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PROJECT PERFORMANCE AUDIT REPORT

BRAZIL: MBR IRON ORE PROJECT

(LOAN 787-BR)

December 20, 1976

Operations Evaluation Department

PROJECT PERFORMANCE AUDIT REPORT

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PREFACE

This report covers an audit of experience under Loan 787-BR to Mineracoes Brasileiras Reunidas S. A. (MBR) in Brazil. Loan 787-BR for US$50 million was approved in July 1971 and became effective on February 4, 1972. The whole amount has been disbursed, and an amount of US$5.7 million repaid, leaving an outstanding of US$44.3 million as of June 30, 1976. The report is based on the attached Project Completion Report prepared by the Industrial Projects Department of the Central Projects Staff, review of related material and discussions with the Bank staff. Comments received from Latin America and the Caribbean Regional Office and from Industrial Project Department on an earlier draft have been taken into account in preparing the report.

PROJECT PERFORMANCE AUDIT REPORT

BRAZIL: MBR IRON ORE PROJECT (LOAN 787-BR)

BASIC DATA SHEET

Amounts (in US$ mln)

	Original	Disbursed	Cancelled	As of 6/30/76 Repaid	As of 6/30/76 Outstanding
Loan 787-BR	50.0	50.0	NIL	5.7	44.3

Project Data

	Original Plan	Actual or Estimated Actual
Conception in Bank	July 1967	
Board Approval	July 1971	
Loan Agreement	8/25/71	
Effectiveness	2/ 4/72	
Physical Completion	July 1973	July 1973
% of original project actually completed	100%	100%
Loan Closing	12/31/76	Dec. 1976
Total Costs (mln)	US$155.2	US$201.4
Economic Rate of Return (including the railway project)	18.3% (at 10 mtpy)	18.5% (at 11.5 mtpy)

Mission Data

		No.of Weeks	No. of Persons	Manweeks	Date of Report
Preappraisal	6-7/1970	2	5	10	7/23/1970
Appraisal	10-11/1970	2	5	10	12/ 3/1970
Subtotal		4		20	
Supervision I	Jan. 1973	1.5	3	4.5	2/ 9/1973
Supervision II	Dec. 1975	2	2	4	12/12/1975
Subtotal		3.5		8.5	

Follow-on Project

No further loan is planned

PROJECT PERFORMANCE AUDIT REPORT

BRAZIL: MBR IRON ORE PROJECT

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HIGHLIGHTS

This report deals with an audit of performance under Bank Loan 787-BR for US$50 million, approved in 1971, for a project to mine and process for export 11.5 tons of iron ore in the State of Minas Gerais, Brazil.

This has been a well-executed project, with considerable benefit to the Brazilian economy. The financial and economic returns of the project are good, despite a large cost over-run, mainly because of design changes which increased saleable output, with better prices. The main lesson to be drawn from the project is the need to ensure parallel implementation of related project - in the present case, a railway project intended to transport the iron ore - on which the success of the concerned project may depend; in the case of the MBR project, the shortfall in the loading of iron ore was however not such as to hurt the project significantly.

Points that may be of particular interest are:

- design changes that significantly improved the project (paras. 6, 8, 21 and PCR, Annex II, paras. 20-22);

- need for parallel implementation of related projects (paras. 17-19).

PROJECT PERFORMANCE AUDIT MEMORANDUM

BRAZIL: MBR IRON ORE PROJECT

(LOAN 787-BR)

1. This Memorandum reports on an audit of performance under Bank Loan 787-BR for US$50 million, approved in 1971, for a project to mine, process and ship 11.5 million tons per annum of iron ore in the State of Minas Gerais, Brazil. The audit is based on information contained in the Project Completion Report (PCR) prepared by the Industrial Projects Department of the Central Projects Staff (Attachment A). This has been supplemented by information contained in Bank files and discussions with Bank staff concerned with various aspects of the project.

