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SELECTED ABSTRACTS ON ENGINEERING GEOLOGY AND RELATED SUBJECTS

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By Severine H. Britt

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CONTENTS

INTRODUCTION

The 126 abstracts of this report are a second selection from a much larger number of abstracts recently prepared for use within the Geological Survey. This selection, like the first one, published as Circular 75, is meant to represent material that is not generally brought to the attention of geologists directly and, for the most part, may not appear in English-language abstracts normally consulted by American geologists. Eighty-four of the abstracts deal with articles in foreign publications; 57 are originals, 59 are quoted or adapted from English-language abstracts, and 10 are based on foreign-language abstracts. Abstracts noted as "author's abstract" or "author's summary" are quoted verbatim. All others were prepared by the writer, David J. Varnes (D.V.), or Dorothy R. Hill (D.H.), or were modified by them from original abstracts. A few of the abstracts bear a notation that complete translations have been prepared. A limited number of these translations are available on request to the Geological Survey, Washington 25, D. C.

Abdun-Nur, E. A., and Wantland, D., 1950,

Electrical resistivity method applied to the investigation of construction materials deposits: American Society for Testing Materials, Proceedings, v. 50, p. 1364-1378; discussion, p. 1379-1382.

"The problem of investigating deposits of rock and gravel in the plains area (the Dakotas, Nebraska, Kansas, Oklahoma, and the eastern portions of Montana, Wyoming, and Colorado) is outlined. The electrical resistivity method as applied to the solution of this problem is discussed. Techniques and simplified apparatus are described. the usefulness of the resistivity method in supplementing and guiding drilling in the exploration of such deposits is demonstrated by examples of actual investigations, supplemented with cost data. It is concluded that, in deposits of similar materials, the electrical resistivity method provides an effective, quick, and economical means of determining depths, delineating the extent, and estimating the quantities of materials involved."—Author's summary.

Bradley, W. F., and Grim, R. E., 1951,

High temperature thermal effects of clay and related materials: American Mineralogist, v. 36, nos. 3-4, p. 182-201, 10 figs., bibl.

"A selected series of clay minerals and related silicates are examined by thermal, optical, and x-ray diffraction methods, with a view toward establishing the significance of the various observed thermal effects. The heating range for the thermal curves is extended to 1300°C, and the study of specimens so fired is supplemented by the examination of the various materials after firing to several intermediate temperatures. Detailed hypotheses are presented for the mechanisms of several of the structural changes observed as new phases are developed, and the influence of types of structures upon the nature and rapidity of such changes is discussed."—Authors' abs.

Building Research Station, 1950,

The weathering, preservation, and maintenance of natural stone masonry, Pt. 1: Department of Scientific and Industrial Research, Building Research Station, Digest 20, London.

This Digest contains a discussion of the factors that cause the various building stones to "weather" and the processes whereby they act, with emphasis on the value of washing limestone buildings regularly and the precautions that may be taken against the contamination of building stones by soluble salts.—Adapted from abs. 185, Bldg. Sci. Abs., 1951.

Pt. 2: Building Research Station, Digest 21, Aug. 1950.

The discussion of the agencies that affect the weathering of building stones and the maintenance of stone masonry is continued. Damage by frost, thermal expansion, corrosion of iron cramps and dowels, and by vegetation such as lichens, mosses, and ivy, is discussed; and methods are given for dealing with various kinds of stain on stone work. There are also notes on stone preservatives and paints, cleaning of stone work with steam or water sprays, re-dressing of old stone, plastic repairs, mortars, and rain penetration.—Adapted from abs. 186, Bldg. Sci. Abs., 1951.

De Beer, E. E., 1950,

Une méthode rapide pour la détermination de la teneur en eau des tas de sable et de gravier [A rapid method for determining the water content in heaps of sand and gravel]: Travaux publics de Belgique, no. 3, p. 457-464.

"In relation to the correct adjustment of the water-cement ratio for concrete mixes, a method is detailed for obtaining a reasonably accurate value of the water content in sand and gravel within half an hour after the sample is taken. This rapid method eliminates the usual 24-hour oven-drying procedure by utilizing the apparent loss in weight of the materials when immersed in water. Only two weighings are therefore needed, although care should be taken to ensure complete removal of all included air when the sample is immersed in water, and also that no solid particles are carried over with the scum when the water is poured off. The accuracy of the method depends on the skill of the operator and, for important concrete jobs, it is advisable to check periodically the figures against those obtained by the usual oven-drying method."—Abs. 1285, Bldg. Sci. Abs., 1950.

Dériberé, M., and Esmé, A., 1950,

La bentonite, les argiles colloïdales et leurs emplois [Bentonite, colloidal clays and their applications]: 3rd ed., 240 p., 59 figs., Paris, Dunod.

Bentonite has special properties, particularly that of swelling in contact with water, thus forming a voluminous and gelatinous mass. Many applications have been made of these properties. After giving general information on clayey materials, colloidal state, and bentonite deposits and their properties, the authors review the applications of bentonite to: ceramics; molding sand; purification and clarification of water; clarification of wines and liquors; plastic material and rubber industries; manufacture of paper, soaps and detergents, maintenance materials, and insecticides; research of hydrocarbons; and others.

Duke, C. M., 1949,

Engineering properties of coral reef materials: American Society for Testing Materials, Proceedings, v. 49, p. 964-976.

"The biological and geological aspects of coral reef formation are summarized briefly. The material of coral reefs is classified as (a) recently formed "coral," (b) older consolidated limestone, and (c) "cascajo," which includes lagoon sediments, talus, broken skeletal remnants of coral-building organisms, and the detritus of eroded reefs. The results of tests on cascajo from Guam, supported by experience, indicate that properly selected material may be stabilized for road-making purposes and is satisfactory as concrete aggregate. It has been found that the basic principles developed for design and construction with more usual materials apply to reef-derived materials. A bibliography is given on the origin and growth of coral reefs and on the properties of reef-derived materials."—Abs. 906, Road Abs., 1951.

Mielenz, R. C., Greene, K. T., and Schieltz, N. C., 1951,

Natural pozzolans for concrete: Economic Geology, v. 46, no. 3, p. 311-328, 8 figs., 2 tables, bibl.

"Many geologic formations in the United States yield pozzolans or materials which can be converted into pozzolans by grinding and calcination. When properly selected, processed, and used, pozzolans will reduce costs, improve quality of concrete, protect concrete against effects of reaction between aggregate and cement alkalies, and inhibit attack by aggressive waters. With improved knowledge of their properties and sources, use of pozzolans is increasing. The geologist and petrographer can aid materially in the search for and exploitation of deposits, and in selection of processing methods. Natural pozzolans owe their activity to five substances, namely: volcanic glass, opal, clays, zeolites, and hydrated aluminum oxides. Each active substance contributes characteristic properties to the pozzolan; consequently, the quality of proposed materials and need for special processing usually can be predicted from petrographic analyses. Geologic formations known to yield pozzolans are indicated, and data on 95 samples representative of tested formations are summarized. Properties and response to heat treatment of pozzolans of the various activity types are discussed."—Authors' abs.

United States Bureau of Reclamation, 1951,

Earth manual: Tentative ed., xxi + 322 p., 165 figs., June 1951; reprinted with revisions, Feb. 1952.

This manual on the use of earth materials for foundation and construction purposes covers the following subjects: (1) Earth materials in construction—use; basic soil components; identification, classification, and description of earth materials; engineering properties of earth materials. (2) Investigation of earth foundations—foundation requirements; investigational objectives; foundation reconnaissance; preliminary exploration; detailed explorations; exploration procedures. (3) Investigation and selection of earth construction material sources—general requirements; terrain characteristics of earth materials deposits; investigational stages. (4) Investigation of riprap and rockfill sources—riprap as a constructional material; investigation and exploration for sources. (5) Subsurface exploration—methods and equipment; undisturbed samples; disturbed samples. (6) Inspection; field laboratory facilities; reports. (7) Control of earth construction—embankment control for rolled earth dams; evaluation of performance of earth dams; control of other earth work. Appendix—sampling; classification; laboratory and field tests; instruments installations.

Woolf, D. O., 1951,

Methods for the determination of soft pieces in aggregates: Public Roads, v. 26, no. 7, p. 148-156.

"At the request of the American Society for Testing Materials, an examination of methods of determining the proportion of soft pieces in coarse aggregates was undertaken in 1941 by the U. S. Bureau of Public Roads (Physical Research Branch). A necessary preliminary was a review of the classification, nomenclature, and tests adopted in the various States; this showed wide variations in all three respects, but the tests were of two main types, based respectively on the examination of individual particles and on the effect of "soft" particles on the properties of the aggregate as a whole. In the investigation proper the test methods used were (1) visual inspection; (2) scratch hardness tests; (3) determination of specific gravity and water absorption; (4) impact tests; (5) abrasion tests; (6) static loading; and (7) soundness tests (freezing-and-thawing). Descriptions are given of the procedures adopted, including the several types of impact test and the development of a special compression test for use with soft aggregates. This compression test, the Los Angeles abrasion test, and the soundness (freezing-and-thawing) test were then applied to several commercially produced gravels; the tabulated results show that the indications given by the three methods show very poor agreement, and it is concluded that the three tests represent entirely different methods of assessing failure. In 1946 another series of tests was started, the aggregates being artificial mixtures of quartz gravel with known proportions of soft aggregate; standard gradings were used in each case. The proportions of soft material found by different types of scratch hardness, impact, compression, and abrasion test are tabulated in comparison with the actual composition of the mixture. The scratch hardness test carried out with a brass pencil was found to give results closest to the actual values, and this method, which is equally convenient for field and laboratory use, is recommended for general adoption. This test identifies soft pieces but does not distinquish other deleterious particles which may be present in an aggregate."—Abs. 905, Road Abs., 1951.

CONSTRUCTION WORKS

Armstrong, C. F., 1950,

Soil mechanics in road construction: 215 p., figs., glossary, bibl., London, Edward Arnold & Co.

This book comprises a general survey, including at fair length recent developments in Great Britain, and is an attempt to set down in concise form the most up-to-date knowledge on the subject of soil mechanics as applied to road construction. An endeavor has been made to cover every aspect about which a road engineer is likely to require information. After a description of the general behavior of soils and soil moisture, the author recalls the history of soil as a constructional material. He shows the development of various phases of soil mechanics and how its principles can be applied to road construction. A summary of soil problems is followed by a study of the following topics:

(1) Research made into the problem of soil mechanics in various countries and particularly in America and Great Britain.

(2) Method by which a soil survey is carried out for the purpose of road construction—construction of new roads, investigation of road failures, geophysical surveys, earth resistivity, seismic and other methods, and useful references concerning the requirements of a soil survey.

(3) Systems of particle size classification of soils.

(4) Testing of soils—identification tests, sedimentation analysis, compaction tests, field density measurements, field and laboratory tests for bearing capacity, stabilization tests, and routine testing.

A chapter each develops the following subjects: design of flexible pavements, foundation design, treatment of embankments and cuttings, subsoil drainage, and soil stabilization.

Banks, James A., 1952,

Problems in the design and construction of Knockendon Dam: Institution of Civil Engineers, Proceedings, v. 1, no. 4, p. 423-443, 14 figs.

"Two reservoirs in Scotland, Knockendon and Muirhead, were under construction concurrently in the same locality. Both dams were designed for the same maximum height, 90 feet, and were to be earth embankments formed of boulder clay of similar characteristics. Knockendon dam, which forms the subject of this paper, was modified during construction in the light of experience gained at Muirhead, to which comparative reference is made. Before Muirhead dam was completed, movement of the earthwork occurred and remedial measures, which included limiting the height of the dam to 70 feet, had to be adopted; the modifications which it was possible to introduce at Knockendon at an earlier stage enabled Knockendon dam to be constructed to its full intended height of 90 feet. Particulars are given of the initial investigation at Knockendon which determined the modified design, and of a subsequent investigation to ensure that the anticipated strengths in the embankment were being maintained. Observations were taken of pore-water pressures in the boulder clay and an analysis is given of the probable stability of the embankment, based on these results. A salient factor in the relative stability of the two dams was that, whereas the rate of construction of Muirhead dam was greatly accelerated, the Knockendon dam was constructed slowly; and the reference is made in the paper to the possible effect on earth dam design of the rapid rate of construction achieved by the use of modern muck-shifting plant."—Author's synopsis.

Bazant, Z., and Zaruba, Quido A., 1949,

Stavba podzemní drahy ve Stockholm [Construction of Stockholm subway]: 21 p., 10 figs., bibl., Prague [Czecho-slovakian], Ceské vysoké uceni Tech.

The construction of the subway in Stockholm was started in 1945. It crosses very different geologic formations and consequently the methods of construction were varied: a tunnel was pierced in hard rocks; trenches dug in soft formations and lined; and walls set in the ground, braced by steel props and connected by a roof, with subsequent clearing of the cavity.—Based on abs. 51-1-681, Annales des ponts et chaussées, no. 1, 1951.

Bendel, L., 1950,

Die Felduntersuchungen im Strassenbau [Field investigations in road construction]: Strasse und Verkehr, v. 36, no. 6, p. 146-154, 9 tables, 13 figs, Solothurn.

Information is presented in tabular form on the field investigations that should be undertaken to find out the geological nature and physical properties of the soil. The tables cover the following subjects:

(1) Preliminary investigations—topographic, geologic, and hydrologic conditions; previous technical history of the foundation ground; construction of adjacent structures; climatology.

(2) Field investigations for road construction—mode and purpose of investigations relative to geology and hydrology; sampling; physical, biological, and chemical properties of the soil; physical and chemical properties of water.

(3) Engineering and geological field surveying—observations of natural exposures, morphology, paleontology, petrography, sedimentation, tectonics, hydrology, equipment for the engineering-geologic field survey, mode of investigations for the determination of the geologic structure of the foundation ground, pits, bore holes, pile driving, geophysical methods, and psychophysical working methods.

(4) Engineering-mineralogical investigations of rocks—general valuation of the quality of rocks used in road construction, characteristics, and valuation of the individual types of rocks.

(5) Determination of the physical properties of the soil in the field—compressibility, bearing capacity, frost action, range of grain sizes, capillarity, consistency, dynamic properties, and hydrology.

(6) Determination of the chemical properties of soils—hydrogen-ionic concentration, lime content, and humus content of the soil.

Bonnard, D., and Bonjour, J., 1950,

Résultats pratiques de l'examen préalable des sols de fondation des routes [Practical results from the preliminary examination of soils for road foundations]. Strasse und Verkehr, v. 36, no. 6, p. 155-161, 8 figs., Solothurn.

