Project planning and progress control for the Grootegeluk Coal Project*

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SYNOPSIS

This paper gives a brief description of the control measures used in the establishment of the Grootegeluk Coal Mine, near Ellisras in the Transvaal. Specific reference is made to the planning of funds, cost and financial control, and economic evaluation.

SAMEVATTING

Hierdie referaat gee 'n kort beskrywing van die beheermaatreëls wat toegepas is met die vestiging van die Grootegeluk-steenkoolmyn naby Ellisras in Transvaal. Daar word spesifiek verwys na die beplanning van fondse, koste en finansiële beheer en ekonomiese evaluering.

Introduction

The approach to project planning and progress control in the mining environment of the South African Iron and Steel Industrial Corporation Limited (Iscor) has changed drastically over the past ten years or so.

At that time projects often overran the required completion dates to the embarrassment of both the contractor and Iscor. The latter never knew exactly where it stood in regard to the progress of its mine contracts. This lack of feedback on progress implied that there were deficiencies in the overall plans since the effects of contract progress could not be passed back to Iscor's sections. The contractor regarded Iscor's interest in the progress of his contract as interference resulting from a lack of trust. When Iscor began to insist on programmes, the contractor often produced two programmes: one that he worked to, and one for Iscor that gave a rosy picture until late in the contract stage, when it might show the situation as deteriorating rapidly.

Iscor therefore decided to undertake a thorough investigation of project planning.

Project Planning and Progress Control at Iscor

Iscor established a separate Project Planning and Progress Control Section (PP & PC), which is located in the Industrial Engineering Department. When a new project is started, PP & PC is now included in the project team.

Good planning must start in the pre-contract stage. From Iscor's point of view, this means that the enquiry documents should contain clauses covering all aspects of the planning, leaving the contractor in no doubt as to what Iscor expects in terms of planning. At the tender stage, Iscor expects a fairly detailed programme on which it will comment, and the successful tenderer must then expand the programme to Iscor's satisfaction right at the start of the contract.

Iscor insists that there should be only one programme in use. It does all the processing of programmes on its own equipment and provides the contractor with the computational results.

The updating of the programme is a joint effort between the contractor and Iscor. The updating is done by activity, and consensus is reached by the parties on the status of each individual activity. The progress is then evaluated with reference to the official programme, and the results are used as the basis for action. (This implies that Iscor is in control of all changes in programme, and that all progress discussions are based on the official programme.)

Project Planning for Grootegeluk

As part of the project team for the construction work at the Grootegeluk Coal Mine at Ellisras, Transvaal, PP & PC had the responsibility of setting the planning framework, reporting progress at the appropriate levels, and assisting with the planning of corrective measures. The organization is shown in Fig. 1.

The first step in the planning was the establishment of a planning framework. This consisted in the definition of the possible contracts that would make up the project, and of the following standard chain of basic activities, for each of which the duration of the work was estimated:

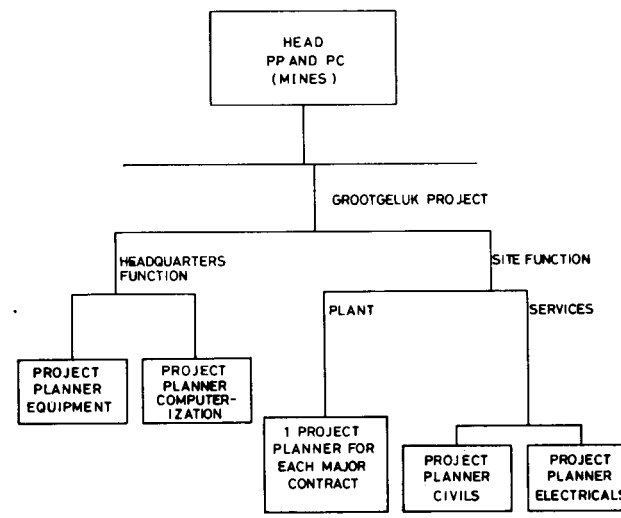

Fig. 1—Organizational chart for project planning and progress control

* Paper presented at the Colloquium on Project Management in the Metallurgucal Industry, held in Johannesburg by the South African Institute of Mining and Metallurgy on 16th September, 1980.

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— Enquiry preparation and issuing
— Tender period
— Adjudication and recommendation
— Contract period (including commissioning).

All the activities to be performed by others, e.g. construction of the railway line, were defined, and estimated durations were obtained.

