Personnel requirements for traffic striping may be decreased 50 percent. Convenience to public traffic is greatly enhanced. California Highway Maintenance Work Standard for placing median barrier stripe using the conventional cold paint system is 3.7 man-hours per mile of stripe. Using the hot paint system, it is estimated that the labor requirement may be reduced to 0.6 man-hour per mile.

Transportation Safety Activities of HRB Cover Wide Range of Problems and Modes

James K. Williams*

In today's society, problems and needs change very rapidly. Programs, especially in the field of transportation safety, must be responsive to emerging needs.

While reviewing the current transportation safety program of the Highway Research Board, I want to stress that these programs are not static. They are tuned to changing needs and conditions. It is important to keep our focus on the future. At the same time, it can help our perspective to take an occasional fast glance over the shoulder to see just where we have been. This also serves to link up the past, present, and future.

The Highway Research Board traces its origin back to the 1920's, when other events affecting our national concern for highway safety were also occurring. A few years earlier, the Federal-Aid Road Act of 1916 was enacted by Congress. The Act made available federal aid for highways provided that the funding was matched by the states and was administered by state highway departments.

The United States entered the 1920's with a little over 9 million automobiles and trucks registered. By 1924, nearly 20 million vehicles were registered in the country. During the same year, more than 20,000 people were killed in automobile accidents. In 1925, gasoline tax laws were introduced that made it possible to estimate motor vehicle mileage. The 1925 traffic death rate was computed at 17.9 deaths per each 100 million miles of automobile travel.

It was during the early and middle 1920's that traffic accidents began to create widespread concern. Even these early years revealed the roots of our present-day traffic problem—inadequacies and deficiencies in roads, vehicles, and drivers.

The transition from horses to horsepower presented many problems. The main problem was to determine how to match highway design with performance requirements to make the roadways safer and more adequate for the vehicles and the users. Early research was scattered and isolated.

Out of this situation grew a concept for a coordinated national highway research program. The concept resulted in the organization of the Advisory Board on Highway Research in 1920 within the Division of Engineering of the National Research Council of the National Academy of Sciences. Four years later, the name was changed to the Highway Research Board.

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The original concept of the Board encompassed research of the vehicle, the road, the road user, and their environment, together with their interrelationships. The basic mission has not changed; only the mechanics have changed to keep up with advancing technology in research and communications.

With the continuing rise in automobile registrations, travel, and accidents during the early 1920's, a number of organizations proposed that a national conference on highway safety be held. Secretary of Commerce Herbert Hoover called the first such conference in 1924. A second National Conference on Street and Highway Safety was held in 1926.

The history of any program to cope with a serious national problem normally unfolds according to a general pattern. During the early approaches to the problem, there is a great deal of searching and groping for solutions. These initial approaches to a problem are nearly always based on trial and error.

Gradually, different experimental efforts are applied to the problem. Through an exchange of information and a sharing of experiences, common practices and procedures begin to take shape. As this process continues, a body of basic principles and methods eventually emerges. The history of traffic safety efforts in the United States is no exception to this general pattern.

It would require considerable time and space to trace all of the developments that have influenced the Board's present-day transportation safety program. As early as 1930, a Traffic Department, one of six created in that year, was primarily concerned with traffic analysis, regulations, and safety. In 1943, the Department of Traffic and Operations absorbed the former Department of Traffic and resulted in an expanded highway safety program.

The year 1945 saw the inauguration of the Highway Research Correlation Service to collect information on past, present, and proposed research works related to highway transportation and to disseminate information about these projects. The National Cooperative Highway Research Program was created in 1962 as a means for accelerating research into acute nationwide problem areas affecting highway planning, design, construction, operation, and maintenance.

These developments have been briefly mentioned only to provide a historical backdrop for a discussion of current transportation safety programs. The Board's safety activities today are largely centered in Division A, Regular Technical Activities. At the same time, Division D, NCHRP, also directs research attention to many problem areas in the field of traffic operations and safety. Division B, Special Technical Activities, also contributes to the Board's overall safety program through its work in the development of information transfer systems.