2. The loan was for installing facilities to mine and ship 10 million tons of iron ore per annum. (The Bank had also provided a loan (Loan 786-BR) for strengthening and extending related railroad facilities intended for transporting the iron ore.) In the course of implementation, some changes were made in the project, with the concurrence of the Bank, to improve its viability. The project was completed on schedule, but with a considerable over-run in capital cost. The volume of initial loadings was lower than envisaged owing to failure of the railroad project to keep to the schedule.

3. Considering the price and exchange fluctuations which took place during the period (1971 and 1973) when the project was under construction, project implementation is considered satisfactory. The revisions made in project design were well-conceived and helped in improving the viability of the project. The higher project cost can be attributed partly to these changes and partly to inflationary conditions prevailing during the period of implementation. The main lesson to be drawn from the project is the need to ensure co-ordination with, and ensure parallel implementation of, related project on which the success of the concerned project may depend: in this case the failure of the railroad project to come up on schedule caused shortfalls in loadings of iron ore from the project; these were however not such as to hurt the project significantly.

I. Background

4. The original project was to provide mining facilities to produce 10 m. tons of iron ore at Aguas Claras, near Belo Horizonte in the State of Minas Gerais, and to construct an ocean terminal complex on Guaiba Island in Sepetiba Bay, with a handling capacity of 15.0 million tons per year. At an early stage the Bank required that adequate environmental protection measures be incorporated in the project.

5. The project involved transport of the iron ore from Aguas Claras to the Sepetiba Bay terminal by rail. The Bank had provided a separate loan (786-BR) to strengthen and extend the facilities on the Brazilian Railways, which was related to the iron ore transport from the project under review.

6. One major change, contemplated initially but kept pending until a more detailed study was made, was to add a pellet feed fines plant to the facilities. This improved the recovery from the original 84 per cent to almost 97 per cent, thereby not only raising the final through-put (to 11.5 million tons as against 10 million tons originally envisaged) from the same quantity of ore mined, but also reducing the waste surplus. The cost of the additional facilities was placed at US$9.3 million.

II. Implementation of the Project: Cost Over-Run

7. The project was completed on schedule (July 1974) at a capital cost of US$183.7 million (against the original estimate, including contingencies and excluding initial working capital, of US$146.6 million). Shipments since then to fiscal 1976 are shown in the following table:

(000 tons)

Year ending March 31	Schedule	Actual	Variance
1974	n.a.	1,783	n.a.
1975	10,068	7,453	(2,615)
1976	10,554	9,684	(870)

n.a. = not applicable since no schedule was established.

8. The total over-run on the capital cost of the project, excluding contingencies, was US$67.6 million; there were savings of US$4.8 million (US$3.3 million on oil slop facilities and US$1.5 million through deferred payment on Brazilian Government guarantee fee)*, making for a net over-run of US$62.8 million. The cost over-run was due mainly to design changes and unanticipated inflationary conditions prevailing during the time of implementation of the project. An annexure to this audit gives a break-up of the items responsible for, the amounts and the reasons for the over-run. The main segments of the project in which over-runs occurred were Ocean Terminal (+ $38.6 million), Mine and Preparation plant (+ 14.0) and Engineering and Project Management (+ 8.7). Of these, US$9.3 million, under Mine and Preparation plant, was for a pellet feed fines plant which was added with Bank's approval and which helped increase considerably - by almost 15 per cent - the final throughput from the project.

9. Identified items accounted for an over-run of US$40.2 million; of the balance, US$11.7 million was for additional costs on staff, supervision and unspecified design changes, and the remaining US$15.7 million due to

* Subsequently changed to "postponements on loan drawdowns".

unidentified price increases. (i) Identified items related to additional equipment (+ $22.0 million), changes in design (+ 10.6), additional work (+ 6.0) and price increase (+ 1.6 for tugs). (ii) Additional cost on staff, supervision and unspecified design changes was incurred in respect of engineering and project management (+ 8.7), MBR administration (+ 2.3) and owner's advance expenditure (+ 0.7). Unidentified price increases accounted for the remaining over-run on the capital cost of the project.

