OVERVIEW OF NHTSA RESEARCH ACTIVITIES IN DRIVER EDUCATION AND LICENSING

John W. Eberhard
National Highway Traffic Safety Administration

Under the Highway Safety Act of 1966, the National Highway Traffic Safety Administration was charged with the responsibility to reduce the accidents and injuries of highway users. As part of the efforts to identify the potential of driver education and licensing in reducing accidents, the NHTSA (then the National Highway Safety Bureau) initiated analyses of driver education evaluation requirements (2) and of driver licensing practices (1). The results of this research pointed to the need for a detailed analysis of the driving task to determine educational program needs and a new set of standards for determining an individual's qualifications to receive a driver's license.

DRIVING TASK ANALYSIS

The basis of NHTSA's program to develop driver performance objectives is analyses of passenger car (3), truck and bus (4), and motorcycle (5) tasks. These analyses identified the driver and non-operational tasks involved in safe performance within the highway system under a variety of environmental and traffic conditions. Criticality indexes that have been established for each passenger car task (3) and each truck and bus task (4) serve as a guide for selecting the instructional and testing objectives that are most critical to safe driving performance. With criticality indexes for each task and improved accident investigation data, NHTSA will be able to identify the skill, knowledge, attitude, and physical/medical fitness requirements for safe driving.

PROGRAM RATIONALE

Based on state-of-the-art reviews and several task analyses, a program plan has been established to improve driving performance by upgrading driver preparation, initial driver licensing, driver reexamination, problem driver rehabilitation, and license restriction. A tailored treatment approach to education, training, and control will be used as the basis for developing programs in these areas. With this approach, the individual is first screened to determine whether training or regulatory action is needed. Emphasis in the research program is, for passenger car operation, on finding ways to make it possible for greater numbers to drive safely; it should not be limited to removing greater numbers of drivers. Therefore, there is a need to provide those responsible for training and examining drivers with the most efficient and effective techniques for guaranteeing that all road users possess the minimum capabilities for safe operation

in the highway system. Thus, there is need to develop (a) a safety-oriented curriculum for driver preparation, (b) safe driver performance standards against which applicant capability can be compared, and (c) driver improvement techniques for those whose capability is below standard. Furthermore, based on evidence that drivers whose licenses are suspended or revoked continue to drive (7), more effective enforcement of license restrictions needs to be developed and implemented.

In the case of motorcycles, trucks, and buses, there might be greater potential to use traditional selection methods that would result in a greater proportion of applicants being denied a license. This may be particularly true for truck and bus operators whose vehicles pose a great threat to life and property. This is not to say that NHTSA is not concerned with providing safety-oriented training materials for such vehicle operators; rather, emphasis will be placed on more stringent and comprehensive performance standards for initial licensing and for retention of the license by those with one.

DRIVER PREPARATION

Of all of the highway safety programs, driver education is one that has an outstanding opportunity to effect accident reduction. Drivers are motivated to develop their driving capability most as they prepare to qualify for initial licensing. Because of this, the bulk of the research in driver education has been focused on the development of a safe performance curriculum for the largest group of initial license applicants in the country: high-school-aged youth.

Driessen (6) points out that, in current driver education courses, "Much time is spent in learning about the car and in 'learning to drive,' but, only secondarily, 'learning to drive safely'." As Driessen and others have recognized, there is a need for more safe performance material in driver education. Consequently, the safe performance curriculum places great emphasis on the knowledge and skills required for safe performance and deemphasizes some more traditional topics such as engine repair and automobile insurance.

The NHTSA program in driver preparation consists of a safe performance curriculum for secondary schools, traffic safety education program, advanced driver education, motorcycle safety education, commercial truck and bus operator training, and driver education for special groups (e.g., handicapped, aged).

