Richards Bay Coal Terminal

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SYNOPSIS

Terminals form part of the transportation chain from producer to consumer in the world-wide conveyance of bulk commodities. As such, they are a vital link in providing a buffer between widely differing transporation modes.

It is essential in the conceptual design of such terminals that an overall view of the entire system of which they form a part is taken. Only in this way can it be ensured that the system will operate smoothly and without disruption, for in the end such disruptions can have dramatic repercussions, both on the cost of the commodity in the market place and on production.

In this respect, computer simulation is a useful tool in arriving at the optimum design for the system. The Richards Bay Coal Terminal provides a good example of such an approach. Commissioned in 1976 to handle 12 Mt per annum, it is now handling 24 Mt per annum, with plans for further expansion to 44 Mt per annum in the future.

SAMEVATTING

Terminale maak deel uit van die vervoerstelsel vanaf produseerder tot verbruiker in die wêreldwye vervoer van massa handelsware. As sodanig is dit 'n deurslaggewende skakel om 'n buffer tussen grootliks verskillende vervoerwyses te verskaf.

Dit is noodsaaklik in die konseptuele ontwerp van sodanige terminale, dat die algehele sisteem waarvan hulle deel uitmaak in die breë geheel beskou moet word. Slegs op hierdie wyse kan verseker word dat die sisteem glad en sonder onderbrekings sal loop aangesien sodanige onderbrekings dramatiese gevolge kan hê, beide op die koste van die handelsware op die mark en op produksie.

In hierdie verband is kompersimulasie 'n nuttige instrument om by 'n optimale oorkoepelende sisteemsontwerp uit te kom. Die Richardsbaai-steenkoolterminaal is 'n goeie voorbeeld van so 'n benadering. In gebruik geneem in 1976 om 12 Mt per jaar te hanteer, hanteer dit nou 24 Mt per jaar met toekomsplanne om dit tot 44 Mt per jaar uit te brei.

Introduction

The transportation of a bulk commodity such as coal from the producer to the consumer can be a complex activity, depending on a multitude of different factors. In most cases where export or import takes place, a number of transport modes are involved, including conveyor belt, rail, road, and ship, giving rise to a transportation system (Fig. 1).

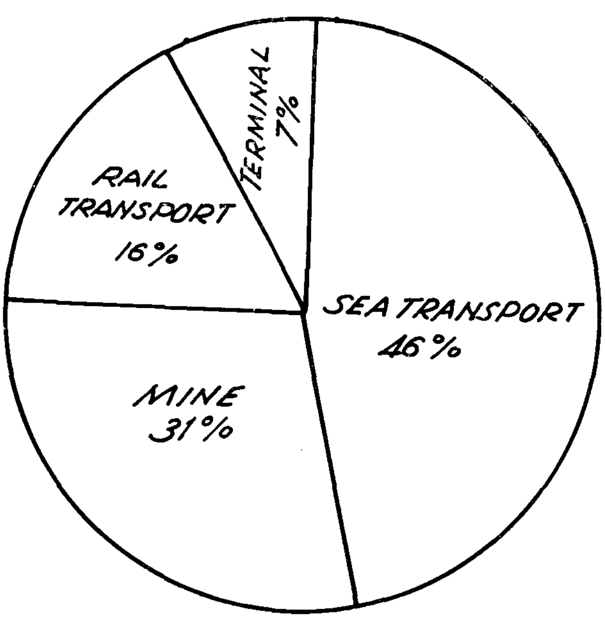

Fig. 1—Typical distribution of the costs of South African coal (c.i.f.)

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As this system accounts for a significant portion of the total cost of the commodity in the market-place, it is essential that this aspect should be well researched and understood before any new major export project, such as South Africa's coal-export venture, is embarked on.

Generally, and particularly in the case of South Africa's coal export project, terminals provide the link between different transportation modes from the user to the producer. Accordingly, terminals should be seen as an integral part of the transportation–distribution system and not merely as a stockyard.