10. The cost over-run can be attributed to (i) additional facilities, (ii) additional work and (iii) price changes. The first two items accounted for a total of three-fourths of the over-run, and the price increase was responsible for the remaining quarter of the over-run.

11. Additional facilities related to items not originally included in the project. These comprised a pellet feed fines plant (+ $9.3 million), an ore processing plant (+ 1.4) and a re-screening plant (+ 11.3). It may be mentioned that the re-screening plant had to be added at the Ocean Terminal as tight physical specifications, imposed under the purchase contracts, had to be met - an eventuality which was not foreseen as market requirements are stated to have changed after the project was approved. In this area, there was also a saving in the form of lower investment in oil slop facilities (- 3.3).

12. Additional work comprised site preparation (+ $1.1 million) and increased rock excavation and dredging (+ 4.9). In the same category would come various changes in design arising out of detailed testing or to provide additional capacity; such changes were concentrated at the Ocean Terminal, involving mainly change in pier design (+ 7.4), change in railway trestle design (+ 3.2), and the consequent increase in engineering and project management work (+ 8.7). Against this the total physical contingency provided was US$11.8 million. Given the nature of work (mainly infra-structural work at the Ocean Terminal), it would appear justifiable to have provided higher physical contingency.

13. Price increases accounted for a part of the over-run in project cost. The main area in which price rises operated was in Ocean Terminal facilities. The amount provided for price escalation was US$13.9 million, while price increases (+ $1.6 million for tugs and + $15.7 million for unidentified items) amounted to US$17.3 million. In the inflationary situation prevailing in the period, the shortfall in the contingency for price escalation could not have been anticipated.

14. On the whole, given the nature of the project and the timing of its implementation, the rise in project cost appears to be justified and could not generally have been anticipated.

15. Of the net over-run (net of savings) of US$62.8 million in capital cost, and amount of US$25.7 million ($13.9 million as price escalation and $11.8 million as physical contingencies) had been provided in the project cost, leaving a financial requirement of US$37.1 million to be covered. In addition, an increase of US$9.1 million (from US$8.6 million to US$17.7 million) in working capital requirement had to be found. Additional financing, mainly in the form of commercial bank loans, was arranged to cover these requirements.

III. Operation of the Project: Financial and Economic Return

16. The project was completed on schedule, and the first shipments commenced in November 1973 as stipulated under contractual arrangements. Total shipments by March 31, 1975 amounted to 8.6 million tons as against the appraisal estimate of 10 million tons. The shortfall was due partly to difficulties with railway transport. Shipments in fiscal 1976 amounted to 10.2 million tons.

17. Arrangements had been made for co-ordination between the iron ore project and the railway project, and these worked smoothly. There were, however, initial problems in getting adequate railroad handling capacity when the iron ore project was completed. These difficulties arose partly because the railroad line (financed by Bank Loan 786-BR) was not completed on schedule (the delay related mainly to the program of rehabilitation and of improvements to increase line capacity) and partly because the load on the railroad system was heavy. The railroad project was only 85 per cent completed by 1975-end, and final completion is not expected before 1978-end. The delay in the completion of the railroad project was mainly due to changes in the railways' program and delays in procurement. In addition, interruptions in traffic occurred in actual operations (including derailments and collapse of a bridge); sometimes, locomotives assigned to haul MBR ore were shifted to other priority traffic. All these factors led to shortfalls in loadings of iron ore. A full audit on the railway project must await its completion.

18. When the railway project was approved by the Bank, a condition was included in the contract between the railways and MBR, imposing a penalty on MBR for shortfalls in freight traffic below 9 million tons per year. However, there was no corresponding obligation set on the railways to handle all the traffic (to a specified minimum) offered by MBR. It might have been desirable, given the initial difficulties and (though no present problems exist) likely future difficulties, to introduce in the contract a penalty clause for failure to lift MBR cargo up to a specified minimum.

19. At present the railway system is able to take the full load offered by the MBR iron ore project (the loading in the month of June 1976 being more than 1 million tons of iron ore). A revision in the freight rate, effective April 1, 1976, which gives the railways higher rates on the MBR traffic, should also provide an inducement to the railways to carry traffic offered by MBR.

