 5	a 1 b * 97 c 2
2. You should allow extra following distance when you are behind a: a. Station wagon b. Passenger car c. Delivery van	a - b 1 c * 99	a - b 2 c * 98
3. At an intersection without traffic controls, the Law says: a. Who has the Right-of-Way b. The must yield the Right-of-Way c. Nothing about the Right-of-Way	a 26 b * 64 c 9	a 34 b * 58 c 8
4. If you smoke you should clean the inside of your windows frequently because: a. Smoke leaves a film on the glass b. The stale smell can be distracting c. Dust tends to settle on the insides of car windows	a * 97 b 1 c 2	a * 100 b - c -
5. If a driver wants to see cars in his "blind spots", he should: a. Check in the inside rearview mirror b. Check in the outside rearview mirror c. Check over-the-shoulder	a - b 1 c * 99	a 4 b 17 c * 79
6. When backing up you should: a. Look out the rear window b. Look in the car's inside rearview mirror c. Look out the driver's window	a * 96 b 3 c 1	a * 90 b 6 c 4
7. How can you signal the driver behind you that you are planning to slow down in the middle of the block? a. Put on your emergency flashers b. Put on your turn signals c. Tap your brake pedal several times	a 1 b 3 c * 96	a 4 b 5 c * 91
8. When you enter a crowded freeway from an entrance ramp you should: a. Slow down on the ramp to wait for a gap b. Stop at the end of the ramp to wait for a gap c. Maintain speed and let other drivers make room for you	a * 89 b 6 c 5	a * 80 b 18 c 1

* Correct Answer

NEW DRIVERS AND RENEWAL APPLICANTS	NEW	RENEWAL
	Percent	Percent
9. In order to stop at 50 mph you need about: a. 1/4 of a block b. 1/2 of a block c. 3/4 of a block	a 4 b * 82 c 14	a 1 b * 86 c 12
10. At which temperature will any icy road be most slippery? a. Well below freezing b. Slightly below freezing c. Just at freezing	a 14 b 18 c * 68	a 6 b 31 c * 63
11. You are in the right lane of a freeway. As you come up on an entrance ramp, you can see a car about to enter. The best thing to do is: a. Change lanes to the left b. Slow down c. Maintain your speed and position	a * 50 b 38 c 12	a * 67 b 21 c 12
12. You should allow extra space for: a. Cars backing out of driveways b. Cars pulling into driveways c. Cars parked in driveways	a * 80 b 15 c 5	a * 67 b 25 c 8
13. When it is safe to return to your lane after passing? When: a. The driver you just passed signals you over b. You look over your shoulder and see the car is behind you c. You can see both headlights of the car in the inside mirror	a 1 b 16 c * 83	a 2 b 20 c * 78
14. If your car begins to hydroplane, you should: a. Slow down by letting up on the gas pedal slowly b. Slow down by shifting to the lower gear c. Slow down by pumping the brakes quickly and firmly	a * 81 b 9 c 10	a * 81 b 11 c 7
15. You have to go around an object to avoid a collision. Steer hard and: a. Brake firmly b. Pump the brake c. Stay off the brake	a 7 b 36 c * 57	a 8 b 32 c * 59
16. If you have had three beers, about how long will it take for all the alcohol to leave your bloodstream? a. One hour b. Two hours c. Three hours	a - b 17 c * 83	a 4 b 10 c * 86

* Correct Answer

NEW DRIVERS AND RENEWAL APPLICANTS	NEW	RENEWAL
	Percent	Percent
17. You can help the driver behind you keep a correct following distance by: a. Driving at a steady speed b. Driving 3-5 mph faster than the car behind c. Driving 3-5 mph slower than the car behind	a * 91 b 8 c 1	a * 9[illegible] b - c 1
18. To make a right turn off of a four-lane highway, you may turn from: a. The lane to the right of the center of the road b. The lane nearest the curb or edge of the roadway c. Either lane depending on oncoming traffic	a 14 b * 82 c 4	a 6 b * 94 c -
19. Adjust your rearview and side mirrors: a. Before you get into the car b. Before you start driving c. Whenever you need to use them	a 3 b * 97 c -	a 4 b * 96 c -
20 You are stopped at a railroad crossing with more than one track. You should cross: a. When the train is well down the track b. As soon as the train has passed c. When the train is out of sight	a * 57 b 2 c 41	a * 61 b 2 c 37
21. You are parking uphill and there is no curb. How should you place your wheels? a. Turn your front wheels toward the street b Keep your wheels straight ahead c. Turn your front wheels away from the street	a 19 b 1 c * 80	a 26 b 1 c * 73
22. You see a pedestrian is about to walk in front of your car. You should: a. Tap the horn lightly b. Flash the lights c. Honk the horn loudly	a 43 b 1 c * 56	a 51 b 1 c * 48
23. You see someone on foot or on a bicycle close to the road. They don't see you. You should: a. Stop and proceed slowly b. Brake sharply c. Tap your horn lightly	a 8 b - c * 92	a 28 b - c * 72
24. The speed limit in residential areas, unless otherwise posted is: a. 20 mph b. 25 mph c. 30 mph	a 5 b * 93 c 2	a 2 b * 97 c 1

* Correct Answer

NEW DRIVERS AND RENEWAL APPLICANTS	NEW	RENEWAL
	Percent	Percent
25. On rainy and foggy days or at night when you can only see 100 feet ahead, you should not drive faster than: a. 20 mph b. 30 mph c. 40 mph	a 19 b * 68 c 12	a 35 b * 61 c 4
26. The best way to keep your car from hydroplaning is: a. Drive at a constant speed b. Apply the brakes firmly c. Keep your speed down	a 7 b 1 c * 92	a 3 b 2 c * 94
27. You should allow extra following distance behind big trucks because: a. You need the extra space to see the road ahead b. Other drivers tend to pull behind trucks before they try to pass them c. If you follow too closely, you will get caught in the truck's slipstream	a * 93 b 1 c 6	a * 92 b - c 7
28. When you merge on a freeway, you should have a gap of: a. 8 Seconds b. 6 Seconds c. 4 Seconds	a 15 b 23 c * 62	a 22 b 20 c * 57
29. A tire blows out. You should: a. Stay off the brake b. Apply the brake firmly c. Pump the brake	a * 56 b 4 c 40	a * 74 b 3 c 22
30. The first driving ability affected by alcohol is: a. Coordination b. Skill c. Judgment	a * 17 b 3 c 80	a * 10 b - c 90
31. The amount of alcohol in a one ounce "shot" of whiskey is the same as that in: a. One can of beer b. Two cans of beer c. Three cans of beer	a * 87 b 9 c 4	a * 68 b 21 c 11
32. You are approaching a school bus which is picking up and dropping off children. You must: a. Stop, then proceed slowly b. Stop until the road is clear of children and the bus is moving c. Sound your horn and watch for children as you pass	a - b * 98 c 2	a - b *100 c -

