COOLING, L. F., SKEMPTON, A. W., GLOSSOP, R. & GOLDER, H. Q. (1975). *Géotechnique* **25**, No. 4, 629–656.

British Geotechnical Society Twenty-fifth Anniversary Report

The Twenty-fifth Anniversary of the British Geotechnical Society was marked by a special meeting held on Wednesday 4 December, 1974 at the Institution of Civil Engineers and attended by BGS members and guests.

The Society was inaugurated in January 1949 by the British National Committee of the International Society for Soil Mechanics and Foundation Engineering, under the chairmanship of Mr W. K. Wallace, with Mr A. Banister (at that time Research Officer at the ICE) acting as Secretary on behalf of the Institution of Civil Engineers. The members of its first committee were L. F. Cooling, W. E. Doran, Dr W. H. Glanville, H. J. B. Harding, Professor S. E. Hollingworth, D. J. Maclean, Professor A. W. Skempton, A. H. Toms, Guthlac Wilson, J. A. Banks and Professor A. H. Naylor.

In 1964 the Society broadened its scope to cover rock and ice-and-snow mechanics and changed its name accordingly to the British Geotechnical Society. By the end of 1974 its membership had increased to over 800. In May 1974 the Chairman, Dr A. D. M. Penman, suggested that a special meeting should be held to celebrate the Society's Silver Jubilee and that Dr L. F. Cooling, Professor A. W. Skempton and Mr R. Glossop should be invited to give an account of its development and achievements, and to suggest further speakers who could contribute. Thus a complete picture could be presented, refreshing the memory of older members of the society and giving younger members an insight into its origins.

The early history of soil mechanics at the Building Research Station

L. F. COOLING

At this meeting to celebrate the Twenty-fifth Anniversary of the British Geotechnical Society, I have been asked to give some sort of background to the scene by recalling some of the events in the early days at the Building Research Station and to describe the origins of Soil Mechanics in this country.

This early history is not very well documented and my account will need to rely to some extent on memory, but I have done my best to verify the facts as far as I can. From my personal records, mainly, I have compiled a sort of calendar-diary dealing with people and events (Table 1).

My story starts with an old country mansion at Garston in Hertfordshire, called Bucknalls, with its stables, greenhouses, kitchen-garden and a few odd hutments, which had become the home of the Building Research Station of the DSIR where Dr R. E. Stradling was the Director. C. F. Jenkin, who was Professor of Engineering at Oxford University, had been carrying out research there since 1926 on the lateral pressure exerted by granular materials. On retiring from this Chair he moved to Bucknalls in 1929, where he was given facilities to continue and

Table 1. Early history of soil mechanics at the Building Research Station

Personnel and event involved	Comments
1929–33 Professor C. F. Jenkin started at BRS to continue work begun at Oxford in 1926 on pressure exerted by granular materials. In 1932 started work on mechanics of clay, choosing kaolin as typical material. Retired owing to ill health in 1933	Supported by B A Earth Pressures Committee
1933 BRS Soils Laboratory started in September: L. F. Cooling, D. B. Smith, A. Newman. Lines of work: continuation of Jenkin's researches; soil physics in relation to road problems for the Road Research Board	
1934 Development of classification tests and results for British soils. Completing notes summarizing Jenkin's work on kaolin	Soil sampling and field work on road sites
1935 First RRB Annual Report includes paragraphs on soil physics. Soil section transferred to Engineering Division under Dr W. H. Glanville. A. Newman transferred to concrete section. G. C. Wilson joins section	Field problems include Kensal Green wall embankment and slips at Winchfield and Botley
1936 Two papers submitted to First International Conference on Soil Mechanics held at Harvard, Cambridge, USA. L. F. Cooling attends Conference and his report on it is published in the *Journal of the Institution of Civil Engineers* by Inst. Research Comm. A. W. Skempton transferred from concrete section	ICE forms committee to take over work of B A Earth Pressures Committee
1937 D. B. Smith leaves. H. Q. Golder recruited from Forest Products. R. L. A. Lloyd joins. L. B. Jordan joins. Dr Glanville becomes Assistant Director of RRL. Soils section started at RRL under A. H. D. Markwick. G. C. Wilson transferred to RRL	Patney Bridge failure. Field studies increase. Chingford Dam failure
1938 Visit of university professors of civil engineering to BRS laboratory. Railway companies make substantial financial contribution to work at BRS	Waterloo Bridge. War Office Buildings
1939 Increase in staff includes: Button, Samuels, Brown, Potter. Short study periods and practical instruction given to university lecturers and to engineers. Terzaghi gave James Forrest Lecture in June. War declared in September	Field problems include: Walton Dam, Staines Dam, Abbotsinch
1940 Soil Mechanics Discussion Group at the Institution. (Discontinued early in 1941)	Field problems include Kippen
1941 Laboratory and field investigation of specific practical problems	Belfast Dock. Muirhead Dam. Park Village East wall
1942 Staff changes: A. L. Little (April), Mrs Butler (May), W. H. Ward (September), H. Q. Golder left (October)	Belsize Park tunnel. Greenock harbour wall
1943 Staff: McNamee (October), transferred to Mathematics, 1945. (Course by RRL on soils, concrete and bituminous materials). Code of Practice drafting starts	Cold-stores, grain silos. Gosport wall
1944 Staff: A.D.M. Penman (August)	Fens (Eau-Brink Cut). Borth Bog
1945 War in Europe ends. Series of four lectures given at the Institution on the principles and application of soil mechanics. The Civils' Research Committee set up a small committee to discuss resumption of work by the Earth Pressures Sub-Committee (Mr W. K. Wallace). Staff: T. C. Chaplin (September)	Small houses on shrinkable clays. Leakage of King George V Reservoir
1946 Staff: G. G. Meyerhof (January) (left 1952). (At RRL, Markwick dies and D. J. Maclean takes over). L. Casagrande (August) left March 1950. A. W. Skempton left and went to Imperial College	EP measurements at Poole and Whitehall

complete his work. This culminated in two papers, one to the Royal Society in 1931 on the pressure exerted by granular materials (which dealt with the principle of dilatancy) and the other to the Institution of Civil Engineers in 1932 on the pressure on retaining walls. Having completed these tests, Professor Jenkin directed his attention to the study of cohesive materials, choosing kaolin (china-clay) as a typical material. Unfortunately his health failed soon after the start of this work and he was forced to retire.

In September 1933, a soil physics section was formed at BRS, partly to continue Jenkin's work but also to carry out extramural contracts for the newly formed Road Research Board to study soils in relation to road problems. I was chosen to lead this section. For a number of years, I had been studying the capillary properties of porous materials, and knew something of soil physics. With me was D. B. Smith, who had been Jenkin's assistant, and A. Newman. After two years the latter moved to the concrete section and eventually became the Station's expert on concrete.

As a first task, notes summarizing Jenkin's work on kaolin were completed and put on record as Station Notes. Field work on road sites was commenced and an apparatus for taking undisturbed soil samples was constructed. Laboratory tests were started following the lines along which soil mechanics was developing abroad. Classification tests, such as liquid limit, plastic limit and so on were developed, and correlation curves were obtained for British soils. These were published in the Road Research Board Annual Report for 1935 under the heading of 'Soil Physics'.

It soon became apparent that the basis of the research needed to be broadened to include a wider range of civil engineering problems. So the section was then placed in the Engineering Division under Dr W. H. Glanville and it became known as the soil mechanics section. One achievement I recall from these early days is that, following long discussions, Dr Glanville and I made out a case for me to attend the First International Soil Mechanics Conference at Harvard University, Boston, USA, in 1936. The case proved good enough to pass the Treasury, no mean achievement in those days. Two papers and a laboratory report were accepted from BRS and I was the only person from this country to participate in the conference. On my return I wrote a report on the conference and it was published in the *Journal of the Institution of Civil Engineers* by the Sub-Committee on Earth Pressures, which had recently taken over the work of the British Association Earth Pressures Committee, keeping the same chairman, Mr F. E. Wentworth-Sheilds.

At the end of 1936, another event occurred, which was not only very fortunate for me but, I venture to say, also of great importance to our subject. Mr A. W. Skempton was transferred from the concrete section at BRS to the soil mechanics section.

In 1937 D. B. Smith left and H. Q. Golder joined us from the Forest Products Laboratory. With the growth of the section, more accommodation was needed and we were moved out of the 'stable block' into a new suite of laboratories and offices, which had been concocted by converting the old greenhouses at Bucknalls. Here we quickly settled down, and soon progress was being made in the development of apparatus and laboratory techniques, and experience was being gained in the field of study of practical problems.

Then in August 1937 a failure occurred in a part of the bank which was being constructed for the new Chingford Reservoir. BRS was asked to investigate and report on the cause of failure; which it did. This investigation aroused considerable interest among practising engineers, and directed attention to the practical value of soil mechanics methods. Fig. 1 shows a scene at the Chingford site, when a field test is being made to measure the density of the fill. On the left of the picture I think you can recognize Golder and Skempton; on the right I am seen talking to Wynne-Edwards (the late Sir Robert Wynne-Edwards) who was Job

Engineer. There was some discussion about the factor of safety that should be aimed at for remedial measures, and Wynne-Edwards asked me who was the best expert in the subject. I told him a fellow named Terzaghi, who was Professor at the Technische Hochschule in Vienna. The next I heard was that Wynne-Edwards had taken an aeroplane to Paris, and had brought Terzaghi over here to act as consultant. This was the beginning of a very long and close friendship between the two. Fortunately Terzaghi agreed with our analysis and report.