It is a fact that there is usually a large disparity between the unit size of transport conveying coal to the export point and that of the carrier taking the commodity away, e.g. trains versus ships. Secondly, the schedules of two such modes of transport vary vastly. It is essential, then, that some form of buffer should be provided to regulate the flow of the commodity as it passes from one transportation mode to the other, and this is the main function of a terminal.

The capital cost of the terminal in the transportation system, while significant, is certainly not the largest cost. However, the temptation to 'save a buck' in this sphere, at the expense of flexibility and some stand-by capacity, should be resisted when one considers the consequences of disruptions at the export point. For example, a modern large bulk carrier can cost between $10 000 and $30 000 a day in delay penalties, while any major disruption at the terminal could shut down mining activities and disrupt rail schedules, also with heavy financial loss.

An optimum overall transportation system should be regarded as an entity, and the interrelation of one component with the other should be carefully studied before such a system is designed.

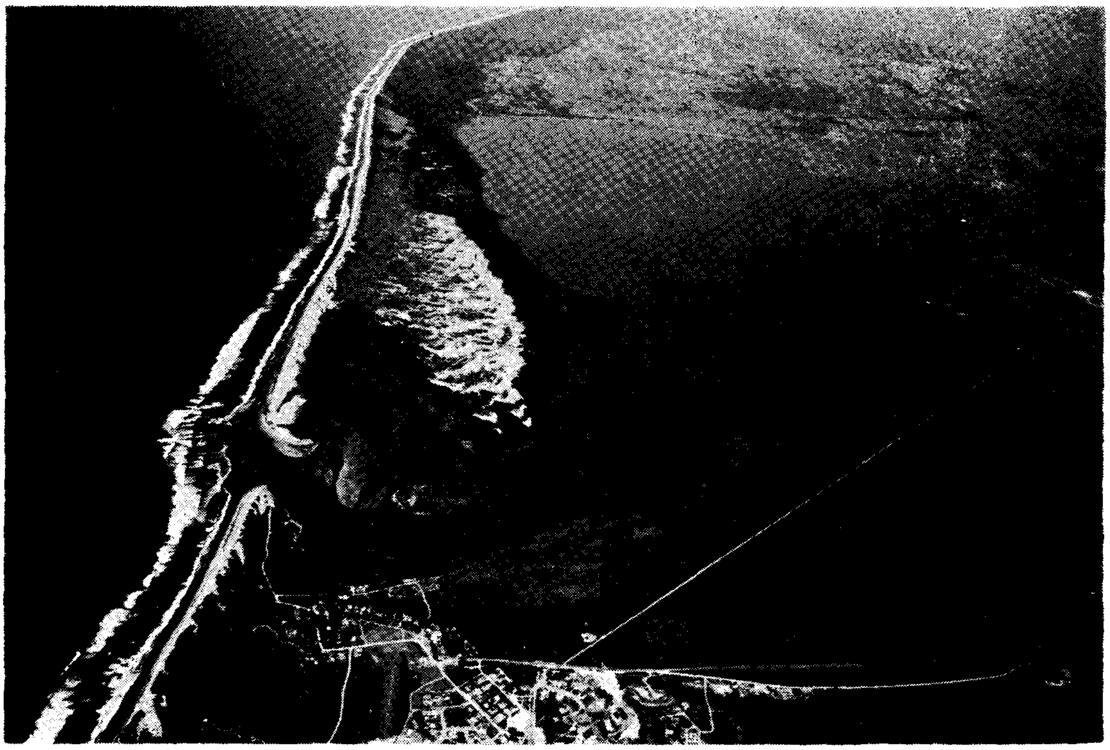

Fig. 2—Richards Bay before the development of the harbour (photograph by Duncan Greaves, AIP)

This paper deals with the development of the Richards Bay Coal Terminal, which provides a good example of the philosophy governing the design of a transportation system.

Background

With the sanction of the South African government in the late 1960s to export 27 million tons of low-ash, blend-coking coal to Japan over ten years, the industry set about finding a suitable port. After investigations into existing ports and various locations for new ports, Richards Bay was chosen as the most suitable site for a new deep water port. (Fig. 2).

