COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS:

1964/17

THE FOURTH AUSTRALIA - NEW ZEALAND CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING ADELAIDE - AUGUST, 1963

by

E.G. Wilson

THE FOURTH AUSTRALIA - NEW ZEALAND CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING

ADELAIDE - AUGUST, 1963

by

E.G. Wilson

RECORDS 1964/17

CONTENTS

THE FOURTH AUSTRALIA-NEW ZEALAND CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING

ADELAIDE - AUGUST, 1963

SUMMARY

The Fourth Australia-New Zealand Conference on Soil Mechanics and Foundation Engineering was held in Adelaide in August, 1963. The conference covered a wide field, but particular attention was paid to soils and the laboratory techniques of soil testing. The examination and assessment of rock foundations attracted few papers and this side of the subject would be furthered by geological papers on concrete dam foundations and on grouting. The origin of ground water in soil and the control of soil water were neglected subjects that could receive attention at future conferences.

INTRODUCTION

The Fourth Australia-New Zealand Conference on Soil Mechanics and Foundation Engineering was held in Adelaide from 19th to 23rd August, 1963. It was attended by 178 delegates from Australia and New Zealand, representing consultant engineers, constructional engineers, government departments and instrumentalities, and the universities. Three overseas delegates were at the conference: Professor Aboshi, University of Hiroshima, Japan, J.W. Hilf, Bureau of Reclamation, U.S.A.; and G.P. Raymond, Queens University, Kingston, Ontario, Canada. The Bureau of Mineral Resources was represented by E.J. Polak of the Geophysical Branch and E.G. Wilson of the Geological Branch. The list of delegates at the conference is on file in the Geological Branch (file No.212/111), and the papers presented at the conference are listed in appendix I.

PAPERS

Papers presented at the conference fall into the following categories (the number of papers in each category is indicated in brackets):

- Earth and rock-fill dams (9)
- Equipment for soil testing (8)
- Concrete dams (1)
- Settlement in soils (2)
- Earth pressures on sheet piling (3)
- Permeability measurement (2)
- Stress in rock (2)
- Pavements (4)
- Building foundations (2)
- Geology of foundation problems (1)
- Theoretical papers (diverse subjects) (7)

Dams

The construction of earth and rock-fill dams and the allied subjects of soil sampling and testing comprised almost half of the programme; by comparison, the only concrete dam

discussed (Keepit Dam) was part of a paper presented by Mr Stafford, of the Water Conservation and Irrigation Commission, Sydney, entitled "Foundation Experiences in New South Wales Dams" (Preprint of conference papers, p.115). This paper dealt with the construction of one concrete and two earth dams; it contained details of the grouting procedure adopted for each dam and commented on the effectiveness of grout made with varying water/cement ratios (water/cement volume ratios ranged from 2:1 to 8:1). In the general discussion, opinions were expressed that curtain grouting of dams was often expensive and unnecessary, but blanket grouting was in general approved. The dissatisfaction with curtain grouting would be partly overcome if water-pressure testing could be used to predict the grout take.

Water/cement volume ratios ranging from 2:1 to 30:1 were mentioned in the discussion on grouting; this seems to signify the lack of a reliable and proven technique. While the basic aim of cementing rock fractures has been accepted, techniques of varying efficiency are used to carry out the process; in addition, the variation of each technique that is permissible on the grounds of expediency and economy without compromising the result has to be determined. There was no discussion of chemical grout, but a bibliography on the subject was presented to all delegates.

Papers on foundation investigation for concrete dams, and papers on grouting that will clarify the efficiency and economics of the process should be considered for future conferences.

Settlement in soil

The building of silos and fuel tanks on unconsolidated soils requires an estimate of the settlement that will take place when the facilities are in use (Plate I(i). The papers on this subject dealt with both natural and reclaimed areas. Papers dealing with the use of sheet piling for wharf facilities examined the allied problem of assessing the horizontal earth pressures that piling would have to withstand (Plate I(ii). The visit to the new Port Adelaide silos and bulk loading terminal illustrated the problems involved in constructing facilities on poor foundations.

Pavements

A general paper on pavements by Clegg and Yoder analysed the stresses that take place in pavements and dealt with the fundamentals of pavement design. It was pointed out that in addition to the stresses involved in the mechanics of pavement behaviour, the engineer must also consider climate, repetition of load, and drainage. There were no papers on the occurrence of underground water; a better understanding of this subject would assist the engineer to keep base and sub-grade materials free of water, thereby making the pavement less sensitive to changes of climate and rainfall.

The other papers on pavements dealt with cement stabilisation. Companies engaged in this work would like to see a wider use of the process, but it is clear that pavement behaviour is so dependent on the base and sub-base material, that indiscriminate cement stabilisation is to be discouraged; however, the process does give good results when suitable base and sub-base material is present.