* Correct Answer

	NEW	RENEWAL
33. If the road is slippery, you should keep a following distance that is: a. A normal distance from the car ahead b. Closer to the car ahead than normal c. Farther from the car ahead than normal	Percent a - b - c * 100	Percent a 2 b - c * 98
34. A green arrow on a traffic light means: a. You may turn in the direction the arrow is pointing b. You may not turn in the direction the arrow is pointing c. You may turn in the direction the arrow is pointing after you come to a complete stop	a * 96 b - c 4	a * 98 b - c 2
35. Don't use your windshield wiper fluid on very cold days because: a When the fluid is cold it can scratch your windshield b. If your wiper blades are very cold, moisture will make them crack c. The fluid will freeze on the windshield	a 1 b 7 c * 92	a 2 b 2 c * 96
36. You are entering a freeway. You should check traffic on the freeway by: a. Using the inside mirror b. Using both the inside and outside mirrors c. Using the side mirror and looking over your shoulder	a - b 14 c * 86	a - b 11 c * 88
37. You have to turn around using a driveway. The safest way to do it is: a. Pull forward into the driveway b. Back into the driveway c. Make a U-turn in the driveway	a 47 b * 43 c 10	a 28 b * 59 c 13
38. You are driving on a freeway and see an accident ahead. You should warn the driver behind you by: a. Tapping the brake pedal several times b. Turning on emergency flashers c. Waving your hand up and down	a * 78 b 19 c 3	a * 72 b 26 c 2
39. You are driving on a rainy day and it's hard for people to see you. You should: a. Turn on the parking lights b. Turn on the high beam headlights c. Turn on the low beam headlights	a 2 b 6 c * 92	a 5 b 3 c * 92
40. If bad weather makes it hard for you to see, you should: a. Speed up to get off the road quickly b. Increase your following distance c. Drive in the lane closest to oncoming traffic	a 3 b * 89 c 7	a 4 b * 87 c 6

* Correct Answer

NEW DRIVERS AND RENEWAL APPLICANTS	NEW	RENEWAL
	Percent	Percent
41. The speed limit posted on a road is 55 mph. If it is raining, you should: a. Maintain a 55 mph speed b. Reduce your speed to about 45 mph c. Reduce your speed to about 30 mph	a 3 b * 80 c 17	a 6 b * 86 c 8
42. You are nearing the top of a hill on a two-lane country road. As you approach the top of the hill, you should: a. Keep a steady speed b. Speed up slightly c. Slow down and be ready to stop	a 11 b 2 c * 87	a 1 b 1 c * 98
43. Signs and lane markings that say "no passing zone" tell you: a. That you can't see far enough ahead to pass b. That there are oncoming cars c. That oncoming cars may be passing	a * 72 b 18 c 10	a * 79 b 10 c 11
44. You plan to turn onto a city street from a stop. You need a gap in traffic that is about: a. 100 feet b. 1/4 of a block c. 2/3 of a block	a 33 b 38 c * 29	a 30 b 41 c * 29
45. You have to turn quickly to avoid a collision. You should hold the steering wheel with your hands: a. Next to each other on the top b. Across from each other on the side c. On the top and bottom of the wheel	a 3 b * 80 c 7	a 6 b * 79 c 14
46. You are stopped in traffic and see that you are about to be hit from the rear. You should get ready to: a. Apply the brakes b. Cover your face with your hands c. Shift to neutral	a * 53 b 23 c 24	a * 67 b 18 c 15
47. You are going on a 400 mile trip. You should plan on a rest stop at least every: a. 2 hours b. 3 hours c. 4 hours	a * 62 b 23 c 15	a * 77 b 14 c 9
48. You have to yield to a pedestrian: a. Only when the pedestrian is in the crosswalk b. Only if the traffic lights are in the pedestrian's favor c. Always, even if the pedestrian is not obeying traffic controls	a 9 b 4 c * 87	a 2 b 3 c * 95

* Correct Answer

	NEW Percent	RENEWAL Percent
49. A driver is coming to an intersection with two way traffic. He should check: a. Left b. Left, right and left c. When cars are coming	a 1 b * 98 c 1	a - b * 98 c 2
50. Which of the following will help you sober up? a. Fresh air b. Coffee c. Time	a 4 b 6 c * 90	a - b 1 c * 99
51. Use your high beam headlights at night: a. As little as possible b. Only on unlighted streets c. When there are no cars in front of you	a 15 b 8 c * 77	a 12 b 6 c * 80
52. While driving in the city, you should look ahead as far as: a. One block ahead b. 1/2 block ahead c. The car in front of you	a * 59 b 40 c 1	a * 56 b 39 c 5
53. You are passing another car. You should sound your horn: a. If the other car is signalling a right turn b. If the other car is coming up on a car ahead of it c. If the car is going slowly	a 16 b * 76 c 8	a 10 b * 64 c 24
54. The driver should use hea lights when it rains or snows: a. To see the road ahead b. To be seen by others c. To warn others of bad conditions	a 20 b * 78 c 2	a 15 b * 84 c -
55. You are driving .. fog. Which of the following is most important for deciding how fast you should drive? a. How far you can see b. How quickly you can stop c. The amount of traffic	a * 80 b 11 c 9	a * 90 b 7 c -
56. The speed limit in school zones is: a. 20 mph b. 25 mph c. 30 mph	a 14 b * 85 c 1	a 15 b * 81 c -

* Correct Answer

NEW DRIVERS AND RENEWAL APPLICANTS	NEW	RENEWAL
	Percent	Percent
57. The best reason for driving more slowly at night than during the day is that: a. You cannot see as far ahead b. You may get sleepy because of less traffic c. Drivers tend to be more careless at night	a * 88 b 5 c 7	a * 95 b 1 c 2
58. You are on a two-lane road with cars coming the other way. The car behind you is following too closely. You should: a. Speed up to increase the distance from the car behind b. Apply your brakes to slow down, then resume speed c. Wait until there is a break in traffic, then slow down	a 17 b 20 c * 63	a 11 b 17 c * 70
59. You are on a two-lane road and want to pass. The left lane is clear but there is a curve ahead. It is safe to pass only if: a. The curve is at least 1/3 mile away b. You can complete the pass before you reach the curve c. The curve is at least a mile away	a * 22 b 59 c 19	a * 74 b 16 c 7
60. You are involved in an accident that involves personal injury. You must file a written report with the Division of Motor Vehicles within: a. 24 hours b. 5 days c. 1 week	a 40 b * 54 c 6	a 36 b * 56 c 5
61. With good headlights, at 50 mph, the driver can see clearly: a. 4 seconds ahead b. 8 seconds ahead c. 12 seconds ahead	a * 42 b 33 c 25	a * 78 b 10 c 10
62. You are on a two-lane road and want to pass. A car is coming toward you. It is unsafe to pass if: a. The oncoming car seems to be standing still b. The oncoming car seems to be getting closer c. The oncoming car seems to be going the other way	a 9 b * 85 c 6	a 8 b * 91 c 1
63. One vehicle that is required to stop for railroad crossings is: a. A cattle truck b. A dairy truck c. A school bus	a 1 b - c * 99	a - b - c * 99
64. A red arrow on a traffic light means: a. You may turn in the direction the arrow is pointing b. You may not turn in the direction the arrow is pointing c. You may turn in the direction the arrow is pointing after you come to a complete stop	a 1 b * 69 c 30	a 4 b * 76 c 20

