REVIEWS

These reviews have been prepared by the Soil Mechanics Information Analysis Center of the U.S. Army Corps of Engineers' Waterways Experiment Station in Vicksburg, Miss. The evaluators are named in parentheses at the end of their comments.

Cyclic Strength of Undisturbed Sands from Niigata, Japan

REFERENCE: Silver, M. L., "Cyclic Strength of Undisturbed Sands from Niigata, Japan," Technical Report S-78-10, prepared under contract with Department of Materials Engineering, University of Illinois at Chicago, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Miss., August 1978, 174 pages.

Standard penetration tests, undisturbed field sampling, laboratory index property tests, and laboratory cyclic triaxial strength tests were performed on cohesionless soils from Niigata, Japan, to determine why some soil deposits failed by liquefaction while apparently similar deposits remained stable during the 1964 earthquake. Undisturbed samples for testing were obtained from two relatively close together sites. Undisturbed soil sampling was performed with a newly designed Japanese large-diameter sampler and with an Osterberg sampler, so that U.S. and Japanese sampling procedures could be compared. Results of the tests are given. It was also found than any form of sampling, sample handling, or specimen preparation for relatively clean cohesionless soils weakens the soil by some amount, and therefore, test results reported may be considered as a lower bound on expected field behavior of soils from Niigata. 30 references.

Plane Shock Wave Studies of Geologic Media

REFERENCE: Anders, G. D. and Larson, D. B., "Plane Shock Wave Studies of Geologic Media," UCRL-52357, Lawrence Livermore Laboratory, Livermore, Calif., 31 October 1977, 23 pages.

Plane shock wave experiments were conducted on eight geologic materials to determine the importance of time-dependent mechanical behavior. Of the eight rocks studied, only Westerly granite and nugget sandstone appear to show time independence. In the slightly porous materials (1–5%), Blair dolomite and sodium chloride, and in the highly porous (15–40%) rock, Mt. Helen tuff and Indiana limestone, time-dependent behavior is associated with the time required to close the available porosity. In water-saturated rocks the time dependence arises because the water that is present shows no indication of transformation to the higher pressure ice phases, thus suggesting the possibility that a metastable form of water exists under dynamic conditions. 18 references. (Authors.)

Evaluation

The report by Anderson and Larson contains Hugoniot data for eight different rocks generated from light gas gun experiments at stress levels and strain rates far above those of interest in conventional geotechnical engineering problems. The data are of interest to those concerned with high-velocity projectile impact, cratering, or ground shock from very large explosions. Six of the eight materials tested showed a dependence of material properties on strain rate. Comments on constitutive modeling of rate-dependent materials are offered. Collapse of porosity and phase change are discussed in terms of their contributions to rate dependence (P. F. Hadala.)

A Unified Approach to Densification and Liquefaction of Cohesionless Sand

REFERENCE: Nemat-Nasser, S. and Chokooh, A., "A Unified Approach to Densification and Liquefaction of Cohesionless Sand," Technical Report 77-10-3, Earthquake Research and Engineering Laboratory, Northwestern University, Evanston, Ill., October 1977, 45 pages.

Based on an energy consideration, a unified theory for the densification and liquefaction of a homogeneous sample of cohesionless sand is proposed. The theory is based on the observation that the energy required in a cyclic shearing of the sample increases as the void ratio approaches its minimum value, and decreases as the pore water pressure increases. On the basis of rough estimates, explicit relations are developed for both the densification and liquefaction phenomena, and the results are applied to predict some of the existing experimental data. Although crude approximations are made, the results seem to lend considerable credit to the basic idea. 14 references. (Authors.)

Experimental Retaining Wall Facility—Lateral Stress Measurements with Sand Backfill

REFERENCE: Carder, D. R. et al, "Experimental Retaining Wall Facility—Lateral Stress Measurements with Sand Backfill," TRRL Laboratory Report 766, Transport and Road Research Laboratory, Crowthorne, England, 1977, 18 pages.

Experimental evidence shows that residual earth pressures produced by the compaction of sand behind a rigid retaining wall were significantly higher than would be expected from the self-weight of the soil alone. However, only very small movements (4 mm) of the test wall away from the soil were sufficient to reduce the earth pressures to the active condition for a fill height equivalent to 3.4 metres. A study of the passive case showed that a peak lateral thrust occurred on a metre-high test wall after a movement of about 25 mm of the wall into the soil. 6 references. (Authors).

Evaluation

The report by Carder et al is of some interest to engineers dealing with pressure distribution behind retaining walls. Most of the information is already known to the profession, except the use of laser beam in monitoring deformations. The report might be of potential use to researchers concerned with residual stress due to compaction behind retaining walls. The finding in this report confirms previous research in this area; however, the quantitative results require more tests to be accepted as a realistic addition to the design procedure of retaining walls. The findings achieved a limited objective, and further investigation is necessary to enhance their quality. The finding does not constitute a significant change in the state-of-the-art regarding design or construction of retaining walls. (M. M. Al-Hussaini.)