Geology

The paper, "Foundation Problems in Metropolitan Auckland", relates foundation problems to the geology of the area. Poorly consolidated Quaternary sediments with interbedded volcanics (flows and tuff) produce conditions in Auckland that are not encountered on the Australian mainland, but which may be found in New Guinea. This paper is a reliable guide for engineering projects in such areas.

Other subjects

Theoretical papers ranged over a number of subjects such as the analysis of soil testing procedures, mathematics of permeability, and the statistical nature of soil fabrics and granular materials. Two papers on foundation settlement in dwellings discussed the foundation problems that are found in Adelaide suburbs.

CONFERENCE TOURS

C.S.I.R.O. Urrbrae

The C.S.I.R.O laboratories at Urrbrae were inspected on the afternoon of Wednesday, 21st August; the inspection was followed by a demonstration of the following rigs for soil sampling:

1. The Proline Portable rig is a light power-driven auger and soil sampler that fits into the back of a Holden utility; it can be carried by two men. The rig is easily set up and dismantled and is adequate for the sampling of unconsolidated soils.

If a number of holes are to be drilled there may be loss of time in dismantling and setting up that would be avoided by a trailer-mounted rig. A demonstration in dense clay soils would be required before the suitability of such an auger for use in the A.C.T. is established.

2. The Proline tractor-mounted soil-sampler and auger is designed for rugged operation and rough terrain. It is suitable for soil sampling and drilling to shallow depths; a measure of its rugged construction is the fact that it will recover a 6 inch diameter soil sample.

3. The trailer-mounted Gemco auger drill is similar to that operated successfully by Monier Earth Drilling Co. in Canberra and in the Northern Territory. The drill is rugged and versatile and can be used for drilling holes of 3" to 6" diameter to depths of 150 feet (Plate I(iii).

4. The C.S.I.R.O. truck-mounted drill consists of a large Proline drill that has been specially mounted for soil sampling. It has been operated successfully in the field. The rig was used to demonstrate the latest C.S.I.R.O. soil-sampling devices.

Port Adelaide

On Friday, 23rd August, the silos and bulk handling terminal at Port Adelaide were visited. These facilities are under construction and are founded on nests of piles set at a depth of 50 feet (Plate I, i and ii).

At the Torrens Island power station site, compaction of loose sand in the topmost 30 feet of soil by the Vibro-flotation process was demonstrated by Cementation Co. (Australia) Ltd. The equipment is essentially a long probe containing an electrically driven vibrator that sinks into the soil under its own weight when lubricated by jets of water (Plate I, iv). The vibrator compacts the surrounding sand to a radius of about three feet and the voids created by compaction of the sand are filled by additional sand or fill that is fed in around the top of the probe (Plate II). Similar tests have already been carried out at Chowilla damsite and at Kwinana, W.A.

Post-conference tour

The post conference tour proceeded to Broken Hill via Port Pirie, and returned via Menindee, Mildura and Renmark. Full details of the tour are given in the folder on the Post-Conference Tour.

CONCLUSION

Papers for presentation at the next conference to be held at Auckland in 1967 should cover fields that were somewhat neglected in the past. All aspects of earth and rock-fill dams have been well covered, but concrete dams deserve more attention. The subject of grouting came under lively discussion in Adelaide and the diverse opinions that were expressed indicate that more investigation or education is required in this field. There have been no papers on the origin and control of ground water in the soil.

This conference is one of the few in which Australia and New Zealand are associated and Australians have much to learn from the New Zealanders in the field of soil mechanics in relation to foundations. The geology of the Recent deposits of Australia has received scant attention in the past, but a lively interest in this section of geology is being fostered by the field of foundation engineering. New Zealand has a vast experience in dealing with unconsolidated and poorly consolidated, non-homogeneous materials of glacial and volcanic origin; close association with New Zealand will greatly assist the study of the scanty but significant Recent deposits that are encountered in foundation engineering in Australia.

APPENDIX I

FOURTH AUSTRALIA-NEW ZEALAND CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING, 1963

List of papers

The stability of overtopped rock-fill dams.
J.K. Wilkins.

Deep sounding cone penetrometer.
A.H. Gawith and A.H. Bartlett.

The prediction and field verification of settlements on cohesionless soils. T.A. Farrent.

The effect of non-linear foundation settlement on the distribution of bending moments in a building frame.
G. Sved and H.L. Kwok.

The strength of clay-cement.
A. Herzog.

Earth dams in Victoria .. a historical review.
F.M. Lee and M.G. Speedie.

Measurement of earth pressures on a sheet pile breastwork.
C.F. Mead.

The permeability of an idealized two-dimensional porous medium using the Navier-Stokes equations.
K.K. Watson.

Effective stress parameters in unsaturated soils.
I.B. Donald.

Arthurs Lakes rock-fill dam .. foundation pore pressures and total foundation pressures.
M.D. Fitzpatrick.