* Correct Answer

	NEW		RENEWAL	
65.	Percent		Percent	
What common seeing error do new drivers make?	a	9	a	3
a. Check mirrors too frequently	b	5	b	-
b. Look too far down the road	c	* 86	c	* 95
c. Look at the road right in front of the car				
66.				
What is the rule for checking your car mirrors?	a	* 87	a	* 81
a. Check several times a minute	b	5	b	8
b. Check the outside mirror more than the inside mirror	c	8	c	10
c. Check more often on freeways than in cities				
67.				
Before pulling out to pass a car, you should:	a	5	a	4
a. Check the side mirrors	b	6	b	3
b. Check the side mirrors and look over your shoulder	c	* 89	c	* 93
c. Check the side mirror, rearview mirror and look over your shoulder				
68.				
How many seconds ahead should you look when you drive?	a	14	a	15
a. 5-10 seconds	b	* 81	b	* 68
b. 10-15 seconds	c	5	c	15
c. 15-20 seconds				
69.				
Which way should the front wheels of a car be turned when parking downhill?	a	-	a	-
a. Straight	b	* 96	b	* 95
b. Toward the curb	c	4	c	5
c. Away from the curb				
70.				
Which of the following road surfaces freezes first?	a	* 89	a	* 98
a. A bridge	b	3	b	-
b. An intersection	c	8	c	2
c. A tunnel				
71.				
You see a truck moving up ahead. Under what condition would it be necessary for you to slow down?	a	8	a	25
a. The truck is on a long gradual curve	b	* 82	b	* 71
b. The truck is starting up a long gradual hill	c	10	c	4
c. The truck is starting down a long gradual hill				
72.				
It is very foggy. You should slow down and:	a	10	a	4
a. Put your lights on high beam	b	* 89	b	* 95
b. Put your lights on low beam	c	1	c	1
c. Put your emergency flashers on				

* Correct Answer

	NEW		RENEWAL	
		Percent		Percent
73. When you hear a siren or see an emergency vehicle coming up behind you, you should: a. Continue driving b. Stop where you are c. Pull over to the right and stop	a b c	1 - * 99	a b c	- - *100
74. Passing near an intersection is unsafe because: a. The other car blocks your view of the intersection b. You have to pass through the other driver's blind spot c. There may be a stop sign at the intersection	a b c	* 58 14 28	a b c	* 75 7 17
75. You want to drive through an intersection. The light is green, but the intersection is blocked. What should you do? a. Stay out of the intersection until it clears b. Enter the intersection and wait c. Turn left and find another route	a b c	* 92 4 4	a b c	* 98 2 -
76. To stop quickly to avoid a collision: a. Push the brake pedal hard and hold it b. Push the brake pedal hard in a quick pumping action c. Push the brake pedal and apply the emergency brake	a b c	5 * 85 10	a b c	7 * 91 2
77. If the rear end of your car begins to skid toward the right side of the road, you should steer to the right and: a. Pump the brakes b. Apply the brakes lightly c. Stay off the brakes	a b c	8 7 * 85	a b c	2 7 * 91
78. If your car's suspension is bad, you can expect: a. Tires to wear b. Play in the steering c. Squealing brakes	a b c	* 46 42 12	a b c	* 55 40 5
79. The safest speed to drive in traffic is: a. About 10 mph faster than other vehicles b. The same speed as other vehicles c. About 10 mph slower than other vehicles	a b c	1 * 93 6	a b c	- * 95 5
80. A flashing yellow light means: a. Slow down and check both ways b. Come to a full stop and go on when the way is clear c. Stop and wait until the light changes to green	a b c	* 93 6 1	a b c	* 94 3 3

* Correct Answer

NEW DRIVERS AND RENEWAL APPLICANTS	NEW	RENEWAL
	Percent	Percent
81. Which of the following rules applies to traffic circles? a. Cars in the circle must yield to cars entering the circle b. Cars entering the circle must yield to cars in the circle c. Cars leaving the circle must yield to cars in the circle	a 6 b * 91 c 2	a 3 b * 97 c -
82. What does a driver with good seeing habits do? a. He looks ahead at the middle of the road b. He looks directly in front of the car c. He looks ahead and "scans" from side to side	a - b - c *100	a 1 b 1 c * 98
83. If the glare from the headlights of an oncoming car blinds you, you should focus your eyes: a. On the center of the roadway b. On the right edge of the roadway c. Straight ahead	a 6 b * 93 c 1	a 8 b * 90 c 2
84. At highway speeds it is important to look about 1/4 mile down the road because: a. It gives you time to avoid dangerous situations b. It takes 1/4 mile to stop completely c. It helps you keep up with traffic	a * 91 b 7 c 2	a * 82 b 17 c 1
85. You are planning to turn right at an intersection ahead. You should signal: a. 1/2 block from the intersection b. 1 block from the intersection c. Just before the intersection	a * 69 b 19 c 12	a * 79 b 9 c 12
86. On a hot day, when will the road be most slippery? a. Just after it starts to rain b. After it has been raining a few hours c. After it has stopped raining	a * 74 b 17 c 9	a * 95 b 3 c 2
87. Which area is likely to be the most slippery after a rainfall during freezing weather? a. The roadway over a culvert b. Roadways in shadowed areas c. Areas paved with asphalt rather than concrete	a 16 b * 78 c 6	a 35 b * 66 c 1
88. If you meet an oncoming car and there is a parked car on your right, you should move: a. Towards the oncoming car b. Towards the parked car c. Halfway between both cars	a 3 b 46 c * 51	a 2 b 28 c * 69