Later in 1937, Dr Glanville became Assistant Director at RRL and it was decided to set up a separate soils laboratory there, which was led by A. H. D. Markwick. G. C. Wilson was transferred from BRS to RRL.

The attention given to the subject was now increasing rapidly and in 1938 the main railway companies showed their active interest by making, through the Institution, a substantial financial contribution to the work of the section at BRS.

As for the soil mechanics team, these were days of great enthusiasm. We knew we had an important job to do, but we did not know how fortunate we were to be in on the ground floor of a subject which was destined to show such amazing growth. We led a fairly free and easy existence, worked hard and played hard. Perhaps I may be permitted to illustrate this by a short anecdote called to mind by the name L. B. Jordan.

'Little Ben' was our laboratory assistant and about six feet tall. He was the son of 'Big Ben', an ex-marine and boss of the 'heavy-gang' at BRS, who could lift anything with a length of rope and a block and tackle. Little Ben was a keep-fit enthusiast and when he left to join the Navy, he had to sell his gymnastic equipment. We bought his rowing machine, a contraption of springs and pulleys with a sliding seat. This used to stand in the corner of my office and was used frequently, especially early in the morning. I recall that it was an awesome sight to see Golder trying to work off a hangover by going for a spin 'up the river', with great banging and clattering and loud groans.

Also in 1938, several Universities began to look into the possibility of including instruction in soil mechanics in their degree courses, and heads of their civil engineering departments paid a visit to BRS to inspect the work in progress. In due course, this led to a number of university lecturers and practising engineers attending BRS for short periods of instruction including participation in the current work in progress (Appendix 1).

In June 1939, Professor Terzaghi gave the James Forrest Lecture at the Institution, which he entitled 'Soil mechanics—a new chapter in engineering science'. This masterly review made a considerable impact and increased still further the general interest in the subject.

In September 1939, war was declared, and after an initial period of uncertainty, the programme of work in soil mechanics at BRS was continued but with more emphasis being laid on practical applications. To maintain our contact with practising engineers early in 1940, BRS organized a soil mechanics discussion group, and through the good offices of the ICE several informal meetings were held at the Institution. Five such meetings took place, with attendances of between 30 and 40 (Appendix 2), but unfortunately they had to be discontinued early in 1941. The signed attendance sheets of these meetings are still kept in the BRS records.

The war years saw an urgent expansion of civil engineering works. This led to a considerable development in the application of soil mechanics and an increasing number of people in various organizations became actively concerned in site investigation and soil testing. At BRS the soils work was almost entirely diverted to the investigation of specific practical problems although we also found the time to write a few papers. The staff increased and some changes took place although, during the war, there was direction of manpower and restriction of job movement. One change occurred, the details of which I was never able to

Fig. 1

fathom. This was when W. H. Ward came from a job on an ordnance factory construction in South Wales, to take the place of H. Q. Golder, who left in 1942 to join the staff of Mowlem's. Here his job afforded Golder new scope for his activities and in the years that followed he continued to make a substantial contribution to the growth of soil mechanics. W. H. Ward soon fitted into the team and was a great source of strength. Indeed throughout the years he has made and still continues to make his unique contribution to the subject.

The work at BRS covered a very wide range of problems. In all of these, field work was very important and rank was no protection from donning the gum boots and working the drill rigs. There is no doubt that the subject as a whole made rapid advances during the war years. At BRS alone we were concerned with some seventy investigations and in all of these we were working with practising engineers. The problems handled included failures in earth dams, retaining walls and quay walls; and site investigations for graving docks, flood protection works, factories and other large buildings.

At the RRL parallel developments took place in soil studies where wartime problems, concerned with airfields and roads, called for a large expansion of facilities and staff. Special mention should be made of the lecture courses given for personnel of the Army and the RAF, which were subsequently published in book form under the title 'Soils, concrete and bituminous materials'.

When the war ended in 1945, the position of soil mechanics had become firmly established. Two civil engineering contracting firms had set up their own soil laboratories, many organizations had engineers trained in the subject, and the subject was included in the curriculum for degree and postgraduate courses at a number of universities.

During June 1945, a series of four lectures was given at the Institution under the title of 'The principles and application of soil mechanics', by Cooling, Skempton, Glossop and Markwick. These were published in paperback form by the Institution of Civil Engineers in 1946.

The Civils' Research Committee also set up a small committee, under the chairmanship of Mr W. K. Wallace, to discuss the resumption of work by the Earth Pressures Sub-Committee. This is the stage reached by 1946, from which point the story will be taken up by Professor Skempton.

APPENDIX 1: LIST OF STUDENTS WHO HAVE ATTENDED BRS FOR THE PURPOSE OF STUDYING SOIL MECHANICS

D. Wooltorton—Office of Executive Engineer, Burma, 1936
I. M. Yehya—Egyptian Education Office, 1938
W. N. Elgood—Bristol University, 1938
P. L. Capper—University College, London, 1938
B. G. Manton—Imperial College, London, 1938
A. H. A. Hogg—Durham University, 1938
M. F. Barby—LMS Railway, 1939
A. H. Toms—Southern Railway, 1939
E. G. Abercromby—Metropolitan Water Board, 1939
E. J. Matheson—GWR, 1939
J. K. Anderson—LNER, 1939
W. McGregor—Glasgow University, 1939
T. M. Yu—Imperial College, 1939
A. R. Javes—Anglo-Iranian Oil Co., 1939
S. W. F. Morum—Anglo-Iranian Oil Co., 1939
R. Glossop—John Mowlem, 1939
S. Gawlinski—Polish Research Centre, 1940
I. C. dos M. Pais-Cuddou—Birmingham, 1940
J. Paton—Babtie, Shaw and Morton, Glasgow, 1942
W. S. Canning—GWR, 1942
Hammond—GWR, 1942
Hinton—GWR, 1942
K. Olpinski—Imperial College, 1942
F. G. H. Blythe—Imperial College, 1943
K. R. Rollinson—Cambridge University, 1943
J. Kolbuszewski—Imperial College, 1943
Dr Cassie—King's College, Newcastle, 1943
Wilson—Legrand, Sutcliff and Gell, 1943
Atkin—Colonial Office, 1943
Richards—Wimpey's 1943
J. J. Bryan—PWD, Malaya, 1944
D. J. Palmer—Oxford University, 1944
I. G. Doran—Queen's University, Belfast, 1944
H. B. Sutherland—Glasgow University, 1944
Mears—McAlpine's, 1945
Derrington—McAlpine's, 1945
Duff—Rendel, Palmer and Tritton, 1945
A. W. Bishop—Metropolitan Water Board, 1945
D. J. Henkel—South Africa, 1945

APPENDIX 2: SOIL MECHANICS DISCUSSION GROUP, 1940–1941—RECORDS OF MEETINGS TAKEN FROM MANUSCRIPT NOTES BY BRS STAFF

First meeting

The first meeting was held at the Institution of Civil Engineers on 12 April, 1940.
Mr Wentworth-Sheilds in the chair; 40 members present.
Paper by L. F. Cooling on soil mechanics and its application to engineering problems.
Discussion by James, Glossop, Barbey, Toms, Seaton and Allin.

Second meeting

The second meeting was held at the Institution on 16 May, 1940
Mr Carpmael in the chair; 36 members present.
Paper by H. Q. Golder on practical examples of stability analysis.
Discussion by Gourley, Chatley, Skempton, Tattersall, Glossop, Allin, Cooling, Stevens, James and Markwick.

Third meeting

The third meeting was held at the Institution on 6 June, 1940
Dr Chatley in the chair; 35 members present.
Paper by A. W. Skempton on foundations.
Discussion by Toms, Sayers, Nachshen, Allin, Harding, Turner, Holloway, Markwick and Bateson.

Fourth meeting

The fourth meeting was held at the Institution on 4 July, 1940.
Mr Wentworth-Sheilds in the chair; 22 members present.
Three short talks by Cooling, Skempton and Golder.

Fifth meeting

The fifth meeting was held at the Institution on 30 January, 1941
Mr Buckton in the chair; 28 members present.
Paper by R. V. Allin on soil reactions to pile driving.

Meetings were discontinued owing to enemy action.

Notes on the origins and early years of the British Geotechnical Society

A. W. SKEMPTON

The period 1946–50 witnessed much activity in the organization of soil mechanics in this country. The establishment by the Civils of a Committee on Soil Mechanics and Foundations dates from November 1946. The British National Committee of the ISSMFE was formed in March 1947. The first issue of *Géotechnique* appeared on 5 June, 1948. Great Britain was well represented at the International Conference in Holland 21–26 June, 1948. The decision, by the Civils' Council, to form a British national section or society dates from October 1948, and it was set up in January 1949 under the National Committee. The first meeting of the Society was held on 19 October, 1949, the twenty-fifth anniversary of which we are celebrating this evening. The Civils took over responsibility for publishing *Géotechnique* in November 1949. The arrangements for the First European Conference, organized by the National Committee, were agreed in December 1949, and the conference was held at the Civils in June 1950, the proceedings being published in the December issue of *Géotechnique*.