Working backwards from certain key dates, e.g. the required shipment of first coal, and taking into account the logical relationships between the activities, PP & PC established an overall programme showing the calendar periods for the execution of each of the contracts. To this were added the activities representing the services required, e.g. water, roads, etc., both temporary and permanent. This step is really an iteration process involving the redefining of contracts, the splitting or combining of contracts, the changing of times allowed for contract execution, and the earmarking of certain contracts for execution by Iscor's internal work teams. The end result is an overall planning framework showing the completion periods for the components of the project, which establishes the target completion date for each contract (Fig. 2). It is realized that this overall programme is dynamic, and activities may be added or deleted from it. However, changes to target dates are frowned upon and are avoided as far as possible.

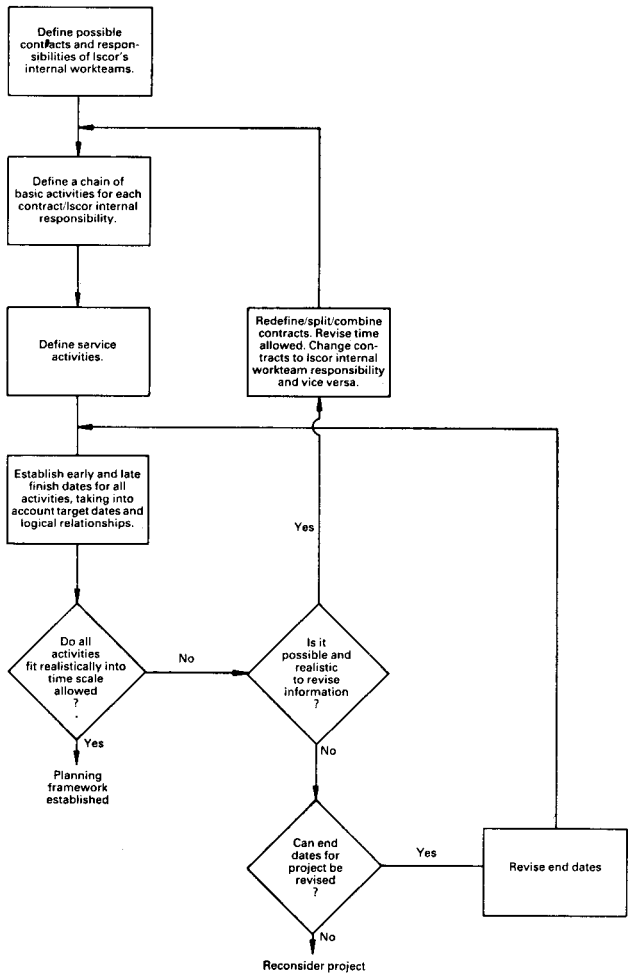


Fig. 2—Flow diagram for the establishment of a planning framework within a given time scale

Progress Control for Grootegeluk

The activities forming the overall project programme were represented in the form of a barchart (Table I). PP & PC updated this document every month and presented it to the top management of the project as a monthly progress report. This document formed the agenda for the monthly project-progress meeting, at which the different sub-project leaders had the opportunity to discuss the progress and decide on overall corrective measures.

The information in the progress report for each contract or Iscor internal construction task was based on a detailed programme for each contract. This programme was drawn up by the relevant contractor to meet Iscor's requirements as set out in the enquiry documents. The programmes used by Iscor can be of the following types.

(1) *Networks of the precedence type* (*Fig.* 3). Network activities are defined as having a duration of not more than 18 working days. They are further defined clearly so that the measurement of progress is facilitated. Networks are used where the number of activities is large, where there are many logical interrelationships between activities, and where computer assistance is required. Networks would be used, for example, for the erection of a plant where the erection programme alone contained 3000 to 4000 activities.

(2) *Barcharts.* These are used where fewer activities are involved and where they are homogeneous and of fairly long duration. An example would be the construction of a single office block.

(3) *Graphs* (*Fig.* 4) *and line of balance.* These techniques are used for a few continuous activities of long duration, as for example the construction of the water pipeline from the Hans Strijdom Dam to the mine; or where activities are of a repetitive nature with specialized work teams per activity, as for example the construction of a housing scheme.