20. The financial and economic returns on the project remain satisfactory, despite the large cost over-run, mainly because of better than estimated realization per ton of iron ore. The average ore price realized worked out to US$11.81/ton in 1975-76 (against the appraisal estimate of US$8.38/ton).

21. The following table gives the financial performance of the project:

(US$ million)

	1973-74		1974-75		1975-76	
	Est.	Actual	Est.	Actual	Est.	Actual
Shipments (in million tons)*	1.4	1.1	8.6	7.5	11.0	10.2
Gross Revenue	11.7	8.7	72.1	73.4	124.7	120.4
Cash Operating Costs	10.5	8.5	41.3	43.9	65.5	62.3
Net Profit Before Tax	(10.6)	(5.4)	7.2	0.6	17.6	22.8

* These relate to the total operations of the company, and not only to shipments out of Aguas Claras.

The low railway rates (revised only in April 1976) also helped improve MBR's profitability in the initial years. The financial returns are expected to work out to 19% with a production build-up to 11.5 million tons per year (as against 18.8% at 10 mtpy originally estimated and 17.3% at 11.5 mtpy revised). The main factors in the maintenance of the financial return are the increase in price of iron ore, and the higher recovery (97 per cent as against 84 per cent) due to project revision.

22. A supplementary note on the economic rate of return, prepared by the Industrial Projects Department, is attached as supplement to the PCR. The economic rate of return on the project, works out to 18.5 per cent (at a projected sales build-up of 11.5 million tons per year) against an estimated 18.3 per cent at the time of appraisal (at 10 mtpy). The economic rate of return improves to 23.5 per cent when a shadow exchange rate for Brazilian Cruzeiro (at present set at a factor of 1.29) is used.

23. Various economic benefit indicators are as follows: (i) The earning of foreign exchange is expected to be higher than originally envisaged (estimated at US$86 million as against US$66 million for 1975-76) because prices of iron ore, calculated in U.S. dollars, rose (so that the depreciation of the Br. Cruzeiro has not affected the foreign exchange earnings). (ii) The project will pay to Brazilian railways freight charges of US$40 million (and more later), improving its capacity utilization and profitability - and thereby reducing the load on the Government budget. (iii) Total benefits to the Brazilian Government - from taxes and freight earnings - would be substantial. (iv) The project created direct additional employment of 1,134 persons (appraisal estimate 940 persons); the average capital cost, per job created, increased only marginally from US$156,000 to US$162,000.

24. The borrower paid due attention to environmental aspects, as required under its covenants with the Bank.

IV. Procurement and Project Supervision

25. Procurement out of Bank funds was according to Bank specified procedures. Brazilian manufacturers accounted for 44% of the contracts for internationally bid equipment and construction material.

26. With satisfactory project design and implementation, the Bank's role in the preparatory and implementation phase was the minimal deemed necessary. In the preparatory phase, the Bank emphasized the need to maintain environmental standards. During implementation, the Bank fielded supervisory missions every year. The company and its consultants kept the Bank fully informed of the implementation of the project, obtained Bank's consent, where necessary, for project changes, and complied with covenants under the legal arrangements.

27. The main favorable aspects of the project were its completion on schedule, its improved profitability and its contribution - in terms of foreign exchange earnings and improved railway working - to the Brazilian economy. The borrower has taken acceptable measures for protection of the environment.

28. The main unfavorable features in the course of implementation were the large (25 per cent, allowing for contingencies) over-run in project capital cost and the failure of the Bank-financed railway project to keep up to the iron-ore project schedule, leading to an initial shortfall in loadings (expected to be made good by 1977).