* Correct Answer

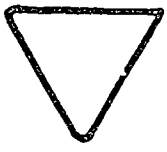
NEW DRIVERS AND RENEWAL APPLICANTS

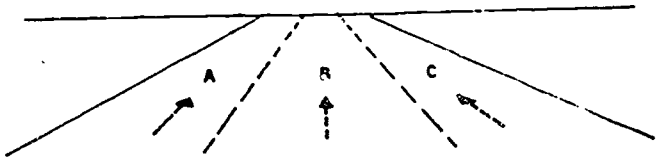
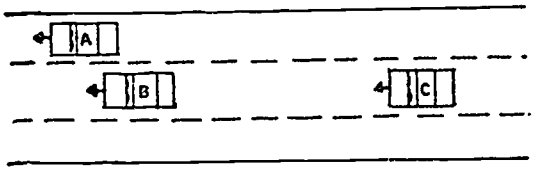
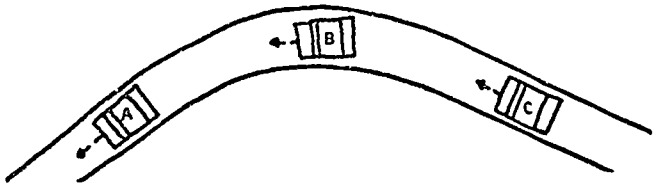
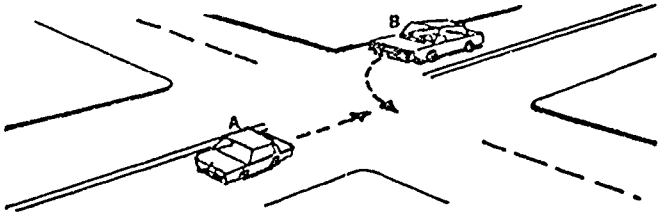
	NEW Percent	RENEWAL Percent
89. You should increase your following distance when you are behind a:		
a. Passenger car	a 4	a 3
b. Station wagon	b 3	b 1
c. Motorcycle	c * 93	c * 95
90. You are crossing a city street from a stop. You need a gap in traffic that is about:		
a. 100 feet	a 13	a 16
b. 1/2 of a block	b * 65	b * 75
c. 1 block	c 22	c 8
91. When changing lanes on a freeway, you need a gap in traffic of:		
a. 2 seconds	a 16	a 10
b. 4 seconds	b * 58	b * 64
c. 6 seconds	c 26	c 26
92. If your gas pedal sticks, what is the first thing you should do:		
a. Pull the pedal up with your toe	a 6	a 4
b. Pull the pedal up with your hand	b -	b 1
c. Shift to neutral	c * 94	c * 95
93. You should have your eyes checked every year or so becuase:		
a. Your vision may change without you knowing it	a * 89	a * 97
b. The law requires it	b 5	b -
c. The eye strain caused by driving makes vision checks necessary	c 6	c 3
94. People who smoke marijuana and then drive, tend to:		
a. Lose control of the car	a 24	a 10
b. Be more alert	b 1	b 1
c. Make more mistakes	c * 75	c * 89
95. The most important car control to use in handling most skids is the:		
a. Steering wheel	a * 94	a * 98
b. Brake	b 5	b -
c. Gas pedal	c 1	c 2
96. You are approaching an intersection with a yield sign, you should:		
a. Come to a full stop and check both ways	a 13	a 12
b. Slow down and check both ways	b * 85	b * 87
c. Keep a steady speed and check both ways	c 2	c 1

* Correct Answer

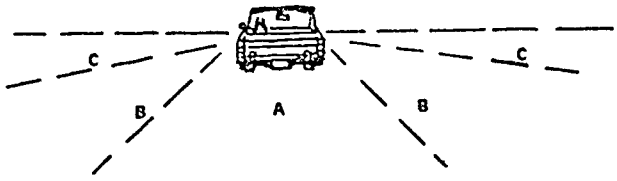
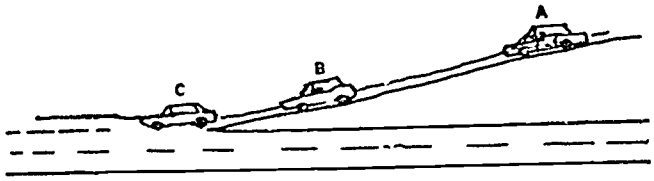
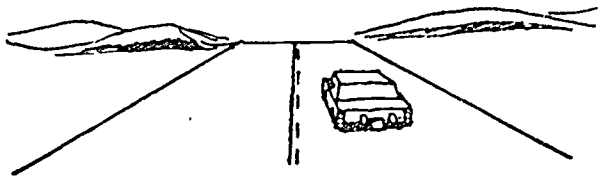
NEW DRIVERS AND RENEWAL APPLICANTS	NEW	RENEWAL
	Percent	Percent
97. It is necessary to use low beams any time you are: a. On a freeway b. On a lighted street c. In a fog	a 13 b 10 c * 77	a 7 b 13 c * 80
98. When you look over your shoulder to check traffic you should do it: a. Quickly b. Slowly	a * 98 b 2	a * 92 b 8
99. You are at an intersection. A stopped bus is blocking your line of vision of the cross street. The safest thing to do is: a. Sound your horn and continue driving b. Edge forward slowly c. Wait until the bus moves	a - b 3 c * 97	a - b 4 c * 96
100. You must dim your headlights if an oncoming car is within: a. A half mile b. A block distance c. 50 feet	a 20 b * 65 c 15	a 20 b * 66 c 14
101. You intend to turn into a driveway just after an intersection. When should you signal? a. Before you enter the intersection b. As you enter the intersection c. At the driveway	a 5 b * 82 c 13	a 2 b * 91 c 7
102. You come to an intersection and your view to the side is blocked by buildings. You should: a. Maintain speed and look both ways b. Slow down and look both ways c. Stop then edge forward slowly until you can see clearly in both directions	a - b 17 c * 83	a - b 18 c * 82
103. You are leaving a freeway. Slow down: a. Just before the exit lane b. Just after you move into the exit lane c. At the end of the exit lane	a 20 b * 73 c 7	a 23 b * 69 c 8
104. If you are driving 15 mph slower than the traffic flow. It: a. Makes an accident less likely to happen b. Makes an accident more likely to happen c. Doesn't change the chances of an accident	a 3 b * 89 c 8	a 1 b * 97 c 2

* Correct Answer

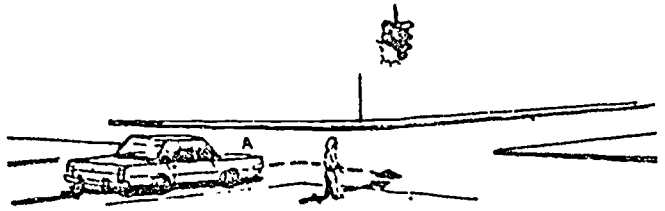
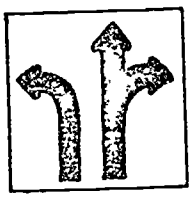
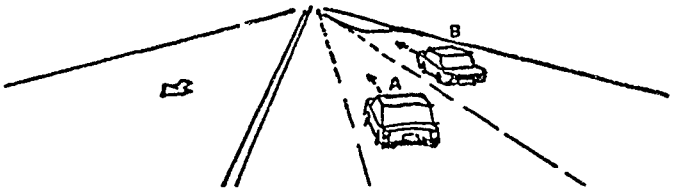
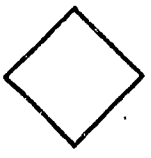
	NEW	RENEWAL
105. Under normal conditions, you need to keep a following distance of: a. 1 second b. 2 seconds c. 3 seconds	Percent a - b * 97 c 3	Percent a - b * 82 c 18
106. If there is oncoming traffic on your left and a bike rider on your right, you should: a. Move to the left b. Speed up to pass the bike before the car comes c. Slow down and let the car pass, then pass the bike	a - b 1 c * 99	a - b - c *100
107. To pass another car on a highway, you need a clear distance of about: a. 1/3 of a mile b. 2/3 of a mile c. A full mile	a * 55 b 34 c 11	a * 81 b 15 c 3
108. How many ounces of alcohol does it take to affect your driving? a. 1 ounce in an hour b. 2 ounces in an hour c. 3 ounces in an hour	a * 72 b 25 c 3	a * 76 b 23 c 1
109. Your car starts pulling to one side when you stop. You should check: a. The steering b. The suspension c. The brakes	a 19 b 18 c * 63	a 11 b 1 c * 88
110.  The shape of the above sign means: a. Stop b. Yield right-of-way c. Slow traffic keep right	a - b *100 c -	a 1 b * 97 c 2

