

The Secretary,  
The Institution of Civil Engineers,

DEAR SIR,

In his Paper "Interference between foundations with special reference to surface footings in sands" (*Géotechnique*, 12:1:15-22) J. G. Stuart has outlined concepts which can have an important influence on the design of closely spaced foundations in sands.

There are a number of points which deserve further mention in connexion with the discrepancies between the proposed theory and the actual experimental values. That the theoretical values did not agree with experiment is not due to experimental technique since the accuracy of repeatability was established. Hence the causes for difference may be classified under two headings: (a) the chosen soil parameters are not representative of the actual sand under test, and (b) the failure mechanics is different from that assumed in the calculations. The following contribution is based on some tests and simple calculations which the Writer carried out while a member of the pile group research team at Belfast University under the general supervision of Mr Stuart.

- (i) The small scale of the tests means that the sand is stressed in a layer only a few inches deep. The difficulties of density control near to the sand surface and the problems associated with the measurement of the mechanical properties of the sand are obvious. It is likely therefore that the experimental results refer to a set of strength parameters different from those employed in the calculations. Surface heave is also important especially for very shallow foundations (depth/width less than 0.5) and will reduce the efficiency values.
- (ii) The assumed theoretical failure zones are greater than observed (a) visually from the plan of surface heave records and (b) from instantaneous records taken as a pair of foundation strips were loaded behind a plate glass-sided box. It will be interesting to see the results of efficiency calculations obtained by constructing failure patterns which take the body forces in the rupture zone into account in a rigorous manner. Better agreement with experiment is expected.
- (iii) Asymmetrical failure patterns are more likely than the symmetrical patterns which the results of many visual observations support. This partly explains the discrepancy between experiment and theory especially at the intermediate spacings. The causes of asymmetrical failure patterns may be non-perfect rigidity of the foundations and possibly slight local variations in sand density, but it is interesting to record that during the loading of pairs of surface footings and deep strips at intermediate spacings, asymmetrical failure always took place. When a pair of foundations fail asymmetrically the failure of the individual strips consists of two parts. One side of the strip will fail freely as a wide footing and the other side will fail as a narrow footing, both at the same depths but at different "effective depths", i.e. different depth/width ratios. Fig. 1, which is a sketch drawn from a time-exposure photograph, shows the asymmetrical failure patterns around a pair of shallow strip

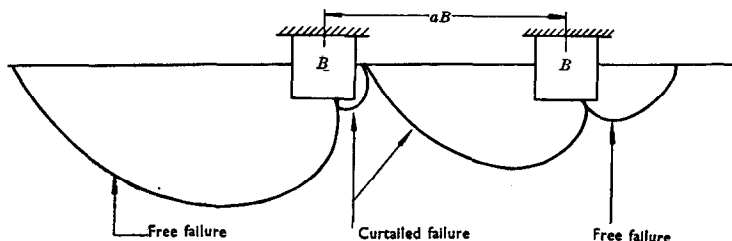


Fig. 1. Asymmetrical failure of a pair of shallow strip foundations

foundations at an intermediate spacing. The effect of asymmetrical failure is even more pronounced when the foundations are shallow as the nett result of the asymmetry is the partial release of the arch between the individual foundations which would be formed if symmetrical failure took place. A detailed account of this phenomenon has been given in a thesis (Hanna, 1960) and mentioned in a recent Paper (Stuart and Hanna, 1961).

Yours faithfully,  
THOMAS H. HANNA, B.Sc., Ph.D.

George Wimpey & Co. Ltd,  
Central Laboratory,  
Hayes, Middlesex.  
19 June, 1962.

#### REFERENCES

- HANNA, T. H., 1960. "The behaviour of pile groups in sand." *Thesis Queen's University of Belfast*.  
STUART, J. G., and T. H. HANNA, 1961. "Groups of deep foundations: A theoretical and experimental investigation." *Proc. Fifth Int. Conf. Soil Mech. Paris. Engineering* Volume 11, Paper 3B/23.

## BOOK REVIEW

### Applied clay mineralogy, by Professor R. E. Grim

Published by *McGraw-Hill, New York*, 1962. Price 97s. 411 pp.

This book is by a famous Clay Mineralogist and deals with an aspect of clay mineralogy not hitherto covered by a text book. This work considers briefly, but adequately with the essentials of the structure and properties of clay minerals and then deals in some detail with the use of clay mineralogy to ceramic products, foundry moulding sands, engineering properties, petroleum exploitation, refining of organic chemicals and then deals in a short manner with many other uses of clay. Except of the last chapter through no fault of the Author, the subject matter is dealt with fully and in most cases an easily comprehensible manner. There are one or two minor errors, for example the Attenberg limits are introduced on p. 58 but are not explained until p. 205, and also the sketches of kaolinite bonded sands Figs 4-33 have no scale, which is a defect.

This book should be read by all who are interested in clay science. It will be a pointer to those who regard clay mineralogy as of academic interest only, since it clearly shows the relationship between the clay mineral and the bulk property. To those who are already interested in one aspect of clay technology it should be of great benefit to realize the multiplicity of clay technologies.

H. G. M.

## NEWS ITEMS

### Problems of constructions on loess soil

The scientific conference arranged by the Institutes of High Learning of the Union of Soviet Socialist Republics was held at the Civil Engineering Institute of Voronezh, from 20 to 23 February, 1962. It was the fourth regional conference on the problem of buildings erected on loess soils, the third being held in 1957 in Dniepropetrovsk.

The special attention paid to this problem in the U.S.S.R. was evidenced by the large number of participants—320 representatives of numerous institutes for higher education,