BREAKDOWN OF CAPITAL COST

(US$ Million)

	Appraisal	Actual	Reasons
Mine and Preparation Plant	46.4	60.4	Pellet feed fines plant (+ 9.3) Ore Processing plant (+ 1.4) Site preparation (+ 1.1)
Ocean Terminal	42.8	81.4	Change in pier design (+ 7.4) Rescreening plant (+11.3) Change in railway trestle design (+ 3.2) Increased tug prices (+ 1.6) Increased rock excavation and dredging (+ 4.9) Decreased investment in oil slop facilities from Bank assumptions (- 3.3) Miscellaneous price increases and inflation
Engineering and Project Management	14.9	23.6	Increased Bechtel supervision of Brazilian engineering and construction Design changes and unanticipated procurement procedures
MBR Administration	2.7	5.0	Staff carrying charges during extended financing negotiations. Inflation.
Owner's Advance Expenditures	1.5	2.2	Unanticipated staff increases Staff carrying charges during extended financing negotiations
Price Escalation	13.9	-	Transfer to direct costs above
Physical Contingency	11.8	-	Transfer to direct costs above
Interest Charges During Construction	12.6	11.1	Deferred payment of Brazilian Government guarantee fee *
FIXED ASSET COST PLUS INTEREST DURING CONSTRUCTION	146.6	183.7	

* Subsequently changed to "postponements on loan drawdowns".

CAUSES OF OVER-RUN

(In $ million)

1.	**Additional Equipment**		
	Mine and Preparation Plant		
	Pellet feed fines plant	+ 9.3	
	Ore processing plant	+ 1.4	
	Ocean Terminal		
	Rescreening plant	+ 11.3	
	Less oil slop facilities	- 3.3	
			+ 18.7
2.	**Changes in Design**		
	Ocean Terminal		
	Pier design	+ 7.4	
	Railway trestle design	+ 3.2	
			+ 10.6
3.	**Additional Work**		
	Mine and Preparation Plant		
	Site preparation	+ 1.1	
	Ocean Terminal		
	Rock excavation and dredging	+ 4.9	
			+ 6.0
4.	**Additional Staff and Supervision**		
	Engineering and Project Management	+ 8.7	
	MBR Administration	+ 2.3	
	Owner's Advance Expenditure	+ 0.7	
			+ 11.7
5.	**Balance Representing Price Increases**		
	Mine and Preparation Plant	+ 2.2	
	Ocean Terminal		
	Tugs	+ 1.6	
	Other Miscellaneous	+ 13.5	
	Less interest charges	- 1.5	
			+ 15.8
			62.8

BRAZIL: MBR IRON ORE PROJECT (LOAN 787-BR)

PROJECT COMPLETION REPORT

BASIC DATA

Borrower	:	Mineracoes Brasileiras Reunidas, S. A.
Guarantor	:	Government of Brazil
Loan Amount	:	US$50 million
Period of Grace	:	3 years
Repayment Period	:	15 years
Interest Rate Charge	:	7 1/4 per annum
Commitment Charge	:	3/4 of 1% per annum
Guarantee Fee	:	2% per annum
Maturities	:	December 1, 1974 to June 4, 1986
Disbursed	:	US$50.0 million
Repaid (10/21/75)	:	US$2.73 million
Amount Outstanding (10/21/75)	:	US$47.27 million
Date of Loan Agreement	:	August 25, 1971
Effective Date	:	February 4, 1972
Closing Date	:	December 31, 1976
Exchange Rate	:	Appraisal 1971 - US$1 = NCr 4.06
	:	Completion 1975 - US$1 = NCr 8.67
Appraisal Report	:	No. PI-10 dated June 16, 1971
Fiscal Year	:	Twelve months ending March 31

SUMMARY AND CONCLUSIONS

1. At appraisal the MBR project involved the construction of mine facilities at Aguas Claras, near Belo Horizonte, for the production of approximately 10.0 million tons per year of high grade iron ore, and an ocean terminal complex on Guaiba Island in Sepetiba Bay, with a handling capacity of 15.0 million tons per year.

2. The project was completed on schedule due to excellent project planning and management. Total financing required for the project increased by US$46.2 million (30%) from an estimated US$155.2 million at appraisal, to US$201.4 million on completion. Of this increase US$33.4 million (22%) was due to approved changes in project scope, engineering detail and working capital requirements, while US$12.8 million (8%) was due to inflationary pressures and price overruns.