Flexible Pipe Deflections at Santa Ana River Siphon, Calif.; Sidney, Mont.; and Carrington, N.D.

REFERENCE: Howard, A. K., "Flexible Pipe Deflections at Santa Ana River Siphon, Calif.; Sidney, Mont.; and Carrington, N.D.," GR-3-77, U.S. Bureau of Reclamation Engineering and Research Center, Denver, Colo., May 1977.

Data from three Bureau of Reclamation buried flexible pipe installations were compiled for use in a comprehensive survey of buried flexible pipe deflections. The installations included are: (1) a 3200-mm (126-in.) welded steel pipe at Santa Ana River Siphon, Calif., (2) a 990-mm (39-in.) reinforced plastic mortar pipe at Sidney, Mont., and (3) two test sections of 250-mm, (10-in.) and 300-mm (12-in.) PVC (poly[vinyl chloride]) pipe at Carrington, N.D. The pipe deflections were related to the type of soil surrounding the pipe and the degree of compaction of the soil, the pipe strength, and the load on the pipe. Data on the range of deflections and the deflection increase with time are also tabulated. 6 references. (Author.)

Lime Stabilization of Friant-Kern Canal

REFERENCE: Howard, A. K. and Bara, J. P., "Lime Stabilization of Friant-Kern Canal," REC-ERC-76-20, U.S. Bureau of Reclamation Engineering and Research Center, Denver, Colo., December 1976, 53 pages.

Since its construction in the late 1940s, the Friant-Kern Canal has experienced cracking, sliding, and sloughing of the side slopes in areas of expansive clays in both the concrete-lined and earth-lined portions. In the early 1970s, Bureau of Reclamation designers decided to remove portions of the canal lining, flatten the slopes, and reline the canal using a compacted soil-lime mixture in an attempt to stabilize the slopes. The project added 4% (based on dry soil weight) granular quicklime to the soil. Laboratory tests on the compacted soil-lime mixture showed that (1) soil-lime was about 20 times stronger than the untreated clay, (2) the strength of the soil-lime increased with time, (3) the plasticity index of the natural soil was reduced from 40 to 10 or less after adding the lime, and (4) the compressive strength of the soil-lime was dependent on the compacted density. 12 references. (Authors.)

Evaluation

The report by Howard et al contains several facts relative to construction using lime. It also provides beneficial data for lime stabilization work in the Friant-Kern Canal area and possibly with other expansive type soils. The information reported herein is interesting and is an excellent case study, but no new procedures or breakthroughs are reported. Results are adequately backed up by laboratory results, and there is a good balance of laboratory results and field results. However, long-term effects are unknown. Questions about leaching and cracking must be answered. The results reported in this report are encouraging, but it certainly does not solve the problem for all soils. (J. C. Oldham.)

Proceedings of the 27th Annual Highway Geology Symposium

REFERENCE: *Proceedings of the 27th Annual Highway Geology Symposium,* University of Florida, Gainesville, Fla., 1976, 217 pages.

Partial contents: "Subsurface Cavity Detection: Field Evaluation of Gravity, Radar, and Earth Resistivity Methods"—L. S. Fountain; "Cavities"—G. Omnes; "Applications and Economics of Engineering Geophysics"—R. C. Benson; "Understanding the Phenomenon of Piping"—H. L. Moore; "Shale Deterioration Related to Highway Embankment Performance"—W. E. Strohm; "Shrinkage Factor for Fill Construction, Iowa"—S. Kumar; and "Evaluation of Gravel Deposits Using Remote Sensing Data, Wabash River Valley North of Terre Haute, Ind."—T. R. West.

In-Situ and Laboratory Determinations of Shear and Young's Moduli for the Portsmouth, Ohio, Gaseous Diffusion Add-On Site

REFERENCE: Curro, J. R. and Marcuson, W. F., "In-Situ and Laboratory Determinations of Shear and Young's Moduli for the Portsmouth, Ohio, Gaseous Diffusion Add-On Site," Miscellaneous Paper S-78-12, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Miss., August 1978, 99 pages.

A field geophysical investigation was performed to determine shear and Young's moduli as a function of depth for a site near Portsmouth, Ohio. This investigation included crosshole, downhole, and surface refraction investigation techniques. A supplementary set of laboratory resonant column tests was performed with a Drnevich resonant column device. Laboratory undisturbed specimens were excited in both the longitudinal and torsional modes to obtain both Young's and shear moduli as a function of strain. Both laboratory and field data are presented and compared. 8 references. (Authors.)

Ninth International Conference on Soil Mechanics and Foundation Engineering

REFERENCE: *Ninth International Conference on Soil Mechanics and Foundation Engineering, Soil Sampling: Papers Presented at the Specialty Session 2,* Institute of Civil Engineers, London, 1977, 155 pages.

