

# Methods of Making Material Surveys

OLIN W. MINTZER and ROBERT E. FROST

Research Engineers, Joint Highway Research Project, Purdue,  
(Synopsis of Paper Presented at Highway Research Board  
Meeting 18 Jan. 1952\*)

This paper reports on the activity of the authors for their part of a committee assignment under the chairmanship of Mr. Finney for Committee D-5, Highway Research Board. Our part of this study has been to show how airphotos and various non-engineering maps could be used to obtain information which would assist in material surveys. This was provided for in the general purpose of the committee assignment which was to bring up to date the various methods of conducting materials surveys and make them available to the engineering public.

In accomplishing this, four areas in southwestern Indiana were selected which were covered by airphotos, an agricultural soil map, a topography map, and a geology map. The four areas lie in Gibson and part of Posey counties within a few miles of each other. For each area, an independent survey was made using only the data which would be provided by the particular method when used alone. The methods used in this study are by no means new to the engineering profession. The use of agricultural soil maps for engineering soil survey has been presented before the Purdue Road School, Highway Research Board, and other organizations on previous occasions. Likewise, the importance of geology maps, topography maps, and airphotos for use in soil and material surveys is to be found in the literature. The use of maps and literature in obtaining engineering information is the subject of a graduate course in civil engineering at Purdue University.

Much of the literature on this subject is of the "it can be done" type and not the "how-to-do-it" type. Some basic principles have been set forth but procedures and techniques or "methodology" have not. With this in mind the secondary purpose of this study is to show step-by-step how these methods can be used and to

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\* See: Proceedings 31st Annual Meeting Highway Research Board, January 1952.

present a comparison of the results of the surveys for each example area studied by each method. The methods reported on require the materials prospector to learn a "new language"—to reorient his concepts of materials occurrence and location. The methods referred to are: (1) the use of aerial photographs; (2) the use of agricultural soil survey maps; (3) the use of geological maps; and (4) the use of topographic maps.

These methods cannot be used without previous study toward developing an understanding of the principles and techniques. Basically there are two approaches to the use of any or all of these four methods—(1) the use of prepared guide keys and (2) the application of the principles of the method itself. Research personnel can prepare keys for use by others. These keys must be translations of the data into engineering terminology. Proficiency of the key method depends on the key, its completeness and its clarity, as well as upon the user in being able to grasp the key significance. Considerable background study coupled with detailed sampling is needed in the approach based on application of the principles of the method itself. Ultimately, a key is not necessary as proficiency is gained. However, time and cost does not permit the use of the latter on a widespread basis for material surveys. Hence, the basic need is for the preparation of guide keys to permit efficient utilization of these four methods.

For this particular study guide keys were prepared. These were the result of literature survey in obtaining information concerning the natural setting of each situation for those methods involving the use of maps. For airphotos, a guide key was developed to fit the local situation from data obtained from the area itself and from the principles of photo interpretation as developed previously. In addition to the development of a guide key, data were translated into engineering terminology and expressed on maps using the Joint Highway Research Project symbolization which shows by types and arrangement of a few simple basic lines and dots such items as parent material, land form, drainage characteristics, and approximate textural ranges.

The report presents in detail, each method of analysis together with the original source map, a land form overlay, and the corresponding materials map. The various guide keys developed for each method are also shown in the report.

There are many advantages in studying the literature available in fields such as the studies made available by the physiographer, the geologist, the agricultural soil surveyor, the topographer, and the photo analyst. The chief advantage lies in the fact that the materials

prospector can screen the data and determine the high points of each source of information—those points which are the most significant to an understanding of the area under study.

From study of physiographic literature the type of land surface is determined such as, plain, plateau, mountain or basin. The relationship of the area with respect to the surrounding physiographic provinces is determined. The agents responsible for the development of the landscapes will be set forth.

The study of geologic literature reveals the history of an area—the origin of the area and the development processes contributing to its present form. Such items as relative age and type of materials in the major land units are determined. From the geology map and accompanying literature, the major parent materials, whether in place or transported by wind, water, ice, or gravity, will be determined and can be located accurately. In one sense, geology is the basis for all material surveys.

From the topography map the magnitude of the landscape is determined. The various land forms are represented together with their respective positions relative to the base level of erosion. The magnitude of the land forms is represented clearly. The topography map provides a record of the earth sculpturing which has taken place.

For a grouping of surface soils into parent materials the maps and the literature provided by the agricultural soil surveyor are used. Since the pedologic concept is followed in reports of this type, it is here where advance information concerning expected soil profile types and characteristics is obtained. The literature of this source presents information concerning not only the soil catenas of family groups, but information concerning the variations such as types and phases. Detailed description is concentrated on the developed profile—that which supports plant life.

The aerial photograph records the sum and total of all of the above. It is a pictorial representation of the area recording the major as well as the minor details. In addition to picturing the distribution and density of the natural cover and cultural features such items as macro-relief are clearly shown. These minute details are often grouped in an “all inclusive” symbol on other maps since expense precludes their being included in the representation of the area. The aerial photograph provides a basis of comparison—it is an impartial representation—not prepared through the eyes of another. Its successful use is limited to the interpreter alone. The air-photo can supplement where macro-detail is needed; it can supplant where no information is available.