Safe Performance Curriculum for Secondary Schools

Based on the driver education task analysis for passenger car operation, instructional objectives for driver preparation have been defined. In turn, based on these objectives and a need to perform a definitive evaluation of the accident reduction potential of driver education, a study to develop and evaluate a safe performance curriculum has been initiated (9). This study, being conducted in Kansas City, Missouri, is an attempt to overcome the deficiency in curriculum development and research methodology that has been a problem in driver education. A consistent research issue has been failure to randomly assign students to the various programs to be evaluated. In Kansas City, students will be randomly assigned to either a safe performance curriculum, a minimum-skills program designed to enable the individual to pass the licensing exam, or no formal driver education program (i.e., the experiment's control group). The project is designed to answer the basic question, "Can driver education reduce accidents and injuries?"

As part of the curriculum development program, performance measures are being developed to determine students' comprehension of course content during the program, pace students' progress through the course, and determine students' qualifications for graduation at the end of the course. NHTSA intends to develop these measures into standardized performance measures for use not only by teachers in assessing student performance but also by state departments of education or other responsible state agencies in evaluating program quality and effectiveness. It is intended that preliminary standards will be available for this purpose in 1975; these standards will be revised and refined after careful regional implementation of the driver education program.

The next phase in the development of an effective high school driver education program will be to determine which components of the safe performance curriculum are successfully meeting the training needs of students in both inner-city and rural environments. The purpose of this effort is to systematically implement the curriculum and curriculum parts on a broad base to determine which components of the curriculum are most effective and which need enhancement. It is during this period that plans call for a more refined diagnostic test program to be used to assign students only to those components of the training program that they need. As part of this evaluation it is anticipated that the requirements will be identified for training devices and aids to reduce teacher work load and to improve the effectiveness of the instructional experience. Furthermore, research designed to improve in-car instruction will be conducted.

Traffic Safety Education

Because novice and young adult drivers are overrepresented in the accident statistics, it is necessary to develop more effective training programs for these groups. Specifications are being prepared for a research program to identify the potential benefits of certain types of driver experiences prior to licensing age. This program will include preparation of a study series at the junior high and elementary levels on motivating the development of perceptual skills and knowledge. When practical and educationally sound, these experiences prior to driver training will be combined with early road user experiences (e.g., motor bike and bicycle use and passenger and pedestrian education).

Advanced Driver Education

NHTSA's research program in advanced driver education is evolving from evaluating existing driver training programs (10) to designing innovative training programs. The new programs will be based on instructional objectives from the task analysis, accident experience, and driver performance data. These programs will identify new requirements for accident investigation and data analysis dealing with driver errors that lead to accidents.

A study using existing classroom and emergency skills training procedures is being evaluated by American University in cooperation with the U. S. Coast Guard to determine the accident and injury reduction potential of a program designed for young adult males (i.e., USCG recruits) (10, 11). This program uses combinations of the Air Force traffic safety materials for the classroom phase and selected basic and emergency skills training exercises for behind-the-wheel instruction. Data on both intermediate (instructional objective attainment) and ultimate (accident and injury involvement) criteria were obtained from the recruits. Information on driving behavior patterns relative to the use of alcohol, drugs, night driving, and fatigue was also obtained to determine the characteristics of accident-involved recruits. The results of this effort should provide a strong basis for the design of better advanced driver education and driver improvement programs.

Another study to evaluate existing techniques was conducted by Pelz and Schumann (12) who compared (a) police highway safety assemblies, (b) trigger films (i.e., 1- to 3-minute films on driver behavior designed to trigger safety discussion among participant groups), and (c) trigger films with mailings on highway safety tips and activities. The trigger film technique, which had a lot of appeal, was experimentally evaluated before distribution to determine the accident-violation reduction potential. The evaluation showed that the trigger film technique as employed in this study was not an effective traffic accident countermeasure.

Currently, American University is designing an advanced driver training program in conjunction with the USCG driver improvement program. This program, which is also based on driver task analysis, uses recruit performance test data and accident data to generate innovative driver training techniques.