This report shows how to determine the geotechnical characteristics of soils for subgrades and foundations and how to calculate the foundation dimensions from these characteristics. Field and laboratory methods are considered, particularly those to determine the granulometric composition, permeability, water content, and bearing ratio of soils—these being the most useful and rapid methods. The interpretation of the results of the geotechnical study is outlined and illustrated by a few practical instances. The information presented is based on more than ten years' experience in work carried out by the Laboratoire Géotechnique de l'Ecole Polytechnique de l'Université de Lausanne, the Service des Routes de l'Etat de Vaud, and other Swiss organizations.

Bouvet, J., 1950,

Les terrassements du canal de Donzère-Mondragon [The earthwork of the Donzere-Mondragon Canal]: Annales de l'Institut technique du bâtiment et des travaux publics, Sols et fondations, no. 3, p. 75-82, 8 figs., Paris.

The harnessing of the falls of Donzere-Mondragon on the Rhone involves the construction of a diversion canal 28.8 km long (about 18 mi) and a power house capable of an annual output of about 2 billion kwhr. The construction of the canal, the cross section of which is slightly larger than that of the Suez Canal, involves 50 million cu m (about 65 million cu yd) of excavation, the major part of which will be carried out by electric floating dredgers, complete with belt conveyors, which enable the spoil to be deposited at once. The design and construction of the canal raises problems which encroach on soil mechanics.

(1) Watertightness of upper canal: The upper canal, which is dug in very porous alluvial soil (sand and gravel), will not allow of any waterproof lining. But, as the ground contains gravel beds without sand, and as a result of permeability tests carried out on the site, it seemed necessary to design a lining for the banks, consisting of excavated soil with which the walls of the canal could be fairly quickly sealed. In spite of this, however, one cannot count on achieving adequate watertightness from the beginning; it is therefore proposed that the upper canal be filled gradually; several months must elapse before the natural consolidation effected by the waters of the Rhone will allow of raising the water to the normal level.

(2) The drainage effect of the lower canal: The lower canal is cut deep into the plain and forms a very powerful drain, which is liable to lower the water table and harm agricultural production. To counteract this, a system of wells has been designed for restoring the level of the water table.

(3) Designing the profiles of dikes: As the spoil contains a large proportion of silt, the traditional profile of a dike in porous materials on porous soil (Kembs type) has been adapted to local conditions; a model profile for silt dikes will also be used.

(4) Depositing the soil of the lower canal: The cube size of the spoil to be deposited on the edge of the canal raises a difficult problem on account of the liquid consistency of the silty spoil extracted by the dredgers. —Adapted from author's abs.

Dunham, C. W., 1950,

Foundations of structures: 692 p., figs., New York and London, McGraw-Hill Book Co.

This book contains a detailed study of foundations for civil engineering structures. The properties of soils as foundation materials are explained. Information on site exploration is given on determination of the bearing capacity of soils, and also on supports, spread footings, foundation walls, and mats. Foundations subject to overturning forces are dealt with in chapters on pile foundations, cofferdams, caissons, bridge piers, and abutments. The foundation for a large stack is studied. Problems with their answers are given at the end of each chapter.

Ehrmann, P., 1949,

The Castillon dam: Annales des ponts et chaussées, v. 119, no. 5, p. 605-645; Paris.

"A detailed illustrated description of the design and construction of the concrete arch dam at Castillon on the Verdou River. The structure is about 325 ft high, 13 ft thick at the crown, 55 ft thick at the base, and contains some 164,000 cu yd of concrete. The crest is topped by a crown comprising a roadway 19 ft wide and two pavements each about 3 ft wide. High-strength concrete was obtained by using "plastic" mixes in place of wet (fluid) concrete and by careful study and calculation of the grading and of the vibration procedure. Owing to the numerous large and small cracks in the much faulted calcareous rock on one side of the valley, it was necessary to assure thorough consolidation and waterproofing of the side supports of the dam; a full account of the grouting operations is given. A preliminary watertight membrane was obtained by injecting a quick-setting mixture of cement, inert material, and bentonite; when this layer had hardened, a grout of cement plus inert material was injected to fill all cavities using a dense mix near the side walls and leaner mixes further back from the dam. The special dilatometric measurements used to detect deformations in the structural concrete are also described."—Abs. 2?2 Bldg. Sci. Abs., 1950.

Ischy, E., 1948,

Lutte contre les érosions souterraines. Digue du Lac Noir [Protection against subterranean erosion. Lac Noir Dam]: Travaux, no. 164, p. 378-382, 9 figs., Paris.

This paper describes the methods by which the foundation of an earth dam with concrete cut-off wall, built on glacial moraine, was made impervious after the foundations had developed serious leaks. The method used was to emplace a grout curtain near the upstream toe and to grout the underlying moraine between the curtain and the cut-off wall. Various grout materials, such as cement-sand-clay, pure cement treated clay, and silica gel were used, depending upon the size of voids to be filled. Special apparatus was used to introduce the various grouting materials as desired into certain sections of the bore holes. —Complete translation prepared (no. 18).

Kogler, F., and Scheidig. A., 1948,

Baugrund und Bauwerk [Foundation ground and construction]: 5th ed., 275 p., 248 figs., Berlin, Wilhelm Ernst und Sohn.

This reference treats a variety of subjects dealing with foundations, including: questions relating to the resistance of soils and foundations; the necessity of making a soil investigation before building; geologic and hydrologic study; investigations about the nature of the soil—borings, physical properties of soils, propagation and distribution of pressures exerted on the soil; causes, nature and computation of subsidences; pressures produced by the various types of structures; prevention and measurement of dangerous subsidences; safe loads; raft foundations; piles; frost action; regulations regarding foundations—responsibility in case of accidents.

Ott, J. C., 1945,

Quelques aspects du problème de la poussée sur les tunnels [A few aspects of the problem of pressures on tunnels]: Bulletin technique de la Suisse Romande, 71e année, no. 1, p. 13-22; no. 4, p. 41-50; 43 figs.

Experiences acquired from large tunnel construction works (Gothard, Simplon, Jura tunnels, Lotschberg, Amsteg Gallery, and La Croix tunnel) are described. The irregularity of the pressure manifestations appears as a striking fact. Pressures on tunnels can be considered the result of the combination of three factors: height of overburden—that is, depth of the tunnel under the soil level; physical and mechanical properties of the ground; and time. A study is made of the properties of soils, classification of soils, and the evolution of the theories for the calculation of pressures on tunnels. Tests on small-scale models are described, and examples of calculation are given—calculation of pressures at great depth and of thrusts near the ground surface.—Complete translation prepared (no. 29).

Stiny, Josef, 1950,

Tunnelbaugeologie [Geology applied to tunnel construction], 366 p., 192 illus., Vienna, Springer-Verlag.

This work covers geologic investigations, in office and field, involved in the construction of tunnels and underground installations such as power plants, transformers, ammunition storage plants, factories, etc. Consideration is given to stratification layers and structure of mountains as they must be considered in tunnel construction, including sequence of layers and earthquake hazards in underground cavities. Each of the following topics is developed in detail: excavation methods, both manual and mechanical, by boring and blasting; heat conditions in underground chambers—variation of heat of the crust and relation of degree of heat to depth within the earth; propagation of sound and vibration waves through mountains; water problems; air conditioning of galleries, noxious gases; earth pressures around tunnels; layout and construction methods; underground cavities for special purposes—pressure tunnels, air defense installations, gun emplacements and underground troop shelters, power plants and transformers, factories, etc; selection and characteristics of building stones; continuing geologic consultation; and final geologic report. Each chapter is followed by numerous bibliographic references.

Tennessee Valley Authority, 1949,

Geology and foundation treatment: Tennessee Valley Authority, Technical Report 22, 548 p., 175 illus., 13 tables, Washington, U. S. Government Printing Office.

This report covers the general subject of foundations for dams and related structures and comprises a record of the more important facts concerning the geology and the foundation treatment required in the construction of the major water control structures of the Tennessee River system. The dams of the Tennessee River system were constructed by TVA under a variety of geologic conditions. Especially is this true on a number of projects where the structures had to be founded upon limestone. On these projects major geologic study was necessary and great expense and extensive treatment were required. No two of these limestone projects are alike. After an introductory statement as to the geology of the region and a discussion of methods and equipment involved in foundation treatment and preparation, the geology and remedial treatment of foundations for the various projects are described in some detail.

Thomas, H. H., 1948,

Clark Dam, Tasmania—Investigations undertaken preparatory to its design and construction: Journal of the Institution of Engineers of Australia, v. 20, no. 9, p. 97-106, 14 figs., bibl., Sydney.

This paper summarizes some of the investigations undertaken in connection with the design of Clark Dam, an arch-gravity dam 200 ft high, now under construction on the Derwent River at Butler's Gorge, Tasmania, to supply the Tarraleah power station. A report is given of the general study of the hydrology and topography of the district, which established the practicability of the Tarraleah Power Development, and of a second hydrological study, which determined the spillway capacity. The geologic investigation showed that there would be a safe thickness of dolerite beneath the dam; however, two inclined seams of decomposed dolerite traverse the foundations of the dam and will require local treatment. Various possible types of dams were considered and the arch-gravity type was selected upon estimate of the cost. An outline is also given of the basic research concerning construction materials, cement, concrete, aggregates, concrete placement, and outlet works.

Dutta, K. K., 1951,

Subsurface exploration at dam sites [abs]: 38th Indian Science Congress, Bangalore, Proceedings, pt. 3, p. 132-133. Indian Science Congress Association, 1 Park Street, Calcutta.

"A dam is a major engineering structure; its construction is costly, and failure of a dam is catastrophic. Most failures have been attributed to defective foundation conditions. Hence foundation investigation before construction is at present the standard practice. Foundation investigation consists of a considerable amount of subsurface exploration in addition to geological mapping. Subsurface exploration helps in determining (1) type and design of dam suitable for the site; (2) depth of cutoff wall necessary in an earth dam; (3) nature of rocks in the foundation for a masonry dam; (4) depth of weathering, and amount of excavation necessary for a masonry dam; (5) nature of weak features in the foundation like joints, faults, solution channels, cavities, etc., requiring treatment; and (6) depth of water table, which influences leakage from reservoirs. Subsurface exploration helps in the selection of the most economic site for a dam, at a nominal cost. It is carried out by means of pits, trenches, tunnels, and drill holes, and also by geophysical methods. Pits, trenches, etc., allowing visual examination of the rocks in situ, are preferable; but they cannot be used for deep exploration and below river beds, where drilling is essential. Core drilling is preferable to percussion methods. Geophysical methods are very helpful in finding depth of sand and gravel in river beds."

Edmunds, F. H., 1950,

The geological approach to site investigation: Structural Engineering, v. 28, no. 3, p. 55-60.

"The influence of geological factors on the design of foundations is discussed and a number of structural and civil engineering jobs in various parts of Britain are described as examples of the applications of geology to site investigations. Sources of geological data available to the engineer are indicated as well as the method of geological approach to a site investigation. It is emphasized, that, wherever structural engineering works of any large size are proposed, both time and money may often be saved by carrying out the site investigation in consultation with a trained geologist." Abs. 506, Bldg. Sci. Abs., 1950.

Harned, C. H., 1950,

New tools, techniques and talents used in 1951-model bridge foundation studies: California Highways and Public Works, p. 36-42, 10 photos, 4 figs., Nov.-Dec. 1950.

This article contains descriptions of new tools and methods developed by the bridge department of the California Division of Highways for conducting modern foundation studies: drilling equipment capable of conducting any conceivable drilling operation in any kind of earth material to depths of about 400 feet; testing apparatus enabling the measurement of important physical characteristics of foundation materials; pile-testing apparatus; automatic power unit; load tests for footing foundations; skin friction tests for determining pile lengths and bearing capacities for fraction piles.

Institution of Civil Engineers, Civil Engineering Codes of Practice, Joint Committee, 1950,

Site investigations, Code no. 1: Gt. George St., London, S. W. 1, Institution of Civil Engineers.

"The Code deals mainly with the investigation of the suitability and characteristics of sites as they affect the design and construction of civil engineering works and the security of neighboring structures. It has been assumed that in selecting the site, due regard has been paid to the wider social and economic considerations affecting the community at large. This does not exclude the possibility that two or more alternative sites may require detailed investigations before a final choice can be made. The Code is intended to summarize in a convenient form the information it is desirable to obtain, and has been drawn up in relation to conditions existing in the British Isles. Occasional reference is made to conditions overseas, where this has appeared desirable. Whilst detailed consideration is given to both soil and geological conditions in connection with foundation problems, constructional materials are treated more briefly and if considered advisable later, will form the subject of a separate Code of Practice." —Abs. 536, Civil Eng. and Public Works Rev., v. 46, Feb. 1951.

Kuhne, F., 1947,

Tiefbohrtechnik und Geologie [Technique of deep drilling and geology]: Die Technik, v. 2, no. 8, p. 347-350, 6 figs., Berlin.

This paper discusses the application of deep drilling in relation to geology and the necessity of close cooperation between driller and geologist. The purposes of deep drilling are the exploration of the farther boundary of a known deposit, employing both horizontal and vertical drilling, and the investigation of an unknown deposit. Objectives of the latter are preliminary geophysical research; a preliminary geologic profile to be provided to the driller, with information on the layers he is expected to encounter, the depth to be reached by the drill, and the direction and angle of the inclined drill to be eventually performed in case of faulting or disturbance; survey of the bore hole; determination of porosity and strength by the Schlumberger or Martienssen method; cessation of the drilling operation; and filling up the bore hole.

Luthin, J. N., 1949,

A reel-type electric probe for measuring water-table elevations: Agronomy Journal, v. 41, no. 12, p. 584-585, 2 figs., bibl., Madison, Wis.

In order to measure the water table, piezometers consisting of 3/8-inch perforated iron pipes were driven into the ground in tile-drained fields with either 2 or 6 inches of the piezometers extending above the surface of the ground. A probe or water-elevation-measuring device was developed, which gives the largest number of readings in the shortest time, can be used without stooping, is sturdy enough to stand up under rough field usage by untrained personnel, and is inexpensive and simple to construct. The paper gives a description of this device.

Minikin, R. R., 1948,

Structural foundations: 539 p., 210 figs., bibl., London, Crosby Lockwood & Son, Ltd., 1948.

This book is a presentation of the rules of engineering practice essential to the construction of stable foundations. Chapters and sections deal with the following matters:

(1) Methods used in preliminary surveys to obtain data as to area, plan, surface contours, and vertical sections; nature and condition of the terrain; nature and characteristics of the subsoil, and the ground water level; and the depth at which firm ground is encountered.

(2) Exploration methods, such as probing, sinking deep pits, boring, and underwater test pits.

(3) Criteria for recognition of soil and rock types, including a classification of rocks and their main characteristics.