By that time the Society, with well over a hundred members, was firmly established and three of its main functions had already been exercised: running informal discussion meetings, organizing conferences and acting as the British Section of the ISSMFE. The editing of *Géotechnique* has always been a separate, though very closely linked, activity. In all this work, and especially in founding the Society, the Institution of Civil Engineers has contributed greatly.

In this paper I give a fairly detailed account of the vital years 1946–50. Only the more outstanding developments have been mentioned in the period 1951–61, but the next three years are again given in some detail as they saw the enlargement of the Society's activities to include rock mechanics and also the change of name from the British National Society of Soil Mechanics and Foundation Engineering to the British Geotechnical Society. The events since 1964, which will be remembered by most of the present audience, have been omitted owing to lack of time and space.

I am grateful to the President of the Institution for permission to study the Council Minutes and the minutes of various committees, from which the following account has largely been derived. Mrs Z. Gilleland and Miss Diana Lombard have given valuable assistance in the preparation of these notes. I am also indebted to Professor Bishop for discussions and access to his letter files for the period 1962–65 during which he played a leading part in the Society's affairs.

A very brief outline of the teaching of soil mechanics in the universities from 1938 to 1950 has been added in the Appendix, to supplement the early history of soil mechanics in Great Britain as presented in the papers by Dr Cooling and Mr Glossop.

ORIGINS 1945–48

19 December, 1945

The Civils' Research Committee, which includes among its membership Mr Wentworth-Sheilds, Sir George Burt and Mr Evans (Director, BRS), sets up a small committee to discuss the resumption of work by the Earth Pressures Sub-Committee. Mr W. K. Wallace is to be chairman of this group with Dr Chatley, Professor Gilbert Cook, Mr Evans, Dr Glanville, Mr T. M. Seaton and Mr E. G. Walker as members.

20 June, 1946

Mr Wallace's committee recommend that a Soil Mechanics and Foundations Committee be established.

22 November, 1946

Membership of the Soil Mechanics and Foundations Committee is drawn up. Mr Wallace to be chairman, with Mr A. Banister (Institution Research Officer) as secretary, and ten other members (Table 1).

31 January, 1947

The Soil Mechanics and Foundations Committee meets. It is decided to compile a bibliography covering the period 1920–46, to review the teaching of soil mechanics in the universities, and to arrange visits to BRS and RRL.

15 March, 1947

The Civils' Council Minutes of this date include the following item (Minute 5723): 'In response to the suggestion of Mr. L. F. Cooling and Mr. A. W. Skempton, the Council agreed to convene a British National Committee to concern itself with the preparation of Papers from this country for presentation at the Second International Conference on Soil Mechanics and Foundation Engineering to be held in Holland in 1948 under the Presidency of Dr. Terzaghi, and nominated the following members to serve on the Committee (Table 1). It was also agreed that Mr. A. Banister should carry out the secretarial duties pertaining to the Committee.'

April 1947

The British National Committee holds its first meeting. Arrangements are made to obtain papers for the conference.

May 1947

The organizing committee of the Rotterdam conference issue a preliminary bulletin.

16 September, 1947

The British National Committee reviews synopses of papers and reports, and accepts 76.

31 October, 1947

The Soil Mechanics and Foundations Committee considers replies from the universities. A few more are received before the end of the year.

It emerges from these enquiries that soil mechanics is now (i.e. in the academic year 1947–48) being taught to a greater or lesser extent in twelve universities or colleges, and is about to start in three others (see Appendix). In most cases quite detailed syllabuses were submitted with lists of the laboratory work involved.

15 December, 1947

Most of the papers for the conference are sent to Holland.

15 January, 1948

By this date the National Committee has forwarded all 72 papers and reports to Holland (four of the synopses not having materialized as satisfactory papers).

This submission represents nearly 20% of the total contributions to the conference, and provides remarkable evidence of the vigour of the British School.

3 February, 1948

The bibliography for the years 1920–46 is completed in manuscript.

27 April, 1948

The President of the Institution, Sir Roger Hetherington, reports to Council that he has invited several members interested in soil mechanics to meet him, and has pressed on them the desirability that any organization or society devoted to this subject should be closely linked with, or affiliated to, the Institution.

21–26 June, 1948

Second International Conference at Rotterdam. Great Britain is strongly represented: by 74 delegates, including the Vice-President of the conference (Mr Skempton) and a general reporter (Mr G. Wilson). 57 Papers from Britain are published together with 15 reports of laboratories. The National Committee also presents a report.

22 June, 1948

During the conference a special meeting is held to discuss draft statutes prepared by Mr T. K. Huizinga (secretary to the conference) and previously circulated to all national committees. With Professor Terzaghi in the chair, 23 national representatives attend, including Mr Huizinga for Holland, Dr E. de Beer for Belgium (general reporter) and Mr Wallace for Great Britain. One of the Articles (No. 5) agreed at this meeting concerns the setting up of national societies or sections of the ISSMFE.

24 June, 1948

At an open meeting the statutes, with some minor changes, are ratified by the Conference.

17 September, 1948

The British National Committee on Soil Mechanics recommends to the Civils' Council, in accordance with Article 5, that 'a British Section of the International Society of Soil Mechanics and Foundation Engineering be formed under the control of a British National Committee'.

19 October, 1948

The Council of the Institution of Civil Engineers orders this recommendation to be carried out (Minute 6871).

STAGE 1 1949–50

31 January, 1949

The British National Committee, having reconstituted its membership (Table 1), holds a meeting to establish the British Section of the International Society. Statutes are agreed. Applications for membership are to be submitted for approval; the entrance fee to be £2 with a subscription of 10*s* 0*d* per annum; the AGM to be held in October; the Civils to undertake the secretarial work.

1 June, 1949

Total membership now 68, and increasing steadily.

19 October, 1949

First AGM of the British Section of the ISSMFE. Election of two new committee members for 1950–52 (H. Q. Golder and L. J. Murdock) to replace those retiring (by rotation); followed by the first informal discussion meeting. Two topics were introduced, by Mr R. Glossop and by Dr L. J. Murdock. As I recall, about thirty members were present; the names of the ten who took part in the discussions are on record (Fig. 1).

30 November, 1949

First meeting of the *Géotechnique* Advisory Panel, with Mr Wallace in the chair.

Géotechnique first appeared in June 1948 under the joint editorship of Mr R. Glossop and Mr H. Q. Golder, who issued four numbers in 1948–49. From 1950 the journal has been published by the Civils.

13 December, 1949

After much detailed planning, the programme and arrangements are agreed for the first European Conference; organized by the National Committee of the ISSMFE and to be held in 1950, at the Civils, on the measurement of shear strength of soils in relation to practice.

15 January, 1950

Publication of the Bibliography on soil mechanics 1920–46; prepared by the Soil Mechanics and Foundations Committee.

18 May, 1950

Second informal discussion meeting of the British Section, introduced by Mr Glossop and Dr W. Eastwood. Eight members participated in the discussions.

5–8 June, 1950

Shear strength conference. Eight Papers: from Great Britain (Skempton & Bishop and Golder & Ward), Holland (Geuze & Tan), Belgium (De Beer), Switzerland (Haefeli and Bjerrum), Sweden (Kjellman) and France (Mayer); and a summary of the Conference (Roscoe). Proceedings published in *Géotechnique*. About 60 people attended the Conference, roughly half from this country and half from mainland Europe.

22 June, 1950

Supplement to the Bibliography completed for 1947–48. No meetings of the Soil Mechanics and Foundations Committee were held after October 1950, but further Supplements were issued by the Civils up to 1958.

16 November, 1950

Second AGM of the British Section. Election of two new Committee members for 1951–53 (K. H. Roscoe and A. H. Toms), followed by the third informal discussion meeting.

STAGE 2 1951–61

9 January, 1951

The Advisory Panel decide to issue *Géotechnique* quarterly from 1952.

17 October, 1951

Third AGM. New committee members elected for 1952–54 (R. Glossop and D. J. Maclean). Fifth informal discussion meeting.

23 January, 1952

Sub-committee formed to consider papers for the Third International Conference.

7–9 July, 1952

Second European Conference, held in Paris.

5 August, 1952

Twenty-eight papers accepted for submission to International Conference.

22 October, 1952

Fourth AGM. New committee members elected for 1953–55 (W. H. Ward and A. L. Little).

INTERNATIONAL SOCIETY OF SOIL MECHANICS AND FOUNDATION ENGINEERING

BRITISH SECTION

Ordinary Meeting.

Wednesday, 19 October, 1949 at 5.45 p.m.

Chairman: Mr. W. K. Wallace.

1. An informal discussion was held at which Mr. R. Glossop introduced the subject :-

Recent practical examples which have proved the accuracy of laboratory predictions

and Dr. L. J. Murdock introduced the subject :-

Examples of stress measurements in timber for excavations.

2. In the discussion that followed Messrs. Guthlac Wilson, A. H. Naylor, I. K. Nixon, L. J. Murdock, H. Q. Golder, A. W. Skempton, A. H. Toms, M. J. Tomlinson, L. F. Cooling and H. J. B. Harding took part.

Fig. 1

29 March, 1953

Death of Dr Guthlac Wilson, member of the British National Committee since 1947. He had studied soil mechanics at Harvard University 1938–39 and became the leading consulting engineer in this field in the post-war period.