The specific gravity of a volcanic soil
J.H.H. Galloway.

The damping characteristics of dynamically-stressed clay.
P.W. Taylor and B.K. Menzies.

Testing small undisturbed samples.
R.H.G. Parry.

Progress report of strain gauge measurements on an anchored bulkhead wharf.
R.F. Beverley.

Some construction aspects of the Benmore Earth Dam.
G.A. Tait.

Pressure measurements on Tullaroop Dam culvert.
D.H. Trollope, M.G. Speedie and I.K. Lee.

The optimum treatment and mechanism of electro-chemical hardening of a residual Wianamatta derived Sydney Basin clay.
A.F.S. Nettleton.

Structural analysis and classification of pavements
B. Clegg and E.J. Yoder.

Laboratory and in-situ experiments on the problem of immediate opening of soil-cement base to general traffic.
T. Yamanouchi and M. Ishido.

Foundation experience in New South Wales dams.
C.T. Stafford.

The effect of high curing temperature on the unconfined compressive strength of a heavy clay stabilized with lime and with cement.
J.B. Metcalf.

Field permeability tests at Blowering and Warkworth Dam sites, New South Wales.
H.R. Brice and I.S. Watson.

Towards the statistical definition of a granular mass.
W.G. Field.

A test embankment with sand drains on a weak and compressible foundation at Perth, Western Australia.
J.G. Marsh.

Automatic pore pressure meter forfield use.
H. Aboshi.

Determination of the horizontal coefficient of consolidation of an alluvial clay.
H. Aboshi and H. Monden.

Stress and deformation in rock and rock support, Tumut 1 and 2 Underground Power Stations.
L.G. Alexander, G. Worotnicki and K. Aubrey.

An investigation of the performance of a neutron moisture meter.
B.G. Richards

On the spatial distribution of fabric elements in rock and soil fabrics.
D. Lafebar.

Foundation problems in metropolitan Auckland.
R. Gilmour.

The role of surface forces in determing the physical behaviour of soils and clays.
J.P. Quirk.

An examination of some methods for strength measurement in soils.
O.G. Ingles and S. Frydman.

The measurements of, relation between, and factors affecting the properties of rocks.
E.J. Polak.

Elastic settlements of footings with a rough interface.
I.K. Lee.

Triaxial testing and three-dimensional settlement analysis.
E.H. Davis and H.G. Poulos.

Post-construction deflocculation as a contributary factor in the failure of earth dams.
C.D. Aitchison, O.G. Ingles and C.C. Wood.

Slip circle stability analysis using the snocom electronic computor.
A.D. McConnell and N.O. Boughton.

Instrumentation of earth dams on the Snowy Mountains Scheme.
A.D. Hosking and J.I. Hilton.

The engineering seismograph and its use by the Snowy Mountains Authority.
D. Svenson, R.H. Bowering, and T. Kirkpatrick.

An apparatus for studying the non-continusous transient flow of water in unsaturated soil columns.
K.K. Watson.

Undisturbed soil sampling in Australia and the need for a basic series of samplers.
G.D. Aitchison and J.G. Lang.

Current status of undisturbed soil sampling in Australia.
G.D. Aitchison and J.G. Lang.

A basic series of samplers for undisturbed sampling of soil.
G.C. Aitchison and J.G. Lang.

Port Adelaide Visit

a. Columnar sections showing sediments encountered near Port Adelaide. J.B. Firman.
b. Visit to site of Torrens Island power station. (Paper deals with soils testing).
c. Vibroflotation field demonstration. (A process for compacting granular soil in situ). The Cementation Co. (Australia) Ltd.
d. The Port Adelaide grain terminal.
e. Port Adelaide bulk loading berth.

Proposed River Murray dam at Chowilla
Engineering and Water Supply Department, South Australia.

Post-Conference Tour

a. Port Pirie shipping facilities.
b. Blanchetown Bridge, S.A. Highways Department.
c. Broken Hill Water Board - includes notes on the Menindee Lakes Scheme.

Commerical Literature

AM-9 Chemical Grout.

Bibliography references in technical journals.

Cyanamid.

Gemco Top-drive rotary drill.

Gemco hollow-auger sampling equipment.

Plate I.

(i) Bulk storage terminal - Port Adelaide

(ii) Sheet steel piling - Bulk handling wharf Port Adelaide.

(iii) Trailer-mounted Gemco Drill

(iv) Vibroflotation equipment

Plate II.

(i) Vibroflotation probe ready to descend.

(ii) Vibroflotation probe (10 feet) descending - water is from jets near head of probe.

(iii) Vibroflotation probe down 30 feet - rubble surrounding probe is backfill material that is pushed into hole as probe is withdrawn.

(iv) Vibroflotation probe being withdrawn - front-end loader carries backfill to the probe.