

Review of Laboratory and Field Methods of Measuring Road Surface Friction

Report of Subcommittee E to the First International Skid Prevention Conference
Charlottesville, Virginia, September 8-12, 1958

● THIS CONSTITUTES the final report of Subcommittee E, Review of Laboratory and Field Methods of Measuring Road Surface Friction. The report is a result of the deliberations of the subcommittee prior to, during, and subsequent to the Conference. It was hoped originally that a subcommittee report could be compiled to represent an international viewpoint but since it was not practical for the European representative to attend the meetings of the subcommittee it was decided that the report could only refer specifically to the American situation. Mr. Giles, Head, Surface Characteristics Section, British Road Research Laboratory, is a member of Subcommittee E and was most helpful in the subcommittee activities prior to and during the Conference, but was unable to attend the subsequent session during which the ideas behind the present report were discussed.

The report is divided into five major sections in conformance with the following objectives of the conference:

1. To exchange available information within each of the individual fields and between these fields relevant to the problem of adequate traction.
2. To inventory existing knowledge of the subject.
3. To inventory existing deficiencies in present knowledge and practices.
4. To develop a comprehensive program of research.
5. To demonstrate and correlate test results of existing equipment and methods for measuring skid resistance, and initiate a program to develop standard testing procedures.

COMMENTS ON THE EXCHANGE OF INFORMATION AND INVENTORY OF EXISTING KNOWLEDGE

It was the subcommittee's responsibility to organize that portion of the Conference program relating to a review of laboratory and field methods of measuring skidding. The program was comprised of 17 papers, six of which were authored by Europeans. It is these papers that constitute the fulfillment of Objectives 1 and 2 of the Conference, and therefore, the contents of this report are concerned principally with Objectives 3, 4, and 5.

INVENTORY OF EXISTING DEFICIENCIES IN PRESENT KNOWLEDGE AND PRACTICES

In addition to the developing of a Conference program summarizing current information on methods of measuring road surface friction, one of the major aspirations of Subcommittee E was to encourage research in the area of laboratory and field testing. To encourage further research and channel it into the most fruitful areas, a list of some of the needed research is given below. It might be noted that most of the specific recommendations are concerned with field testing. This is so because field testing is far more advanced technically than laboratory testing and the problems more apparent. The subcommittee recognizes the excellent pioneer work that some organizations are doing in developing laboratory methods of evaluating pavement surfaces and materials. Laboratory tests are, however, only in the exploratory stage and the exact direction that the research should take is less clear.

The subcommittee would like to call attention to some of the areas needing further work. It is recommended:

1. That a survey or surveys be made in this country and abroad on:
 - a. The design characteristics of existing field friction measuring machines.

- b. The instrumentation used on the various field machines.
 - c. The calibration procedures used on the various field machines.
 - d. The methods suitable for measuring the dynamic normal forces active on the measuring wheel(s) of the various machines.
2. That basic research be undertaken on the phenomena during skidding at the interface of the tire, water film, and pavement.
 3. That information be developed on the most suitable method and rate of application of water during field testing, and further that a universal expression of waterfilm thickness or rate of application be developed.
 4. That the effect of temperature of tire, surface, and water on the coefficient of friction be determined.
 5. That work on the laboratory methods of test be extended and especially the correlation of laboratory and field results.

DEVELOPMENT OF A COMPREHENSIVE PROGRAM OF RESEARCH

Subcommittee E feels very strongly that the work begun by the subcommittee should be continued by the formation of a group within some continuing and permanent organization such as the Highway Research Board. Unless this is done some of the interest generated by the subcommittee activities will be lost. The subcommittee is especially anxious that some continuing body encourage and coordinate research work on existing deficiencies of present testing methods. It is the committee's belief that only through the efforts of some continuing group can a dynamic approach to the solution of the testing phase of the slipperiness problem be expected.

The subcommittee was successful in interesting some of its own members in working on certain phases of the deficiencies listed above. It is possible that some of the agencies represented on the subcommittee will be working on each of the items above, depending upon how expeditiously the research can be worked into the programs of the various agencies. ¹ This by no means should be thought to indicate that work by others should not be encouraged for the problems are complex and will need the combined efforts of many research agencies. It is hoped that others can be encouraged to participate in working on the needed research.