A team of consultants engaged by the Transvaal Coal Owners' Association studied the overall project from mine to port. Several options were investigated in depth before the final configuration was agreed upon, for both the overall system and the port terminal facility. A powerful tool that assisted in this decision-making was a computer simulation model, particularly as regards the optimum design of the coal terminal itself.

Computer Simulation

When one observes the operation of a well-designed and operated terminal facility from the outside, it appears to be a deceptively simple operation with little indication, generally, of the delicate interplay of many complex factors.

Smooth operation does not occur fortuitously, however, but is dependent on careful definition of parameters at the outset of the project. Such parameters include

1. number of grades of coal to be handled,
2. size of rail cars and train composition,
3. train arrival pattern, and whether scheduled or unscheduled,
4. terminal storage capacity,
5. ship size,
6. grades per ship,
7. ship arrival pattern,
8. port operating rules,
9. machinery availability, allowable utilization,
10. berth occupancy,
11. ship costs or demurrage,
12. train demurrage,
13. weather conditions.

Owing to the interaction of these and many other factors, computer techniques are required for successful prediction of the operation of the facility and hence for the development of an optimum design for the overall plant and the selection of the correct equipment. The basic simulation model is shown in Fig. 3.

Phase I (1972 to 1976)

The first phase was commissioned on the 1st of April, 1976, at a capital cost of R43 million, to handle 12 Mt per annum, with 11 grades of coal. (Fig. 4 shows Richards Bay Harbour after this development.)

The efficacy of the basic design of the system was proved when, in the second year of operation, 13 Mt were ship-loaded. During this initial phase, allowance was made for further expansion to 20 Mt per annum (Fig. 5), and the decision to proceed with this project was taken during the latter part of 1976.

Phase II (1976 to 1979)

The Phase II expansion of the Terminal was fully commissioned by April 1979 (Fig. 6), the capital cost being R33 million. It soon became obvious that enhanced throughput was possible, and in May 1979 it

