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GROUND PROFILE
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Nº 8
March 1976

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NEWSLETTER OF THE DIVISION OF GEOTECHNICAL ENGINEERING.
SOUTH AFRICAN INSTITUTION OF CIVIL ENGINEERS.

CORRESPONDENCE

THE ENGINEER AND THE ENGINEERING GEOLOGIST

The leader in Ground Profile, Newsletter No. 7, dated December, 1975 refers.

I would like to congratulate the writer of the above leader on what must surely rank as one of the most biased articles ever to have been printed under the auspices of a technical division.

In support of the above statement, allow me to present an analysis of the adjectives and adverbial expressions used by the writer to describe the civil engineer versus the engineering geologist. Readers of this letter may then draw their own conclusions.

- The engineer is described as a geotechnical engineer; the geologist as an engineering geologist.
- The engineer is a professional engineer; the geologist a so-called para or quasi engineer.
- Registered engineers have competence and integrity; geologists are money-hungry.
- The engineer is a professional person; the geologist a scientific person.
- While it is difficult to persuade the layman of the professional intent of engineers; he will have to shoulder the burden of accepting scientists and geologists.
- Consulting and contracitng civil firms have prominent men or outstanding leaders. The quality of the leader attracts the public eye, makes innovations, breaks new ground and enhances the profession or group; geologists are drawn by the magnetic pull of economic forces to the lucrative fields of quasi engineering operations.
- The choice of leader of the geotechnical team is one of discipline precedence or right to the top post; the geologist had the ability to perform tasks.
- Professionalism consists of rewarding competence; not of shielding incompetence.

There is an old saying: "If the cap fits ----------". However, as a senior engineering geologist, I consider the choice of many of the above descriptive terms to be extremely biased and even derogatory towards myself and my colleagues.

JOHN M. WEAVER, MSAICE, MAEG.

(It is true that if the cap fits wear it; on rereading the article I do not believe there is a cap, let alone one that fits or can be worn. Indeed, if there is a cap it is the engineers', not the geologists'.

EDITOR)

SOME GEOTECHNICAL PROBLEMS ASSOCIATED WITH PROPOSED CONTAINER TERMINALS

The decision was taken by the Government last year that by the 1st July, 1977 most of South Africa's import and export cargos would be containerized.

Terminals for deep sea container handling will eventually be established at Durban, Cape Town, Port Elizabeth, East London and Walvis Bay, and Inland Terminals will also be established at City Deep, Johannesburg, and Pretoria.

The South African Railways and Harbours Administration has undertaken the detailed planning of the container Deep Sea and Inland Terminal systems, and have commenced large scale operations for the preparation of suitable deep sea berths and container handling and storage areas. This has involved extensive planning and the design of heavy duty pavement areas for container handling and storage with extensive crane facilities for loading and transfering from rail and road transportation systems. Each Terminal consists of a large area with roadways, container handling facilities and storage areas with separate administrative offices, sub-stations, ablutions and various other buildings. Facilities are also provided for the repair and maintenance of the large handling equipment such as trailers, haulers and straddle carriers.

Development of the coastal Terminals has necessitated an extensive geological investigation at each site, and the assessment of suitable foundation systems for each building.

The problem associated with the design of foundations on reclaimed land can generally be attributed to the origins of the soils lying beneath these sites. In this context the soils can be divided into those which were laid down naturally and those which were created by man.

The sites which appear to be most attractive for coastal reclamation are those which have a large area of land within or just above the tidal range. These sites would not have been suitable for normal development but with a minimum amount of filling they can be raised to an acceptable level. The physical appearance of these areas often results from their estuarine origins; origins which may have scarred the underlying bedrock with river channels and which have often laid down an overburden consisting of sands interspersed with layers of normally consolidated clays.

The geotechnical problems on such sites are normally associated with the variations in the bedrock level and in the strata thicknesses and with the high compressibility of the soft clay layers. The behaviour of the clays is further complicated by the anisotropy inherent in a layered system. The existence of thin layers of sands and silts within the clays causes the permeability to be higher in the horizontal plane than in the vertical plane. Consequently, conventional oedometer tests tend to underestimate the coefficient of consolidation. A reliable value can only be determined after the soil permeability has been measured in the field.