Partial contents: "Large-Diameter Sand Sampling to Provide Specimens for Liquefaction Testing"—K. Ishihara and M. L. Silver; "Laboratory Sampling Study Conducted on Fine Sands"—W. F. Marcuson, S. S. Cooper, and W. A. Bieganousky; "A Simple Method for Undisturbed Sand Sampling by Freezing"—Yoshimi et al; "Methods to Evaluate Quality of Undisturbed Samples of Sands"—I. Tohno; "Sample Disturbance Influencing Shear Strength of Cohesive Soils"—H. Begemann; "Effect of Sampling on the Drained Properties of Leda Clay"—G. P. Raymond; "Research of Stiff Clay Sampling"—T. Seko and K. Tobe; "A Large Sampler for the Evaluation of Soft Clays Behavior"—A. Burghignoli and G. Calabresi; "A Study of Large-Diameter Piston Samplers"—G. Holm and R. D. Holtz; "Application of the Statistical Method in the Control of Compaction of Soils"—F. F. Guedes Soares; "Sampling Macroporous Soils"—A. Kezdi et al. Discussions of papers are given in a separate volume.

Resonant Column Test

REFERENCE: Drnevich, V. P., "Resonant Column Test," Miscellaneous Paper S-78-6, prepared under contract by Soil Dynamics Instruments, Inc., Lexington, Ky., U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Miss., July 1978, 78 pages.

The resonant column test is used to determine by vibration the shear modulus, shear damping, rod modulus (Young's modulus) and rod damping of cylindrical specimens of soil in the undisturbed and remolded conditions. The vibration apparatus, apparatus calibration, and calculations are described. The reduction of all resonant column test data is presented in a computer program. (Author.)

Publications of the Institute for Foundation Engineering, Soil Mechanics, Rock Mechanics, and Waterways Construction

REFERENCE: Publications of the Institute for Foundation Engineering, Soil Mechanics, Rock Mechanics, and Waterways Construction, RWTH (University) Aachen, Federal Republic of Germany, W. Wittke, Ed., English edition of Vol. 3, Aachen, 1977, 227 pages.

"Ring Shear Tests on Clay" by Bohmuil Boucek describes a new ring shear apparatus that produces no normal pressure or moment of torsion in the joint between the upper and lower side rings during the shearing process. This allows the normal force and moment of torsion acting upon the sample to be measured. Results of experiments using disturbed saturated clay and this device are presented. "Determination of the Bearing Capacity and Pile Driving Resistance of Piles Using Soundings" by Dieter Rollberg examines the problem of determining bearing capacity and dynamic pile-driving resistance from the results of soundings. Results of test loads and drivings of 248 piles on 55 different construction sites were compared with accompanying sounding diagrams. From these, equations for determining bearing capacity and dynamic pile-driving resistance from the result of soundings were derived statistically. 88 references.

Permeability of Fly Ash and Fly Ash-Stabilized Soils

REFERENCE: Parker, D. G. and Thornton, S. I., "Permeability of Fly Ash and Fly Ash-Stabilized Soils," conducted for the Arkansas State Highway Department in cooperation with the Federal Highway Administration, University of Arkansas, Department of Civil Engineering, Fayetteville, Ark., December 1976, 85 pages.

Fly ash, soon to be produced in Arkansas, is a good potential stabilizing agent for many Arkansas soils. The fly ash produced from Wyoming low sulfur coal reacts chemically like quick lime, generating heat and possessing self-hardening characteristics. Two soils, an organic clay and a sand (classified OH and SP-SM by the Unified system) were tested for permeability with the fly ash. As the percent of fly ash increases, the permeability of soil-fly ash mixtures decreases. Cracks developed in 100% fly ash samples due to a reaction in the self-hardening fly ash. Fly ash deposited in a slurry at a water content of 25 to 40% has a permeability of 3×10^{-6} cm/sec. Permeability decreased with time within the first seven days. Effluent from the tests had a high pH, alkalinity, and dissolved solids concentrations. 35 references. (Authors.)

Evaluation

The report by Parker and Thornton should prove interesting and informative to anyone working with fly ash as a soil stabilizer. The amounts used, in some cases as much as 50% fly ash, are much greater than those normally used with conventional soil stabilizers. The sand/fly ash data are the most interesting, with permeabilities decreasing from 3.3×10^{-3} to 1.5×10^{-6} cm/sec while corresponding unconfined compression values increased from 38.2 to 372.3 lb/in.^{2} after only seven days of unspecified cure. No data are tabulated in the report other than the basic soil/fly ash parameters. The actual text follows a review of Darcy's work and begins on page 43. The fly ash used is high in calcium and could account for the high strength values. Environmental effects are well presented and compared with those due to the use of lime. The permeability of the clay soil, 8×10^{-6} cm/sec to begin with, is reduced to 2×10^{-6} cm/sec after adding 50% fly ash. The number of repetitions employed to realize these data and a statement of repeatability expected by the author would be helpful. Further study of the high temperatures following mixing fly ash, soil, and water and the exact amounts of fly ash needed for a particular purpose is needed. Should additional study indicate the desired effects are permanent, that is, longer than 80 days, then this waste product should prove cost-effective and environmentally acceptable. (C. R. Styron.)