A second program being developed that relies heavily on new training technology is the accident avoidance training and testing program. Investigators will attempt to

derive the skill requirements associated with accident avoidance and will identify classroom and behind-the-wheel procedures for training and testing. A pilot test will be conducted to determine program effectiveness and the costs associated with achieving prescribed skill levels. The project will also identify the characteristics of groups that might benefit from such training (e.g., emergency vehicle operators and young adult drivers). The program will be based on the data obtained from multidisciplinary accident investigation teams and other accident investigation and analysis results. Furthermore, it will aid in the design of advanced accident investigation procedures, which will enable the next generation of training programs to be based more on observable and measurable driver performance characteristics. Finally, specific accident avoidance training programs will be evaluated with selected groups to determine the accident reduction potential.

Motorcycle Safety Education

Motorcycle accidents are most likely to occur in the first year of operation: 30 percent of the accidents in California involve riders with less than 1 year's experience (13). There is concern about whether motorcycle safety training will reduce the total number of motorcycle accidents, for it may encourage more people to ride. However, the 12 percent accident reduction resulting from the Honda course in Japan is encouraging (14).

NHTSA is considering a cooperative agreement with the Motorcycle Industry Council Safety and Education Foundation to develop and evaluate safety-based motorcycle training programs and driver licensing test procedures. Curriculum development for the motorcycle training program will follow the same steps taken in the development of a safe performance curriculum in secondary schools, which made use of the task analysis, and development of instructional objectives based on that analysis. The requirements for data on motorcycle operator performance in both normal and accident situations will be specified, which will facilitate development of advanced countermeasures and training programs. Because of the inherent danger of motorcycle operation caused by the design of the vehicle, NHTSA will place emphasis on establishment of more comprehensive, more stringent licensing standards.

Evaluation of the curriculum will be designed to determine the effect of motorcycle training on total accidents and the possibly negative effects of encouraging people to ride who might not otherwise do so. Both trained and untrained riders will be followed for several years to determine whether trained riders have fewer or less severe accidents than untrained riders.

Commercial Truck and Bus Operator Training

NHTSA is assisting the Bureau of Motor Carrier Safety in the development of a driver training program for commercial truck and bus operators (22). BMCS's goal is to upgrade the training provided for motor carrier operators and to determine the feasibility of developing a training program that would enable 18-year-olds to be commercial operators. As part of its consulting services, NHTSA is attempting to determine the feasibility of testing the new training program in a setting that affords the same type of experimental evaluation used to evaluate other NHTSA education and training programs. Possible test sites and cooperating organizations have been identified including the U. S. Army at Fort Eustus, the Office of Education through their career education development program, the Department of Labor, North Carolina State University, and Ryder's National Professional Driver Training School.

Adult Education

In the area of adult education, NHTSA, in cooperation with the Air Force Inspection and Safety Center, has plans to develop traffic safety education materials for the general driving public. It includes ten 1-hour audiovisual presentations on the principles of safe driving. NHTSA will evaluate the accident reduction potential of the new materials for

both Air Force personnel and the public.

In a study by Hutchinson (15), driving errors and total accidents were reduced 17.4 and 12.5 percent respectively at eight urban intersections in Kentucky. This reduction was due to a series of announcements on local television, inasmuch as in-county residents who had the opportunity to view the TV programs improved whereas out-of-county residents did not.

Following the promising work of Hutchinson, FHWA and NHTSA agreed to jointly evaluate motorists' problems in effecting freeway entrance and exit maneuvers. After the proper and improper maneuvers are identified, driver training materials and signs, markings, and traffic engineering improvements will be developed. Controlled studies designed to determine the effect of the driver training and the traffic engineering improvements will be conducted.

DRIVER LICENSING

NHTSA's approach to improving the effectiveness of driver licensing is based on the development of safety-related driver performance standards. The factors being investigated are (a) an analysis of critical driving tasks according to vehicle types, (b) accident investigation data including vehicle and highway factors, and (c) driver characteristics. The intent is to develop measuring instruments (e.g., driver vision tests, background questionnaires) to determine the degree of licensing privilege an individual should be granted. Four grades of licensing requirements (by vehicle type) are currently anticipated: (a) initial applicant testing and weakness identification with emphasis on determining the requirement for issuing a probationary license; (b) renewal applicant testing and weakness identification; (c) aged driver testing with emphasis on identifying medical, senescence, and physical limitations and assigning appropriate restrictions or rehabilitation requirements to each limitation; and (d) diagnostic testing of problem drivers (negligent operators).