15–20 August, 1953

Third International Conference, at Zürich. 51 delegates from Great Britain. The British Section is honoured by the appointment of Mr A. Banister as Secretary of the ISSMFE (in succession to Professor D. W. Taylor); by the election of Dr A. W. Skempton (a general reporter at the Conference) as the first European Vice-President of the International Society; and by the choice of London as the venue for the Fourth International Conference.

11 November, 1953

Fifth AGM. New committee members elected for 1954–56 (H. B. Sutherland and G. E. Wild).

17 March, 1954

Organizing committee set up to arrange the Fourth International Conference. Dr W. H. Glanville (Chairman), Mr A. Banister (Secretary), Dr L. F. Cooling (Chairman, Papers Sub-Committee), Mr R. Glossop (Chairman, Visits Sub-Committee), Mr R. M. Wynne-Edwards (Chairman, Finance Sub-Committee) and six other members. Mrs R. Glossop (Chairman, Ladies Sub-Committee).

17 March, 1954

On the same day a Special General Meeting is held to approve new statutes. Name changed from 'British Section of the ISSMFE' to British National Society of Soil Mechanics and Foundation Engineering. Entrance fee *15s 0d*, annual subscription *£1 10s 0d* to include *Géotechnique*. The British National Committee remains unchanged in name and terms of reference, namely 'To implement the Statutes of the International Society . . . as applicable to Great Britain and Northern Ireland'.

21–24 September, 1954

Third European Conference, at Stockholm. Papers and discussions published in *Géotechnique* (vol. 5) with the aid of grants from Richard Costain and Co., John Mowlem and Co. and George Wimpey and Co.

25 November 1954

Sixth AGM. Election of new committee members for 1955–57 (S. J. Button and P. L. Capper), followed by the eleventh informal discussion meeting.

Hitherto the meetings have been bi-annual. For the next five years there are three discussion meetings annually. In the session 1959–60 the number is increased to four.

20 January, 1955

Mr Wallace, having retired as Chairman, is replaced on the Committee by Mr R. M. Wynne-Edwards (nominated by the Civils' Council) and Dr Cooling is elected Chairman. A resolution is passed recording 'the appreciation of the Committee and the British National Society to Mr. Wallace for his work in founding the Society and undertaking the chairmanship for six years'. A presentation is made to him by the Committee on 24 March.

Mr Wallace became President of the Institution in November 1955, but remained as chairman of the *Géotechnique* Advisory Panel until 1959.

January, 1956

Bulletin No. 1 for the London Conference issued.

16 July, 1956

A sub-committee has refereed papers submitted to the International Conference and accepts 22 papers for publication, this number being the quota allowed by the Organizing Committee.

12–16 August, 1957

Fourth International Conference, held in London at the Civils. The organization of this conference is the greatest task so far undertaken by the British Society. 772 delegates attend, and 256 ladies. Dr L. F. Cooling is the British representative on the Executive Committee. Professor A. W. Skempton is elected President of the ISSMFE for the period 1957–61 in succession to Professor Terzaghi. Mr Banister continues as Secretary to the International Society.

22–27 September, 1958

Fourth European Conference, at Brussels.

16 October, 1958

Tenth AGM. Decision to award a prize for the best paper each year.

28 October, 1959

Eleventh AGM. The first British Soil Mechanics Society Prize, for 1958, is awarded to K. H. Roscoe, A. N. Schofield and C. P. Wroth.

17 February, 1960

It is decided to hold an annual lecture, to be known as 'The Rankine Lecture', financed from funds surplus to the requirements of the Organizing Committee of the Fourth International Conference and now placed at the disposal of the British National Committee.

11 May, 1960

Mr Banister ceases to be Secretary of the Committee. It is agreed that 'as a token of

appreciation of the valuable work that Mr Banister has performed on behalf of the British National Committee over a period of twelve years, a gift . . . be made to him'.

Mr R. F. Farmer takes over the duties, but Mr Banister remains Secretary of the ISSMFE until the end of 1961.

26 October, 1960

Membership of the Society now 357.

25 January, 1961

First Rankine Lecture, by Professor A. Casagrande.

30–31 March, 1961

Conference on pore-pressure and suction in soils organized by the British National Society and held at the Civils.

The first of several conferences on specialized topics organized by the Society for its members, 140 of whom attended on this occasion. In addition the Society invited about 20 engineers from overseas, and of the eighteen papers six were by our visitors: three from Europe and one each from South Africa, Australia and the United States.

14–22 July, 1961

Fifth International Conference, held in Paris. President, Professor A. W. Skempton; Secretary, Mr A. Banister. 152 delegates from Great Britain headed by Professor J. K. T. L. Nash[1], Chairman of the British National Committee. 26 Papers are submitted from this country. Professor A. Casagrande is elected President of the ISSMFE for the period 1961–65.

13 December, 1961

Permission is sought from the Institution to increase the number of discussion meetings from four to five, to ensure the inclusion, each year, of at least one meeting on rock mechanics.

STAGE 3 1962–64

16 January, 1962

The Council grants permission to hold an additional meeting.

17 January, 1962

Second Rankine Lecture, by Dr L. F. Cooling.

c. January, 1962

At about this date, Mr Banister having left the Civils, Mr A. McDonald (Secretary of the Institution) takes over as Secretary of the ISSMFE.

4 April, 1962

Thirty-seventh informal discussion meeting introduced by Dr Ch. Jaeger, on rock mechanics.

9 May, 1962

Mr R. A. Bell takes over from Mr Farmer as Secretary. He is succeeded by Mr P. B. E. Thompson in October 1965 who in turn is succeeded by Mr P. C. Beresford in May 1971.

6 October, 1962

The International Society for Rock Mechanics (ISRM), recently formed by Dr L. Müller at Salzburg, holds a General Assembly at which the question of setting up National Committees is discussed.

[1] Professor J. K. T. L. Nash became Secretary General of the ISSMFE in 1968, following Mr A. McDonald (Secretary 1962–67).

14 October, 1962

In a letter of this date Professor Casagrande (President, ISSMFE) writes as follows: 'There has been a considerable amount of correspondence between Bjerrum, Skempton and myself, and personal discussions with Professor Terzaghi, on the basis of which it was decided we cannot change at this time the name and scope of our International Society. However, there are no objections if on the national level activities on soil and rock mechanics are carried out by the same national committee'.

The debate on these questions continued for another year but this important statement by Professor Casagrande remained the guiding principle both at national and international levels.

16 January, 1963

Third Rankine Lecture, by M. Armand Mayer.

8 May, 1963

As the Society now includes rock mechanics as well as engineering geology in its programme, consideration is given by the Committee to changing the name of the Society. Professor Skempton and Mr Tomlinson are to report.

22–24 May 1963

Conference on grouts and drilling muds in engineering practice, organized by the Society and held at the Civils.

9 October, 1963

Professor Skempton and Mr Tomlinson make their report verbally, and after discussion the Committee agrees that it would be most undesirable to change the name of the ISSMFE, but that there are advantages in changing the name of the British National Society to 'The British Geotechnical Society' without in any way altering the relationship with ISSMFE. The matter is to be placed before a Special General Meeting in December and a note is to be circulated to all members setting out the pros and cons.

15–18 October, 1963

Fifth European Conference, at Wiesbaden.

21 November, 1963

The Committee decides to enlarge its membership specifically to include representatives from engineering geology and rock mechanics.

3 December, 1963

A meeting, arranged by Professor E. L. J. Potts, is held at the University of Newcastle 'to discuss the possibility and necessity of setting up a British National Society of Rock Mechanics, which can act under the aegis of the ISRM'. The meeting is attended by 31 people, with Professor Nash (Member of Council, ICE) in the chair. The principal participants are Dr Bishop (Chairman, British National Committee ISSMFE, also representing the International Congress on Large Dams), Professor Potts (member of the Board of Directors ISRM), Professor R. A. L. Black (mining engineer) and Dr J. L. Knill (engineering geologist). After a lengthy discussion it is agreed not to set up a separate society but to co-operate with what is about to become the British Geotechnical Society in its enlarged form, and that when in due course the ISRM has prepared acceptable statutes the affiliation of the BGS to this International Society would be possible.

11 December, 1963

Dr Cooling, Professor Skempton and Mr Little are requested by the Committee to select papers on soil mechanics and foundation engineering from the *Proceedings* and *Journal of the Institution of Civil Engineers* for reprinting in the form of a book. (This book eventually appeared under the title *A century of soil mechanics* published by the Civils in 1969. It consists of sixteen Papers ranging in date from 1844 to 1946 and a bibliography covering the years 1836–1948 compiled by Miss Joyce Brown.)

11 December, 1963

At a Special General Meeting the proposal to change the name of the British National Society of Soil Mechanics and Foundation Engineering to The British Geotechnical Society is carried by a large majority. The new name is to come into effect from 1 January, 1964.

9 January, 1964

At a Committee meeting attended, by invitation, by eight representatives from the fields of engineering geology and mining engineering, new statutes of the BGS as drawn up by the Chairman, Dr A. W. Bishop, are agreed. The statutes define the aims of the Society and a revised (enlarged) constitution of the Committee, and state that 'The Committee of the BGS shall serve as the British National Committee of the ISSMFE'. In addition, 'The BGS shall also enter into appropriate relationships with such international societies as lie within its field of interest and are approved by the Annual General Meeting or by a Special General Meeting'. This clause is inserted to provide for affiliation to the ISRM.

