This science is not finite yet, but it has many possibilities. Tabler hopes to make further investigations along these lines with the help of a closed-circuit television system that will allow the current conditions from Laramie to be monitored. Visual monitoring of weather and the telemetry of other pertinent data from other recording instruments may prove to be some of the biggest breakthroughs in the history of highway maintenance.

Such a system may be quite a few years away, but with increased knowledge about a given section of highway and the weather conditions that generally prevail, more data and an advanced state of the art may permit prognostication beyond wildest expectations.

HUNDRED EXPERTS FILL FIVE SESSIONS AT BOARD'S HUMAN FACTORS WORKSHOP

Henry M. Parsons*

The Fifth Annual Human Factors Workshop in Highway Transportation was held January 16 in Washington, D.C., at the 51st Annual Meeting of the Highway Research Board.

Attesting to the relatively flourishing state of human factors in highway transportation, more than 100 persons currently or formerly doing research in this field attended. Organized by J. E. Uhlaner with the support of Slade Hulbert, former chairman of the HRB Committee on Road User Characteristics, the early workshops were somewhat informal but are now sponsored annually by HRB with enthusiastic backing from William N. Carey, Jr., HRB Executive Director, and Harold L. Michael, chairman of the HRB Group 3 Council.

This year five concurrent all-day sessions were arranged by A. James McKnight, workshop chairman. Their highlights illustrate the scope and variety of human factors interests in highway systems.

Led by Albert Burg, the session on "The Role of Vision in Driving" discussed the following themes:

- Visual functions required by the driving task—how these can be determined, measured, and modified through training and experience; concepts of face validity and the "design driver"; and compensation for visual deficiences.
- Existing vision screening of driving-license applicants, nonuniformity among the states, and lack of data to support the cutoff scores.
- Use of eye-movement recording techniques in research.
- Rear-vision requirements in relation to vehicle design and current and proposed standards.

Among recent developments have been a System Development Corporation study of visual requirements by Robert L. Henderson, a combination vision

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screening and knowledge testing device in Michigan, an Ohio State University technique for recording a driver's eye movements, and a prototype periscope device for rear vision.

Recommended were:

- More information on the role of vision, more research to get the information, and wider dissemination of available information;
- Vision screening not so much to remove drivers from the road as to identify those with visual problems and to encourage them to get treatment or remedial training or to learn how to compensate;
- More use of restricted licensing; and
- More research on rear vision, including "visual noise" in wider fields of vision.

"Driver Communication Requirements," the theme of the session chaired by Robert K. Safford, has usually had three emphases: communication to the following car (only) in car-following situations; advisory information about traffic conditions ahead; and new electronic systems for route guidance. This year the last of these was missing, as was any systematic discussion of inter-driver communication in the context of vehicular traffic as a social situation. John N. Snider described studies indicating that percentage of change in headway (distance between two cars) was the critical factor in a motorist's car-following behavior; eight percent on the average will lead him to discriminate a change. According to Gregory E. Austin, a road condition advisory system for some of the Los Angeles freeways may be installed soon. Road-embedded antennas would transmit low-power radio messages to vehicles from a computer. Sources of data could be helicopters and police cars equipped with Sylvania "digicom" data link terminals now being tried out in Oakland, California. Other topics included:

- A suggestion by Catherine Owen to increase signaling between automobiles, with marine methods as one model;
- Vehicle designs that increasingly isolate the driver so he cannot hear horns, sirens, and train whistles;
- Problems of emergency call systems, such as voice versus digital options and inaccurate or facetious inputs from the general public;
- Marking of vehicles driven by alcoholics;
- A current investigation (according to Robert M. Nicholson) of displaying a driver's license on the windshield; and
- The question of whether indicators to change lanes or leave the freeway during heavy traffic should be optional or mandatory.

