SYMPOSIUM ON SURFACE AND SUBSURFACE RECONNAISSANCE

INTRODUCTION

By G. W. McAlpin[1] and L. E. Gregg[2]

Reconnaissance, by one definition, is an examination of some object, region, or operation with regard to its natural features. In the reconnaissance of earth deposits at the surface and below, the soils and related materials are not only the objects being examined for natural features, but also they are natural features of the area in which the examination is being made. This fundamental relationship is the basis for three of the four general approaches to surface and subsurface reconnaissance, and it is an influencing factor in the interpretation of results from the fourth.

Knowledge of soils as engineering materials has developed mainly through attempts to classify and describe the physical characteristics of the material, determine its behavior under different circumstances, and provide scientific bases for treating it as an integral part of an engineering structure. In the course of this development interest was centered on physical characteristics and the mechanics involved to the extent that occurrence or soil development was practically ignored. When the interrelationship between soil occurrence and general soil properties was recognized, a great deal of interest shifted to the development of methods by which the soil-forming processes could be identified and the subsurface conditions most adequately and economically described.

Traditionally, subsurface conditions had been estimated solely on the basis of bore holes to a desired depth and on tests on samples extracted from the borings. This limited the direct information to the specific locations at which the borings were made. Correlations among borings formed the basis for estimating continuity of strata or similarity of subsurface conditions throughout the area of interest—provided the borings were close enough or numerous enough to avoid haphazard inference. However, when the concepts of soil formation were introduced, the inferences became a system of data supported by the evidence of natural phenomena, and the information obtained from the borings could be projected over a broader expanse with reasonable confidence.

To establish this viewpoint in the evaluation of soils as engineering materials, methods of long standing in surveys for other purposes were adopted in toto or in modified form. Both the geologic and pedologic approaches to reconnaissance are founded on procedures that were developed over a period of at least 40 years. The first, as the name implies, makes use of the geologic interpretation of land forms and under-

[1] Director, Bureau of Soil Mechanics, New York Dept. of Public Works, Albany, N. Y.
[2] Assistant Director of Research, Kentucky Dept. of Highways, Lexington, Ky.

lying deposits. From a geologic standpoint, the object is to reconstruct the sequence of events responsible for a formation or group of formations and to define the character of the deposits in a general way. With few exceptions, the soils have not been considered of primary importance to the geologic objective, and in most of the past surveying they were seldom included in literature or maps comprising the geologic interpretation. However, the events responsible for the formations of interest to the geologist were responsible for the soils, hence logically soil properties may be inferred from a set of geologic data.

In a similar way, pedologic interpretations defined general soil properties regardless of the standpoint from which the soil was viewed. Simply stated, the pedologic concept of soil science is based on the premise that similar soils develop from similar parent materials under similar environmental conditions. The influences of each environmental factor and even slight differences in soil profiles produced by these various influences have been emphasized to the point of almost infinite differentiation or classification of soils. However, the grouping is such that there are various levels of differentiation which can be selected in accordance with the detail that is practicable for a given use.

Airphoto interpretation, which is of fairly recent origin, is another approach to reconnaissance based upon the fundamental relationships involved in soils as natural features of land forms. The technique within itself does not constitute a distinct science; rather, it provides a distinctive means for observing land surface conditions in such a way that subsurface conditions can be inferred when the observations are interpreted in the light of the same scientific facts that apply to the geologic and pedologic approaches. All three make use of the same scientific facts, but the possibilities for observation of broad areas and the numerous evidences recorded in aerial photographs that are beyond the scope of record in operations limited to the ground represent definite advantages in reconnaissance that were not available prior to the development of the airphoto technique.

Geophysical methods, which comprise the fourth approach to reconnaissance, imply the making and interpretation of specific measurements for physical properties exhibited by the earth deposits in place. The processes by which the earth materials developed are only incidental to this approach, since the physical measurements represent the deposits regardless of the sequence of events involved in their formation. Obviously, the knowledge of land forms and characteristic processes of their development can be utilized in analyzing the results of measurements and projecting data to points where measurements have not been made. Geophysical methods are generally divided into the resistivity and the seismic procedures, the first being dependent upon the variations in electrical conductivity as determined by the variable properties of the subsurface materials. In contrast, seismic determinations measure the elastic properties of materials in the profile and their separate abilities to transmit sound waves rather than electrical currents. Both procedures had considerable applications in other fields prior to their adaptation to engineering soil reconnaissance.

At the time Subcommittee R-1 on Surface and Subsurface Reconnaissance was established within ASTM Committee D-18, the need for defining certain aspects of reconnaissance procedures was recognized. Rapid development in this field had, in some instances, created

erroneous impressions of applicability. On the one hand, it was not known what degree of accuracy or depth beneath the surface lay within the scope of certain methods, and enthusiasm tended toward exaggerations. On the other hand, an air of mystery retarding the valid use of the methods was definitely in evidence. With those two factors in mind the subcommittee established as an immediate objective the definition of limitations as well as applications of the various approaches. This symposium, and the panel discussions utilized in the oral presentation, represent the first steps toward development of data by which this objective may be reached.