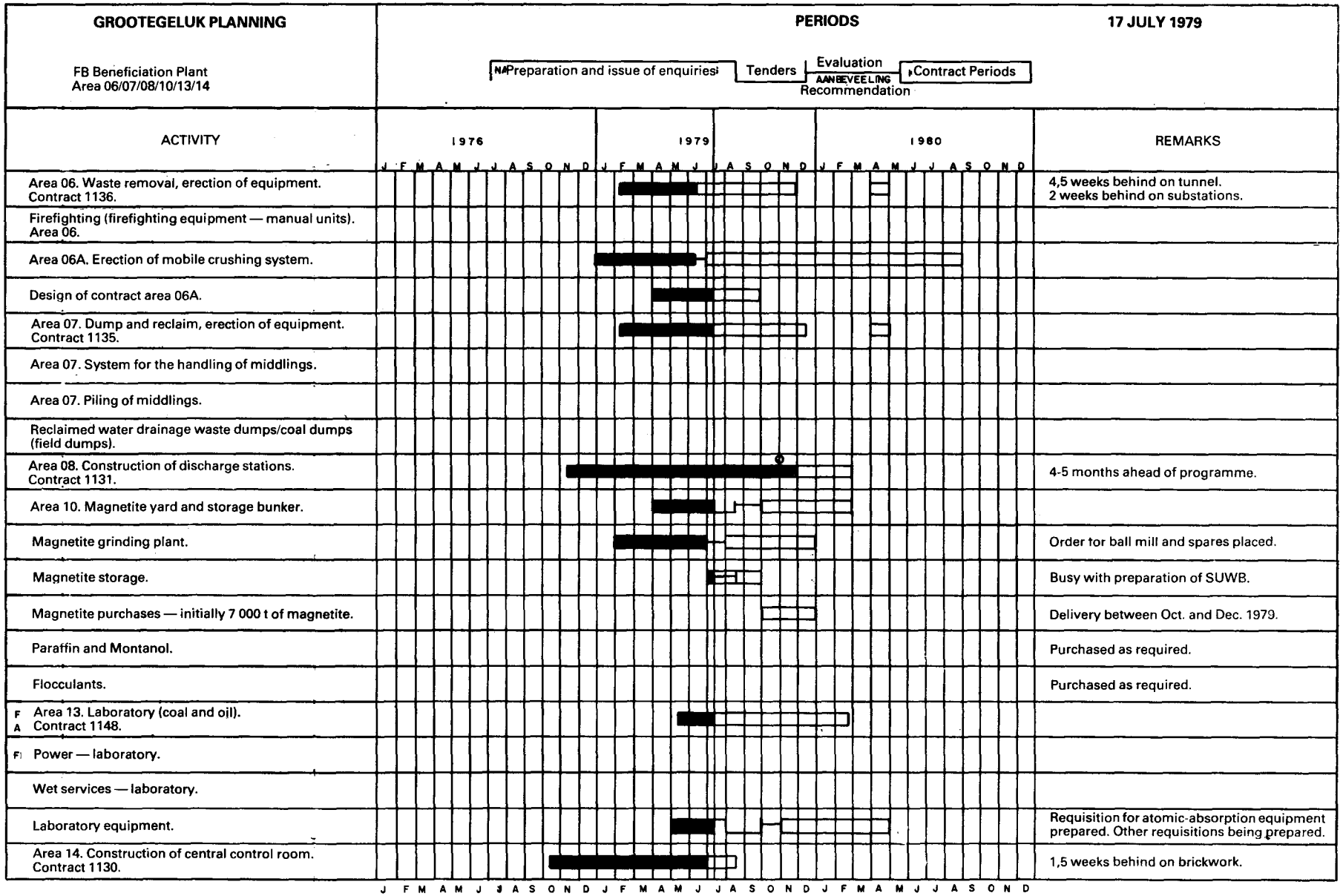
As mentioned earlier, the updating of the programmes is a joint effort between the contractor and Iscor, the procedure being as follows.

The project planner assigned by Iscor to a particular contract and the contractor's representative examine the site and formally agree on activity progress. The relevant programme is then updated. This updating process, even for large networks, takes about two or three days, which includes the examination of the results and critical paths. The monthly site meeting is then held based on the updated programmes, which are not more than two or three days 'out of date'. The monthly progress report is based directly on the updated detailed construction programmes.

As in all planning, it is a problem to ensure that the duration of each activity is realistic because it depends not only on the work content but also on the resources allocated to the activity. Iscor keeps a close watch on the estimated durations by comparing the durations of completed activities with those of similar uncompleted activities, estimating the work rates when programmes are updated, and closely watching the use of float.