The session on "Driver Performance Prediction" had two parts, off-road methods of prediction and on-road methods, with John W. Eberhard and Ray C. Peck as chairmen. Participants tried to identify all the operator variables to measure in an off-road test according to (a) how closely they were related to accidents and (b) how reliably human performance could be related to each variable. But the attempt failed because of disagreement as to what variables were being discussed. John A. Whittenburg, in charge of a driving survey of U. S. Coast Guard personnel for the American University's Development Education and Training Research Institute, said intermediate performance criteria should be developed for diagnosing driving performance deficiencies. It was brought out that an American Institutes for Research study has shown parallel parking to be a good predictor of driving performance. A 1971 study report by David M. Harrington for the California Department of Motor Vehicles has indicated that "citizenship grade" in school (rating of work habits, cooperation, and classroom behavior) correlated positively with safe driving among 16 and

17 year olds. Donald Pelz described a device that he said measures a person's danger or apprehension level while he views a motion picture of emergency driving situations; it may be able to identify individuals with a greater likelihood of accident involvement. Leon G. Goldstein urged looking at accident data by class of driver and digging out information buried in the data—such as the fact that young drivers are involved in a disproportionate number of single-vehicle accidents. In summarizing accident data from 14,000 North Carolina automobiles, Patricia F. Waller disclosed that drivers under 16 were 100 times more likely to have an accident if the passenger in the front seat was under 21. She suggested that licensing might have a lower minimum age for adult-accompanied drivers and a number of levels, such as novice, intermediate, veteran, and master. Further discussion of driver licensing centered around matters such as (a) how difficult and time-consuming should examinations be; (b) the need to identify drivers with potentially unsafe physical and behavioral deficiencies; and (c) the need to furnish to such drivers means for overcoming their deficiencies, e.g., by referral to an ophthalmologist or by providing driver improvement training. Several participants felt that licensing should aim at warning of risk and require remediation rather than elimination from driving. Perhaps the nature and feasibility of remediation will be systematically examined in a future workshop.

"Driver Performance at the Freeway Interchange," a session led by James I. Taylor, drew attention to a number of investigators and their projects. Hugh W. McGee has directly observed erratic maneuvers and used roadside driver interviews to study the area, and Robert W. Felsburg has employed films to measure the point of entry in the deceleration lane and radar to measure exiting speeds. Diagrammatic signs have been investigated by Fred R. Hanscom with films of erratic maneuvers; by Gretchen E. Kolsrud with tapes and switches to measure placement speeds and lane changes; by Truman Mast with in-vehicle sign simulation by a rear-seat projector showing signs on a windshield screen; and by Arthur W. Roberts with both television and direct observation of erratic maneuvers. With laboratory apparatus, Terence B. Jackson has found that male drivers prefer route numbers and names first on signs, whereas female drivers prefer place names first. Robert S. Hostetter suggested that the technique of observing erratic maneuvers may produce misleading results. Through interviews, Hugh McGee's project found three sets of causes for erratic maneuvers in freeway interchanges: information factors, e.g., inadequate advance information; geometric factors, e.g., inadequate view of the exit area; and "human factors," e.g., inattentiveness. John W. Hutchinson noted the difference among drivers in reacting to interview questions, including the relative unreliability of aggressive drivers. Design problems in satisfying driver information requirements were discussed by Gerson J. Alexander, Paul Fowler, Ronald C. Pfefer, George E. Frangos, and others already mentioned, with the conclusion that not all information needs of motorists are known and the considerable knowledge now available is being insufficiently exploited.

A state-of-the-art review was given by Moses Aronson and Eugene Gilland in the session on "The Role of Driving Simulators in Improving Highway Operations," chaired by Burton W. Stephens. Improvements in television resolution and techniques for presenting depth of view have progressed steadily, but color fidelity has made less progress; computer-generated imagery has some TV's terrain resolution problems but profits from eliminating many servocontrol difficulties. In describing an American Institutes for Research study of standards for training simulators, driving ranges, and instrumented test vehicles, Robert W. Horner questioned the value of fixed-base, preprogrammed devices for teaching any but the simplest procedures. Mark Kirkpatrick described how North American-Rockwell Corporation was studying methodology for objectively

comparing ways of presenting routing and directional control information. According to Harold E. Kerber and Eugene E. Pazera, earlier investigation of engineering fidelity and performance validity has contra-indicated using simulator results for absolute (but not relative) estimates of driver performance. In other discussion it appeared that a variety of simple part-task and several relatively high-fidelity simulators, complementing field and analytic studies, have contributed to policy decisions and regulations concerning road signing and vehicle design. Current work encompasses licensing, training, and regulating commercial and professional drivers. But the outlook for large investments in new facilities in the near future seems bleak despite high potential payoff. Current facilities are more likely to be upgraded and aerospace facilities modified so they can handle the many unique problems and severe requirements for visual fidelity in driving simulators.

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