(4) A study of the bearing capacity of ground.

(5) Clay and soil mechanics as applied to problems of everyday engineering.

(6) Engineering works such as earth embankments and cuttings, retaining walls, bridge abutments, foundations in general, miscellaneous footings, reservoirs, viaducts, and tall chimneys.

(7) Artificial consolidation of subfoundations—the "Compressol" system, and its development, the "Lolat" system; grouting, pier footing, chemical consolidation, and electro-osmosis. A short bibliography on soil mechanics is included.

Pinsard, M., 1947,

Foncage d'un puits en sables boulants, procédé Honigmann [Shaft-sinking in quicksand—Honigmann process]: Révue de l'industrie minerale, no. 520, p. 191-199, 10 figs., Paris.

The author describes the use of the Honigmann process for sinking a shaft 19 ft in diameter through loose water-bearing gravel, sand, and clay to a depth of about 1,000 ft in the Cologne coal basin. In this process a series of borings is made, each of which increases the diameter of the shaft until it is slightly larger than the intended finished diameter. Each boring is driven to the full depth of the shaft. The shaft lining, consisting of metal rings, is assembled as it is lowered into the shaft, and the space between the tubing and the wall is filled with cement. Costs as compared to similar shafts sunk by the artificial freezing process indicate the Honigmann process is cheaper to a diameter as large as 4.5 m, comparable in the range of 4.50-5 m, and more expensive for bores over 5 m diameter.—complete translation prepared (no. 19). DV.

Remenieras, M. G., and Terrier, M. M., 1951,

La sonde électrothermique E.D.F. pour le forage des glaciers [The EDF electrothermic glacier drill]: Union géodesique et géophysique international, Association international d'hydrologie scientifique, Bruxelles, 1951, tome 1, p. 254-260, 5 figs., bibl.

After a brief history of the various methods used to drill in glaciers, a study is made of the theoretical speed of advance of a thermic drill, which acts by melting the ice, and of the optimum characteristics of the heating (electrical resistance) of the drill. A description is given of an electrothermic drill, developed by the Service des Etudes et Recherches Hydrauliques d'Electricité de France, that was used to drill in the glacier of the Mer de Glace near Chamonix to determine the position of the bedrock. The results of the first drilling operations made on the Mer de Glace are given. The rate of progress of the drilling was 20-25 m per hour for a drilling diameter ranging between 60 mm and 80 mm. The deepest drill was stopped at the bedrock at 195 m beneath the surface of the glacier. The study ends with a few considerations on the precautions to be taken in the use of the drill, and on its field of practical application.

LANDSLIDES AND SUBSIDENCES

Baker, R. F., 1952,

Determining corrective action for highway landslide problems in analysis of landslides: National Research Council, Highway Research Board Bull. 49, p. 1-27, 15 figs., bibl., Washington.

This study was designed to prepare an approach to the analysis and correction of highway problems dealing with landslides in unconsolidated materials. Statements are outlined which are fundamental to the analysis of a landslide relative to its correction as a highway problem, and a detailed classification is given of the most common measures that have been used in controlling or avoiding landslides. The preliminary analysis of a landslide, a field study, and a stability analysis are discussed.

Florentin, M., 1947.

Étude des glissements des talus argileux [Slides in clay slopes]: Laboratoires du bâtiment et des travaux publics, Compte rendu des recherches effectuées in 1947, p. 153-170, 19 figs., bibl. ref. Paris.

This article is a discussion of the theoretical considerations involved in the shearing of clay and the application of these principles to the study of a specific case: landslides which occurred in the bank of the Genissiat power station, built on a ridge of glacial marl. The slides were caused by the overload produced by excavated material, laid down in three successive terraces on the north side and at a short distance from the station, and were accelerated by hydrostatic conditions of the slope. Results are given of the investigation at a location and of laboratory research made to obtain guide for recognition of: (1) the characteristics of the soil; (2) the evolution of these characteristics under the influence of the moist load constituted by the dump material and under the influence of the slides; and (3) the safety factor that could be expected after removal of the dump and after drainage for the purpose of reducing the accumulation of water within the slope. The measures that were adopted to stabilize the slope are also give.—Complete translation prepared (no. 30).

Great Britain Ministry of Works, Inter-Departmental Committee, 1951,

Mining subsidence, effects on small houses: Special Rept. 12, 23 p., 12 figs., London, His Majesty's stationery office.

This report was prepared by a committee appointed by the Ministry of Works to undertake a technical investigation into methods of preventing and minimizing damage cause by subsidence to houses in mining areas. It contains technical information which is not readily accessible elsewhere and cannot fail to be of interest to local authorities, architects, town planners, and others in areas where subterranean excavation is causing settlement and disturbance. It deals with the nature of subsidence produced by mining operations, the general approach to a problem in mining subsidence, and the recommended precautions.

Holmsen, Per., 1949,

Om kvikkleire og betingelsene för dens dannelse [On quickclay and the conditions by its formation], Geologiska Föreningen i Stockholm, Förhandlingar, band 71, p. 616-619, fig.

Some remarks on account of C.-G. Wenner's paper (Fakta om Sveriges lerförekomster, Geologiska Föreningen i Stockholm, Förhandlingar, band 71, 1949) regarding the relation between slides and the occurrences of quickclay. Author emphasizes the fact that in Norway both are associated with raised fjordbottoms and that the deposition of the clay in salt water gives it a surplus of water which is quickly disengaged by stirring, while the consistency changes from plastic into liquid.—From abs. by C. Caldenius, in Ann. rev. of 1949 Swedish literature, Geol. Foren. Stockholm Forh., band 72, no. 4, 1950.

_____1952,

Landslips in Norwegian quick-clays; p. 1-17, 4 figs., 8 bibl., refs. (Royal Norwegian Council for Scientific and Industrial Research, Geotechnical Institute), Oslo, April 1952.

"In Norway, quick-clay deposits occasionally cause large landslips, or rather, landslides. This article attempts to give an outline of the mode of occurrence, the geographical distribution, some common features as to the mechanism and supposed causes of the slips. Particular reference is given to the famous landslide in Vaerdalen, north of Trondheim, in 1893, where nearly 3 square kilometers of cultivated land and about 55 million cu m were transformed into a heavy liquid washing down the valley toward the fjord. One hundred and eleven persons lost their lives in this catastrophe."—Author's synopsis. 1950.

Hundt, Rudolf, 1950,

Erdfalltektonik [Tectonics of subsidences]: 145 p., 136 illus., bibl., Halle (Saale), Wilhelm Knapp, 1950.

In the first part of the book the author develops the following topics: (1) origin of a normal subsidence, relation between faulting (tectonics of large movements) and tectonics of subsidences (tectonics of small movements); (2) the influence of tectonics of subsidences on recent landscapes; (3) underground disappearance of rivers and brooks; (4) formation of cavities; (5) karst phenomena; and (6) earthshocks.

The second part deals with the significance of subsidences with regard to: (1) lignite deposits; (2) rocks and soils; (3) ore deposits; (4) sinter deposits; (5) fossil layers; and (6) hydrology.

The third part refers to deep-boring profiles and others in Thuringia, Central Germany; in the Zechstein (Permian limestone) of the west and south rim of the Harz; and in the stratified series of rocks (Permian limestone) in Niedersachsen, showing the composition of the subsoil in areas where subsidences have occurred or may occur. An abundant bibliography is given.

Larew, H. G., 1952,

Use of field, laboratory and theoretical procedures for analyzing landslides, in Analysis of landslides: National Research Council, Highway Research Board Bull. 49, p. 28-39, 5 figs., bibl., Washington.

"This paper presents field and laboratory data obtained from three actual landslides. The study was confined to a two-dimensional analysis of a shear-type failure in shallow deposits of unconsolidated materials. The data were used to check the validity of the circular-arc method of slope analysis. The soil strength required for stability, as determined from this method of analysis, was compared with the strength of the soil as measured by laboratory tests. The data are insufficient to indicate definitely the range of applicability of the circular-arc method. However, when combined with similar data from previous studies the results indicate the limited applicability of this approach and point to the area where further study is needed before it can be used to obtain quantitative answers to the problem of prevention and correction of highway landslides."—Author's abs.

Odenstad, S., 1948,

Skredet vid Lidan [The landslide on the river Lidan]: Geologiska Föreningen i Stockholm Förhandlingar, Band 70, p. 254-257, 2 figs.; discussion, Olsson, Ekström, Brenner, Fellenius, Skaven, Haug, Hörner, and Caldenius, p. 258-263.

"On the left back of the river Lidan a landslide occurred on February 2, 1946. About 0.5 million cu m of the bank and the adjoining sediment plateau slid down, blocking the river for a distance of 800 m and causing the water to rise 11-12 m. The slide has been investigated by borings with piston borer and vane borer. The latter is a new device which is described in detail. The values of the shearing resistance of the clay obtained by the vane borer are found, especially in the deeper parts of the clay, to be greater than those determined by the cone method. The pressure tests give still lower values. There are several causes of the slide, among them a lowering of the baselevel of the river."—Adapted from abs. by C. Caldenius. in Ann. rev. of 1948 Swedish literature, Geol. Foren. Stockholm Forh., Band 71, Rept. 4, 1949.

Pchelincev, V. F., 1946,

[New trends in the field of landslide control]: Priroda, no. 10, p. 20-25, Leningrad. [In Russian.]

This article deals with the various procedures for controlling landslides:

(1) Removal of water already present, or prevention of entrance of additional water in the sliding mass, by means of drainage tunnels (with system of evacuation by drain wells, or pumps, or both), or by ditches in the mass.

(2) Regularization of surface flow.

(3) Mechanical measures—retaining walls, gabions, reinforced concrete poles, and mass movement (removal of earth toward the toe).

(4) Tendency to the application of combined procedures. A study of the physico-mechanical and physico-chemical characteristics of soils is presented. —Translation, abs. 9-15988, Bulletin analytique.

Von Moos, Armin, and Rutsch, R. F., 1944,

Über einen durch Gefügestörung verursachten Seeufereinbruch (Gerzensee, Kt. Berne) [Lake shore subsidence caused by structure disturbance]; Eclogae geologicae Helvetiae, v. 37, no. 2, p. 385-400, 8 figs., Basel.

The causes and mechanics of slumping in an area of the west shore of Gerzen Lake, in Switzerland, are described. The material of the shore is loam, overlain by marl, overlain by peat. The marl had a high water content and loose structure. The natural structure of the marl was disturbed during logging operations, especially by blasting of stumps while the lake was at a low level and the layer of peat was frozen. The marl liquefied and flowed out from under the peat cover. Other examples of similar failures are described. Complete translation prepared (no. 17).

Wilson, A., 1949,

Subsidence in an earth reservoir embankment: Surveyor, v. 108, no. 3013, p. 663-665; Institution Municipal Engineers Journal, v. 76, no. 9, p. 610-619, 1950.

A study is reported of the cause of successive subsidences on an earth embankment and the subsequent remedial measures adopted to safeguard the stability of the embankment. The experimental and observational data showed that the embankment had been founded on shattered and extensively fissured bedrock, and that the effect on the puddle core of this position was the primary cause of the subsidence. Leakage under the overflow weir also caused scouring of the material in the embankment immediately overlying the foundation. Remedial measures comprised the drilling of holes down through the centre of the puddle core and the sealing of the rock fissures by injecting cement grout under pressure. Other injections of grout were made, as in the rock on the reservoir side of the cutoff trench through or under which water had been seeping."—Abs. 510, Bldg. Sci. Abst., 1950.

Wenner, Carl-Gösta, 1951,

Data on Swedish landslides: Stockholms Högskolas Geologiska Institut, Meddelanden, no. 93-94, p. 300-308, 6 figs., bibl. [In English.]

A statistical study of slides in clay on the coastal areas of southern Sweden. The immediate cause of a landslide is usually a decrease in stability, which may be caused by increase of load, removal of counterpressure, or decrease in strength of the clay. Mankind is to blame for most slides, but some are caused by natural processes, such as increase in load due to rain, erosion of sea shores and river banks, or possible deterioration of stability caused by chemical or physical changes in the clay deposits. Stability may be computed by using imaginary slip planes in a circular arc. Four landslides are discussed, in which the position of the slip plane was determined by examining undisturbed clay samples, and comparing the actual position of the slip plane with the computed position. The slides investigated confirm the correctness of computations with slip planes in circular arcs.

Anonymous, 1952,

Landslides on the Razorback Range near Wollongong, 1949 and 1950: Main Roads [Australia], v. 17, no. 3, p. 77-83, 1 map, 3 figs., 6 photos.

Extensive landslides occurred along several highways south of Sydney, in the Razorback Range and at Bully Pass, as a result of exceptional flood rains in 1949 and 1950. In one of the affected areas, layers of clay overlying shale were softened by the downward percolating water which was blocked by the shale. Flow slides occurred and continued for long periods, causing inconvenience and delay to traffic. The remedial measures taken are described but in view of the general instability of the Razorback Range, survey investigations are in hand for alternative route farther east. The cause and description of landslides that took place at several other locations under similar conditions are also given.

MAPPING TECHNIQUES

Hittle, J. E., 1949,

Airphoto interpretation of engineering sites and materials: Photogrammetric Engineering, v. 15, no. 4, p. 589-603, 10 figs., bibl.

The technique of airphoto interpretation for engineering purposes is an important tool in all phases of engineering construction dealing with soil and rock as surface materials. The author explains how airphotos can be used to identify soil and rock materials, groundwater conditions, and geologic features, and how the application of these determinations to specific projects makes it possible to appraise the suitability of site locations for dams, canals, highways, airports, and railroads; to conduct construction materials surveys; to develop sampling programs for detailed investigations of soil and rock materials; and to prepare land-use, drainage, and engineering soil maps.

Maag, E., 1950,

Die bautechnische Badenwertkarte, ein Versuch zur wertmåssigen Klassifizierung des Baugrundes. [The soil evaluation map—an attempt to classify soils according to their value as foundation materials]: Strasse und Verkehr, v. 36, no. 10, p. 310-312; Solothurn. [In German.]

"It is shown on theoretical grounds that the quality of a foundation soil can be expressed in terms of permissible soil pressure, weight of superimposed structure, and bearing area. Cost is shown to be directly proportional to the product of soil density and the factor representing internal friction. It is suggested that a soil map based on the values of this product, as determined from the results of soil surveys, would be of great value to engineers, and such a map of the Lucerne area is reproduced. It is noted that these maps supplement but do not replace geological maps, and that one of their main uses is to indicate where further surveys are desirable. To assist in the preparation of similar maps, use could be made of graphs showing the approximate relationship between the principal properties of soil. A graph is reproduced in which the permeability of different soil groups and the range of variations encountered are plotted on a logarithmic scale in comparison with the corresponding values of plasticity index, porosity, capillary rise, settlement, angle of internal friction, and density."—Abs. 102, Bldg. Sci. Abs., 1951.