3. During project implementation production capacity was increased from 10.0 to 11.5 million tons of saleable ore with the installation of a pellet feeds fine plant and re-screening facilities at a total cost of US$20.6 million.

4. Although the project did not pose any technical, financial, or managerial problems, the specific objective at appraisal to ship 1.4 and 8.6 million tons of iron ore out of Sepetiba Bay in 1974 and 1975 respectively, was not achieved on schedule. The reason for the shortfall of 1.4 million tons was the delay in completing the RFFSA railway project which was financed by the Bank under a separate Loan (No. 786-BR).

A. PROJECT DESCRIPTION AND IMPLEMENTATION

Project Objective and Description

1. The project consisted of the construction of facilities and the installation of equipment to mine, process and ship 11.5 million tons per annum of high grade hematite from the Aguas Claras reserve located in the State of Minas Gerais, Brazil, in the vicinity of the city of Belo Horizonte. The project includes:

(a) Construction of facilities for conventional side-hill open-pit mining of the Aguas Claras ore body and provision of equipment to drill and blast ore and waste material and load said ore and waste material into trucks for haulage to the processing plant or waste dumps;

(b) Construction of an ore preparation plant designed with a rated capacity of approximately 15,000,000 tons of crude ore per annum and installation of machinery for primary crushing, screening and washing, and for hydraulic classification facilities;

(c) Installation of equipment to transfer ore from the preparation plant to stockpiles and from said stockpiles to ore cars for rail shipment;

(d) Construction of a deep water terminal on property owned by the Borrower on Guaiba Island in Sepetiba Bay in the State of Rio de Janeiro, Brazil.

(e) Installation at the terminal of machinery to unload unit trains of iron ore, to stockpile a minimum of three grades of ore, and to load ocean-going vessels of up to 250,000 DWT;

(f) Construction of a pellet feed fines plant at the Aguas Claras mine and provisions of stockpiles for pellet fines at the terminal;

(g) Installation of a re-screening plant at the terminal;

(h) Construction of a railway connection approximately 1,740 meters long linking the terminal on Guaiba Island to the mainland and a railway spur from the existing railway which runs along the northwest shore of Sepetiba Bay.

2. Transport from the mine to the port at Sepetiba Bay is provided by the federal railways (Rede Ferroviaria Federal - RFFSA). Consequently, the improvement of the existing railroad line between Belo Horizonte and the coast, the construction of additional rail facilities and the acquisition of supplementary rolling stock was closely associated with the MBR iron ore project. The Bank provided under Loan 786-BR, a loan of US$46 million to RFFSA to finance part of the new rolling stock, and the spur lines needed to serve the MBR project.

Project Summary Data

3. The following table compares major project parameters at appraisal, with actual results on completion.

	Unit	Appraisal	Actual 1/
Capital Cost of Project	US$ million	155.2	201.4
Capital Cost of Bank Financed Items	US$ million	50.0	57.1
Capital Cost Per Annual ton of Iron Ore:			
10.0 million tons p.a.	US$/ton 2/	15.5	20.1
11.5 million tons p.a.	US$/ton	13.5	17.5
12.0 million tons p.a.	US$/ton	12.9	16.8
Construction Period	Months	39	39
Start-Up Date		7/73	7/73
Plant Capacity :			
Saleable Ore	Tons	10.0	11.5
Mine	Tons	12.0	12.0
Processing	Tons	15.0	15.0
Terminal	Tons	15.0	15.0
Total Shipments			
Year Ending 3/31/75	Mill. tons	8.6	7.5
Year Ending 3/31/76	Mill. tons	10.0	11.0
Number of Employees at 3/31/75		940	1,134
Sale Price	US$/ton	8.38	11.31
Cash Operating Costs	US$ million	47.50	68.10
Profit Before Taxes	US$ million	13.50	17.60

1/ Actual figures relate to the year ending 3/31/76 unless otherwise stated, and are expressed in current dollars.