In determining contract progress and the use of float, Iscor uses the following approach. At the beginning of the contract, the early and late starts of activities are deter-

TABLE I
BARCHART FOR PROGRESS CONTROL AT GROOTEGELUK



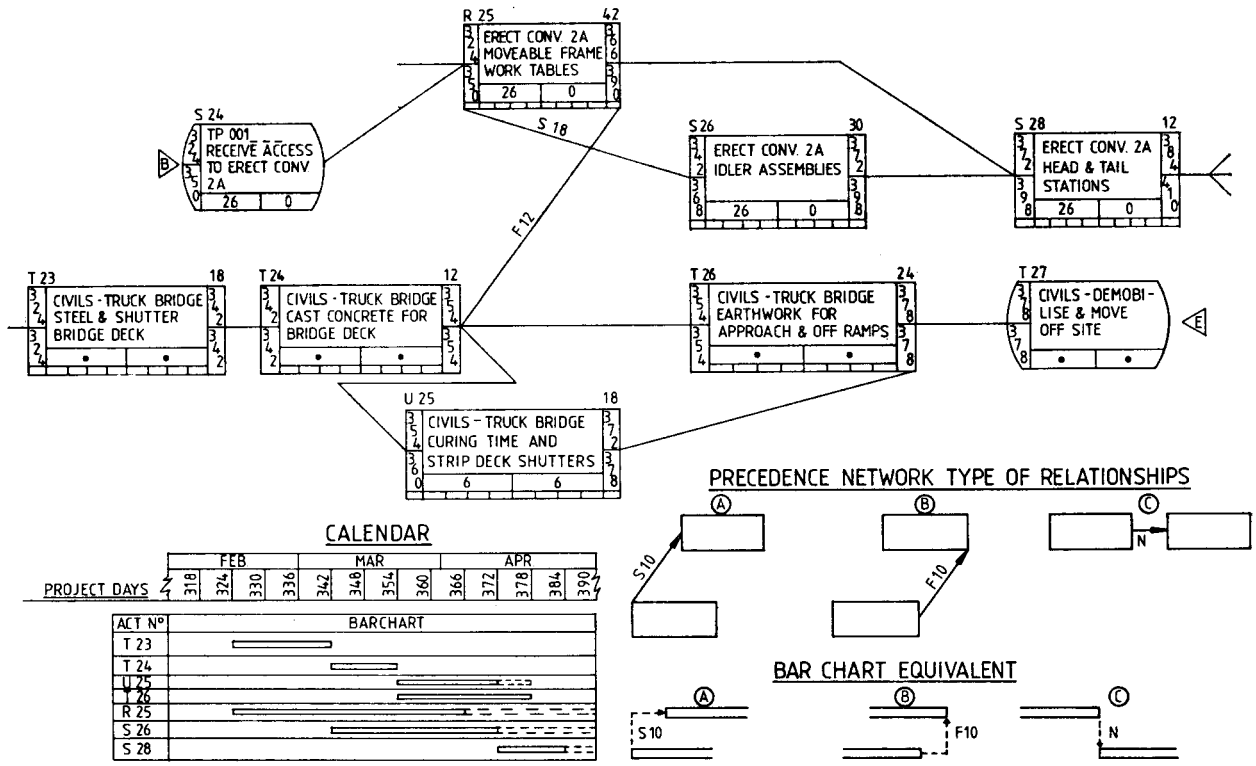


Fig. 3—Part of a network

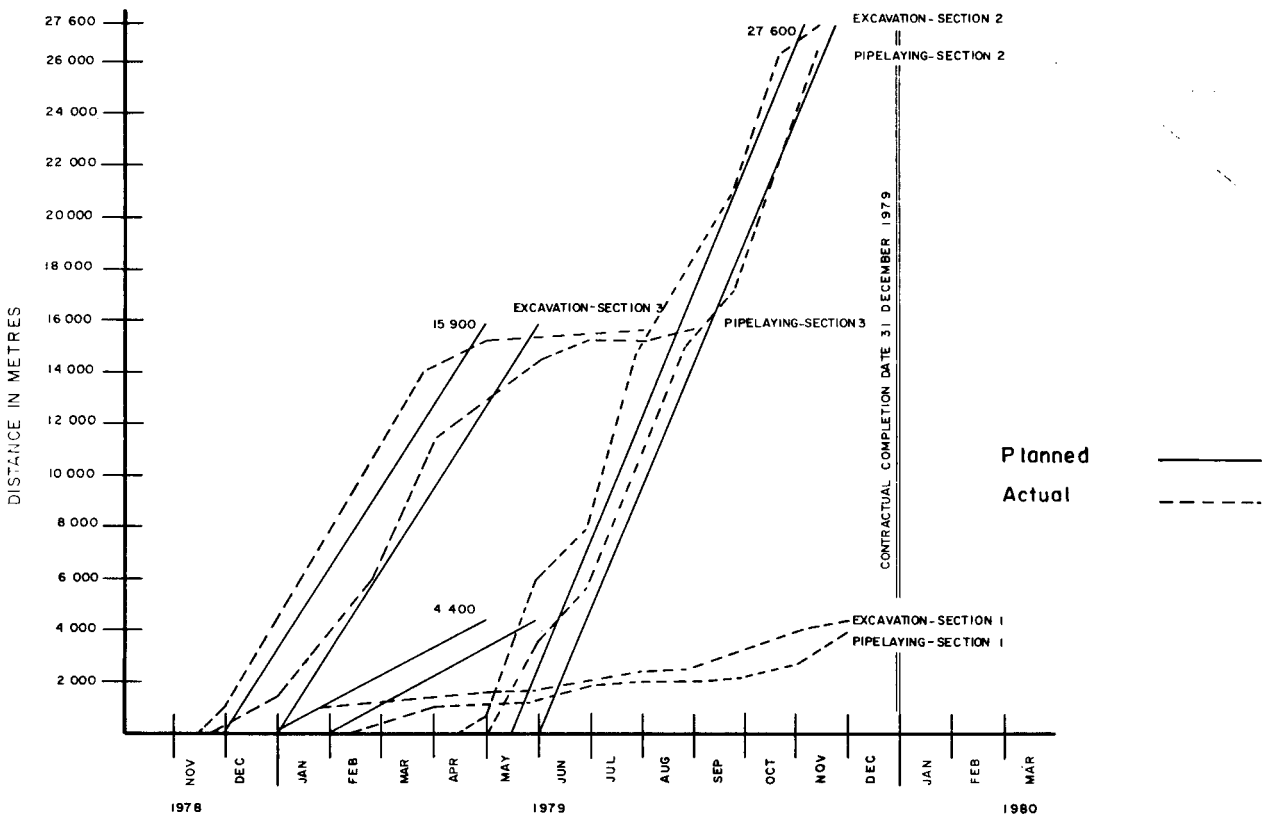


Fig. 4—Graph showing the construction of the main water-supply pipeline at Grootegeluk

mined in the usual way. A scheduled start is then determined for each activity. This scheduled start is not, as is usual, an automatically calculated start with a view to resource levelling. It is rather a manually specified starting date of key activities from which the other scheduled starts are determined, after which the resulting resource levelling is shown. This gives the contractor full control over the scheduling of his contract. Once the scheduled dates are determined, Iscor considers the scheduled dates for activities as the official agreed-upon programme.

If a contractor does not meet the scheduled dates, his contract is regarded as running late with the implication that his resources will peak later in the contract, perhaps to an unacceptable level. The contractor is therefore required to catch up with the scheduled dates and to submit a detailed day-to-day barchart programme that ties in with his official programme, showing how he will catch up with his work. This day-to-day programme is then monitored to ensure that the contractor returns to the limits set by the official programme. The results of the monitoring of the detailed construction programme and the day-to-day programme as well as all related studies are reported to the particular project engineer as the results become available.

Progress Payments and Escalation