The initial licensing examination could be used to ensure that novice drivers receive instructions in avoiding accidents. Certain elements in the licensing examination do relate to accidents (16, 17), but they do not identify those activities that may cause accidents. For example, McRae found a relationship between parallel parking and accidents, and many states, including North Carolina, have now eliminated the parallel parking test from licensing examinations.

NHTSA has emphasized development of accurate, objective, and economical performance-measuring instruments. Once task analyses were performed for passenger cars (3), trucks (4), and motorcycles (5), it became feasible to establish test requirements relatable to the driver's tasks.

Driver Knowledge Tests

Development of the national item bank for driver knowledge (18), which helped to spawn the development of the task analysis for motorcycles, trucks, and buses, was an initial step in driver testing. In addition to the Manual on Uniform Traffic Control Devices and the Uniform Vehicle Code, the research made use of several task analyses to identify safe driving knowledge requirements and tests. As a consequence, many of the new items cannot be found in the prelicense driver manuals currently provided by the states. For passenger car operators, a 1,300-item pool and a series of seven 40-item tests for initial licensing and twenty-eight 10-item tests for driver reexamination were developed. Psychometric data on test/retest reliability, item-total test correlation, and proportion of correct and incorrect responses have been obtained. The effects of geography and age on performance were analyzed. Findings indicated that inner-city residents, Coast Guard recruits, and the aged had the lowest test scores. The aged perform significantly worse than the other groups; however, it is not known whether these differences are simply inferior test-taking ability or an accurate reflection of ignorance that could increase accident likelihood. More than 300 motorcycle items have been developed and test/retest reliability and other statistics are being obtained. Preliminary information on the truck and bus item pool is available; however,

refinement of this pool will be performed at a later date. The project represents the most complete development of driver knowledge test items to date, and guidelines for state implementation will be available from NHTSA in 1974.

Driver Knowledge Manuals

Based on the instructional objectives from the task analysis (8), the safe performance curriculum development (9), and development of the knowledge item bank, a research program will be performed to identify the accident reduction potential of a new set of driver manuals and tests. This study will determine how well manuals designed for initial applicants, renewal applicants, aged drivers, and problem drivers effect accident reduction. The manuals will emphasize safe driving practices for each group. In the evaluation, individuals will be randomly selected to receive either the safe driving manuals or current manuals. Where learning handicaps are identified, alternative systems will be established to guarantee that the total driving population will acquire the most important information on safe driving practices. It is anticipated that these materials will be used for driver improvement as well as driver licensing and will provide at least some minimum level of knowledge in driver training programs that emphasize skill training.

Visual and Auditory Test Requirements

Studies have been undertaken by NHTSA (19) and the Bureau of Motor Carrier Safety (20) to identify the minimum visual and auditory capabilities necessary for safe vehicle operation. Minimum requirements for passenger car operation were identified, and a prototype driver vision test was designed to measure dynamic and static visual acuity, movement in depth, angular movement, and saccadic, steady, and pursuant movements under varying lighting conditions. Many of these items are not currently measured by optometrists and ophthalmologists. Some preliminary normative data are being obtained on initial applicants, aged drivers, and renewal applicants as well as accident-involved problem drivers, particularly those who have visual problems that may have been a causative factor in the accident.

A study of visual factors for truck and bus drivers is being performed for BMCS. NHTSA is providing consulting service. BMCS, as part of its driver physical examination program, is interested in identifying whether an applicant has satisfactory visual and auditory capabilities. In addition to the visual functions identified above, accommodation facility and visual field were identified as functions of special importance to the motor carrier operator. Because motor carrier operators have limited rear visibility, which requires extensive use of mirrors, the need for accommodation facility is obvious.