It is common for coastal areas to be reclaimed by hydraulic filling. Sand is dredged from the sea bed and is pumped to the site in suspension in water. The mixture of soil and water is then discharged into a pond bounded by dykes. The water moves towards the decanting point and, as its velocity reduces, the particles of soil settle out. This process creates a non-uniform distribution of soil types across the site. The

coarse grained sands tend to settle out close to the discharge point, whereas the silt and clay particles collect in large ponds near the decanting point. In the event of a temporary halt in the flow, the fine particles settle out and form a thin layer of soft clay extending over a large area thereby reducing the vertical permeability of the soil mass.

Choice of suitable foundation systems depends to a great extent on the consistency of the hydraulically placed fill and the depth and extent of the underlying clay layers.

Where severe problems have been encountered at Durban Pier 2 site due to the presence of mangrove layers, it has been decided to pile foundations for buildings and heavy structures such as crane beams. For small buildings and structures the foundations have been located on compacted sands achieved by the use of impact vibration equipment. As settlements over these sites can be expected it has been decided to introduce deep-seated levelling datum points to monitor the relative and absolute settlements of all the large structures and buildings.

The Administration has drawn on the knowledge and experience of consultants and the Road Research Institute of the C.S.I.R. in solving the many problems associated with the container challenge.

A RAILWAYS CORRESPONDENT.

COURSE ON EARTH PRESSURES - Cape Town, 28th to 30th April, 1976.

The course will cover the following topics :-

the design of rigid and flexible walls, the selection of soil parameters, the instrumentation of construction and the legal aspects of lateral support.

The cost of the course is R50, so those wishing to participate should send this amount as a registration fee to:

Prof. A.D.W. Sparks,
Dept. Civil Eng.,
University of Cape Town
RONDEBOSCH, 7700.

BIDIM : AN APPRAISAL OF A FILTER FABRIC

While it is not the policy of this newsletter to advertise, it is considered that commercial products can with interest and benefit to members be discussed in our pages. Accordingly, this report on Bidim, a name now frequently heard in the offices of Civil Engineers, is published. EDITOR.

"The field of soil mechanics has made great strides and there is no question that soils engineers can design graded filter systems that will function properly. However, in some cases the design of a proper filter has to be compromised due to the lack of readily available material. Unfortunately, in other instances, intricate and highly detailed, multi-phased, graded filter systems do not function properly due to installation difficulties and haphazard placement by labour during construction. Most of the difficulties previously experienced in design and placement of a competent filter system have been overcome by the development and use of plastic filters." *

"The advent of non-woven fabrics in the field of civil engineering largely as a consequence of their technical advantages in improving the mechanical or hydraulic properites of soils and structures, and resulting also from the important development of the synthetic textiles industry, has made it possible to adopt original solutions to certain problems of soil stabilization." **

"Previous methods used in the construction of permeable protective surfaces under water on sandy soil prone to erosion have given these structures (embankments) only a relatively short life. The reasons for this are to be seen mainly in the fact that it had not been possible to construct effective filter layers under water.

The plastics industry has now made it possible to construct effective permeable protective surfaces under water which have a relatively long life even if the ground is prone to erosion." ***

Reading through these three extracts which form a minute section of the literature now available on filter fabrics, one begins to realise the extent to which non-woven, synthetic filter fabrics have been accepted by the civil engineering industry and the magnitude of the impact which these fabrics have made.

Some six years ago, we decided to introduce Bidim to South Africa. Our early impressions were that the Bidim solutions offered were solutions which had been awaited for many years. In those days we were forced to draw on experience from Rhone - Poulenc, the French manufacturers of Bidim, and certainly with our limited knowledge of civil engineering we were not immediately able to realize the full potential of the range of application types.

* Extract from the proceedings of the Tenth International Conference on Coastal Engineering, held in Tokyo, Japan in September, 1966.

** "An Economical System of Soil Stabilization: The use of non-woven fabrics in earthworks and drainage works" Presented by J. Puig, Chief Engineer of the Regional Laboratory of Roads and Bridges, Toulouse, France.