Mollard, J. D., 1950,

Air photography in irrigation and water-development work: Engineering Journal, v. 33, no. 8, p. 695-699, 7 figs. Montreal.

"A great many distinctive land forms are recorded in air photographs. With an understanding of geologic processes and of soil principles, soil conditions may be interpreted from the photos. Engineering problems can then in turn be predicted and their significance evaluated. Mosaics, contact prints, and stereopairs are used as illustrations. How the interpretation of features observed in these photos can simplify and facilitate preliminary irrigation and water development surveys is also given. Selected examples show unstable valley slopes, alkali-salt soils, heavy clay lakebed soils, gravel deposits, irrigable areas, and valleys sections."—Author's abs.

Munsell Color Company, Inc., 1950, see also Pendleton, R. L., and Nickerson, D.

Munsell soil color charts—special edition for use of soil scientists, geologists, and archeologists: Baltimore, Md.

Pendleton, R. L., and Nickerson, D., 1951,

Soil colors and special Munsell soil color charts: Soil Science, v. 71, no. 1, p. 35-43, bibl. Baltimore, Md.

Soil color is important in describing and differentiating soils. Standardized common color names and Munsell color standards have been adopted by the Soil Survey Division, U. S. Dept. Agriculture, to reduce personal idiosyncrasies in color naming. A special form of the Munsell soil color chart has been designed recently to make more effective use of the color chip standards in specifying small differences in soil color. This new edition of the soil color chart gives a greater range of colors, with holes between samples, and is supplied with masks. It includes all color chips that appear on the regular edition and uses the same names. The use of the Munsell notations is urged in all descriptions of soil color.

Powers, W. E., 1951,

A key for the photo-identification of glacial landforms: Photogrammetric Engineering, v. 17, no. 5, p. 776-779.

This article summarizes a key for the photoidentification of glacial landforms, by means of which a photointerpreter untrained in glaciation or geomorphology can identify correctly the landscape features in a region formerly occupied by continental glaciers. A guide for differentiating and identifying the following 15 landform types is given: lacustrine plains, valley plains of streams, stream-dissected plains or hill lands, dunes, glaciated bedrock-controlled plains, rough end moraine, undulating till plains, drumlins, till knobs other than drumlins, kames, eskers, valley train terraces, kame terraces, outwash plains, and filled basins.

Raup, H. M., and Denny, C. S., 1950,

Photo interpretation of the terrain along the southern part of the Alaska Highway: U. S. Geological Survey Bull. 963-D, p. 1-135, figs., tables, keys.

"This paper is an attempt to apply the combined knowledge and techniques of botany and geology to the photo interpretation of terrain in northern regions—in particular, the area along the southern part of the Alaska Highway in British Columbia and southeastern Yukon, where the forests are composed primarily of only a few species of trees. The authors describe the uses and limitations of these trees and associated shrubs as indicators of such characteristics of the ground on which they grow as soil texture, drainage, presence or absence of permafrost, stability of slopes, and trafficability. Many of the individual species or groups of species, it is pointed out, can be identified on aerial photographs at scales of 1:20,000 or less if one has a general knowledge of the geography of the principal vegetation types and if some account is taken of their topographic position—whether, for example, they grow on terraces, on steep mountain slopes, or above the timber line. The paper includes a brief discussion of the following topics: the local terrain; climate and permafrost; identification of the common forest trees on the ground; the forest types and their relation to the local terrain; the geographic extent of the forests in northern British Columbia and southeastern Yukon; and the modification of the forests after fire. A key for the identification of the vegetation on aerial photographs is given. Aerial photographs arranged as sterotriplets illustrate the methods of identifying the vegetation; they are accompanied by outline maps that delineate the vegetation types visible on each photograph; and the terrain interpretation based on the local vegetation and topography visible on each triplet is stated briefly."—Authors' abs.

Smith, H. T. U., 1952,

Photo-interpretation in applied earth science: Photogrammetric Engineering, v. 18, no. 3, p. 418-428, bibl.

The author gives a review of the historical developments and present capabilities of photointerpretation as an aid in applying the knowledge and methodology of geology and soil science to the practical problems of mineral exploration and development, civil engineering projects, and land-utilization programs. In order to provide a proper perspective on the subject, the relationship between basic and applied phases of the sciences concerned is first outlined, and the role of airphotos in each of these phases is considered.

PHYSICAL PROPERTIES OF ROCKS

Mahadevan, C., and Sathapathi, Waltair, 1951,

Artifacts as chronographs of rock weathering [abs.]: 38th Indian Science Congress, Bangalore, Proceedings, pt. 3, Indian Science Congress Association, 1 Park St., Calcutta 16.

"It is known that weathering of rocks is an extremely slow process for which reason erosion of soils is considered to be an irreparable menance to national welfare. In spite of the fact that time is an important factor of soil formation, very little is known about the rates at which different rocks decay and give rise to soils. Some information can be obtained from the observations made by Ruprecht (1866), on the Tartar-built mounds in the European steppe of Russia; Geikie (1880), on dated tomb stones in Edinburgh churchyard; Dokuchacy (1883), on ruins of Staro-Ladoga fortress; Goodchild (1890), on limestones; Hilger (1897), on powdered rock particles; Hirschwald (1908), on old buildings in Central Europe; Ecoma, Verstage, and Van Baren (1928), on 1883 eruptive material of Krakatao; Akimtzev (1932), on the walls of the Kamenetz fortress in Ukraine, U. S. S. R: Miss Schreckenthal (1935), on alpine glacial moraines; and Hardy (1939), on volcanic-ash soils of Soufrière district in St. Vincent.

"From a very careful study of the weathering undergone by the paleoliths and eoliths from parts of the Deccan and Guntur districts collected by one of the writers (C. Mahadevan), it is found that the depth of weathering of the artifacts in different rock types such as dolerite, argillaceous sandstones, and quartzites from the same locality are different. A study of the effects of weathering on paleoliths and eoliths is a fruitful line of attack on the study of the rate of soil formation."—Authors' abs.

Tchourinov, M. P., 1945,

Modifications par altération dans la composition, la structure et les propriétés des argiles du Crétacé Inferieur [Modifications by weathering in the composition, structure, and properties of the Lower Cretaceous clay]: Academie des sciences de l'U. R. S. S. Comptes rendus, tome 49, no. 5, p. 364-368, 5 tables, Moscow.

Landslides along the bank of the Volga and Sviaga Rivers caused by base exchange and other chemical alterations attending weathering are discussed. The more important alterations include oxidation and decomposition of pyrite in the clay, resulting in an increase in quantity of calcium and magnesium sulphates. Base exchange reactions altered the structure and physical properties of the clay so that the natural water content exceeded the plastic limit, and the liquid limit was greatly lowered. Slides occur only in the weathered and altered zones of the clay slopes. Five tables show analyses and physical properties of the altered and unaltered clay. —Complete translation prepared (no. 15).

Wellman, H. W., 1951,

Differential weathering or anomalous metamorphism; New Zealand Journal of Science and

Technology, sec. B, v. 32, no. 6, p. 950-952, bibl.

"Bartrum has described pebbles of soft mudstone from conglomerate interbedded with indurated sandstone (graywacke) near Morrinsville. The writer considers that the induration of the graywacke is due to low-rank metamorphism which should extend equally to adjoining beds and to all pebbles in a conglomerate. Unless some other explanation can be found for their softness, the pebbles are anomalous. Examination has shown that the soft pebbles are confined to the weathered zone near the surface, and that deeper pebbles are at least as indurated as the graywacke. The softness of the pebbles is due solely to their having once been calcareous, and to the calcareous cement having been weathered out. They represent differential weathering, and not anomalous metamorphism."—Author's abs.

SOILS AND SOIL MECHANICS

General topics

Barriol, J., Bloch, J. M., and Kayser, F., 1948,

Sur la measure de la thixotropie des suspensions de bentonite [On the determination of the thixotropy of bentonite suspensions]: Academie des sciences de Paris, Comptes rendus, v. 226, pt. 2, p. 1899-1901, 1948.

Thixotropy, which is shown by aqueous suspensions of bentonite, is generally expressed by the measurement of stiffness. A description is given of two methods used by the authors to make this determination: the penetration method, by means of brass cylinders, and the torsion method, using a torsion couple. The first method is very rapid and convenient, the second longer, very responsive, and gives an absolute measurement of the thixotropy in a very wide range if the torsion wire is properly selected. The results of both methods are comparable.

Boswell, P. G. H., 1949,

A preliminary examination of the thixotropy of some sedimentary rocks: Geological Society London, Quarterly Journal, v. 104, no. 416, p. 499-526, 8 tables, bibl.

"Although the thixotropic behavior of geological materials (made manifest by the isothermal, reversible, gel-sol-gel transformation) has been utilized in many industries, the thixotropy of naturally occurring sediments appears to have been but little studied. The results of a preliminary examination of a representative series of unconsolidated rocks are therefore presented. Excepting coarse clean sands and gravel, all sediments prove to be capable of assuming the thixotropic state, the degree of thixotropy depending on grain size, grading, mineralogical composition, and the presence of electrolytes. Thixotropic values and their range are given for a large selection of sediments from Britain and abroad, and notes are added on the problems presented by some of the more interesting materials."—Author's abs.

Day, P. R., and Holmgren, G. G., 1952,

Microscopic changes in soil structure during compression: Soil Science Society America Proceedings, v. 16, no. 1, p. 73-77, 6 figs., 2 tables, bibl.

"Compressed specimens of soil were examined microscopically to determine the nature of the changes occurring in moist soil during the application of pressure. A small compression chamber was filled loosely with moist soil aggregates, and the pressure was applied gradually in a controlled manner. The compressed material was removed at various stages and dried. Polished sections were then prepared. The results have been preserved in a series of photomicrographs and show that the volume changes are attributable in large part to plastic deformation of the aggregates. Deformation occurred readily at the lower plastic limit, causing a progressive closing of the interaggregate spaces as the pressure was increased. At water contents below this limit deformation appeared to be localized in the areas of contact between aggregates and consisted mainly of flattening of the aggregates against one another. The incomplete closing of the interaggregate spaces at low water contents was attributed to the increased shearing strength of the material. The theory has been advanced that during compression localized stresses in excess of the shearing strength occur in the contact areas between aggregates and that the resulting flattening causes a diminution of stress on account of the distribution of the load over a greater area; deformation ceases when the shearing stress falls below the shearing strength. According to this theory, the flattening phenomenon acts as a check against unlimited deformation at any given pressure."—Authors' abs.

Delarue, M. J., and Mariotti, M. M., 1950,

Quelques problèmes de mécanique des sols au Maroc [Problems of soil mechanics in Morocco]: Annales de l'Institut technique du bâtiment et des travaux publics, Sols et fondations no. 3, p. 37-50, 16 figs.

"This report is confined to two definite subjects: site tests on rock soils and fissured clays and their behavior under loads.

"(1) Site tests: The first part of these tests is a continuation of the direct measurement of the modulus of elasticity, the principle of which is explained in Mr. Habib's report., Determination of the modulus of elasticity of rocks on the site (Annales de l'inst. tech. du batiment, p. 27-35, 1950). These measurements are used on a large number of different rock types: quartzites, quartz sandstones, soft sandstone, schists and soft conglomerate at Im'fout, basalt at Tim'inoutine, gritstone at Ait-Chouarit, and marl at Afourer. The results of the tests show the importance of the effect of compression which preceded elastic deformation in each case. The stresses in the walls were also measured and the authors give the results of the tests. Finally, measurements of thrust in the tunnel at Afourer were taken, and an investigation made into the effect of the infiltration of water on the strength of the rock. In their concluding remarks, the authors indicate the use which can be made of the results of the tests, particularly for the design of the supports of dams and the examination of the conditions in which rock deteriorates.

"(2) Foundations on fissured clays: This problem is peculiar to Morocco and is very important for Safi. Even light buildings suffer widespread damage through cracks appearing in the foundation clay. Tests were made on the various materials and showed the nature of the effects of swelling. When it first occurs, swelling tends to close up the cracks, at any rate to a relatively great depth, but then swelling of the lower layers produces heaving in the upper layers. The preliminary test needs to be confirmed by a systematic investigation."—Abs., Annales inst. tech. bâtiment.

Dervieux, M. F., 1950,

Problèmes particuliers de mécanique des sols en Algérie [Peculiar problems of soil mechanics in Algeria]: Annales de l'Institut technique du bâtiment et des travaux publics, Sols et fondations, no. 3, p. 51-62, 20 figs., Sept. 1950.

"Two problems peculiar to Algeria are treated in broad outline. The first is set in the town of Algiers, where for many years landslides and crumbling of cliffs have endangered buildings erected on sloping ground. The combined researches of engineers have affirmed the action of infiltration waters and the presence of a bed of glauconite which, lying between the calcareous mass and the foundation layer of clay and marl, enables the latter to be freed of stresses. The overhanging cliff gives way in places and recedes from year to year; marl traverses the slopes. Of all the remedies suggested for counteracting these difficulties, it has been possible to carry out only one: a draining level at the cliff face. This has already reduced the rate of subsidence but sooner or later this drainage will have to be supplemented by supports. The second problem relates to the evaluation of a subterranean reservoir of water, the greater part of which is wasted in the atmosphere by a 'chott' or lake or humid, plastic soil forming an immense evaporating surface. The clays which fill the hollow of this reservoir are pierced by small tubes, in which the air and capillary water are subjected to sudden pressure changes which modify the permeability conditions of these soils and the observation of the static levels of the phreatic water by means of piezometers. The phenomenon has been reproduced by an apparatus erected in a laboratory."—Author's abs.

Ferrandon, Jean, 1948,

L'état d'équilibre limite des massifs filtrants [Limit equilibrium of filtering masses]: Le Génie civil, tome 125, no. 12, p. 230-232.

The properties of limit equilibrium of earth masses form an essential chapter of soil mechanics and have been studied in important original memoirs. They must be taken into consideration for the rational solution of many problems of application: stability of foundations, slopes, earth dikes, retaining walls, sheetpiling, etc. In some instances, such as dikes for dams or along canals, stresses are exerted on an earth mass which is subject to drainage on the downstream side while serving to maintain a water level on the upstream side. The purpose of the present paper is to indicate modifications which, in order to take these pressures into account, should be made to results defined in previous studies.

Forbes, H., 1950,

The geochemistry of earthwork: American Society of Civil Engineers, Proceedings, v. 76, separate no. 7, 20 p.