The major transportation safety activities of the Board are conducted through a network of technical committees composed of officials from all levels of government, college and university faculty members, researchers, engineers, scientists, professionals representing all disciplines related to transportation, and private citizens. To illustrate, technical committees dealing with operational safety matters cover a wide range of activities, including traffic law enforcement, motor vehicle registration, driver education, traffic control devices, visibility, pedestrians, motorist information systems, traffic records, motorist services, road-user characteristics, and transportation of hazardous materials. Still other technical committees are concerned with communications, highway-railroad grade crossings, freeway operations, operational effects of geometrics, and traffic flow theory. There are many others; these are listed only to illustrate the range of technical activities.

A review of a few recent and planned programs will best illustrate the scope of transportation safety activities:

Institute on Motor Vehicle and Traffic Law

The 1972 Institute was sponsored jointly by the Committee on Motor Vehicle and Traffic Law of the HRB and the Legal Affairs Committee of the American Association of Motor Vehicle Administrators. One of the sessions was devoted to Drug and Alcohol Abuse in Relation to Motor Vehicle Operations. The session was planned and conducted to seek insight and perspective in dealing with motor vehicle operation and the legal implications of alcohol and drug abuse relating to such use.

Fourth National Conference on Railroad-Highway Grade Crossing Safety

During the summer of 1972, more than 250 interested professionals gathered at Ohio State University to attend the Fourth National Conference on Railroad-Highway Grade Crossing Safety sponsored by the U.S. Department of Transportation, the National Safety Council, and the Highway Research Board. Among topics covered at the conference were passive protective devices such as new types of signs, active (train-activated) system developments, legal and labor aspects of crossing programs, maintenance programs for devices, urban railroad problems, and program implementation for improvements.

Attention was focused on a number of research needs to foster a clearer understanding of the problems and to develop cost-effective solutions to them. Conference delegates agreed that the search for safer crossing protective systems must be pursued because the elimination of crossings by physical separation will probably never be affordable and also because the loss of 1,500 lives per year cannot be accepted on a continuing basis when we know that the toll can be reduced.

Human Factors Workshop in Highway Transportation

The Sixth Annual Human Factors Workshop in Highway Transportation was held in conjunction with the 1973 Annual Meeting of HRB. It was again sponsored by the Board's Committees on Motorist Information Systems and Road User Characteristics.

The workshops are intended for the users of human factors research and information, researchers engaged in studies of human factors aspects of motor vehicle design and operation and of highway design and safety, and practitioners involved in the design and operation of the highway transportation system.

The 1972 Workshop included sessions on the role of driving simulation in improving highway operation, the role of vision in driving, driver communication requirements, driver performance prediction, and driver performance at the freeway interchange. The 1973 Workshop featured sessions on diagrammatic signs, multidisciplinary accident investigation, driver education, research methodology, and traffic safety program evaluation.

Meeting on Measuring Vehicle Characteristics

The 1972 mid-year meeting of the Board's Vehicle Characteristics Committee was devoted to "Measuring Vehicle Characteristics." The program included field visits to the Arizona Proving Grounds of the Ford Motor Company and General Motors Corporation for demonstrations of traction testing, vehicle handling, and dry- and wet-surface braking, along with demonstration of emission control work. A visit to the Dynamic Science test facilities also provided an opportunity for technical discussions of such topics as "Experimental Safety Vehicle Program—Past and Future," "Accident Avoidance Test-

ing of EXV," "Vehicle Side Crashworthiness Problem," and "Vehicle Rear-End Crashworthiness Problem."

The 1971 mid-year meeting of this committee was devoted to the "Tire-Road Surface Interface" and the problems related to skidding on wet pavements. Mid-year meetings of technical committees, usually held during the summer months, provide an opportunity to schedule activities in different sections of the country, thus stimulating participation by the entire membership.

Workshop on Highway Visibility

During 1972 a timely Workshop on Highway Visibility was conducted by the Board's Committee on Visibility. The workshop was planned to focus attention on several critical areas of visibility as related to highway traffic operations. State-of-the-art papers were presented on such subjects as visual tests for driver licensing, vehicular lighting systems for two-lane rural highways, visibility factors in roadway signing, and warrants for fixed roadway lighting.