5 February, 1964

Fourth Rankine Lecture, by Professor A. W. Skempton

20 May, 1964

At a Special General Meeting the Statutes of the British Geotechnical Society are approved.

25 May, 1964

In accordance with the new statutes the Secretary of the Society, Mr R. A. Bell, writes to the Geological Society, the Institution of Mining and Metallurgy, and the Institution of Mining Engineers, inviting them each to nominate a member of the BGS Committee.

27 August, 1964

By this date nominations have been received for the additional Committee members representing engineering geology and rock mechanics: Professor S. E. Hollingworth (Geological Society), Professor E. L. J. Potts (Institution of Mining Engineers) and Professor R. A. L. Black (Institution of Mining and Metallurgy). They will serve on the Committee officially from 1 June, 1965 but are invited to attend the remaining Committee meetings in 1964.

1 September, 1964

Membership of the Society 550.

14 October, 1964

Sixteenth AGM. The British Geotechnical Society Prize, as it is now called, is awarded to Dr R. E. Gibson (for 1963). New committee members are elected, as usual, and there is an informal discussion meeting (the fiftieth). Some idea of the importance of the BGS Prize is conveyed by the fact that no less than 49 papers had been considered by the referees.

1965–74

In 1968 the BGS became the British Section of the ISRM. With this addition to its functions and with its enlarged Committee (in accordance with the statutes of 1964), the Society continues during the period 1965–74 otherwise essentially unchanged from its original form, and has now (December 1974) completed 25 years of existence.

Table 1

Soil Mechanics and Foundations Committee January 1947–October 1950	British National Committee ISSMFE		
	April 1947–December 1948	Committee of the Society	
		January 1949	January 1950
W. K. Wallace (Chairman)	W. K. Wallace (Chairman)	W. K. Wallace (Chairman)	W. K. Wallace* (Chairman)
A. Banister (Secretary)	A. Banister (Secretary)	A. Banister (Secretary)	A. Banister* (Secretary)
Dr H. Chatley	Dr H. Chatley	J. A. Banks	J. A. Banks
L. F. Cooling	L. F. Cooling	L. F. Cooling	L. F. Cooling*
Professor G. Cook		W. E. Doran	
Dr W. H. Glanville		Dr W. H. Glanville	Dr W. H. Glanville
R. Glossop	R. Glossop		(R. Glossop)*
	H. Q. Golder		H. Q. Golder*
Dr F. M. Lea	Sir Claude Inglis	H. J. B. Harding	H. J. B. Harding
		Professor S. E. Hollingworth	Professor S. E. Hollingworth
(D. J. Maclean)†	D. J. Maclean	D. J. Maclean	D. J. Maclean
J. N. McFeeters‡	J. N. McFeeters		Dr L. J. Murdock
	H. S. Keep	Professor A. H. Naylor	Professor A. H. Naylor
A. W. Skempton	A. W. Skempton	A. W. Skempton	Dr A. W. Skempton*
T. H. Seaton		A. H. Toms	
E. G. Walker	Guthlac Wilson	Guthlac Wilson	Guthlac Wilson*

* *Géotechnique* Advisory Panel, first meeting November 1949
† Maclean joined the Committee later in 1947
‡ McFeeters resigned December 1948

Table 2. Chairmen of the Society

Chairman	Period	Chairman	Period
W. K. Wallace	1949–54	A. W. Bishop	1963–65
L. F. Cooling	1955	W. H. Ward	1966–67
H. J. B. Harding	1956	R. E. Gibson	1968–69
L. F. Cooling	1957–59	M. J. Tomlinson	1969–71
J. K. T. L. Nash	1960–62	A. D. M. Penman	1972–74

Table 3. *Géotechnique*

R. Glossop and H. Q. Golder	1948–49	Joint editors
W. K. Wallace	1950–59	Chairmen of the Advisory Panel
J. K. T. L. Nash	1960–65	
L. F. Cooling	1966–69	
A. W. Skempton	1970–72	
R. E. Gibson	1973–75	

Table 4. Rankine Lecturers

	Lecturer	Year		Lecturer	Year
1	A. Casagrande	1961	8	R. Glossop	1968
2	L. F. Cooling	1962	9	R. B. Peck	1969
3	A. Mayer	1963	10	K. H. Roscoe	1970
4	A. W. Skempton	1964	11	J. C. Jaeger	1971
5	N. M. Newmark	1965	12	P. W. Rowe	1972
6	A. W. Bishop	1966	13	T. W. Lambe	1973
7	L. Bjerrum	1967	14	R. E. Gibson	1974

Table 5. British Geotechnical Society Prize (British Soil Mechanics Society Prize before 1963)

Year	Prize winners	Year	Prize winners
1958	K. H. Roscoe, A. N. Schofield and C. P. Wroth	1966	T. Whitaker and R. W. Cooke I. F. Christie
1959	A. W. Skempton	1967	A. D. M. Penman and G. H. Watson N. N. Ambraseys and S. K. Sarma
1960	T. Whitaker A. W. Bishop and N. Morgenstern	1968	W. H. Ward, J. B. Burland and R. W. Gallois R. E. Gibson and Miss G. C. Shefford
1961	A. W. Bishop	1969	A. W. Skempton and J. N. Hutchinson A. W. Bishop and Z. A. Al-Dhahir
1962	P. W. Rowe P. Lumb	1970	M. J. Tomlinson R. G. James and P. L. Bransby
1963	R. E. Gibson	1971	J. B. Burland
1964	D. H. Cornforth A. W. Bishop, M. F. Kennard and P. R. Vaughan	1972	L. Bjerrum, J. K. T. L. Nash, R. M. Kennard and R. E. Gibson A. C. Palmer K. W. Cole
1965	P. W. Rowe and K. Peaker J. L. Knill and K. S. Jones N. Morgenstern and V. E. Price		

APPENDIX

The universities: soil mechanics teaching 1938–50

Lectures on soil mechanics were given in the session 1938–39 by P. L. Capper at University College, London and by A. H. A. Hogg at King's College, Newcastle (University of Durham). Both were interrupted by the War. The course at Newcastle was revived and expanded by Dr Fisher Cassie in 1943–44. Mr Capper started again at UCL in 1945–46. At Sheffield Professor N. S. Boulton introduced some soil mechanics lectures in 1939–40 and continued giving them until 1953. Also in 1939–40 Dr W. McGregor started teaching soil mechanics at Glasgow. This course continued under McGregor until 1944 (when he left to join George Wimpey and Co.) and then under H. B. Sutherland.

It is interesting that all these people had worked for a short time at BRS before starting their university teaching in soil mechanics: Boulton, Hogg and Capper in 1938, McGregor in 1939, Cassie in 1943 and Sutherland in 1944.

In the session 1945–46, immediately after the War, a course of lectures and laboratory work was introduced at Imperial College by A. W. Skempton (as a Special Lecturer before joining the staff in October 1946) and, as mentioned above, P. L. Capper at the same time resumed at UCL. In the academic year 1946–47 lectures were started at Cambridge by K. H. Roscoe, at King's College, London by J. K. T. L. Nash (who came from the RRL), at Manchester College of Technology by E. Lloyd Morgan and at Manchester University by W. Eastwood. Eastwood left next year for Aberdeen, and his place at Manchester was taken by J. K. Alderman.

A systematic enquiry throughout the country by the Soil Mechanics and Foundations Committee of the Civils, in the autumn of 1947, revealed that regular courses were being given in twelve universities or colleges (see Table 6. My colleagues in the universities have kindly supplied additional information which has been incorporated in this Table). During the next two years three further courses were started, at Queen's University Belfast[2], Bristol, and University College Dundee (St Andrew's) where P. W. Rowe gave the lectures before moving to Manchester in January 1952.

The first full-time postgraduate course leading to the MSc degree or its equivalent began in 1950–51 at Imperial College under the joint supervision of A. W. Skempton, A. W. Bishop and D. J. Henkel. Later developments lie outside the scope of this note, but it may be mentioned that the next postgraduate course started at Birmingham in 1954–55 under Dr J. Kolbuszewski, who had given the undergraduate lectures there since 1951.

It is of interest to add that a paper on engineering geology and soil mechanics was introduced (and taken by many candidates) in the Associate Membership Examination of the Institution in April 1951. The syllabus had been drawn up by the Soil Mechanics and Foundations Committee, and was accepted by the Education and Training Committee on 9 December, 1948. Again as a result of the Committee's enquiries it is known that the following polytechnics and technical colleges were teaching soil mechanics in the session 1948–49: Battersea, Regent Street and Brixton in London, and Birmingham, Bradford, Brighton, Coventry, Loughborough, Norwich and Sunderland in the provinces. The course at Middlesbrough began in 1949–50.