	NEW	RENEWAL
111.	Percent	Percent
	a 7	a 5
The picture shows a stretch of freeway. Which is usually the smoothest lane of traffic to drive in?	b * 89	b * 78
a. Lane A b. Lane B c. Lane C	c 4	c 17
112.		
	a 6	a 15
In this picture which car is hardest for the other car to see?	b * 77	b * 72
a. Car A b. Car B c. Car C	c 17	c 13
113.		
	a 1	a -
If you have to slow down for a curve, you should do it when you get to the position of:	b -	b -
a. Car A b. Car B c. Car C	c * 99	c *100
114.		
	a 10	a 3
The drivers of Cars A and B are approaching each other at an intersection. Driver A plans to go on straight ahead. Driver B plans to turn left. Who must yield the right-of-way?	b * 88	b * 97
a. Driver A b. Driver B c. Neither driver	c 2	c -

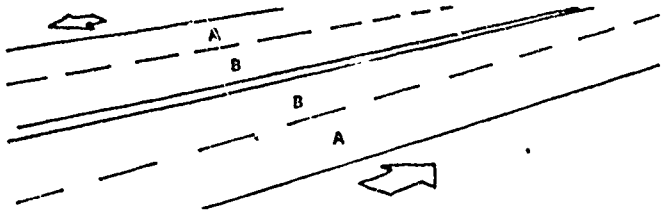
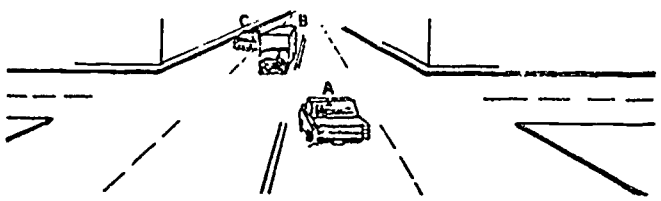
* Correct Answer

NEW DRIVERS AND RENEWAL APPLICANTS	NEW	RENEWAL
115.  A sign like this means: a. A sharp curve to the left b. You must turn left c. You cannot turn left	Percent a 2 b 1 c * 97	Percent a 2 b 2 c * 96
116.  The driver of this car has a "blind spot" in: a. Area A b. Area B c. Area C	a - b * 82 c 18	a - b * 72 c 28
117.  You are entering the freeway pictured above. Adjust your speed to heavy traffic when you are at the position of: a. Car A b. Car B c. Car C	a * 19 b 32 c 49	a * 30 b 33 c 37
118.  This road marking means that the car: a. Can pass anytime b. Can pass when it is safe c. Cannot pass	a 4 b * 95 c 1	a 1 b * 95 c 4

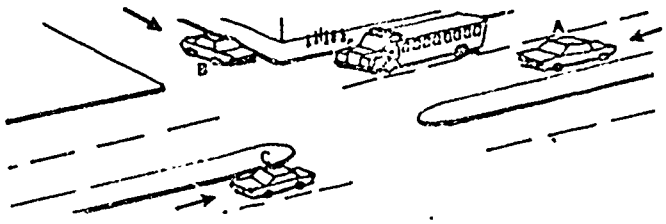
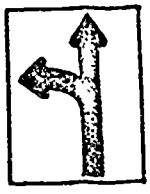
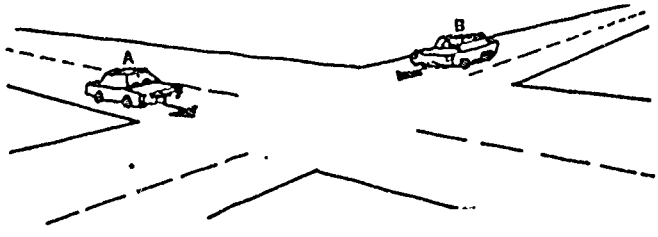
* Correct Answer

	NEW	RENEWAL
119.  The driver of Car A plans to turn right. The pedestrian plans to cross the street. Who must yield the right-of-way? a. The driver of Car A b. The pedestrian c. Neither person	Percent a * 84 b 15 c 1	Percent a * 89 b 11 c -
120.  You want to go straight ahead, which lane would you use? a. The left lane b. The right lane c. Either lane	a - b * 99 c 1	a 1 b * 95 c 4
121.  In the situation like the one illustrated in the diagram, what is the best thing for Car A to do? a. Speed up b. Slow down c. Move to the left lane	a 4 b 35 c * 61	a 1 b 31 c * 68
122.  The shape of this sign tells you it is a: a. Speed limit sign b. Warning sign c. School crossing sign	a 1 b * 88 c 11	a 3 b * 80 c 15

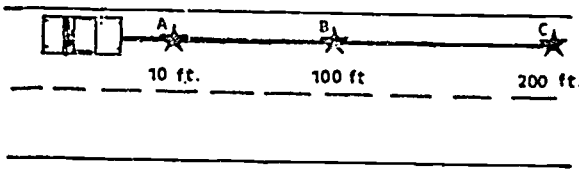
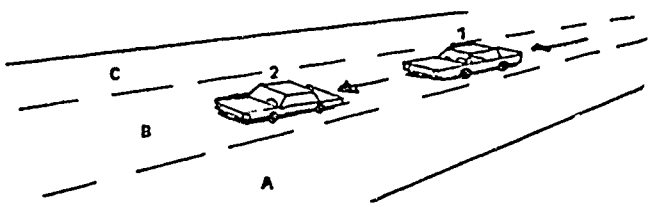
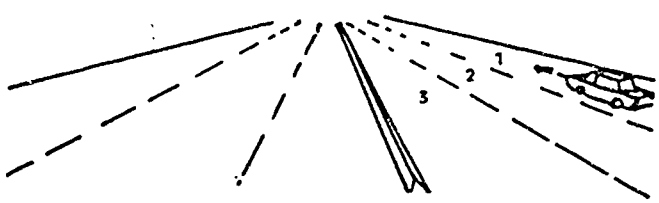
* Correct Answer