"Observational and experimental data are presented relative to the geochemical processes and the mineralogical changes occurring during earth excavation for engineering structures. In presence of air and water compounds are being formed continuously during natural processes of weathering or deposition, and may be affected by the mechanical processes involved in earthwork. The character of the final compounds are important in determining the production of stable, dense, and relatively impervious masses, or of unstable slopes or cuts. In selecting construction material and controlling its use, soil or rock that will react unfavorably with water and the atmosphere should be avoided. Similarly, excavated slopes and faces in natural rock should be considered in the light of the following: (1) mineralogy and structure of the excavated material; (2) its future reaction with the atmosphere and moisture; (3) the effects produced on buildings, etc., in or adjacent to the excavated areas as the foundation soil becomes modified by geochemical change. An understanding of geochemical reactions resulted in a saving in cost of the Swanzy Dam by the elimination of the impervious core or facing planned in the original design."—Abs. 507, Bldg. Sci. Abs., 1950.

Glossop, Rudolph, 1950,

Classification of geotechnical processes: Géotechnique, v. 2, no. 1, p. 3-12, 1 table.

"A number of processes are known which will alter the properties of weak rocks and soils in situ, for the purposes of civil engineering: mechanical strength may be increased, and permeability decreased. The successful use of such processes is possible only if the physical properties of the soils to be treated have been studied, and recent progress in soil mechanics has thus contributed to this branch of engineering. In this article, all the processes now in use are presented in tabular form, and it is shown that they are based on four fundamental principles—drainage, compaction, artificial cementing, and base exchange."—Author's abs.

Habib, M. P., 1950,

Determination du module d'élasticité des roches en place [Determination of the modulus of elasticity of rocks on the site]: Annales de l'Institut technique du bâtiment et des travaux publics, Sols et fondations no. 3, p. 27-35, 12 figs., bibl. Paris.

It is important for the builder to know the modulus of elasticity of a rock formation that is to serve as a foundation, but it is difficult to measure it. After explaining in detail the theory of the elasticity of rock, the author states the principles of the method of testing on the site by means of a jack, the results of which have been calculated in the laboratory. He describes tests that were carried out on the dam at Tignes using this method. The tests proved the existence of a true "site modulus of elasticity," which was very different from the modulus of elasticity measure on the laboratory specimen and always smaller. The method recommended is sufficiently accurate and forms the basis of mechanical site investigations which are complementary to geological investigation. It is very often used in work on hydroelectric power schemes. An appendix gives the formulae for the determination of the surface of an elastic, semi-infinite solid under a load applied over a circle.—Adapted from abs., Annales Inst. tech. du bâtiment.

Hanna, W. S., 1950,

Settlement studies in Egypt: Géotechnique, v. 2, no. 1, p. 33-45, 13 figs., bibl.

"Settlement studies have formed an important part of the research carried out at Fouad I University, Cairo. Comparisons between observed and theoretical settlements, based on the results of consolidation tests, showed that, relatively, the results were quite close; but numerically the theoretical settlements were, in many buildings, 3-4 times the observed values. Studies made seemed to indicate that the disturbance of swelling clays on removal from samplers accounted for an important part of the difference. This led to the development by the author of a sampler that permitted the testing of the sample without removal from the sampler. Under the clay conditions existing in Egypt, the "ring" sampler seems to justify itself: comparisons are made in proof of this point. A few examples are given of buildings on rafts and footings, which raise many foundation problems including that of a lock resting on swelling clays, and also the subject of subgrade reaction. One case of piled foundations is mentioned, bringing to light the special problem of piled foundations under soil conditions such as exist in Egypt."—Author's abs.

Hebert, R., 1950,

Contribution à l'étude de la structure physicochimique des argiles [Physicochemical structure of clays]: Annales des mines, tome 6, p. 3-48, bibl. Paris.

This memoir constitutes an important contribution to the study of the physicochemical structure of clays. The author studies first the deposit of Cormeilles-en-Paris, where one of the best geologic sections of the Parisian region is exposed at the 80-meter-high working face of an operated quarry; he discusses sampling, determination of the mineralogical composition of the samples, chemical analysis, reaction to benzidine, physical methods, spectrographic analysis. The second part of the memoir deals with the study of several mineralogical samples coming from various regions of France, North Africa, and Asia Minor. In a third part the author summarizes the results of testing, particularly the identification of clays and contained elements such as copper, glucinum, manganese, molybdenum, nickel, lead, vanadium, zirconium, silver, arsenic, and other minerals.

Jaky, J., 1948,

Sur la stabilité des masses de terre complètement plastiques (Stability of earthworks in plastic state): Part 3, Müegyetemi közlemények (Pub. Univ. Tech. Sci.) v. 3, p. 158-172, 10 figs., bibl., Budapest. (In French.)

"The author analyzes different states of stress in the mass possessing weight (earth mass) by making use of polar coordinates. Beyond special solutions of Prof. Nádai, it is proved that besides concentric circles as slip lines, more general slip circles are possible, the centres of which move on an arbitrary geometric line and the respective radii of which are functions of the coordinates of the centre. On the other hand, the author succeeded in writing down the partial differential equation resulting from conditions of equilibrium, and its general solution, respectively (Eq. 135 and 136). Two practical examples illustrate the above solution. One presents the fascicle of slip lines around a bore-hole in the plastic body and the corresponding stresses acting on the surface of the hole; the other example shows the state of stress of an earth mass acted upon by uniformly distributed oblique loads. The discussion of further different states of stress may be developed in the way shown."—Author's abs.

Kersten, M. S., and Cox, A. E., 1951,

The effect of temperature on the bearing value of frozen soils: National Research Council, Highway Research Board Bulletin 40, p. 32-38.

"Effect of variations in stability with temperature, density, moisture content, and soil texture was investigated to indicate significance for structural uses of frozen soils in permafrost regions. Four soils of different known densities and moisture contents were placed in a cylinder, frozen, and tested; a thermocouple was embedded for temperature measurements. California bearing-ratio type of tests were made with bearing value arbitrarily taken as unit load for 0.1-in. penetration of steel rod. Similar tests were made on ice. In general, results showed increases in bearing values with decreases in temperature, with increases in density, and with increases in moisture content. Bearing values of sand were much higher than for ice; values for sandy loam were slightly higher than for ice. Values for silt loam were slightly lower and for clay were much lower than for ice. Plots showed that for small decreases in temperature below 32°F the bearing values for soils increased rather rapidly; as temperatures were further lower toward $-5^{\circ}F$, the rate of increase of these values decreased, giving a curve relationship. Plots of bearing values vs. temperature for ice were represented by a straight line. Reviewer believes that results for ice should have been represented by a curve similar to that for soils on the basis of (1) experimental points and (2) such results as those for compressibility of ice presented by N. E. Dorsey, in Properties of ordinary water-substance (New York, Reinhold Publ. Corp., 1940)."—Abs. 2204, Applied Mech. Rev., 1942.

Livingston, Clifton W., 1951,

Research at the Colorado School of Mines in subjects related to the mechanics of rock failure: American Geophysical Union Transactions, v. 32, no. 2, p. 268-278, 13 figs., bibl.

"The paper presents the results of experiments at Colorado School of Mines in subjects related to the mechanics of rock failure. A brief review of Fenner's hypothesis of the distribution of stress around circular and elliptical openings is presented and field evidence cited which supports the hypothesis. An impact loading device useful in studies of rock failure is described, and the attitudes of strain lines in a brittle, lacquer-coated tunnel model, as obtained with the impact loading device are compared with the directions and magnitudes of the principal stresses obtained using an interferometer. The distribution of the strain lines is compared with the stress distribution around the opening, and a strain pattern produced by impact loading is compared with one produced by static loading. Results indicate that the apparatus and techniques can be used to determine the direction of principal stress and to compare static and impact loads producing similar strain patterns."—Author's abs.

Mogaray, A., 1951,

Le comportement des piles fondées en milieu pulvérulent indéfini [Behavior of piers in a foundation stratum of indefinite extent and consisting of very finely divided material]: Annales des ponts et chaussées, v. 121, no. 2, p. 133-166.

"During the reconstruction of war-damaged bridges at Lyons many cases were noted of progressive subsidence under the thrust exerted by the distorted structures. Studies of stability conditions included numerous determinations of the specific gravity and void content of the foundation strata, and investigations of the line of maximum thrust, the supposed position of which was found to be subjected actually to zero thrust. The movements of the foundation soil are shown to be associated with variations in its specific gravity and void content and to be partly reversible if the abnormal pressure of the distorted structure is removed. Methods of repair and of checking further movement in individual structures are described."—Abs. 944, Road Abs., 1951.

Nash, K. L., 1951,

The elements of soil mechanics in theory and practice: 112 p., 56 illus., bibl., London, Constable & Co. Ltd.

This record of four lectures given at the King's College of London is a simple and concise account of the aims, scope, and methods of the science of soil mechanics. The following subjects are treated: history; site exploration; soil classification; nature of clays and sands; Atterberg index tests; sensitivity of clays to remolding; densities; seepage; flow nets; filters; consolidation; shear strength; stability of slopes, retaining walls, and footings; stabilization—natural (surface deposits—compaction; deep deposits—drainage, vibration) and artificial (surface deposits—mixing soils to improve grading, soil cement, waxed fuel oil; deep deposits—cement grout, sodium silicate, freezing, electro-osmosis); pavement design for roads and runways; Westergaard's analysis; California bearing-ratio method; and frost action.

National Research Council of Canada, Associate Committee on Soil and Snow Mechanics, 1952,

Fifth Canadian Soil Mechanics Conference, Proceedings, Technical memorandum 23, 71 p., Ottawa.

This memoradum is the record of a conference of Canadian specialists in the field of soil mechanics, and contains the following papers:

Legget, R. F., Introductory remarks, p. 2.
Schriever, W. R., Toronto subway research, p. 3-6.
Peterson, R., Recent soil mechanics studies of the Prairie Farm Rehabilitation Administration, p. 7-18, 2 figs.
Trow, W. A., Deep sounding methods for evaluating the bearing capacity of foundations on soil, p. 19-33, 7 figs.
Lea, N. D., The Swedish steel foil sampler, p. 34-40, 4 figs.
McCarthy, L. W., The reclamation of tidal marshlands in the maritime provinces of Canada, p. 41-46.
Crawford, C. B., Soil temperatures and frost penetration, p. 47-50.
Torchinsky, B. B., Heaving of curling ice sheets, p. 51-53.
MacDonald, A. E., Soils and foundations work in in Manitoba, p. 54-55.
Baracos, A., Foundation investigation in Winnipeg following the 1950 Red River flood, p. 56-58.
Sinclair, S. R., Resistivity methods of soil exploration, p. 59-60. Soil description, classification, and symbols. Discussion led by R. Peterson, p. 61-63.
Torchinsky, B. B., The neutron moisture meter, p. 64-66. General remarks and business, p. 67-71.

Pogány, A., 1951,

New method of determining earth pressure; Civil Engineering and Public Works Review, v. 46, no. 538, p. 248-250, 4 fig., bibl., London.

The author compares previous earth pressure theories and shows errors and deficiencies which may be postulated. He presents a new theory which pays due attention to factors previously neglected and gives the following results:

(1) The earth pressure perpendicular to a retaining wall, determined by his method, is greater

than that obtained by Coulomb and near to the value of Terzaghi.

(2) The earth pressure acts for the most part above the midpoint of a retaining wall up to the upper third-point of its height, which is in conformity with the latest investigations.

(3) Owing to the introduction of the parameter p, by means of which the limiting parabola is traced, all the physical properties of the working soil are taken into account.

(4) Equilibrium conditions are completely satisfied in this case.

(5) The method of computing the earth pressure is simple, and in more complicated cases gives quicker results than the method of Coulomb, Culman, Poncelet, Rebhan, Winkler, and Ergesser.

Poole, D. M., Butcher, W. S., Fisher, R. L., 1951,

The use and accuracy of the Emery settling tube for sand analysis: U. S. Corps of Engineers, Beach Erosion Board Technical Memorandum 23, 11 p., 7 figs., bibl.

"The accuracy of the Emery settling tube for the analysis of sand particles has been investigated. As pointed out by Emery, this method is more rapid than dry sieving and gives equivalent, or settling, diameters rather than geometric diameters. It is felt that a more exact knowledge of the errors and limitations of the method would be valuable. It was found that the settling-tube analyses for material between 0.062 mm and 1.0 mm had a reproducibility or coefficient of variation of the median diameter ranging from 0.6 to 2.0 percent, reproducibility being poorest for the coarser grades. Over the same range the coefficient of variation for sieving was 0.4-0.7 per cent. For most beach sands the accuracy of the two methods is very nearly the same. The errors that occur during splitting of the sample to the proper size were investigated by several procedures, but the results were not conclusive. The maximum splitting error was 3.6 percent. The effect of material finer than 0.062 mm in the sample was investigated and it was found that no significant difference was produced where the fine material was 10 per cent or less of the total. The effect of material coarser than 1.0 mm in the sample was also investigated and it was determined that all coarse material should be removed before the settling-tube analysis is made. A recommended procedure for making such an analysis is included."—Authors' abs.

Rosenqvist, Ivan Th., 1952,

[Considerations on the sensitivity of Norwegian quickclays]: p. 18-27, 3 bibl. ref., Oslo (Royal Norwegian Council for Scientific and Industrial Research, Geotechnical Institute), April 1952.

"The mechanical properties of the Norwegian quickclays are discussed. These clays are characteristic because of their great sensitivity. Remoulding of the most extreme quickclays causes a recognizable decrease in shear strength to less than 0.1 per cent. Quickclays are often found as lenticular bodies in normal clays. All quickclays are of marine origin. They are not very different from the normal glacial clays in mineralogical composition. The chief clay mineral seems to be illite. The great sensitivity is found to be due to a very low content of dissolved electrolytes. A modest addition of sodium chloride to a quickclay increases the liquid limit considerably and does not influence the plastic limit. An addition of salt changes the quickclay into less sensitive soils. A theory is outlined for the formation of quickclays. According to this theory the quickclays did not differ from the normal marine clays at the time of sedimentation. Subsequently, however, a great part of the salt was removed by diffusion into moving ground water. The configuration of minerals and the shear strength of the clays from which the salt has been removed is not influenced by the loss of electrolytes. Remoulding, however, will disturb the unstable configuration, and so the clay will become almost fluid. Artificial addition of salt is also possible on a large scale. This may be accomplished by either mechanical means or by electrolysis."—Author's synopsis.

Ruckli, Robert, 1950,

Der Frost im Baugrund [Frost in foundation ground]: 279 p., 112 figs., Vienna, Springer-Verlag. [In German.]