Also, as part of the BMCS study, the System Development Corporation (23) has analyzed auditory requirements for truck and bus operators. Unlike the case with vision, no studies on the minimum auditory capabilities required for safe passenger car, truck, or bus operation have been reported. Based on an analysis of the driving tasks (3, 4), essential auditory capabilities for truck drivers were identified: (a) detection of auditory stimuli related to equipment and vehicle inspections and checks prior to driving and during frequent stops and (b) detection of auditory stimuli related to the status of essential equipment under conditions where masking noises are present. Prototype devices that measure visual acuity are being developed for truck and bus operators, and a commercially available audiometer has been selected. Preliminary normative data will be collected to establish standards for vision and hearing of motor carrier operators.

NHTSA extended the vision test development program to include analysis of vision and hearing requirements for motorcycle operation. The need to establish special tests for motorcycle operations will be determined from these analyses. Engineer drawings of integrated visual and auditory test devices will be available in 1974, and preliminary normative data relative to initial, renewal, and problem drivers should also be available.

Driver Background Factors

Because any kind of impairment (21) is crucial to driving, we need to detect whether individuals tend to or do overuse alcohol while driving or are otherwise physically or emotionally impaired. Procedures are needed to identify potential weaknesses in this area for use either in counseling during the examination or reexamination process, or in developing new licensing restrictions. Information on accident-related impairments will be used in the driver education and training research program.

Driving Skill

Additional performance measurement requirements include basic and emergency skill tests. The data for development of these measures will come from the safe performance curriculum evaluation program in Kansas City and the accident avoidance skills training/testing program. Additional measures of behind-the-wheel driver performance will be obtained in conjunction with the development of advanced driver improvement programs for both general and problem drivers.

Driver performance measures for motorcyclists and truck and bus operators will be developed as part of the curriculum and training programs for these vehicles. Implementation of the training programs will provide information on driver demographic factors (i.e., occupation, race, geographic areas, education), knowledge, perceptual skills, visual and auditory capabilities, physical and medical factors, and additional behind-the-wheel data that will enable an identification of the overall contribution of each characteristic to safe highway performance. It is from these curriculum development and evaluation studies that more refined measures of applicant entry requirements can most logically and efficiently be developed.

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Discussion

Frederick E. Vanosdall, Michigan State University

Eberhard reviewed existing NHTSA research activities and driver licensing efforts, state-of-the-art studies, and programs to improve existing elements of driver licensing. His assertion that the easiest way to ensure that novice drivers will obtain adequate accident avoidance instruction is to improve the quality and difficulty of the initial license examination expects a great deal of tests.

Several projects are under way to improve driver testing. The imaginative research instrumentation of visual testing systems has been an outstanding move toward controlled testing. Comprehensive analysis of the driving task has provided the necessary reference material for development of driver knowledge tests. Actual guides for implementation, standardization of procedures, performance levels, and information value understandable by drivers should be part of the research project.

Administrators responsible for driver licensing programs regard practical matters such as test time, test difficulty, examiner time, and public reaction as more important than the more reliable and valid scientific tests. The communication gap between researchers and administrators may retard implementation of new tests. Thus, new examinations may be of little value if they must be proved through long-term studies of subsequent driver performance.

Driver licensing officials consider the road test as one of the most important licensing tests. Eberhard mentions only the skill tests developed for use in measuring driver performance in the Kansas City project. Will such tests be of value in driver licensing programs? Will they be feasible in on-street testing programs? It is hoped that these questions will be answered in later papers as a means of demonstrating the value of such research to driver licensing.

In another area, future driver licensing programs are certain to employ various electronic and automated testing equipment; however, little effort has been made to bring interested researchers together to review and evaluate existing testing systems that, once adopted on a large scale, may lock the entire system into a mechanized era that may retard improvements being developed in current and future research programs.

Future driver licensing research needs include consideration of programs linking driver education, licensing, and improvement to the enforcement and adjudication processes. Integrating these functions into a systematized and coordinated service for drivers may help achieve public respect and appreciation for the quality of safety that driver licensing programs afford. Such efforts, however, need to be demonstrated by laboratory projects. Perhaps such projects are the best method for proving the benefits of research.