Table 6. University courses in soil mechanics, before 1949

University or college	Course started	Lecturer, 1948–49
Aberdeen University,	1947–48	W. Eastwood
Belfast, Queen's University	1948–49	I. G. Doran
Bristol University	1948–49	W. N. Elgood
Cambridge University	1946–47	K. H. Roscoe
Dundee, University College	1948–49	P. W. Rowe
Glasgow University	1939–40	H. B. Sutherland
Glasgow, RTC	1947–48	W. Frazer
Leeds University	1947–48	S. Mackey
London, Imperial College	1945–46	A. W. Skempton
London, King's College	1946–47	J. K. T. L. Nash
London, University College	1945–46	P. L. Capper
Manchester University	1946–47	J. K. Alderman
Manchester, College of Technology	1946–47	E. Ll. Morgan
Newcastle, King's College	1943–44	W. F. Cassie
Sheffield University	1939–40	N. S. Boulton

Geotechnology and Géotechnique

R. GLOSSOP

The progress of classical soil mechanics in England has been described by the two previous contributors from the establishment of the laboratory at the Building Research Station in 1933. I now wish to record a secondary theme, which developed a few years after the first, but moved with it, and also strongly influenced our subject; and I will follow it until 1948, the year of the Rotterdam Conference. It sprang from the introduction to and acceptance by orthodox engineering practice, of a number of processes devised to modify soil properties, in situ, for

[2] I. G. Doran gave this course. He had given some lectures at Queen's University from 1946 while Research Assistant at the Northern Ireland Materials Testing Station.

engineering purposes. These are now generally known as geotechnical processes, but this term was not then current. I shall also describe the origins of the journal *Géotechnique*.

GEOTECHNOLOGY

In volume six of the Proceedings of the Rotterdam Conference of 1948, will be found descriptions of the fifteen soil mechanics laboratories then operating in Great Britain. Of these, three were government establishments, five were attached to universities, two belonged to consulting engineers, and five to contracting firms (Table 1).

At first sight it may seem astonishing that contractors should suddenly have developed an enthusiasm for what was then an esoteric branch of engineering science. Certainly such a thing had never been seen before. It is also to be noted that the first laboratory, in order of date, after the two major government laboratories, was established by a firm of contractors. This happened in the following manner.

In 1930 a contract was let for the construction of the King George V graving-dock at Southampton. This was to be the largest dry dock in the world. It was built for the Southern Railway Company, and the engineer was Mr F. E. Wentworth-Sheilds, then an outstanding member of our profession. As the work necessitated a deep excavation into the Bracklesham Beds, which include lenses and strata of fine sand, under a high artesian head, the engineer specified the use of groundwater lowering, by means of deep tube wells, to relieve this pressure.

Accordingly, the successful contractors, John Mowlem and Co. Ltd, together with Edmund Nuttall Ltd, brought in, as sub-contractors for water-lowering, the Siemens Bau Union of Berlin, a subsidiary of Siemens Schuckert, who had wide experience of the use of tube wells, with submersible electric pumps, for groundwater lowering. By such means a difficult excavation was completed without trouble.

John Mowlem and Co. Ltd, having had many years of experience of excavation works, including shaft sinking and tunnelling in compressed air, were naturally most interested in the success of groundwater lowering, and formed a partnership with the Siemens Bau Union to exploit, in England, water lowering and other processes in which they were expert. Of these, one of the more effective was the Joosten process of alluvial grouting, 'Chemische Verfestigung', which was then translated as 'Chemical consolidation'. This partnership was placed under the management of a young engineer from Mowlem's tunnel department, H. J. B. Harding. Harding's competence as an engineer, and his strictly professional approach to the development of his department soon gained the confidence of the leading firms of consulting engineers, and chemical consolidation became accepted as an important advance in the technique of tunnelling in sand and gravel.

Between 1933 and 1937 Harding carried out much work, and exploited these processes with great ingenuity. He also published several important papers, and indeed laid the foundation for future progress in geotechnology, but in 1937 he was appointed agent to the Bow–Leyton extension of the Central London Railway, and I took over the management of the Siemens Schuckert Partnership from him.

From the first I was impressed by the fact that it was possible to predict the behaviour of groundwater lowering installation from Dupuit's formula for the yield of a well, and from Darcy's law, which involved 'permeability', k, a physical constant for the soil; and as I then knew nothing of soil mechanics, I found this application of physical theory to a geological stratum in situ, most interesting. I thought that the injection of grout might be a converse problem, also involving k. The idea of a small laboratory then occurred to me, but the time was not yet ripe for a firm of contractors to accept such an idea.

During the next two years, I carried out a number of contracts in this field and became aware that a considerable literature already existed in French and German, dealing with what the French already called 'les procédés géotechniques'. To it was soon added the most interesting proceedings of the Erdbaukurs, held at the Eidige Technische Hoschschule at Zürich, in 1938.

At the time, most of these processes had been little used in England, where they were still regarded as particular solutions to particular cases, not always wisely applied. To me they appeared to form a system of logically related techniques, within a well defined body of engineering practice, capable, if correctly used, of solving difficult problems in excavation and tunnelling, over a wide range of soil types; the choice of process, in each instance, being based on the measurement of soil properties made on representative samples. This view was later published.

It was strongly reinforced when, in 1938, I was transferred to the Chingford Reservoir contract, as sub-agent to Wynne-Edwards. Here the full impact of Terzaghi's influence was felt. Wynne-Edwards was his personal friend, and following the failure of 1937 the bank was being rebuilt to Terzaghi's design. Wynne-Edwards introduced me to Cooling, Skempton and Golder, at the Building Research Station, where I was made welcome and got my first training in soil mechanics.

At this time a question arose of the stability of the bank, at points where the underlying London Clay appeared, by inspection, to be weak. With the support of Wynne-Edwards a small laboratory was started on site to measure the strength of the London Clay, by means of the unconfined compression test, and to check the compaction of the fill.

It is difficult now to imagine the situation in 1938. There was no adequate text book of soil mechanics in the English language; the only sources of information were the Proceedings of the First International Conference, held at Harvard in 1936; this was unobtainable, and one was lucky to have access to a copy as I had at the BRS. There were also valuable papers in the Proceedings of the Boston Society of Engineers, by Terzaghi, Arthur Casagrande, and others.

There was no standard practice, for the subject had not yet emerged into industry from the research laboratories, and one designed one's own apparatus and got it made as best one could. This was difficult, for the rearmament programme had started, and even very small

Table 1. Soil mechanics laboratories in the United Kingdom described in reports submitted in December 1947 to the Second International Conference, Rotterdam, 1948

Organization	Laboratory set up, date
Building Research Station, DSIR	1933
Road Research Laboratory, DSIR	1937
John Mowlem and Co. Ltd (Soil Mechanics Ltd)	1939
University of Glasgow	1939
Ministry of Works	1942
George Wimpey and Co. Ltd	1944
R. H. Harry Stanger	1944
Scott and Wilson	1944
University College, London	1945
Imperial College, London	1945
Cambridge University	1946
King's College, London	1946
Le Grand, Sutcliff & Gell	
Ground Explorations Ltd	
Roads and Runways (Engineers) Ltd	

firms were not interested in 'one off' orders. However, the laboratory got equipped by degrees, till it eventually included an unconfined compression device, three Casagrande shear boxes, three oedometers, a liquid limit device, sieves, and an oven. This was enough to do all that was then required.

The staff consisted of F. G. W. Freeman, who recruited a young technician, T. G. Clark, almost straight from school. Freeman soon left to join a film production unit, but Clark, though young, took over successfully. He has subsequently made a distinguished career for himself in materials testing, and is now managing director of Engineering Laboratory Equipment Ltd.

The laboratory was soon working for other Mowlem contracts, and then for other firms. In addition to routine testing, work was started on soil stabilization and on alluvial grouting. This led to stimulating visits to the laboratory of M. Armand Mayer, at 12 rue Brancion, where Karl Langer, an ex-student of Terzaghi's was working on thixotropic clay grouts.

By this time, it appeared to me that the whole field of soil mechanics and of geotechnical processes, formed a distinct branch of civil engineering, with its own disciplines. A report written on these lines has, over the course of time, been completely implemented. I am not saying that I was the first or only person to think thus, but I met no other, and fortunately my colleagues and I, with the support and encouragement of Mowlem's directors, had the opportunity of putting these ideas into practice.

After the outbreak of war, Harding and I spent many evenings while he was fire watching in his Bow–Leyton contract office at Stratford, discussing the details of an organization intended to cover the whole field of soil mechanics and geotechnology.

In 1941 I was sent as agent to the construction of an airfield at Leiston in Suffolk, and being determined having once got a laboratory never to lose it, I hired the laboratory in the local grammar school, which had been evacuated, and arranged for T. G. Clark to transfer most of the equipment from Chingford, and to settle down there. Then, in the following year, H. Q. Golder decided to leave the government service and enter industry. He approached Mowlem's, was taken on, and was sent up to join my staff at Leiston.

At this time a number of newly built concrete runways, up and down the country, were cracking badly under the loads imposed by heavy bombers, and in some cases they became totally unusable in a very short time. All were built on a clay subgrade. Mowlem's were having minor trouble of this kind at Market Harborough, and soon I was in trouble too, for the newly laid concrete at Leiston, underlain by the Chalky Boulder Clay, started to break up under construction traffic. Golder and I, seeing that there was no time to spare, made drastic simplifying assumptions, and devised a method of pavement thickness design, which we tested exhaustively on site, where it gave good results. Later these results were confirmed by the Roads Research Laboratory.

In 1943 Leiston was handed over to the American Air Force and I was transferred to work on Phoenix Units for the Mulberry Harbour.

The soils laboratory had justified its existence, and Sir George Burt moved us into a large flat on the first floor at 123, Victoria Street, which he had been using as an air raid shelter. Here Golder settled down to work, with T. G. Clark as Laboratory Superintendent. This laboratory is described in the Proceedings of the Rotterdam Conference.

Our first major problem was one which we had not anticipated. Since all previous work of this kind had been done in laboratories for research or teaching, no one before had dealt with the sheer volume of tests with which we were faced.