Conference on Changeable-Message Concept of Traffic Control

One significant development in the area of traffic control has been the application of changeable-message signs to alert motorists to hazardous conditions, changes in traffic routing, and other pertinent information such as speed limits and weather conditions. During 1971, the Committee on Traffic Control Devices sponsored a national conference on the changeable-message concept of traffic control. The program attracted representatives of governmental agencies, manufacturers, research groups, and universities to review and discuss successful applications of changeable-message signs as well as problems requiring further study and research. The proceedings of the conference have since been published in a Special Report that is considered to be a landmark in the field.

In addition to these workshops and conferences, there are many ongoing programs of equal significance. Among the conference sessions held during the 1973 Annual Meeting of HRB are two of special interest. The Traffic Records Committee cosponsored a session on multidisciplinary accident investigations. The Committee on Road User Characteristics also sponsored a special conference session on the future role of driver licensing in highway safety.

For several years, the activities of the Board's Pedestrian Committee have been expanding into urgent problem areas. Inasmuch as the interface between the various modes of transportation is, and will continue to be, on foot, matters pertaining to pedestrian circulation and control will have important safety implications. During the past year, this committee has also been asked to investigate the safety problems associated with ever-increasing use of bicycles in urban areas.

One final program reference will serve to illustrate the wide range of the Board's transportation safety program. Recently, a special Task Force on Mass Transit Safety Standards was appointed. This project is being conducted under a contract with the Urban Mass Transit Administration. The first undertaking of this task force will be to develop a synthesis or state-of-the-art report on safety standards as they relate to mass transit—bus, rail, and new systems.

The programs described here are not intended to be inclusive but have been selected to illustrate the broad scope of the Board's interest and the wide range of program efforts in the field of transportation safety. The search for new

knowledge to better understand the accident problem and for more effective countermeasures to improve transportation safety is a never-ending search.

In 1886, Justice Oliver Wendell Holmes of the United States Supreme Court stated in a memorable lecture that "to be master of any branch of knowledge, you must master those which lie next to it." This statement is as true today as it was in the last century. To understand, and in turn to master, any single element or part of the transportation accident problem, we must first understand the entire transportation system and the interrelationships between and among all elements of the system.

Complete mastery may never be possible. From all indications, however, future operational safety programs will be strengthened through greater input from action-oriented research.

Vandalism, Crime Hamper Public Transit; Recent Report Outlines Potential Cures

Vandals and criminals on public transit systems have for some time given both transit operators and the riding public much to worry about. A $230,000 study sponsored by two prominent transit operators' organizations and funded chiefly by the Urban Mass Transportation Administration (UMTA) has resulted in a report on the subject. The report, while giving some eyebrow-raising statistics and citing some dismaying examples, finds that the crime and vandalism situation on public transit, although admittedly deplorable, looks worse than it actually is. Moreover, in a nationwide survey, the investigators found some encouraging examples of transit systems' being able at least to alleviate the problems, if not entirely to solve them. In addition, new research is uncovering some vandal-resistant materials and vandalism-reducing social and educational techniques.

In the fall of 1970, the Urban Mass Transportation Administrator, Carlos C. Villarreal, wrote to both the American Transit Association and the Institute for Rapid Transit, suggesting that a study be undertaken concerning the cost and forms of vandalism and the problems attendant with passenger harassment.

Both the American Transit Association and the Institute for Rapid Transit had committees that were independently considering the problems of vandalism and passenger security. The two associations formed a joint Vandalism and Passenger Security Committee and through the American Transit Association submitted a proposal to UMTA that had the following purposes:

- To ascertain and categorize the scope, severity, dollar costs, and characteristics of the vandalism and passenger security problem.
- To summarize and evaluate types of anti-vandalism and passenger security campaigns, procedures, techniques, and devices.
- To summarize the types and nature of vandal-resistant transit vehicle equipment and materials.

This article is based on a paper presented at the 52nd Annual Meeting of the Highway Research Board by J. Schnell and A. J. Smith. The full paper is scheduled to be published by HRB later in the year.