	NEW	RENEWAL
123.	Percent	Percent
	a * 62	a * 86
On this freeway which lanes should cars use for ordinary driving?	b 15	b 2
a. Lanes marked A b. Lanes marked B c. Either A or B	c 23	c 12
124.	a 1	a 6
	b -	b 1
A sign like this means:	c * 97	c * 93
a. A sharp curve to the right b. You must turn right c. You cannot turn right		
125.	a 22	a 24
	b * 72	b * 71
In the picture, one driver can see well enough to safely continue moving. Which driver is it?	c 5	c 5
a. Driver A b. Driver B c. Driver C		
126.	a 11	a 16
	b * 88	b * 78
This sign means:	c -	c 6
a. A divided highway begins b. A divided highway ends c. A lane ends ahead		

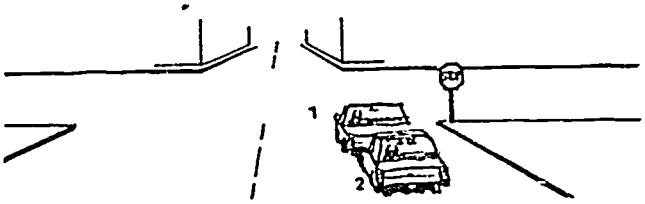
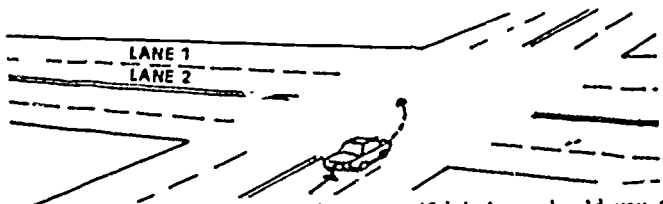
* Correct Answer

	NEW	RENEWAL
127.  In the illustration above, a school bus has stopped on a divided highway. Who must stop? a. Car A b. Cars A and B c. Cars A and C	Percent a 9 b * 87 c 4	Percent a 12 b * 74 c 11
128.  This sign means: a. You must go straight b. You must turn left c. You may go left or straight	a 1 b 1 c * 98	a - b 1 c * 99
129.  This sign means: a. A divided highway begins b. A lane ends ahead c. A divided highway ends	a * 91 b 1 c 8	a * 90 b 1 c 7
130  The cars in the picture are approaching an intersection. There are no signs or traffic lights. Which car must yield the right-of-way? a. Car A b. Car B c. Neither car	a 33 b * 57 c 9	a 18 b * 76 c 6

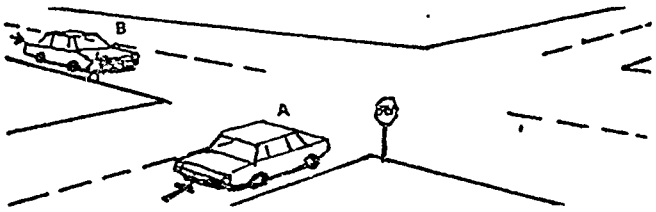
* Correct Answer

	NEW	RENEWAL
131.  Flares are used to mark a stalled car. Look at this picture and choose the correct position: a. Position A b. Position B c. Position C	Percent a 2 b 44 c * 54	Percent a 3 b 31 c * 66
132.  This sign means: a. A U-turn is permitted b. A U-turn is not permitted c. A left hand turn is not permitted	a 1 b * 97 c 2	a 1 b * 96 c 3
133.  In the above multiple lane street Car 1 is going to pass Car 2. Car 1 should use: a. Lane A b. Lane C c. Either lane	a * 85 b 7 c 8	a * 83 b 6 c 11
134.  You are in Lane 1 of a six-lane highway. You want to change to Lane 2. You should check: a. Lane 2 b. Lane 3 c. Lanes 2 and 3	a 16 b - c * 84	a 7 b - c * 93

* Correct Answer

	NEW	RENEWAL
135.  This sign means: a. Two lanes ahead b. Two way traffic ahead c. Divided highway begins	Percent a 1 b * 97 c 2	Percent a 4 b * 93 c 3
136.  This sign means: a. Right lane ends ahead b. Left lane must go straight c. Traffic merging into right lane	a 4 b 2 c * 94	a 12 b 3 c * 85
137.  In this picture the driver of Car 2 should: a. Move out right after Car 1 b. Stop at the corner before moving out c. Wait a moment after Car 1 moves out, then go	a - b * 90 c 10	a - b * 97 c 3
138.  You are planning to make a left turn. Which lane should you turn into? a. Either Lane 1 or Lane 2 b. Lane 1 c. Lane 2	a 11 b 8 c * 81	a 4 b 12 c * 84

* Correct Answer

	NEW	RENEWAL
139.  This sign means: a. A curve to the right b. No right turn c. Freeway exit ahead	Percent a * 97 b 1 c 1	Percent a * 96 b 2 c 2
140.  Car A is at a stop sign. Car B approaches the intersection with his right turn signal on. It is safe for A to proceed when: a. Car B starts to turn b. He sees Car B's turn signal c. Car B completes his turn	a * 34 b 6 c 60	a * 45 b - c 55

* Correct Answer

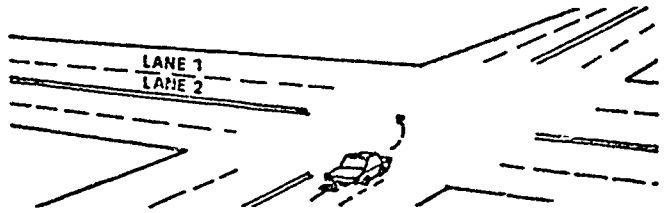
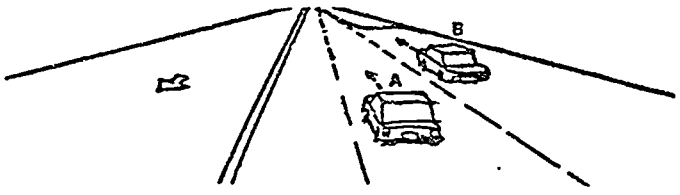
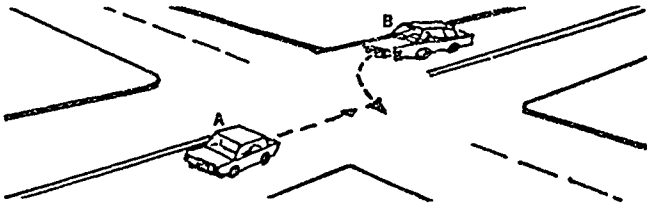
ACCIDENT REPEATERS