The number of samples to be taken, described, stored, and prepared for testing, and the number of tests to be carried out was unprecedented. A standard practice was therefore

evolved, with built-in checks, to ensure that exceptional cases were recognized. Tests were standardized and proformas designed and printed, many of which are still in use.

On the practical side, the 'U4' sampler was devised by A. C. Longsdon and a universal sample extruder by I. K. Nixon. These and several other ideas were later incorporated in the British Codes of Practice.

In 1944, a subsidiary company, Soil Mechanics Ltd, was formed to take over the laboratory and the associated work in geotechnology and specialist contracting and in due course Harding, Golder and I were appointed directors. We were, at last, united as a team under one roof. The excitements of pioneering were over, and we were faced with the long slog of showing that the new firm could stand on its own, and succeed in the field of specialist contracting.

At this point it may be asked, if a little late, why should the history of a firm be included on such an occasion as this, and should I, with propriety, as a one time director deliver such a paper here? So far as I am concerned the answer is 'yes', for the laboratory was not started as a commercial venture, but as a then sophisticated adjunct to a difficult job of dam construction, and its subsequent development was surprising.

There was also a certain element of chance in that having been introduced to geotechnical processes by Harding, I was transferred to Wynne-Edwards' staff and was thus introduced to soil mechanics; and that a problem then arose at Chingford which made my suggestion of starting a laboratory acceptable. It is quite certain that this laboratory, for at least five years, occupied a unique position between the government research establishments on the one hand and the civil engineering industry on the other, so that a branch of engineering science which might have remained a relatively academic pursuit for much longer, was plunged into practical engineering, and contracting at that. That in itself deserves to be put on record.

Others recognized the value of such a laboratory to a large firm of general contractors, and in 1944 Sir Godfrey Mitchell brought Dr W. MacGregor down from the University of Glasgow to set up a planning department and to start a laboratory for George Wimpey and Co. Ltd; and when MacGregor was rapidly elevated to Wimpey's Board, Dr L. J. Murdock took over as Managing Director of Wimpey Laboratories Ltd.

In the next few years several other firms of contractors followed suit.

GÉOTECHNIQUE

Perhaps the most surprising product of all this activity was *Géotechnique*. During the War we had been isolated from workers in all other countries, except the United States. So, at the first opportunity, in 1946, I asked permission from Mowlem's directors for Golder and myself to visit the principal laboratories in Western Europe.

I was detained, so Golder set off first, with W. H. Ward and D. J. Maclean, to Switzerland. I followed later, met Golder in Paris, and together we went on to visit the soil mechanics laboratories in Brussels, Liège, Ghent, Delft and elsewhere. Our visit to Delft was of particular interest, for in Holland a system of soil testing had been developed, based on the work of Professor Buisman, which differed in many respects from that of Terzaghi's school at Harvard. Also, the laboratories at Delft were the largest in the world, and were constantly occupied with practical problems.

Mr T. K. Huizinga, who had already visited our laboratory at 123, Victoria Street, was away, but we were met by the senior member of his staff, E. C. W. A. Geuze. Now all those who have met him will know that Professor Geuze is an outstanding person, both intellectually and socially, so after a most interesting day we asked him to dine with us in Rotterdam.

After a dinner, at which we talked of nothing but soil mechanics, we went on to a night club.

There, undistracted by the floor show, we continued to talk soil mechanics. An account of this occasion, in Golder's inimitable style, will be found in volume nineteen of *Géotechnique.*

Certain it is, that on that occasion, the suggestion was made of starting a journal. The idea of this journal was further discussed by us in Stockholm and Copenhagen, and on our return to England we realized that we had committed ourselves to action. But, if our expedition had committed us to starting a journal, it had also introduced us to most of the leading workers in soil mechanics in Western Europe, and this was of immense help when the time came to solicit contributions to the first number. Indeed, the list of authors in volume one is remarkable.

We then had several decisions to make. Who was to publish it? Who was to edit it? And how was it to be financed?

We approached our friends Cooling, Skempton and Ward, and between us we decided to set up a geotechnical society, primarily to publish the journal, but also to further the cause of soil mechanics in any way that seemed possible.

Clearly Golder and I had to take on the editing and we modestly assumed the title of 'Temporary Editors', thinking that should the society become firmly established, other arrangements might be desirable.

Our first step was to send out a prospectus, or circular letter, and the response was overwhelming. Amongst the many replies, one, from Sir Bruce White, actually enclosed a subscription, a cheque for £1 0*s* 0*d*. That encouraged us, but it was months later before more subscriptions rolled in. All our spare time in 1947 was fully occupied by the journal. Authors were approached and articles promised. Arrangements were made with the Marshall Press, who had previously done printing work for the Siemens Partnership. They gave us much good advice and an estimate. The layout was prepared by Nancy Skempton and remains unchanged to this day—the use of the device on the front cover was suggested by Golder. It is the colophon taken from Coulomb's classic paper of 1773. Purists objected that the cover was no place for a colophon, but happily we ignored them.

It soon became apparent that the subscriptions received, before publication of the first number, might not be sufficient to cover the printer's bill, and as we would not sully our journal by anything so commercial as advertisements, funds had to be sought at some more respectable source.

I called on my own bank, the South Kensington Branch of Williams Deacon's, where I had opened an account for the Geotechnical Society, and spoke with such enthusiasm on the future of our journal that the manager, Mr Esmond Barclay, a most charming man, allowed the Society an overdraft facility sufficient to ensure that volume one got through the press, thus gaining for himself a place in engineering history.

At that time I realized that I had probably underwritten *Géotechnique* for the immediate future: however it caused me no anxiety. Looking back, I am astonished at the complete confidence that Golder and I had in *Géotechnique.* The idea that it might fail never entered our heads. I remember wondering how much space I would live to see it take up on my bookshelves. The score to date is two feet and three inches, so I may yet be spared to see it occupy a yard, or even a metre.

The Society's bank book has been preserved; it is neatly bound in vellum and inscribed in a copper-plate hand, a relic of the days before banks became so impersonal. The first payment into the account was on 22 April, 1948, for the sum of £23 0*s* 0*d*, representing an accumulation of the first subscriptions. From then on there was a steady flow of cheques for £1 0*s* 0*d*. On the other side of the account were relatively large payments to the Marshall Press, which did such an excellent job in printing the first volume.

Towards the end of the book there are three payments which deserve mention:

1953	February 5	Sabin	£14 10*s* 0*d*
	March 31	Chapman	£4 5*s* 0*d*

These sums were for the purchase and mounting of four of the famous Bourne lithographs of the London and Birmingham Railway while under construction.

September 22 N. Skempton £6 6*s* 0*d*

This payment was to Nancy Skempton for a leather bound portfolio for the prints, which were intended as a present to Terzaghi on his seventieth birthday. They were presented to him at a meeting of the National Committee, held at the Institution of Civil Engineers in July 1953. Terzaghi was very pleased with them, and in his will left them to the Terzaghi Library in the Geotechnical Institute at Oslo, where they now hang.

From the minutes of that meeting, it might be supposed that the prints were the gift of the British National Committee. This is an occasion to set the record straight; they were given by the Geotechnical Society.

Another interesting entry is:

1953 5 August Good Intent £79 5*s* 2*d*

The Good Intent was a restaurant in King's Road, Chelsea, and the occasion was a birthday dinner given to Terzaghi by the old Geotechnical Society. It was a memorable occasion. Our guests were all engineers who until then had not met him. We had a saddle of lamb, and plenty of claret.

It was supposed to be an informal evening, with no speeches, but after dinner Terzaghi proposed the health of the Society, and then for a quarter of an hour or so he walked round the table, glass in hand, giving a wonderful dissertation on the philosophy of soil mechanics, illustrated by work which he had recently done in Canada and elsewhere. After that the evening became convivial indeed.

Returning to the main course of events, on 5 June, 1948, the first number of *Géotechnique* was published, and it was well received. Six months later, for it was then a bi-annual, when the second number was issued, it had about 500 subscribers in thirty different countries.

With such a circulation, and one which was steadily growing, Golder and I realized that either we must give up engineering and become publishers, or we must find someone willing to take over the journal.

One possibility was to approach a firm of publishers, the second, which we chose, was to approach The Institution of Civil Engineers. After some understandable hesitation the Council accepted this unusual offer, and on the completion of volume one they took over *Géotechnique* as a going concern. A *Géotechnique* Advisory Panel was formed, on which members of the old Geotechnical Society have served off and on to this day.

Two later events came as a surprise to one, at least, of the original editors. About 1960 I heard that the first volumes of *Géotechnique* were classified by the British Museum Library as 'very rare', and that they were fetching £5 0*s* 0*d* each on the secondhand market: and when *Géotechnique* published a paper on the lunar soils, that indeed was something beyond the range of my imagination in 1948.

With the first Annual General Meeting of the British Section of the International Society for Soil Mechanics and Foundation Engineering (later happily renamed the British Geotechnical Society) on 19 October, 1949, and the first meeting of the *Géotechnique* Advisory Panel on 30 November, 1949, the old Geotechnical Society became redundant, and the second date may be

said to mark its end as an active body. It had been set up largely to start a journal devoted to soil mechanics, and it had done so, and now the future of the journal was assured in the hands of the Institution of Civil Engineers.