*** "The Construction of Permeable Protective Embankment Surfaces Under Water in Shipping Canals during use." Heinrich Meyer, Leitender Regierungsbaudirektor, Hannover.

However, due to the knowledge gained by spending literally hundreds of hours discussing Bidim with civil engineers more and more applications became apparent and were tried with great success. Today we can proudly say that most engineers will make provision for the use of Bidim in projects planned.

In an article of this length it is not possible unfortunately to examine in depth each and every Bidim application type, nor possibly would it be desireable to do so as applications will almost always be based on a variation of fabric functions:- filtration, separation and reinforcement. However, we would like to detail three of the application types in most common use in South Africa.

1. Bidim in road construction over poor quality (usually wet) sub-grade material.

   In this application Bidim is a filter between the sub-base material and the sub-grade. Second, it contains the fill material thus permitting spreading and compaction. In its role as a filter it permits the upward passage of water from the sub-grade during consolidation whilst retaining below the fine sand and soil particles. Similarly the downward passage of construction material is prevented.

   Due to tensile strength, load is spread across the fabric sheet thus preventing sinking of construction plant through the fill material and sub-grade.

   The strength and permeability of the fabric are most important in this application especially if the sub-grade is wet and has a very low C.B.R..

   Insufficient permeability will inhibit the evacuation of water through the filter and so slow down the consolidation process. If the fabric is of low strength bursting under the weight of machines and rollers can occur.

   It is essential to remember that the water passing upwards through the Bidim during construction must be allowed to disperse. The sub-base, therefore, must consist of a permeable material with sufficient voids after packing to permit rapid dispersal of the water.

   In the long term life of the road the fabric represents an important asset, as having a tensile strength, it is immovable by pavement flexing under traffic and so continues to prevent pumping upwards of the fine particles which can, over the years destroy the quality of construction materials and cause pavement failure.

2. Bidim behind gabions or under reno mattress to replace graded filter layers.

   Wire baskets filled with stone are becoming more and more used in the construction of retaining walls and in erosion protection works. There is often, however, a problem of ensuring that the finer bank or embankment elements do not wash through the voids between the large stones in the baskets. This can be done by placing graded filter layers; more frequently nowadays in South Africa and Europe Bidim is used. It is easy to lay, its high tensile strength ensures that it will not be punctured by the stones protruding from the baskets and high fabric permeability permits rapid evacuation of water through the gabions.

3, Bidim as a permeable sub-soil or sub-surface drain lining.

Failure of sub-soil drains due to the clogging of the drainage media can cause massive failures of embankments and roads. Bidim, used to line the drainage trenches before placing the stone drainage media, does in most soil conditions prevent fine soil or sand particles from clogging the drain. Perhaps this application more than any other requires a fabric with an extremely high permeability as in some conditions partial fabric clogging can take place and this can only be tolerated if the initial fabric to ground permeability ratio is very high.

No article on Bidim would be complete without a brief history of the product's conception, details of manufacture and the reasons for the choice of a polymer fabric.

Bidim was the result of research carried out in France by the multi-national chemical and textile giant Rhone-Poulenc and the French civil engineering agencies into the possible use of synthetic fibres in civil engineering. This research showed that synthetic fibres were already being used with good results in the form of woven fabrics. However, new techniques in the textile industry had made possible the production of non-woven fabrics. That is to say fabrics which could be made from continuous fibres multi-directionally oriented as opposed to the normal two directional orientation of fibres in woven fabrics.

Strength advantages of a non-woven fabric over a woven one were obvious as impact on a non-woven sheet could be spread throughout the sheet by the multi-directional nature of the filament web. In addition, filtration could more simulate natural ground filters as it was possible to achieve a fabric with a varying pore size. This is not possible with a woven fabric.

Rhone-Poulenc therefore decided to launch a pilot plant venture to examine the various non-woven manufacturing techniques and to assess the suitability of the various fibres available to them. These were chiefly Nylon, Polypropylene and Polyester.