The author considers the general problem of frozen ground and specific effects of frost on the soil as they affect building techniques. The subject is divided in three main parts:

(1) Scientific description of natural frost phenomena, including a critical discussion of previous conceptions, and the author's divergent theory.

(2) Mathematical investigation of the behavior of soil toward frost, in which the author gives a theory for the calculation of frost penetration and frost heaving, which will help to estimate the results of frost investigations correctly.

(3) Practical applications of the theory, and description of the building methods by which structures can be protected against frost damage.

Salas, J. A. Jr, 1951,

Mecanica del suelo y sus applicaciones a la ingenieria [Soil mechanics and its applications to engineering], p. xviii + 393, ills., Madrid, Editorial Dossat, S. A.

"This book, which is concerned with the properties of soil, the stability and strength of soil masses, and the practical application of soil mechanics, is presented under the following heads.

"(1) The properties of soils: the soil—its origin; grading of soils; fundamental properties: density, condition of consistency, Atterberg limits; forms in which soil water occurs, permeability, interstitial pressures, capillarity; nature and structure of clay, thixotropy, undisturbed samples; compressibility of soils; the resistance of soils to shear stresses; and types of soils.

"(2) Strength and deformation of soil masses: The distribution of pressures in an elastic, homogeneous and isotropic semi-infinite solid; calculation of settlement; earth pressures; stability of slopes; admissible pressures in foundations; the strength of piles and piling; and ground water system.

"(3) Application of soil mechanics to engineering: Design and construction of foundations; roads and railways; hydraulic and maritime works; soil exploration methods and sampling."—Abs. 894, Road Abs., 1951.

Schulze, Edgar and Muhs, Heinz, 1950,

Bodenuntersuchungen für Ingenieurbauten [Soil investigations for engineering works], 464 p., 493 figs., 513 bibl. refs., Berlin W. 35, Reichpietschufer 20, Springer-Verlag, 1950.

The study of soil and ground water has become a necessity, and is generally a source of economy in engineering works. The purpose of the present work, written by two specialists in these subjects, is to guide the engineers in the choice of methods and procedure to follow in order to obtain valuable and adequate information. After a sketch of the investigation program, a first section deals with the geological and geophysical explorations in the field, drilling, and measurement of soil strength. A chapter is given to ground-water investigation in the field. A second section refers to laboratory testing of soil samples: solids, voids, behavior in the presence of water and loading, chemical behavior, special tests. The second part of the book deals with the study of completed constructions: earthworks (compaction, settlements, vibration), masonry, concrete, wood, steel structures (movements, deformations, stress, elongation,and fissuration). A last chapter refers to observations on ground-water levels. —Translated and adapted from abs. 206, Travaux, December 1951.

Sowers, G. B., and Sowers, G. F., 1951,

Introductory soil mechanics and foundations: 284 p., illus., bibl., New York, The Macmillan Co.

The authors stress the rational scientific approach to soil and foundation problems and explain how the theories are applicable in situations that engineers are likely to encounter in practice. The main topics treated are nomenclature and symbols (the names used conform to Soil mechanics nomenclature: Am. Soc. Civil Engineers, Manual eng. practice, no. 22); the nature of soils; the physical properties of soils; soils and soil deposits; seepage, drainage, and frost action; foundations; deep foundations; problems in earth pressure; construction of fills and subgrades; stability of earth masses; and underground investigations.

Stokstad, O. L., and Humbert, R. P., 1949,

Interpretive soil classification—engineering properties: Soil Science, v. 67, no. 2, p. 159-161.

The engineer's interest in soil classification stems from the fact that—in highway and airport engineering especially—the soil is one of his principal construction materials. The determination of soil characteristics, by field studies of the soil profile and through laboratory study of soil material sampled in the field, is used as a means for classifying the soil into types; which, in turn, afford a basis for making predictions of engineering significance. Soil information is brought into play in the solution of engineering problems through (1) soil survey, (2) field check of plans, and (3) construction inspections.

Terzaghi, Karl and Richart, F. E., Jr., 1952,

Stresses in rock about cavities: Géotechnique, v. 3, no. 2, p. 57-90, 9 tables, 16 figs.

"The article contains a discussion of the influence of the shape of cavities, such as tunnels or spheroidal chambers, on the state of stress in the surrounding rock. The mathematical methods which have been used for computing the stresses are given in an appendix. The results of the computation show that the stresses in the rock surrounding spheroidal cavities are lower than those in the rock about tunnels with the same cross section, located at the same depth. As the ratio between the height and the diameter of a spheroidal cavity decreases, the stresses in the rock adjacent to the equator increase, but the height and width of the zone of stress concentration decreases. If the rock located within this zone is not strong enough to sustain the stresses, it flows or it is crushed; but the local failure has little influence on the state of stress in the rock above the roof of the cavity. The most important error involved in the determination of the stresses is due to the uncertainties involved in the evaluation of the stresses which prevailed in the rock prior to the excavation of a cavity."—Authors' abs.

Tschebotarioff, G. P., 1950,

Some unsolved problems of importance for the design of earth retaining structures: Permanent International Association of Navigation Congresses Bulletin 33, p. 90-97, 3 figs., bibl.

In this article the author reviews briefly some existing problems in structural engineering and advisable methods of approach to their solution. He shows the interaction between soils and special types of structures, and as a basis for study of the associated problems he classifies the lateral pressures of cohesive soils as active and passive. The amount of the active lateral pressures of cohesive soils may be investigated (1) by the "strength" method or (2) by the "plastic" method. Problems involved in the analysis of passive lateral pressures of such soils are (1) the effect of stratification on the passive resistance of soils, (2) the stress-strain relations of soils that are stressed in tension, and (3) the sensitivity of sand-clay mixtures to shocks and vibrations. He recommends a closely correlated program of laboratory model testing and field examinations, with a final evaluation of the reliability of large-scale test results in relation to full-scale actual structures.

Tschebotarioff, G. P., 1951,

Soil mechanics, foundations, and earth structures: 655 p., illus. bibl., New York, McGraw-Hill Book Co., Inc.

The author of this text shows how utilization of the techniques of soil mechanics can lead to sound solutions of many problems of foundation works and the engineering of earth structures, within the limitations of these techniques and present-day knowledge of many soil phenomena. Recording of failures, field measurements, and other experimental evidence is extensively treated. The importance to civil engineers of understanding allied geotechnical sciences, especially geology and soil physics, is demonstrated by examples. The effect on soil engineering practice in different countries of varied geological, climatic, and economic conditions is stressed. The following subjects are dealt with: special features of foundation and soil engineering; formation of soils, geology, agricultural soil science, and civil engineering; definitions and tests relating to the properties of solid soil particles; definitions and tests relating to the density and to the consistency of soils; capillary phenomena; permeability of soils, ground-water movement, frost action; consolidation of soils; shearing strength and shearing deformation of soils; stability of vertical cuts and of slopes; stress distribution in soils, bearing capacity of soils; lateral earth pressures; compaction and stabilization of soils; exploration and classification of soils; selection of a suitable type of foundation; spread foundations, excavations; pile and caisson foundations, sheet piling, and underpinning; earth-retaining structures, cofferdams, tunnels and conduits; some soil engineering aspects of dam construction; effects of vibratory and of slow repetitional loading of soils; machinery foundations; and some soil-engineering aspects of highway and airport construction.

Turnbull, W. J., and McRae, J. L., 1950,

Soil tests results shown graphically: Engineering News-Record, v. 144, no. 21, p. 38-39.

"Variations in moulding-water content and density of soils have considerable influences on the strength of compacted soils. A procedure is described for establishing the correct combination of water content and density at which the soil should be compacted in the field in order to obtain optimum, or even adequate, strength values. A graphical method of showing variations in CBR values and in triaxial-shear values with changes in density and moisture content is also presented. The curves permit interpolation of the strength of compacted soils for any given moulding-water content and density within the range of test data obtained."—Abs. 939, Bldg. Sci. Abs., 1950.

Sampling and testing

Berdan, D., and Bernhard, R. K., 1950,

Pilot studies of soil density measurements by means of X-rays: American Society for Testing Materials, Proceedings, no. 50, p. 1328-38; discussion p. 1338-1342.

"Pilot experiments have been made with soil samples in small containers to determine, by means of X-rays, first, the effect of densification on the radiographs and, second, the effect of densification of differential pressure cells buried in the soil samples. Characteristic X-ray images are presented, and some conclusions with respect to the application of this method are discussed. This non-destructive X-ray method leaves the soil sample completely unchanged, regardless of its state of densification, and might become particularly useful in those cases where undisturbed soil samples cannot be obtained. A possible development for future field applications is suggested."—Authors' abs.

Bishop, A. W., and Eldin, Gamal, 1950,

Undrained triaxial tests on saturated sands and their significance in the general theory of shear strength: Géotechnique, v. 2, no. 1, p. 13-32, 15 figs., bibl.

"Results of a series of undrained triaxial-compression tests on saturated sand. These indicate: (1) that, under appropriate conditions, a frictional soil having no true cohesion and a dilatant structure will exhibit zero angle of shearing resistance and will have the shear characteristics of a purely cohesive material with reference to total stresses; and (2) that, if a certain value of negative pore-water pressure is reached during shear, these conditions cease to be fulfilled and an apparent angle of shearing resistance is measured. The factors controlling the changes in pore-water pressure during the application of an all-round pressure are analysed in terms of the relative compressibilities of the soil structure, the pore water, and the soil grains, and of the areas of contact between the soil grains. The analysis leads to the conclusion that the angle of shearing resistance in undrained tests (ϕ_u) in saturated soils should have values which are too small to be observed experimentally. This includes soils having a dilatant structure, although, where this is combined with very low compressibility, the angle ϕ_u becomes appreciable. Initial deviations from full saturation too small to be determined by direct measurement are shown to alter the order of magnitude of the apparent compressibility of the liquid phase to an extent which can cause large angles of undrained shearing resistance to be measured. Deviations from full saturation of a different character occur even in initially fully saturated samples if the pore-water pressure during shear reaches large negative values, owing to the formation of small bubbles of water vapour and air freed from solution. The resulting angle of shearing resistance is estimated theoretically, and is compared with the values measured in the tests on sand, and with certain other tests on silt."—Authors' abs.

Cadling, Lyman, and Odenstad, Sten, 1950,

The vane borer, an apparatus for determining the shear strength of clay soils directly in the ground: Statens geotekniska institut Meddelanden, no. 2, 88 p., 13 pl., bibl., Stockholm.

"Laboratory shear strength tests on clay samples extracted from bore-holes often give too small strength values as compared with values obtained in stability analyses, especially when samples are taken from great depths. This may largely be due to changes in the pressure conditions during the extraction of samples. A method for determining the shear strength of clay soils directly in the ground is described. The strength test is made by driving a vane into the soil and rotating it, while measuring the resistance to rotation. The shear strength is calculated from the torsional moment thus obtained. Tests for determination of an appropriate rate of rotation and a suitable shape of the vane are described. The stress and strain conditions in the soil around a vane are subjected to mathematical treatment based on the results of some laboratory tests. A definite relation is found between the angle of rotation of the vane and the angle of shearing strain in the clay. This relation makes it possible to estimate the elastic properties of the soil. Vane tests made on several sites are described, and the strength values obtained from these tests are compared with laboratory strength values relating to extracted samples and with the shear strength calculated from slides. The vane strength values are closely in agreement with the shear strength values calculated from eleven slides and one loading test, while unconfined-compression test results, especially those concerning deep slides and clays of high sensitivity, are too small, and cone test results are often somewhat too great in shallow slides and too small in deep slides. Generally, vane test results and compression test results seem to agree approximately at small depths, while the former exceed the latter at great depths. Vane test results and cone test results are generally in fairly close agreement.. However, cone results are often somewhat greater than vane results at small depths and smaller at great depths. The more sensitive the clay, and the greater the depth (pressure) from which they are taken, the more difficult it seems to obtain undisturbed samples. Finally, some data on the requisite time for boring with the vane borer are given, and some economical aspects are discussed. "—Authors' summary.

Central Board of Irrigation, Simla, 1948,

Standards for testing soils (tentative): Pub. 42, 195 p.

It was felt that to obtain full advantage from researches carried out in different soil laboratories in India, uniform standards and uniformity of practice are essential so that the results can be compared and correlated. With this object in view, the Central Board of Irrigation engaged the interest of all the organizations in India engaged on soil research and set up a permanent committee for the standardization of soil-testing methods and apparatus. The Committee included representatives of the Central Board of Irrigation, the Indian Road Congress, the Railway Board, the Indian Army, and the Ministry of Transport (Government of India).

This book presents the tentative standards compiled by the committee. It includes methods for the testing of soils, as required for different engineering works recommended by the committee.

For facility of use by laboratories engaged on different types of work, it was also suggested that the subject can be divided into five categories, for which soil analysis is likely to be carried out. These categories are: (1) roads and airfield subgrades; (2) low-cost roads; (3) earth dams; (4) embankments; and (5) foundations for bridges, buildings, dams, etc. Under each head the tests have been again classified under subheads (1) routine tests required for design and construction, and (2) tests for research work, so that each laboratory can equip itself to the extent of its own scope of work.—Adapted from abs. 68, Indian Central Board of Irrigation Abs., Feb. 1949.

Couard, A., 1948,

Détermination par sondages dynamiques de l'angle de frottement interne et de la cohésion des sols en place [Determination of the angle of internal friction and of the cohesion of soils in situ by means of dynamic drilling]: Le Génie civil, tome 125, no. 24, p. 472-474, 1 fig., Paris.

This article describes a light hand drill developed by the author, which offers an economical method of adequately investigating foundation conditions to a depth of about 20 m. This "dynamic" method permits the determination of the resistance, the cohesion, and the coefficient of compressibility of the soil in situ, utilizing data obtained by driving a small olive-shaped shoe at the end of the drill into the ground by the stroke of a calibrated head dropping from a constant height. Comparative reference is made to the so-called static reconnaissance method, which consists of driving a cone into the ground by application of a continuous force. The advantages of measuring the soil properties in situ are given, showing how it avoids the causes of important errors which cannot be eliminated from laboratory tests.—D. H.

Daxelhofer, J. P., 1947,

Remarques sur la resistance au cisaillement des sols et son importance dans quelques cas particuliers [Remarks on the shearing resistance of soils and its importance in some particular cases]: Special ed. from Bullétin technique de la Suisse Romande, nos. 25 and 26, 42 p., 20 figs.

The conditions required for a complete and systematic study of the shearing resistance of a soil are discussed, showing the advantages and disadvantages of the four main types of apparatus used for the determination of the shearing resistance: apparatus for shear by translation, shear by rotion, shear by torsion on solid or hollow cylinders, and triaxial apparatus. Results of typical tests are given—among others, granular material subjected to the triaxial test, and cohesive material tested with the apparatus for shear by torsion. This is followed by some instances of practical application of the determination of the shearing resistance to engineering structures.—Complete translation prepared (no. 28).