CORRELATION STUDY

Another activity in which Subcommittee E participated in an advisory capacity was the correlation study of various field methods of measuring road surface friction. The purpose of this study was to permit a comparison of several test methods currently in use in this country. Measurements were made prior to the conference on pavements exhibiting a wide range of road slipperiness conditions. Since this study is being reported separately it is mentioned here only to record the compliance of Subcommittee E in meeting the first part of Objective 5 of the Conference.

THE INITIATION OF A PROGRAM TO DEVELOP STANDARD TESTING PROCEDURES

It is important to point out again that the thoughts expressed by the subcommittee on standardization were being directed to the American scene and apply only to American conditions.

The standardization question was considered to have two facets: (1) the need for an

¹The following agencies represented on the subcommittee have expressed a desire to work on some phase of the needed research:

1. Tennessee Highway Research Program;
2. NACA, Langley Aeronautical Laboratory;
3. Virginia Council of Highway Investigation and Research;
4. Joint Highway Research Project, Purdue University; and
5. Cornell Aeronautical Laboratory, Inc.

immediate standard of reference, and (2) a permanent standard of reference. The thoughts of the subcommittee on these two facets are related below:

An Interim Standard. It was the belief of the subcommittee that the practical matter of providing pavements with adequate skid resistance could best be served by establishing a single standard of reference. Such a standard of reference must be capable of fulfilling the immediate need of the various highway agencies and it was thought imperative, therefore, that the interim standard be applicable almost immediately. After considerable discussion, it was decided that the stopping distance method would be the most expedient interim standard throughout the country. The subcommittee, therefore, would like to specifically recommend that the stopping distance method be adopted for this purpose. It should be emphasized that while the stopping distance method is being recommended as the standard of reference, any method in which an agency has confidence could be used by them for evaluating pavements and materials. The important point is that the results from a particular device be related to a stopping distance method and that any pavement standards that are to be established be expressed in terms of the stopping distance method.

The subcommittee would also like to point out that additional thought will have to be given to: (1) the instrumentation of the standard stopping distance method, (2) the selection of a standard tire and (3) the procedural aspects of conducting the tests. Those who take up and continue the work of Subcommittee E could handle this matter, but the subcommittee would like to emphasize that the need for these items is immediate and hopes that decisions regarding these items can be made prior to the summer of 1959.

The subcommittee felt that selection of an interim standard was based on practical considerations and that further work should be done in carefully selecting an eventual standard field testing method. Further, it is believed that ASTM and AASHO are the appropriate agencies for handling this matter but it is not known if committees of these organizations are presently available to carry out this work. Subcommittee E suggests, therefore, that the formation of such a subcommittee be discussed with the officials of ASTM and AASHO.

While the subcommittee did not believe themselves to be in a position to make recommendations about the specific details of a permanent standard test they did arrive at certain general recommendations. It was the belief of the group that the standard method should:

1. Measure the sliding coefficient since that condition is the one most frequently met in skidding accidents. The subcommittee would like to point out, however, that other coefficients, the sideway force and incipient, are valuable indices of slipperiness under other conditions.
2. Utilize realistic passenger car loadings and tire pressures.
3. Be capable of being reliably used over the speed range normally employed by passenger vehicles.
4. Be capable of reliably measuring any portion of a road surface. It should be capable of measuring the friction at any point laterally across the road, on grades, curves, and over fairly short sections of pavement.
5. Be usable in all types of traffic without hazard to anyone.
6. Provide a continuous and permanent record of the force measurements (and indirectly the coefficient) and the speed over the site being tested.
7. Be independent of operator variable.
8. Be designed so that weight shift vertically would not affect results significantly.
9. Utilize a standard tire that:
 - a. can be made available over a long period of time.
 - b. has a standard composition, carcass and tread design.

SUMMARY

In summary the subcommittee would like to reiterate the following recommendations:

1. That a group be formed within some permanent and continuing organization like

the Highway Research Board to perpetuate the work begun by Subcommittee E.

2. That the stopping distance method be used as an interim standard of reference and that decisions concerning instrumentation, standard tires, and procedures be made by an appropriate group prior to the summer of 1959.

3. That ASTM and AASHTO initiate the necessary steps to begin work on standardizing a field testing machine, and further, that the recommendations of Subcommittee E as to the general nature of the testing machine be considered in their deliberations.

SUBCOMMITTEE E MEMBERSHIP

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