Polyester was chosen as it was the only fibre which combined properties of excellent strength, low moisture absorption, high resistance to abrasion and creep and resistance to chemicals, acids and alkalis, occurring in normal ground conditions.

The type of non-woven technique chosen was one which relied on fibre strength to transmit stress. In other words, it ensured that the fabric strength was not dependent on jointing at fibre intersection points as this could produce weaknesses. Bidim is produced by extruding molten Polymer and spraying this polymer into a randomly laid multi-directional filament web. This web is entangled by a complex needling process to give a frictional locking of fibres.

Bidim application type in general use in South Africa.

Sub-soil drainage filter.

Filter layer behind gabions and under Reno Mattress.

Filter layer under Rip-Rap slope protection.

Anti-contamination layer in road and air strip construction.

Filter layer in earth dam chimney drains.

Filter layer in sand fill rock face land reclamation works.
Anti-contamination layer under railway ballast.
Filter layer on rock toe embankment supports.
Filter layer in earth dam repair works.
Filter layer under rock breakwaters.
Asphalt reinforcement layer.

A.P. BAKER

MINI-SYMPOSIUM ON SLIMES DAMS

to be held at

Kelvin House - Main Hall - 2 Hollard Street, Johannesburg

ON : Tuesday 27 April 1976 AT : 19h30

PROGRAMME

HRS.	ITEM
19.30	Chairman's Introduction .....A. MacG. Robertson
19.35	The Design and Construction of Slimes Dams .....O.K.H. Steffen
20.05	Discussion
20.15	Failures in Slimes Dams .....Professor J.E. Jennings
20.45	Discussion
20.55	Break for Tea - in foyer
21.10	The Development of Slimes Dams for Township Purposes .....Mr. G.W. Donaldson
21.40	Discussion
21.50	The use of Slimes for Filling Old Mine Workings .....Prof. G.E. Blight
22.20	Discussion
22.30	Close

No proceedings will be published but if anyone wishes to contribute to the discussions they should inform the Symposium Secretary beforehand. Tea will be served during the break.

SYMPOSIUM SECRETARY, Slimes Dams, c/o Steffen, Robertson & Kirsten, P.O. Box 8856, Johannesburg, 2000, Tel : 22-2751/22-2180/22-2100.

SYMPOSIUM ON EXPLORATION FOR ROCK ENGINEERING - JOHANNESBURG

1ST TO 5TH NOVEMBER, 1976

All correspondence concerning the Symposium should be addressed to:

The Secretary, Exploration for Rock Engineering, P.O. Box 8856, Johannesburg, 2000 - South Africa Tel:22-2751

SYMPOSIUM

A symposium on aspects of drilling, rock core and mass description, in-situ testing and instrumentation of rock masses for rock engineering purposes will be held during the period 1st to 5th November, 1976.

PROGRAMME

The programme includes sessions on the following topics:

Drilling Techniques
Testing in Boreholes
Core Logging
Rock Mass Classification
In-situ Stress Measurement
In-situ Rock Mass Testing

Principles of Instrumentation
Instrumentation of
(i) Underground Civil Structures
(ii) Underground Mining Structures
(iii) Surface Excavations and Structures

Five Case Histories will be presented at evening sessions
A pre-symposium tour is planned for mining and civil underground projects and instrumentation installations.

VENUE

The symposium will be held at the University of the Witwatersrand, Johannesburg.

REGISTRATION FEE

A fee of R100 will be charged to cover Registration and a copy of the Proceedings.

CALL FOR PAPERS

Papers on the listed topics are invited from interested persons. Papers should not exceed 6000 words in length and should reach the Symposium Secretary before the 15th May, 1976. All papers accepted will be published in a volume of Proceedings of the Symposium.

FURTHER INFORMATION

Bulletin 1 will be distributed at the end of May, 1976. Persons wishing to receive copies of Bulletin 1 are invited to complete the attached reply form for mailing to the Symposium Secretary.

SHORT COURSE ON FOUNDATION ANALYSIS

10th to 12th May, 1976 - University of the Witwatersrand.