De Beer, E. E., 1949,

Quelques exemples d'application des méthodes d'investigation utilisées en Belgique pour la résolution des problèmes de fondation: [Some applications of the exploratory methods used in Belgium for resolving problems in foundations]: Annales de l'Institut technique du bâtiment et des travaux publics, Sér. nouv., no. 105, 24 p., 27 figs., Paris.

"The theoretical and experimental methods used in Belgium for solving foundation problems are outlined. Deep sounding tests are an important feature of the initial attack on any important foundation problem. These tests give data on the nature, consistency, and degree of compaction of the layers and enable one to decide whether to use a direct or a pile foundation, and to evaluate approximately the length and the bearing capacity of piles, the equilibrium limit of rupture under a direct foundation, and the probable settlement of foundations in compressible soils. In many cases these data are sufficiently accurate to provide a rational and economical solution to foundation problems. Otherwise, undisturbed samples are also taken and their shear strength and compressibility determined in the laboratory. Knowledge of these two quantities, combined with standard formulae, enable the equilibrium limit of rupture and the equilibrium limit of deformation to be more accurately assessed."—Abs . 233, Bldg. Sci. Abs ., 1950.

De Beer, E. E., 1950,

The cell-test: Géotechnique, v. 2, no. 2, p. 162-172; discussion, p. 173-182, London.

"The cell apparatus is usually employed in Belgium and Holland for the determination of shear strength. The results obtained from such tests depend upon the influence of three factors: the possibility of eliminating free pore water, the phenomena which occur in the films of adsorbed water, and the structure of the solid phase of the sample."—Authors' abs.

Deguillaume, Rene, 1948,

Appareil d'essai rapide et sur place de la résistance des terrains de fondation [Device for the rapid test in situ of the resistance of foundation grounds]: Le Génie civil, tome 125, no. 2, p. 30-32, 3 figs.

This article covers the description and mode of operation of a light device developed to make a rapid determination of the maximum pressure that a planned structure may exert on the ground without settling, tilting, or breaking up. The device was inspired by pile driving, which gives directly the loading strength of a soil as a function of the penetration in that soil of a pile driven in by a piledriver. This device has proved very useful and the results obtained with it in the field were confirmed by laboratory tests.—Complete translation prepared (no. 25).

Geuze, E.C.W.A., and Tan Tjong Kie, 1950,

The shearing properties of soils: Géotechnique, v. 2, no. 2, p. 141-161, bibl. London.

"In part 1 the authors described the apparatus for the cell-test and the procedure for carrying out 'quick' tests on cohesive samples. The methods of interpreting the results of the tests are described, and the application of the results to practical problems discussed briefly. Part 2 deals with the triaxial tests concerned, including the mechanism and course of those tests. Results of the 'quick' cell-test and undrained triaxial test are compared in detail, with regard to the test conditions. It is concluded that both tests have their particular application, dependent upon the nature of the problem and the local conditions encountered."—Authors' abs.

Golder, H. Q., and Ward, W. H., 1950,

The use of shear-strength measurements in practical problems: Géotechnique, v. 2, no. 2, p. 117-133; discussion p. 134-140, bibl. London.

"This paper describes the methods used in Great Britain for the analysis of stability problems in which the shear strength of soils is used. The influence of the type of soil and the type of problem on the choice of method is discussed. Particular reference is made to the methods of test described by Skempton and Bishop, and to the $\phi = 0$ method of analysis. Eight examples of the methods, taken from practice, are given."—Authors' abs.

Hansen, J. B., 1950,

Vane tests in a Norwegian quickclay: Géotechnique, v. 2, no. 1, p. 58-63, 6 figs., bibl.

"In the harbour of Horten, in Norway, various geotechnical investigations have been carried out in a stratum of postglacial silty clay about 30 meters thick. The clay has average liquid and plastic limits of 32 per cent and 16 per cent respectively, whereas the natural water content is somewhat greater than the liquid limit. This means that the clay is a so-called quick-clay, which becomes practically liquid on remoulding; it has a sensitivity of the order of 100. The relationship between shear strength and depth has been investigated by means of cone tests and quick shear tests on samples, and by vane tests in situ. The vane tests show that the shear strength remains essentially constant to a depth of about 7 metres and then increases in direct proportion to the depth, the ratio c/p being 0.18, where c denotes shear strength and p denotes effective overburden pressure. The cone tests and the quick shear tests both indicate shear strengths which agree reasonably well with the results of the vane tests above a depth of 15 metres, whereas, below this depth, they are substantially lower than the vane strengths. A Norwegian theory concerning the formation and properties of quick-clays is described briefly. The explanation given is based on the effect of electrolytes on the quantity of water adsorbed by the clay grains."—Author's abs.

Jamison, V. C., Weaver, H. A., and Reed, L. F., 1950,

A hammer-driven soil-core sampler: Soil Science, no. 69, p. 487-496.

"A modification of the Lutz core sampler (Soil Sci. 1947, no. 64, p. 399) is described and illustrated. Modifications include a sliding hammer and an increase in size (to 470 cc) of sample so as to reduce sampling error and variation in results. In loose, very wet, or very dry soil, pushing rather than hammering will cause less soil disturbance, but in compact soils the reverse is true. The tool is unsatisfactory for sampling stony soils or those that are very hard and compact, but it is convenient for use in the field and experimental plots for sampling to depths of less than about 18 in."—Abs. 937, Bldg. Sci. Abs., 1950.

Kjellman, W., Kallstenius, T., and Wager, O., 1950,

Soil sampler with metal foils: Statens geotekniska institut, Meddelanden [Royal Swedish Geotechnical Institute, Proceedings] Band 1, 76 p., 36 figs., bibl., Stockholm.

"In this report a description is given of a quite new device for taking undisturbed soil samples. This device is capable of taking continuous soil cores of very great length, whereas other samplers can take only rather short samples. The principle of the new sampler is to insulate the core from the sampler wall by means of a number of axial metal foils, their upper ends being attached to a stationary piston above the core. The foils are stored in rolls between the outer and the inner wall of the sampler head, and, as the sampler is driven down, they are fed into the core through a horizontal slot in the inner wall. The foils not only protect the core against the sliding resistance due to the sampler wall, but also postively keep the thickness and the structure of each soil layer unchanged when caught by the sampler. On the basis of this principle the development of the new sampler has been going on for many years, and a great amount of experimental work has been carried out. The report briefly describes different models of the sampler which were designed, built, tried, and abandoned before the model now in use came into being. As a result, this Model V, which is comprehensively described in the report, constitutes a sampler ready for hard service under varying practical conditions. The stress conditions in the core during the driving, which are decisive for the success of the operation, are discussed in detail. As a result, a standard value for the inside clearance is recommended. Furthermore, it has been found necessary to compensate for the axial strain on the foils during driving by adjusting the level of the piston. Finally, special measures are recommended to eliminate the difficulties arising in certain soils, such as expansive soils, quick-clays, very soft clays, and quite cohesionless soils. In soft cohesive soils the sampler is driven down by pushing, and two devices used for this purpose are described in the report. In cohesionless soils use is made of jetting by means of water or drilling fluid, depending on the depth and permeability of the soil. Finally, in firm cohesive soils rotary drilling with drilling fluid is resorted to. The requisite unit weight of the drilling fluid in different soils is computed, and its other properties and composition are discussed. The sampler has already been used in practice on many sites, and a great number of cores have been taken from different soils. An account is given of the experience gained. The advantages of the new sampler in comparison with the ordinary types are discussed."—Authors' abs.

Lambe, T. W., 1951,

Soil testing for engineers: ix + 165 p. illus. bibl., New York, John Wiley & Sons, Inc.

This book deals with the laboratory testing of soils. A complete chapter has been allotted to each laboratory test covered: specific gravity test, Atterberg limits and indices, grain size analysis, compaction test, permeability test, capillary-head test, capillary-permeability test, consolidation test, direct-shear test on cohesionless soil, triaxial compression test on cohesionless soil, unconfined-compression test, triaxial compression test on cohesive soil, and direct-shear test on cohesive soil. Observations, determinations, and techniques which are required in more than one test are given in the introduction: soil identification and description, storage of soil samples, handling of undisturbed samples, partially dried clay specimens, water content, void ratio, porosity, degree of saturation, and report of laboratory tests. Appendixes A and B deal with conversion factors, specific gravity of water, viscosity of water, proving rings, drawing of liquid limit device, derivation of equations. A soil mechanics nomenclature and numerous bibliographic references accompany the test.

L'Herminier, M. R., 1950,

Routes et pistes d'envol [Roads and runways]: Annales de l'Institut technique du bâtiment et des travaux publics, Sols et fondations, no. 3, p. 13-25, 4 figs.,

"The report summarizes the activities of the French Soil Research Laboratory from 1938 to 1950 as regards roads and runways. Description of tests made by the laboratory on the Ville de Paris test track, at Fréjus, and on the runway of stabilized soil at Limoges-Feytiat. After the American landing in North Africa, the war effort was directed towards the aerodromes at Blida (Algeria), Ghisonnaccia (Corsica), and the South Algerian supply routes. Since the Liberation of France the most important work has been centered on the organization of the laboratories at the aerodromes at Orly, Montpellier, and Marignane. Their special study has been the determination of the thickness of a pavement with reference to the characteristics of the underlying soil and of the moving loads by means of measuring the bearing modulus and the Californian bearing ratio. As regards road investigation in French overseas possessions, the direction which research should take is specifically stated with the aim of improving the quality of stabilized soils and lowering costs. In conclusion, the author points out that each problem demands a particular solution adapted to local conditions. There is no universal panacea in this field."—Author's abs.

Mayer, M. A., 1950,

Digues et barrages [Dikes and dams], Annales de l'Institut technique du bâtiment et des travaux publics, Sols et fondations, no. 3, p. 3-11, 9 figs.

"This paper deals with the preliminary site investigations for the dams at Carces, Arcisans, Foum-el-Gheiss, Ghrib, and Donzère-Mondragon; waterproofing for the dams at Sautet, Genissiat, Lac Noir and Verdon; tests of stability for the dams controlling the supply of water of the French canals at Charmes, Wassy, and Grosbois; and rock foundations and the measurements of the characteristics of rock foundations (Tignes' tests). In the last-named section are some general indications that the work of the Soils Research Laboratory is developing along new lines. In conclusion the author stresses the importance of soil studies, which involves the participation of the Laboratory in the design and construction of projects. The Soils Research Laboratory must work in conjunction with the Designing Office; only on this condition can the results of tests be usefully applied in practice. "—Authors' abs.

Soil moisture

Coleman, J. D., 1949,

Soil thermodynamics and road engineering: Nature v. 163, no. 4134, p. 143-145, London.

"A fundamental approach regarding the thermodynamics of the soil and the many problems associated with the transfer of moisture in road foundations is being made at the Road Research Laboratory, London. The potential causing the migration of soil water may be regarded as either a hydraulic pressure or a vapour pressure gradient. Movements cease only when suction and vapour pressure conditions are in equilibrium with the acting gravitational field under the prevailing temperature conditions. Gives mathematical calculations for the road problem based on the above hypothesis. "—Abs. 126, India Central Board of Irrigation , June 1950.

U. S. Corps of Engineers, 1952,

Soil mechanics design, seepage control: Engineering Manual for Civil Works Construction, pt. 119, chap. 1, 40 p., 22 plates, bibl.

This chapter of the Engineering manual for civil works is devoted to analyses of seepage problems in the design and construction of hydraulic structures. Coverage is given to the determination of distribution, direction, and magnitude of seepage forces, and the design and construction measures relative to control of seepage in soil foundations and soil structures in Civil Works projects. The main topics are: determination of permeability of soils, flow-net analysis, seepage through embankments, seepage through foundations, seepage-control methods, well theory, design of pressure-relief wells, and filter design.

Lambe, T. W., 1950,

Capillary phenomena in cohesionless soils: American Society of Civil Engineers, Proceedings, v. 76, separate no. 4, 23 p., 17 figs., bibl.

The experimental work reported in this paper was done on one soil, and under one set of test conditions. Horizontal and vertical flow of water in unconnected and interconnected capillary tubes are considered, the differences between soils and a system of capillary tubes examined, and results presented of investigations concerning the extent to which horizontal and vertical columns of soil become saturated by capillary moisture movement. Drainage of capillary tubes and of cohesionless soils is also discussed, and the role of different capillary heads in the various types of capillary flow is explained. —Adapted from abs. 146, Road Abs., 1951.

Lefranc, Edouard, 1948,

Mésure de la perméabilité des sols en place et ses applications [Determination of the permeability of soils in situ and its applications]: Le Génie civil, tome 125, no. 16, p. 304-308, 1 fig.

This article shows how the coefficient of permeability resulting from Darcy's definition can be determined at any point of the water table, and how the knowledge of this coefficient in a sufficient number of proper points may give an approximate anticipation of the flow of water into wells or into excavations, and be of help to the constructor of cofferdams, canals, and dams. After reviewing the experience of Darcy and the classical methods for the determination of the coefficient of permeability, a new method based on the theory of "absorbing pockets" is described with instances of its practical applications.

Matsuo, Schinichiro, 1950,

New graphical solution of stress in the ground water under foundations; Kyoto University, Memoirs of the Faculty of Engineering, v. 12, no. 5, p. 120-127, 2 figs., 3 tables.

After a discussion on graphical methods by D. M. Burmister, N. M. Newmark, and D. P. Krynine of obtaining stresses in the ground under foundations, three new simplified graphical solutions are proposed and explained. Method 1: the solution is obtained when the graphical solution of D. M. Burmister is improved to conform to the theory of O. K. Fröhlich. Method 2: the stress, when the phenomenon of the concentration of stresses in the foundation is considered, can be obtained from a diagram which Newmark obtained by assuming the foundation as an elastic body, without performing the difficult graphical construction required in Krynine's method. Method 3: the solution is obtained by employing the equation for elastic bodies, except that depths are computed according to the nature of the soil. A table shows the results of a comparison between the former methods and the author's new methods. It is noted that the methods of Burmister and Newmark, based upon the elastic theory, are developed and improved, and the laborious construction required in Krynine's method is omitted.

Silfverberg, L., 1949,

[A few physical problems of soils—(1) Permeability of clay under low pressure gradients, and (2) Stabilization of soils by electro-osmosis]: Statens geotekniska institut, Meddelanden no. 2, Stockholm, [in Swedish]: French translation, T. P. Su 2.075, by the Consortium général de Recherches aéronautiques, 139 Boulevard St. Germain; Paris VI.

