REPORT OF SUBCOMMITTEE A RELATIONSHIP OF VEHICLE DYNAMICS TO SKIDDING

K. A. STONEX, GENERAL MOTORS PROVING GROUNDS, CHAIRMAN
R. A. GOEPFRICH, BENDIX AVIATION CORPORATION
D. W. LOUTZENHEISER, BUREAU OF PUBLIC ROADS, U.S. DEPT. OF COMMERCE
W. A. MCCONNELL, FORD MOTOR COMPANY
W. F. SHERMAN, AUTOMOBILE MANUFACTURERS ASSOCIATION
A. F. STAMM, CHRYSLER CORPORATION
RALPH K. SUPER, ROCKWELL SPRING AND AXLE COMPANY

I. INVENTORY OF WHAT WE KNOW

A. Brake Development

The fundamentals of brake systems are treated comprehensively and clearly in the paper "Fundamentals of Braking - Heat Capacity and Control," by J. George Oetzel. This paper lists the primary problems confronting the brake development engineer, and the paper and the appendices cover a great deal of engineering data on the braking problem and braking systems.

Included as a part of this report is an extensive bibliography on the general subject of vehicle braking which has been prepared by the Subcommittee.

The student of the literature is well aware of the numerous problems which still confront the brake engineer in spite of the vast research over more than 50 years. While many problems still remain, it is to be noted that with proper maintenance the performance of modern braking systems on automotive vehicles is reliable and predictable.

B. Theory of Car Control and Stability

During the past five years, an extensive research project at the Cornell Aeronautical Laboratories * has resulted in a partial understanding, at least, of control and stability problems of the automobile. In essence, in the earliest stages, this work adapted the analysis of aircraft stability and control to the automotive problems, developed a tentative theory. and evaluated this theory by careful experimentation. Mr. Jarman summarized a part of this work in his paper. Progress is still continuing in this area.

Dr. Zuk contributed an application of dynamic theory to the treatment of certain perturbations.

C. Tire-Brake Behavior

Many of the problems of vehicle dynamics related to the skidding problem are associated with tire brake behavior. For this reason, many aspects of tire behavior related to the dynamics of the tire-road system are studied by automotive engineers so that the dynamics of the vehicle may be understood better. The paper by Mr. McConnell presented at this Conference, "Traction and Braking Characteristics of Vehicles, "includes such data; significant is the demonstration that the static friction between the tires and the road surface is never reestablished on a rolling tire. From this, he concludes that the maximum benefit which can be derived from an anti-skid device is to regain most of the frictional reaction which is lost at high skidding speeds. Lister and Kemp, in their paper also presented at this Conference, "Experiments with a Device to Prevent Wheel Locking During Braking," give a very interesting study of experiments with such a device. The bibliographies of these papers, particularly McConnell's, include the significant references in this field.

*Research in Automobile Stability and Control and in Tire Performance. Five papers by W. F. Milliken and D. W. Whitcomb; Leonard Segel; W. Close and C. L. Muzzey; A. G. Fonda; D. W. Whitcomb and W. F. Milliken. Presented at a General Meeting of the Automobile Division, the Institution of Mechanical Engineers. in London, November 13, 1956.