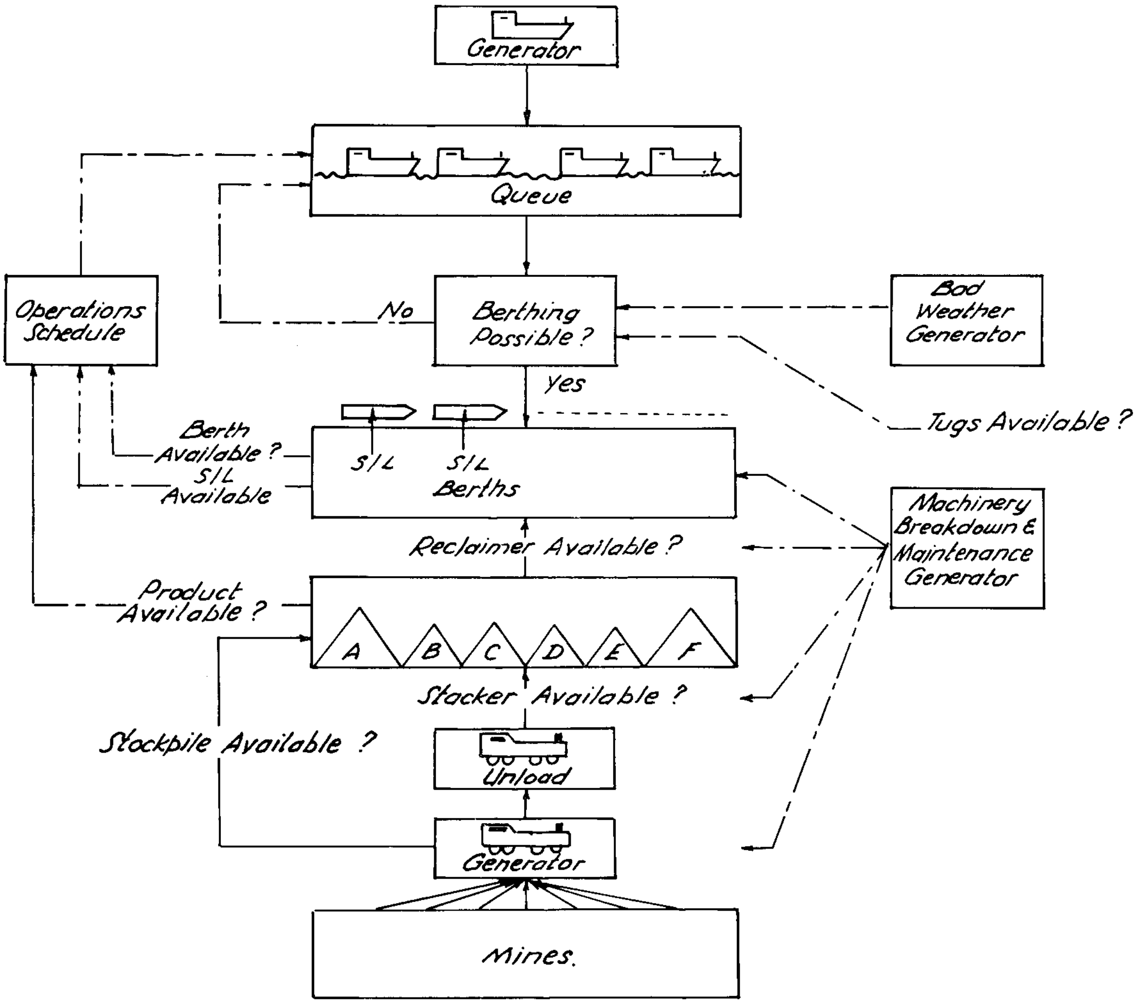

Fig. 3—Simplified block diagram of a basic simulation model for a terminal

Fig. 4—Richards Bay after the development of the harbour, 1976 (photograph by Duncan Greaves, AIP)

Fig. 5—Richards Bay Coal Terminal after Phase I (12 Mt per annum), 1976 (photograph by Duncan Greaves, AIP)

Fig. 6—Richards Bay Coal Terminal after Phase II (20 Mt per annum), 1979 (photograph by Duncan Greaves, AIP)

was decided to increase the throughput to 24 Mt per annum, utilizing the existing plant.

Take in Fig. 6

During the latter part of 1978, the coal industry was given additional export authorities, amounting to a total of 40 Mt per annum from the Transvaal for 30 years and 4 Mt per annum from Natal for 10 years. Accordingly, the Terminal is now preparing for the Phase III expansion.

Phase III (1979 Onwards)

The timing and phasing of further expansion depend mainly on the various possible future marketing scenarios. Technically, it is possible to carry out the expansion to 44 Mt per annum within four years.

In particular, if cognizance is taken of the present state of the international coal market, in which South Africa is competitively placed, it can be seen that the effects of placing additional quantities of coal on the market must be carefully evaluated. This aspect is complicated by the possible actions of competitors and such unpredictable factors as the effect on demand of the vagaries of oil supplies.

At this stage, then, while marketing studies are being carried out and evaluated, it is too early to predict the exact dates on which the Terminal will be expanded further. As a first estimate, it is envisaged that the expansion to 44 Mt per annum could take place in two phases, probably in 1984 and 1986. A further possibility being studied is the up-rating of the existing facility to handle more than the present 24 Mt per annum.

Conclusion

During the past three-and-a-half years since commissioning, the Richards Bay Coal Terminal has received 41 016 025 t (794 450 trucks) of coal by rail, and has exported 39 064 376 t (581 ships). Despite the major mechanical problems experienced with the original two stacker–reclaimers during 1978, it appears that the original overall approach was correct. Moreover, the original assumption made and the decisions taken have placed the Terminal in a favourable position to best serve the coal industry, of which, despite its geographical remoteness, it is an integral part.