	Percent
1. If another car wishes to pass you on a two-lane road, you should: a. Pull over towards the right b. Pull over to the right and wave him past c. Tap your brakes several times	a * 89 b 9 c 2
2. If a car is following you too closely: a. Speed up b. Flash your brake lights c. Slow down	a - b * 94 c 6
3. When driving at highway speed you should generally focus your attention: a. One-quarter mile in front of you b. On the car in front of you c. One-half mile in front of you	a * 75 b 24 c 1
4. When approaching a hill or curve: a. Maintain speed b. Slow down and keep well to the right c. Slow down and keep well to the left	a - b * 99 c 1
5. A green traffic light means, you: a. May proceed only if it is safe to do so b. Must stop and then proceed c. May proceed	a * 92 b 1 c 7
6. In the daytime you can warn another driver that you are coming by: a. Flashing your lights b. Tapping your horn lightly c. Honking your horn loudly	a 3 b * 85 c 12
7. You are entering a freeway. You should check traffic on the freeway by: a. Using the inside mirror b. Using both the inside and outside mirrors c. Using the side mirror and looking over your shoulder	a 3 b 14 c * 83
8. One vehicle that is required to stop for railroad crossings is: a. A cattle truck b. A dairy truck c. A school bus	a - b - c *100

* Correct Answer

	Percent
9. How many seconds ahead should you look when you drive? a. 5-10 seconds b. 10-15 seconds c. 15-20 seconds	a 6 b * 84 c 10
10. If the road is slippery, you should keep a following distance that is: a. A normal distance from the car ahead b. Closer to the car ahead than normal c. Farther from the car ahead than normal	a 3 b - c * 97
11. You come to an intersection and your view to the side is blocked by buildings. You should: a. Maintain speed and look both ways b. Slow down and look both ways c. Stop then edge forward slowly until you can see clearly in both directions	a - b 7 c * 93
12. Under normal conditions, you need to keep a following distance that is: a. 1 second b. 2 seconds c. 3 seconds	a - b * 66 c 34
13. You are in the right lane of a freeway. As you come up on an entrance ramp, you can see a car about to enter. The best thing to do is: a. Change lanes to the left b. Slow down c. Maintain your speed and position	a * 79 b 12 c 9
14. You see a pedestrian is about to walk in front of your car. You should: a. Tap the horn lightly b. Flash the lights c. Honk the horn loudly	a 45 b - c * 55
15. When you enter a crowded freeway from an entrance ramp, you should: a. Slow down on the ramp to wait for a gap b. Stop at the end of the ramp to wait for a gap c. Maintain speed and let other drivers make room for you	a * 69 b 15 c 16
16. How can you signal the driver behind you that you are planning to slow down in the middle of the block? a. Put on your emergency flashers b. Put on your turn signals c. Tap your brake pedal several times	a 7 b 7 c * 86

*Correct Answer

	Percent
17. What does a driver with good seeing habits do? a. He look ahead at the middle of the road b. He looks directly in front of the car c. He looks ahead and "scans" from side to side	a - b 5 c * 95
18.  You are planning to make a left turn. Which lane should you turn into? a. Either Lane 1 or Lane 2 b. Lane 1 c. Lane 2	a 6 b 23 c * 71
19.  In a situation like the one illustrated in the diagram, what is the best thing for Car A to do? a. Speed up b. Slow down c. Move to the left lane	a - b 28 c * 72
20.  The drivers of Cars A and B are approaching each other at an intersection. Driver A plans to go on straight ahead. Driver B plans to turn left. Who must yield the right-of-way? a. Driver A b. Driver B c. Neither driver	a 4 b * 95 c 1

* = Correct Answer

	Percent
1. The first driving ability affected by alcohol is: A. Coordination B. Skill C. Judgment	a 5 b 2 c * 93
2. How many highway deaths are linked to drinking and driving each year? A. 15,000 B. 25,000 C. 35,000	a 1 b * 96 c 3
3. Which of the following helps you sober up: A. Coffee B. Time C. Food	a 4 b * 95 c 1
4. The thing that determines how drunk you are is: A. Type of drink B. Amount of alcohol in your blood C. How long you drink	a - b * 99 c 1
5. In this State you are legally intoxicated if your BAC (Blood Alcohol Content) is: A. .05% B. .10% C. .15%	a 12 b * 82 c 6
6. Which of the following abilities is most affected by drinking: A. The ability to tell one color from another B. The ability to tell one shape from another C. The ability to judge distance	a 1 b - c * 99
7. If you drink and also drive, the <u>best</u> way to control the effect of alcohol is to: A. Stop drinking when you feel the effects B. Eat starchy foods C. Set a limit on the number of drinks	a 12 b 2 c * 86
8. If you are one drink over your limit, how long should you wait before you drive: A. At least 30 minutes B. At least one hour C. At least two hours	a 1 b * 92 c 7

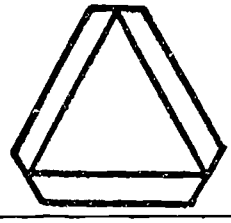
* Correct Answer

	Percent
9. A one ounce shot of liquor has the same amount of alcohol as: A. One can of beer B. Two cans of beer C. Three cans of beer	a * 89 b 4 c 7
10. If you eat when drinking, the food: A. Keeps alcohol from entering your bloodstream B. Slows the rate at which alcohol enters your bloodstream C. Has no effect at all	a 1 b * 94 c 5
11. The maximum fine for Driving While Intoxicated (DWI) in this State is: A. $100 B. $500 C. $1,000	a 3 b 23 c * 74
12. How many drinks does it take to affect your ability to drive safely? A. 1 drink B. 2-3 drinks C. 4 or more drinks	a 21 b * 61 c 18
13. If you refuse to take a breath or chemical test, your license, on a first offense, could be suspended for: A. 30 days B. 60 days C. 90 days	a 24 b 14 c * 62
14. The maximum jail sentence for a second conviction of "Driving While Intoxicated" is: A. Six months B. One year C. Two years	a 21 b * 67 c 12
15. "Implied Consent" law means: A. You have to take a breath or chemical test if you are arrested for Driving While Intoxicated. B. You agree to take a breath or chemical test if you are arrested for Driving While Intoxicated. C. Nothing will happen to you if you refuse to take a breath or chemical test after being arrested for Driving While Intoxicated.	a 21 b * 79 c -

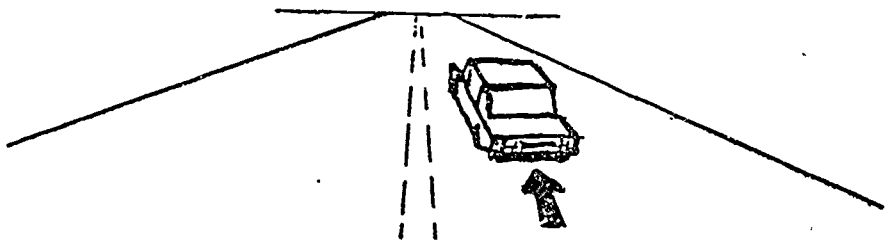
* = Correct Answer.