1. The direct measurement of the permeability of clay is important when this material is used in waterproofing works, for instance in dam construction. Because of its very slight permeability, relatively high hydraulic gradients have always been applied, which never occur in practice. It is of extreme interest that the passing of water through the pores of clay be studied under much more reduced pressures. In his paper, the author gives the description of an apparatus specially designed for that purpose, and also a few results which were obtained by the use of that apparatus and which will possibly modify some theories generally admitted.

2. After giving a few examples of electro-osmotic measurements, the author describes an apparatus designed to determine whether the electro-osmotic water flow produces any pressure on the soil particles. Results were negative. —Adapted from abs. 6, Annales des Ponts et Chaussées, p. 334-A, 1950.

Stabilization

Basart, A. H. M., 1950,

Electro-osmotisch-ontovochting van funderingen [Drying foundations by electro-osmosis]: Bouw, no. 13, p. 206-210, 9 figs., bibl. [In Dutch.]

The penetration of dampness through foundations is ascribed to the difference in potential between the walls and soil, the latter being negative relative to the walls. The principle of the electro-osmotic method consists in creating a connection between the wall and a metallic plate buried in the soil. The effectiveness of the process may be increased by placing on the connection an auxiliary source of energy. A plan is given of an installation applying this principle in the basement of a large building in Holland; results obtained and the costs involved are stated.

Bridgwater, A. B., 1950,

The occurrence of electro-kinetic phenomena in soils: pt. 1, Civil Engineering and Public Works Review, v. 45, no. 526, p. 234-236, Apr. 1950; pt. 2, no. 527, p. 313-315, May 1950; pt. 3, no. 528, p. 385-387, June 1950; pt. 4, no. 529, p. 451-453, July 1950.

Report on laboratory research made at the University of Bristol, for the determination of the electro-kinetic properties of a certain type of soil. It was found that in a soil of the type studied electro-osmosis increased the apparent permeability without modifying the flow lines. The combined action of electro-osmosis and electrochemical consolidation of the soil on the bearing capacity of friction piles is discussed and conclusions are drawn. —Translation of abs. 51-1-80, Annales des Ponts et Chaussées, no. 1, 1951.

Casagrande, L., 1952,

Electro-osmotic stabilization of soils: Boston Society of Civil Engineers Journal, v. 39, no. 1, p. 51-83.

"Author reviews the principles of electro-osmosis as applied to soil stabilization and describes four successful field applications. The power consumption varied from 0.4 kwh per cu yd of excavated soil for large excavations to 2 kwh for smaller (900 cu yd) excavations. An explanation is offered for shrinkage and cracking observed in clay under electro-osmotic treatment. This is based on the theory that gas bubbles inside the soil form a boundary which interrupts the electro-osmotic flow and, in fact, causes a reverse flow down the center of the capillary. In the region of the gas bubble, there is a tension which produces cracks in the soil, and between gas bubbles pore-water tensions produce compression and shrinkage." —Eben Vey, Abs. 2214, Applied Mechanics Reviews, 1952.

Drucker, A., 1950,

[Vertical sand drains as a means of accelerating settlement and of securing stability of road embankments in districts with peaty soils]: Strassen- und Tiefbau, v. 4, no. 10, p. 279-283. [In German.]

This technique has been successfully applied to a stretch of road about 2,650 ft long, in the course of construction of a bypass on peaty soils in Schleswig-Holstein. Construction methods used and results obtained are described and are compared with American experience. —Adapted from Abs. 23, Road Abs., 1952.

L'Hériteau, M. G., 1944,

La stabilisation des terrains [Soil stabilization]: Laboratoires du Bâtiment et des Travaux Publics, Compte Rendu des recherches effectuées en 1944-1945, p. 49-56, 3 figs., Paris.

This article gives the results of tests on (1) maximum dry density and optimum moisture content; (2) Atterberg limits; (3) shrinkage and saturation limits; (4) permeability; and (5) compressibility and swelling of earth materials as they are related to size, size distribution, angularity, mineralogy, and other characteristics of the soil components. It was found that if a large quantity of coarse material is required, rounded pieces interlock better and give higher internal friction than angular fragments. —Complete translation prepared (no. 20). —DV.

Mainfort, R. C., 1951,

A summary report on soil stabilization by the use of chemical admixtures: Civil Aeronautics Administration, Technical Development Report 136, 57 p., 16 figs., 9 tables, Indianapolis, Ind.

This report presents the results obtained from laboratory and field investigations of the soil-stabilizing properties of numerous chemicals with respect to their applicability for road and airport construction. Laboratory testing procedures are described which were developed for evaluating the various chemical soil treatments studied. As a result of this study it has become apparent that a more basic understanding of fundamental soil properties is required before the complex reaction between soils and chemical treatments can be fully evaluated. The composition of natural soils, and their consequent reactivity to chemical modification, has been the greatest variable encountered during this study. Until these variables can be more fully understood and controlled, the future development of soil stabilization cannot be directed with optimum efficiency.

Poisson, Y., 1948,

Traitement d'argile plastique par le courant électrique [Electrical treatment of plastic clay]: Travaux, no. 164, p. 386-387, 7 figs., Paris.

The electrical drainage of clay soils is a well-known procedure used either to drain the soils or to accelerate settling which results from progressive consolidation of the clay under a load. Experiments are described that were made to investigate the mechanical properties of clay before electrical treatment, and then to investigate such properties after treatment (1) by means of direct current, (2) by means of alternating current. Results of the two treatments are given. It is concluded that the treatment by means of alternating current results in hydration and, consequently, has an effect opposite to the desired result; the treatment by direct current produces only temporary drainage.—Complete translation prepared (no. 24).

Rosenqvist, I. T., 1948,

[Electrodialytic experiments at Asrum Lake, Vestfold, Norway]: Meddelelzer från Vegdirektoren, no. 2, p. 21-3.

"In a field experiment in southeastern Norway, approximately $2\frac{1}{2}$ cu. yd. of unstable clay were stabilized by the addition of about 90 lb. of salt, by means of electrolysis. Four perforated iron tube electrodes, $2\frac{1}{2}$ in. in diameter, were driven into the clay at the corners of a meter square and filled with salt over which about $\frac{1}{2}$ gal. of water was subsequently poured. About 50 kwh. of direct current were applied over a period of 42 hr, salt and water being added from time to time as required. The bearing capacity and shear strength of the clay were increased very considerably. Reference is made to the work of L. Casagrande."—Abs. 365, Bldg. Sci. Abs., 1950.

Zaretti, L., 1950,

[Notes on the application of the electro-osmotic process for the consolidation of argillaceous soils]: Energia elettrica, 27, no. 10, p. 625-631, Milano.

"Laboratory tests have been carried out on samples of clay taken from clayey region near Lake Nolveno in Italy. The investigation showed that electrical drainage could be satisfactorily effected either by electro-osmosis or electro-chemical action. In a practical test on the site, only 11.5 kwh. per cu. m. were necessary to consolidate the slopes. Before-and-after loading tests showed a marked improvement in the stability of the treated clay."—Abs. 22, Road Abs., 1952.

OTHER SUBJECTS

Auden, J. B., 1950,

The role of geology in multi-purpose projects: National Institute of Science of India, Proceedings, v. 16, no. 6, p. 431-441, bibl., Nov.-Dec. 1950.

"The paper outlines the principal ways in which the geologist is concerned with multipurpose projects. The reconnaissance investigation of river catchments for selection of dam sites is illustrated by work done on the Kosi and Nayar rivers, which are in regions of complicated tectonics. The necessity for detailed investigations by means of tunnels and borings is discussed with particular reference to the Marora dam site on the Nayar river. The investigation of raw materials for construction, such as cement limestones, and sources of aggregate, and the examination of reservoir basins for leakage and the flooding of mineral deposits, are then outlined with examples from the Kosi, Ramganga and D. V. C. [Damodar Valley Corporation] projects. The paper ends with a discussion of economic potentialities of areas around projects, and the long-term planning which should be adopted before reconnaissance investigations are followed by detailed and costly exploration."—Author's abs.

Benioff, Hugo, 1951,

Earthquakes and rock creep—Pt. 1, Creep characteristics of rocks and the origin of aftershocks: Seismological Society of America Bulletin, v. 41, no. 1, p. 31-63, 20 figs., 3 tables, bibl.

Many seismic phenomena are adequately explained on the basis of a simple elastic theory of rock characteristics in which strain is proportional to stress and is independent of time. It is known, however, that the elastic characteristics of solids in general and rocks in particular depart greatly from these simple assumptions. The purpose of this paper is to investigate the possible relationship of this departure to the origin of aftershocks and to the characteristics of earthquake sequences. Part 1 is concerned with the creep characteristics of rocks and the origin of aftershocks. In part 2, which will appear at a later date, earthquake sequences will be discussed. The following subjects are studied in part 1: strain characteristics of rocks, empirical creep functions, creep theory of aftershocks, aftershock sequences of Long Beach, Manix, California, Imperial, and Signal Hill earthquakes.

Caillère, S., and Kraut, F., 1951,

Le role de la minéralogie dans la construction des barrages [The role of mineralogy in the construction of dams]: Le Génie civil, v. 128, no. 18, p. 345-347, 6 figs.

Marly calcareous shales of Middle Cretaceous age from the dam site planned in the Djenjen Oued Valley

(Department of Constantine, Algeria) were found to disintegrate rapidly when exposed to the atmosphere. In order to find out the cause and mechanism of the breaking up of the rock, numerous methods of artificial alteration were tried, and resistance tests and a minute chemical study of the shales were made but failed to solve the problem. Mineralogic methods were then resorted to and showed that the Djenjen Oued shales disintegrate through the known process of sulphate alteration. The increase of volume due to the formation of gypsum causes the disintegration of shales, which is made easier by their micaceous texture. —Complete translation prepared (no. 32).

Hennes, R. G., and Chang, K. H., 1951,

Evaluation of earthquake hazard to foundations: Trend in Engineering at the University of Washington, v. 3, no. 1, p. 14-18.

"The resonance frequency and the damping coefficient of foundation soils are discussed in relation to earthquake-resistant design. During an earthquake the normally low resonance frequency of a soft, saturated soil (particularly if noncohesive, such as loose, fine sand) overlying solid bedrock may receive a much greater amplitude and acceleration from prolonged vibration of the underlying rock and the soil itself may even be transformed into a denser state. Damage to structures founded on such soils may thus arise unless the damping properties of the soil are adequate. A description is given of a mechanical vibrator developed by the University of Washington, Engineering Experiment Station, for determining the dynamic properties of the soil in situ. The small-amplitude vibrations in the earth are picked up electromagnetically and the wave forms are obtained by a combination of amplifier and cathode-ray oscillograph. The calibration of the instruments is simplified by use of a laboratory shaking table providing vibrations of known frequency and amplitude. Amplitude-frequency curves and damping coefficients are reported for five different sites in Washington and are discussed in relation to foundation conditions. Low natural frequency and low wave velocity are indicative of lower bearing capacity and higher settlement under dynamic action, and therefore of inferiority in foundation conditions. The data also seem to show that a high water table over an unfavorable soil site increases the damping capacity relative to that of a site having more favorable soil conditions but a lower water-table."—Abs. 107, Bldg. Sci. Abs., 1951.

Jakosky, J., 1950,

Exploration geophysics: 2d ed., xvi + 1195 p., 706 figs., 28 tables, Los Angeles, Calif., Trija Publishing Co.

"Much of this book has been completely rewritten in order to include the important developments of the past decade, with the aim of creating a text which not only presents background and theory, but also shows in a practical manner how these fundamentals may be applied to the problems of exploration. It is organized under the readings: introduction; geologic and economic background of exploration geophysics; magnetic methods; gravitational methods; electrical methods; thermal methods; radioactivity methods; bore hole investigations; physical principle pplied to production problems; land tenure, perm and trespass practices, insurance; and patents. It cc ins a name and place index and a subject index."—A . 505, Bldg. Sci. Abs., 1950.

Newton, Carroll T., 1951,

An experimental investigation of bed degradation in an open channel: Boston Society of Civil Engineers, Journal, v. 38, no. 1, p. 28-60, 18 figs, 1 table, bibl.

"The problem of estimating the degradation that will result downstream in alluvial rivers following the construction of large dams confronts the agencies responsible for river control programs. A limited laboratory investigation simulating the problem in nature, but under controlled conditions, illustrates the general process and pattern of degradation of the bed resulting when the normal amount of bed load carried by the stream in an equilibrium condition is withheld at an upstream point. Further laboratory investigations of similar nature will be valuable in verifying analytical methods for calculating expected degradation in nature; however, specially adapted laboratory apparatus and procedures are recommended."—Author's abs.

United States Beach Erosion and Shore Protection Board, Corps of Engineers, 1951,

The source, transportation, and deposition of beach sediment in southern California: U. S. Beach Erosion Board Technical Memorandum no. 22, 113 p., 12 pl., bibl.

"Beach studies are of importance as a basis for engineering design of harbors, shore protective works, and other commercial and recreational facilities. Geologists find modern beaches to be of particular interest as sources of information about sedimentary processes and as clues to the origin of certain ancient deposits. This thesis is the result of work undertaken for the Los Angeles District Engineer Office and of graduate work at the University of California, Los Angeles. It deals with the source, transportation and deposition of beach sands along the southern California coast from Carpinteria to Point Fermin. Vicinity maps are on plates 1 and 2."—Authors' introduction.

United States Bureau of Reclamation, 1948,

Selected bibliography of technical papers written by engineers of the Bureau of Reclamation, 186 p., Technical Library of the Bureau, Denver, Jan. 30, 1948.

The bibliography lists 948 papers on various subjects among which the following may be of interest to engineering geologists: abutments, anchors, aqueducts, arches, bentonite, blasting, bridges, building materials, conduits, dams, drainage, earth, earthquakes, embankments, erosion, excavation, explosives, flow net, foundations, galleries, geology, gravel, grouting, hydraulics, hydraulic structures, hydrodynamics, hydroelectric power plants, hydrology, land reclamation, petrography, piling, pozzolana, reservoirs, retaining walls, runoff, sand and gravel, seepage, silt, soil, mechanics, spillways, stress analysis, surveying, tunnels, and uplift pressures.

Von Moos, Dr. A., 1943,

Ein Baugrundarchiv der Stadt Zürich [Subsoil archives of the city of Zürich]: Schweizerische Bauzeitung, v. 122, no. 3, p. 29-30.

The author reports the establishment of archives of information relating to earthwork engineering and the geology of foundations, and describes the method of filing observations, information, and discoveries concerning the subsoil of the city of Zürich.—Complete translation prepared (no. 26).

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