But that is not quite the end of the story. In 1969 I received a letter from Williams Deacon's Bank to say that they had become aware of an account in the name of the Geotechnical Society, in which a sum of money rested, but through which no transactions had passed for many years. They saw that my name was associated with it, and could I explain to them what it was. I got in touch with Cooling, Skempton and Ward, and we agreed that as The Institution of Civil Engineers was about to celebrate its 150th Anniversary, it would be appropriate to devote the remainder of our funds to the purchase of a suitable gift, from the Geotechnical Society to the Institution. I wrote to Golder in Canada, who agreed, and in due course two suitably engraved silver Armada bowls were chosen, which we hoped might be suitable for use as ash trays on the Council's dining room table. The presentation was made at a luncheon party given by the President of The Institution, Mr Shirley-Smith, at which Mr Watson, Dr Cooling, Dr Ward and myself, were present.

In making the presentation I said, 'the Society, which had been responsible for publishing the first two volumes of *Géotechnique*, had been left with surplus funds which had lain in the bank for many years. The members had unanimously agreed that they could be put to no better end than to make such a gift, on the occasion of the 150th Anniversary of The Institution, in recognition of the encouragement and help which it had given to soil mechanics and geotechnology since the early days of these subjects.'

The bond between the British Geotechnical Society and The Institution of Civil Engineers is, indeed, a strong one, and may we bear in mind the ungrudging support which our very senior partner has always given to us, without which we would never have become an effective body.

There can be no question of the success of *Géotechnique* under its present management. It is now, and has been since 1952, a quarterly journal, with a worldwide circulation of more than 4000 copies, and it is acknowledged to be the most important publication in the field of soil mechanics.

In a foreword to the first number Terzaghi described it as 'a clearing house for significant information in the field of soil mechanics and engineering geology', and in the editorial to the same number was written, 'This Journal is intended to fulfil four purposes; to promote international collaboration between workers in Soil Mechanics and related sciences; to publish papers on specialized aspects of these subjects, such as might not be acceptable to the Proceedings of Institutions and Societies devoted to Civil Engineering; to encourage the pursuit of Engineering Geology; and to make the results of research available to the practising Civil Engineer'. All these four objects it has achieved.

In conclusion, I wish to say how much we owe to four outstanding engineers of their generation, Sir George Burt, Sir Jonathan Davidson, Mr W. K. Wallace, and Mr F. E. Wentworth-Sheilds, who constantly supported us. I should also like to express our gratitude to Mr A. Banister who was, for 12 years, Secretary to the British National Committee.

Discussion

H. Q. GOLDER

Cooling, Skempton and Glossop! The last time these names were so coupled was when four lectures on soil mechanics were given at this Institution in 1945 (the fourth was by the late

Mr Markwick). Herein Mr Glossop used, for possibly the first time in English, the term 'geotechnology'. This inspired Dr Golder's muse

Impassioned eloquence arise,
Salute the engineering dawn
Manna descended from the Skies
When Geotechnology was born.
Cooling, Skempton and Glossop cast
their pearls to serve a porcine meal.
What matter if the pearls be false,
So that the swine be real!

He then referred to people who had contributed in the early days. The late Sir Robert Wynne-Edwards was the man who first brought Terzaghi to England, on the Chingford dam. At the time when Glossop and Golder were trying to start *Géotechnique* they received from Wynne-Edwards the following verse

Come, Soil Mechanics, Inc. of dust,
Come, stabilize yourselves a crust
Upon the thixotropic sand
Surrounding us on either hand
So that we can more safely glide
From one side to the other side
As is expedient; deviate
In our opinions from the straight
Triaxially or even more
And still be reasonably sure
No one will let us down, no one
In Europe that is—once that's done
We can relax, for none can pay
Dollars for truth from USA.
Write to the suckers, form a clique
Offer to publish once a week;
Admire each greatly, don't despise
The fellow travellers—each supplies
A pound if suitably impressed.
And as a hall-mark of the best
Let's Patronize the name of Terz
To fill the coffers of the Burts.

The late Dr Guthlac Wilson in a 1946 paper pointed out that the arch over the door of Westminster Cathedral was cracked due to consolidation of the London Clay underlying the Thames Gravel under the great weight of the very high tower to the south of the doorway. With Henry Grace he also wrote a paper on the settlement of London due to underdrainage. Arguments thereon at the Skemptons' house ended with him entering Skempton's bedroom at 3 a.m., shaking him awake and saying 'You are quite right, Skem!'

The late Sir Reginald Stradling, as Director of Building Research took a keen interest and was a wise 'old' man. Finding a factor of safety of 0·5 for an earth bank design Dr Golder wrote 'therefore, the bank cannot be built'. Dr Stradling crossed this out and said 'You musn't say that Golder, some BF will go and build it and then we'd look silly!'

Sir Harold Harding took us into tunnels in London Clay and showed us what 'stiff fissured clay' really looked like. He has made several notable contributions including a James Forrest Lecture and 'Harding's Law' which is explained as follows. In response to a request for a three-ton drop hammer to be sent out for pile-driving in Mombasa harbour Harding sent two. Replying to the irate protest about cost he wrote: 'If you are working over water and you only have one hammer, sooner or later you will drop it in the drink. If you have two hammers you will never drop either of them in the drink. This is a well known, scientific fact!'—Harding's Law.

EQUIPMENT AND APPARATUS

Some very good apparatus and field equipment were developed by the British school in the early days.

The portable unconfined compression apparatus was developed at BRS about 1937 for Chingford. Autographic and simple for solving $\phi = 0$ problems quickly in the field, it has not been improved though the design has been changed.

The shear-box with controlled rate of strain designed at BRS about 1940 is still standard laboratory equipment.

The origin of the vane apparatus was somewhat unusual. Sir Jonathon Davidson, Chief Engineer MWB visiting Chingford thrust his walking stick into the clay revealed in a trench below the bank. It went in quite easily and he remarked 'I wouldn't build a bungalow on that'. In advance of the invasion of France it was necessary to ascertain by night reconnaissance the suitability of the beaches for the landing of tanks. Cooling said immediately 'You want a spring-loaded walking stick or something you can push in and twist'. So the idea of the vane was born.

Another first was the sand sampler for taking undisturbed samples of sand below water—an original idea of Glossop's designed with improvements by Bishop.

SOME EARLY CASE HISTORIES

Early jobs by the BRS are briefly referred to in the following text.

Chingford

Probably the first time movements at a slip surface were scientifically monitored was at Chingford. With six-inch nails inserted, one above and one below the essentially horizontal slip surface, and a two-foot rule, Skempton measured the relative movement. This slip led to the development of the two-circle method of analysis and of the unconfined compression apparatus; and they met Terzaghi.

Kippen

At Kippen a shear failure occurred in soft clay below a small almost square building, a rare occurrence providing an opportunity to assess the then disputed relationship between the bearing capacities of square and strip footings. Dr Golder regards Skempton's paper thereon as a little 'classic'.

Waltham Abbey

At the Royal Gunpowder Factory at Waltham Abbey a protective bank of clay placed against the walls of a building had failed. The profile was redesigned to increase the factor of safety to 1·2. The bank was rebuilt and it failed again. When questioned, the engineer admitted that he had rebuilt the bank to the original design, intending to cut it to the new shape later. This is singularly consistent behaviour on the part of a material which people who do not understand it call 'treacherous clay'.

Finally he referred to two incidents recalled to mind by the earlier speeches.

London Conference 1957

As well as the Ladies' programme Mrs Glossop organized the banquet for 1200 people at Grosvenor House for the London Conference of 1957. She asked Dr Golder to help. They were met by a gorgeous young man with whom they arranged the menu, choosing for a white wine Piesporter Goldtröpfchen, probably 1955. At the dinner Dr Golder was not amongst the 'top brass' at the large table but sitting comfortably somewhere on the rim with his friends.

He was therefore astonished when the head waiter came to his table with a bottle of Piesporter, opened it, and asked him to try it. This he did, reflecting inwardly 'what a chance to turn it down—1200 people.' However he had neither the nerve nor the reason, for it was excellent.

Rotterdam Conference 1948

One of the most satisfactory features of the Rotterdam Conference was that they met and got to know so many people, including many notable characters. Professor Geuze was one. He and Mrs Geuze entertained about twenty of them to an evening 'rijsttafel' at their house in Rotterdam. Also present were the Glossops, Skempton and Terzaghi.

Professor Geuze had previously warned some of them that Terzaghi always drank cognac, but as he only had one bottle of cognac but plenty of Dutch gin would they ask for the latter. When, a bottle of each in his hands, Geuze eventually approached Terzaghi he replied 'When I am in Holland I always drink Dutch gin'. He then took the almost full bottle, poured himself a glassful and placed the bottle on the floor by his chair. The evening was stimulating and of great interest. The rijsttafel was excellent. Terzaghi continued his fascinating stories. About 2 a.m. Terzaghi picked up his bottle of gin and examined it. It was empty. He said 'Now we go home'. They went home.

Looking back over the years Dr Golder remembers with pleasure working with a bunch of diverse people, arguing and disagreeing, yet how well they got on together and the fun of it.

Once Garston raised a brood of bastard chicks
Who had no thought of steel or stone or bricks
But, fathered by some unknown strange gargoyle,
Began to play about with pats of soil,
And working in a humble glass-lined annexe
Were metamorphosed into Soil Mechanics.