	Percent
1. When you plan to drive for a long time without stopping, you should get plenty of rest and then: a. Eat a large meal b. Eat a light meal c. Drink several cups of coffee	a 6 b * 38 c 6
2. When you are driving on a two lane road, you are legally permitted to pass: a. If there is a solid yellow line in your lane b. If there is a dashed yellow line in your lane c. If there is a double solid yellow line	a 2 b * 97 c 1
3. If you miss an exit from a freeway, you should: a. Pull over to the shoulder and back up b. Continue to the next exit and then return on the freeway c. Pull onto the median and make a U-turn	a - b * 100 c -
4. Drivers who have poor peripheral vision (inability to see to the sides) should: a. Wear glasses b. Concentrate on looking straight ahead c. Move their eyes back and forth	a 38 b 2 c * 60
5. When you take a long trip, you should limit your driving to: a. About 300 miles per day b. About 500 miles per day c. About 700 miles per day	a * 89 b 11 c -
6. One way of reducing your chances of an accident is: a. Avoid rush hour traffic b. Drive slower than the speed limit c. Drive only at night	a * 81 b 18 c 1
7. You are backing your car. What is the best way to see what is behind you? a. Look in both the rearview mirror and the sideview mirror b. Look out the driver's window c. Look over your right shoulder and out the rear window	a 14 b 1 c * 85
8. When taking any medicine you should: a. Consult your doctor about the effects before driving b. Drive only if you have a short distance to go c. Keep your window open and drive more slowly	a * 96 b - c 4

* Correct Answer

	Percent
9. You are approaching a busy intersection and don't know which way to go. If there is no place to pull over, you should: a. Maintain speed and continue in the same direction you are going b. Slow way down and look for street signs c. Stop and decide where to go before continuing	a * 74 b 21 c 5
10. If you have trouble seeing at night you should: a. Wear tinted glasses b. Limit your night driving c. Look at the center line as a guide	a 1 b * 84 c 15
11. The triangular sign to the right identifies a: a. Deer crossing ahead b. Steep grade ahead c. Slow moving vehicle 	a 5 b 15 c * 76
12. If you don't feel comfortable driving as fast as other traffic, you should: a. Drive on lightly traveled streets b. Drive only on freeways c. Drive at night when the traffic is light	a * 98 b 1 c 1
13. You are driving through an unfamiliar area. You should: a. Use a heavily traveled main route b. Take someone with you to help with directions c. Drive slowly so you can read the street signs	a 4 b * 60 c 36
14. A sign like this is an advanced warning of: a. A school crossing b. A bus stop c. A shopping center 	a * 95 b - c 5
15. If you want to drive a little slower on a freeway, which lane should you use? a. The middle lane b. The right lane c. The left lane	a 1 b * 99 c -
16. You want to change lanes. You can see if a car is in your blindspot: a. Only if you check your rearview mirror b. Only if you check your sideview mirror c. Only if you turn and look over your shoulder	a 3 b 13 c * 82

* Correct Answer

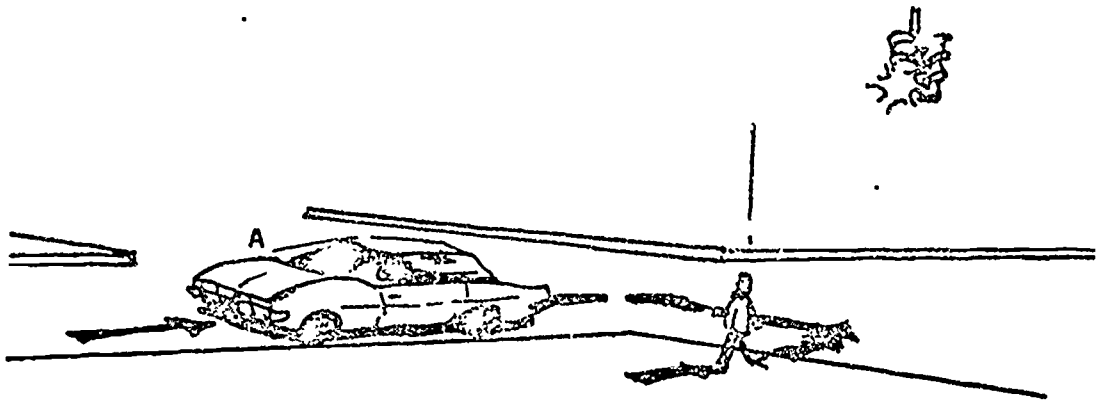
	Percent
17. To keep from being blinded by the headlights of an oncoming car, you should: a. Wear tinted glasses b. Look to the center line of the road c. Look to the right edge of the road	a 1 b 3 c * 96
18. When driving in freeway traffic, the safe speed is: a. The same speed as other drivers in your lane b. Slower than other drivers in your lane c. Faster than other drivers in your lane	a * 98 b 2 c -
19. You are about to enter a freeway from an entrance ramp. You should: a. Stop at the end of the ramp and wait for a gap b. Maintain speed on the ramp and look for a gap c. Edge out and force the other drivers to make a gap	a 33 b * 67 c -
20.  The above lane markings are a pair of dashed lines. This means that: a. You cannot change lanes b. You can change lanes c. You may or may not be able to change lanes depending on traffic signals.	a 14 b 49 c * 35

* = Correct Answer

VIOLATORS

	Percent
1. In order to stop at 50 mph you need about: a. 1/4 of a block b. 1/2 of a block c. 3/4 of a block	a 6 b * 57 c 37
2. The speed limit posted on a road is 55 mph. If it is raining, you should: a. Maintain a 55 mph speed b. Reduce your speed to about 45 mph c. Reduce your speed to about 30 mph	a 4 b * 90 c 6
3. If you are driving behind a motorcycle, how much following distance should you allow? a. 1 second b. 2 seconds c. 3 seconds	a 0 b 17 c * 83
4. You are on a two-lane road and want to pass. The left lane is clear but there is a curve ahead. It is safe to pass only if: a. The curve is at least 1/3 mile away b. You can complete the pass before you reach the curve c. The curve is at least a mile away	a * 41 b 43 c 15
5. A driver is entering the freeway from a ramp. Another driver is in the right-hand lane of the freeway. Which driver has to yield the right-of-way? a. The driver on the entrance ramp b. The driver on the freeway c. Neither driver	a * 72 b 19 c 9
6. When you are completely stopped, it is easier to see: a. Things that are moving b. Things to either side c. Things in the distance	a * 67 b 24 c 9
7. You should stop for a yellow light: a. If you can't make it through the intersection before the light turns red b. If there is no one behind you c. If you can stop safely	a 30 b 1 c * 69
8. People who drive a lot of miles in a year should be expected to: a. Drive more safely than other drivers b. Drive just as safely as other drivers c. Get more traffic tickets than other drivers	a * 63 b 35 c 2

* Correct Answer

	Percent
9. You are driving on a highway during a rainstorm. Suddenly the rain gets so heavy that you can hardly see a car just 100 feet ahead. To avoid a collision you should keep your speed. a. Under 10 mph b. Under 20 mph c. Under 30 mph	a 24 b * 51 c 25
10.  The driver of Car A plans to turn right. The pedestrian plans to cross the street. Who must yield the right-of-way? a. The driver of Car A b. The pedestrian c. Neither person	a * 82 b 12 c 2

* = Correct Answer