Activities are defined in such a way that each activity can be related back to a specific item in the tender price (a number of activities can, of course, relate back to the same tender-price item). When updating is done, the progress can thus be related directly to the payments. An activity can similarly refer to a specific escalation formula. By the selection of activities referring to the same escalation formulae, banana (S) curves can be drawn up for specific escalation types. In this way, banana curves can be drawn up for civil as well as mechanical/electrical/plant erection works. (Note: The 'early', 'late' (banana), and 'ideal' S curves relate respectively to the early, late, and scheduled starting times of the associated network activities).

Conclusion

The Grootegeluk team found the planning approach that is outlined here effective, providing timely information on all levels. It was further found that all the contractors participated fully in the planning effort, used the results effectively, and benefited from the joint effort.

Electric steel

The first European Electric Steel Congress will be held in Aachen, Federal Republic of Germany, from 12th to 14th September, 1983.

The subject of the Congress is 'Steel making in electric furnaces', and the following topics will be featured:

- New developments in the design and operation of electric-arc furnaces
- After-treatment of steel in ladles
- Methods used in the production of unalloyed, medium-alloy, and high-alloy steels
- New developments in the fields of induction melting, and of d.c. arc and plasma-arc furnaces
- Environmental and ergonomic developments
- Energy- and cost-saving procedures (process control, reduction of electrode consumption, reduced expenditure on refractory materials, etc.).

Further information is available from the Verein Deutscher Eisenhüttenleute, D-4000 Düsseldorf 1, Postfach 82 09. Telephone: 0211/88 94-1, Telex: 8 587 086 vst d.