The aim of this course is the introduction and review of the basic theories of foundation analysis and design. The course is designed to intergrate field investigation, laboratory testing procedures, foundation analysis and foundation recommendations.

The course is being organised at the request of the AEG and is directed primarily at Geologists, Engineering Geologists and Geotechnical technicians.

Some of the topics that will be covered are as follows :

(i) The concept of Effective Stress

(ii) One dimensional consolidation

(iii) Shear Strength as is pertinent to bearing capacity estimation

(iv) The problems of heave and collapse.

Those who are interested in the course are invited to contact

Mr. M.J. Gowan
Department of Civil Engineering
University of the Witwatersrand
JOHANNESBURG, 2001

The course fee is R30,00.

INTERNATIONAL SYMPOSIUM ON SOFT CLAY - JULY 1977, BANKOK, THAILAND.

The exact dates have not yet been finalised, but the aim is to hold the Symposium in the week preceeding the Ninth International Conference.

Topics to be covered include :

(i) Historical development of civil engineering in soft clay.

(ii) Engineering geology of soft clay deposits.

(iii) Strength properties.

(iv) Compressibility and settlement.

(v) Stability of earth structure.

(vi) Stability of foundations.

(vii) Excavation methods and tunneling.

(viii) Seismic problems.

(ix) Sampling, techniques and field instrumentation.

(x) Methods of improvement.

(xi) Modern techniques of analysis.

IX INTERNATIONAL CONFERENCE ON SOIL MECHANICS AND FOUNDATION ENGINEERING

TOKYO, JULY 1977.

Special Bulletin No. 2 is available from the Division Secretary, c/o Jones and Wagener Inc., 901 Europa House, 32 Plein Street, JOHANNESBURG, 2001.

Prospective authors are reminded that they should submit 300 word summaries to the Division Secretary by 30th April, 1976. Completed papers must reach the Division Secretary before the 30th June, 1976.

A total of 30 pages in the proceedings have been allocated to South Africa. Accordingly, the length of papers permitted will depend on the quality and number of papers finally accepted.

Speciality Session on Geotechnical Engineering and Environmental Control.

The purpose of this Speciality Session is to provide an opportunity for geotechnical engineers to discuss the role of geotechnical engineering with respect to the environment.

All members participating in the Ninth Conference are welcome at the Speciality Session.

A call is made for papers on the following topics :

(i) Environmental problems associated with geotechnical activities and their control.

(ii) Geotechnical aspects of environmental protection.

(iii) Interaction between geotechnical engineering and other disciplines and their joint effects on environmental protection.

(iv) Geotechnical utilization and control of environmental wastes.

(v) Effects of environmental changes on the behaviour of soils.

(vi) Modeling of Geotechnical data for environmental planning and environmental impact assessment.

Those who intend participating or submitting papers should contact the Divisional Secretary for further information.

JOINT MEETING OF THE GEOTECHNICAL DIVISION AND THE AEG

STANDARDIZED CORE LOGGING

At this meeting there will be presented for the first time the:

PROPOSED STANDARD CORE LOGGING PROCEDURE
by the AEG Committee on Core Logging.

VENUE: Kelvin House, 2000 hrs., Monday 24th May, 1976.

EDITORIAL

This newsletter, GROUND PROFILE, is published under the auspices of the Division of Geotechnical Engineering. The committee of the Division appoints the editor, but the editor is not a member of the committee.

General editorial direction has been approved by the committee, but that is where the influence and control of the committee stops. The editorial content of the newsletter is chosen, edited and arranged by the editor, and VIEWS EXPRESSED IN THE NEWSLETTER REFLECT ONLY THE IDEAS OF THE PERSONS WRITING AND SIGNING THE ARTICLES.

Ideas and opinions do not, unless otherwise indicated, reflect the opinions, ideas or ideals of the Divisional committee, but are the views of those persons whose names appear at the end of each article. Where articles or news items are unsigned, in general, they will have been written by the editor.

On this score readers are reminded that the collection of news reflects my own sphere of ken, and that if the newsletter is to reflect the broadest possible spectrum of views then readers are invited and urged to make contributions themselves.

JACK CALDWELL