

SPOTLIGHT

on open-pit and strip mining

by B.C. ALBERTS*

An international conference on 'The Planning and Operation of Open-pit and Strip Mines' was held at the University of Pretoria from 9th to 13th April, 1984. The Conference was organized by the Mining Alumni Society of the University of Pretoria and The South African Institute of Mining and Metallurgy. Delegates of the mining fraternity from all over the world and Southern Africa attended the Conference. These included more than 400 delegates from Australia, Austria, Botswana, Brazil, Canada, Germany, Holland, SWA-Namibia, the United Kingdom, the United States of America, Zimbabwe, and South Africa.

Addresses

The following addresses were delivered during the plenary sessions of the Conference.

Mr B.C. Alberts of Iscor spoke on 'Management of open-pit mines'. In his address, he looked at the application of management systems on an open-pit mine, particularly management by objectives. He concluded that, apart from needing to apply good management systems and to have an advanced knowledge of mining, the manager of an open-pit mine required the specialized knowledge of maintenance and metallurgy that can be gained by well-planned training and exposure. He stressed the importance of a good organizational structure and a well-designed information system.

'Open-pit development since 1970 with special reference to South Africa' was the subject discussed by Mr P.W.J. van Rensburg of Gold Fields of South Africa. He highlighted the progress made in all the areas that had been covered at the symposium held in 1970. His address confirmed the necessity for follow-on symposia, which will probably be held every ten years so that the progress during the preceding ten years can be determined.

Mr P.V. Young, President of the Canadian Institute of Mining, talked on 'Changing technology in the management of open-pit mines'. He covered three areas. Tribology is an important area of applied science in Canada, and this formed the first subject of discussion with specific reference to lubrication, corrosion, and wear. This was followed by a discussion on remote sensing, in which the remote temperature-sensing of coal stockpiles at the Grootegeluk Coal Mine was used as an example. Mr Young concluded his address by looking at the application of microcomputers in management.

Papers

Twenty-four papers on mine planning, mining operations, equipment selection and maintenance, and new

developments were presented during the four days of technical sessions. Papers of special interest are briefly referred to below.

An Approach to Computer-aided Opencast Mine Planning

The factors underlying decisions on the development of open-cast mines were discussed in logical sequence to illustrate what governs the long-term layout plan and the scheduling of sequences for an open-cast mine. It was clearly indicated that an integrated approach is imperative if the objective of an optimized plan of action is to be achieved.

Operating Features and Control Aspects of the Palabora Copper Open Pit

Since the Palabora Mining Company started operating a large-scale low-grade conventional truck-shovel open pit in the north-eastern Transvaal (1964), various operating features and controls have been implemented in an effort to maintain or increase operating efficiencies in the face of expanding production rates and increased mining congestion. The present situation was described, with emphasis on pertinent aspects of mine planning, drilling and blasting controls, and developments in the load and haul area.

Evaluation of Replacement Techniques and Philosophies

One paper started with a review of the classical concept that economic life is defined by the period that ends when the equivalent annual cost of owning and operating an item of equipment reaches a minimum. It was shown that this concept is no longer valid for two very real reasons:

- the operating cost of modern equipment does not rise constantly with time as presumed in the model;
- inflation necessitates a careful study of the costs associated with owning and operating the next generation of equipment when the replacement of the present generation is considered.

A model that overcomes these two shortcomings was then presented. It was structured to compare costs of present and future generations of equipment, and was used to define economic life as the period that ends when the next year's cost of keeping a machine exceeds the minimum equivalent annual cost of a replacement machine. This model was discredited on the grounds that future costs are difficult, if not impossible, to estimate, and that machines are seldom, if ever, replaced on a one-to-one basis owing to changes in design of the equipment and in mining technology. Classical cash-flow analysis was offered as the only viable technique for economic decision-making.

The paper proposed a replacement philosophy based on the definition and measurement of mechanical quality in a machine. The rationale for this stems from the fact that

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Seen here from left to right are Mr J.P. Deetlefs, Prof. A.N. Brown (rear), Mr J.P. de Vos, Mr P. Young (Canada), Mr B.C. Alberts, Mr J.P.S. Steyn, Mr C.O. Esterhuysen, Mr C.J. Rossouw, Prof. D. Joubert, Mr B.H.L. Leach, Mr D.W. Steyn, Minister of Mineral and Energy Affairs, Dr O.K.H. Steffen.

escalating equipment costs have created a situation in which economic life exceeds physical life, and it is therefore the latter that dictates the replacement decision. Methods for the comparison of mechanical quality, output from an equipment system, maintenance effort, and input into an equipment system, were proposed.

It was shown that a sound replacement philosophy can be based on the concept that equipment life ends when the ordered relationship between mechanical quality and maintenance effort breaks down.

Electrification of Haul Trucks

During 1979 it became clear to Iscor management that the unrealistic escalation in the cost of diesel fuel would cause an unacceptable escalation in production costs at the Sishen Iron Ore Mine. In the light of this and the appeal from the South African authorities to economize on the use of fossil fuels, an urgent feasibility study on the application of a trolley-assist system at Sishen was launched by Iscor management.

Tests and economic evaluations proved that the system would be technically feasible, with a discounted cash-flow return of more than 50 per cent and a reduction in the consumption of diesel fuel of 120 MI over the next ten years. The implementation of the system at Sishen was approved, and the construction of 7,7 km of line and the conversion of sixty-six 154t trucks were completed in March 1983.

A paper was presented on the electrification of these haul trucks.

Blasting Explosives in Open-pit Mines

A discussion took place on the important physical prop-

erties of the various types of dry mixes (AN/FO and Al/AN/FO), slurries, blasting emulsions, and heavy AN/FO. Experimental results were presented to show the critical role of density on the performance of each of these types of blasting product. Relative masses and bulk strengths were given for the explosive performance under optimum conditions, and it was indicated how these might be used in the optimization of drilling and blasting costs.

Posters

The poster presentation held during the Conference was very well attended and elicited favourable comment. Altogether, 17 posters were presented.

Proceedings

The proceedings of the Conference, including all the posters, will be published shortly and will be obtainable from The South African Institute of Mining and Metallurgy.

Technical Visits

Technical visits were made to the Rietspruit, Duvha, Optimum, Kriel, and Arnot strip mines in the Witbank-Middelburg Coal Fields of the Transvaal. These visits afforded delegates the opportunity to view strip-mining activities in practice.

Social Activities

Social activities during the Conference included a braai and banquet, as well as daily lunches in a marquee at the University. A comprehensive programme was organized for the affiliates, with visits to places of interest in and around Pretoria.



Mr Wally Waldeck looks on as some of the delegates from Brazil enjoy themselves.



Delegates from Botswana enjoying themselves at the banquet.



Seen here are from left to right Mr J.P. Deetlefs, Mr S.A. Oosthuizen, Prof. Ir P. von Leeuwen, name unknown, Mr W. Waldeck, Prof. A.N. Brown.