2/ Long tons.

Project Construction and Completion

4. Project construction, under the supervision of Bechtel Engineering, proceeded according to schedule despite earth sliding problems, and an expansion of the original project scope. The first ore was shipped to the coast on July 3, 1973 as programmed in the appraisal report. MBR's contractual obligations called for shipping ore to Japan as of October 1, 1973. This schedule was met and the first ore carrier left the Sepetiba Bay terminal in November 1973. Annex II shows the appraised and actual project implementation schedules. Timely project completion was mainly due to the work, and good cooperation between MBR, Hanna Mining Co., and Bechtel Overseas Corporation.

Change in Project Scope and Cost

5. Total financing required for this project amounted to US$201.4 million, which is about 30% above the original estimate of US$155.2 million. This cost increase was mainly due to :

(a) A change of project scope, and capacity with the installation of a pellet feed fines plant, and a re-screening plant. The investment required was US$20.6 million, thus accounting for 45% of the total cost overrun of US$46.2 million;

(b) Price escalation not covered by the appraisal estimate, amounting to US$12.8 million;

(c) Changes in general project design following detailed engineering, and other adjustments during the construction phase costing US$6.8 million;

(d) Additional working capital requirements of US$9.1 million.

6. The inclusion of a pellet feed fines plant at the Aguas Claras mine, and re-screening facilities at the Sepetiba Bay terminal which enlarged the project's scope at an appraised cost of US$19.6 million was approved by the Bank in mid 1972, after MBR demonstrated the project's high financial and economic rate of return. The pellet feed fines plants incorporates a filter plant, and auxiliary equipment to de-water, stock-pile and reclaim 1.5 million tons of minus 100 mesh fines annually from tailings disposals. This new investment increased MBR's recovery of saleable ore from the original estimate of 84% to 97% of crude ore mined, and the saleable ore output from 10 million TPY to 11.5 million TPY. Technical changes in project design and scope are discussed in detail in Annex III.

7. The following table summarizes the differences between the appraised and actual project cost, detailing major reasons for cost changes by category.

Breakdown of Capital Cost
(US$ Million)

	Appraisal	Actual	Reasons
Mine and Preparation Plant	46.4	60.4	Pellet feed fines plant (+ 9.3) Ore processing plant (+1.4) Site preparation (+1.1)
Ocean Terminal	42.8	81.4	Change in pier design (+ 7.4) Rescreening Plant (+ 11.3) Change in railway trestle design (+ 3.2 Increased tug prices (+ 1.6) Increased rock excavation and dredging (+ 4.9) Decreased investment in oil slops facilities from Bank assumptions (- 3.3) Miscellaneous price increases and inflation
Engineering and Project Management	14.9	23.6	Increased Bechtel supervision of Brazilian engineering & construction Design changes and unanticipated procurement procedures
MBR Administration	2.7	5.0	Staff carrying charges during extended financing negotiations. Inflation.
Owner's Advance Expenditures	1.5	2.2	Unanticipated staff increases Staff carrying charges during extended financing negotiations
Working Capital	8.6	17.7	Increased iron ore inventories Increased spare parts (+ 1.5)
Price Escalation	13.9	-	Transfer to direct costs above
Physical Contingency	11.8	-	Transfer to direct costs above
Interest Charges During Construction	12.6	11.1	Deferred payment of Brazilian Government guarantee fee
TOTAL FINANCING REQUIRED	155.2	201.4	

Financial Plan and Cost Overrun Financing

8. The additional US$46.2 million required to complete the project was financed with previously committed loans, and new long term debt funds as detailed below :

Financing Plan

	APPRAISAL		ACTUAL	
	US$ Million	%	US$ Million	%
LONG-TERM DEBT				
IBRD	50.0	32.2	50.0	24.8
Japan Trading Co.	50.0	32.2	50.0	24.8
Japan Exim Bank	7.0	4.5	8.1	4.0
US Exim Bank	9.1 1/	5.9	13.8	6.8
US Commercial Banks	9.1 1/	5.9	28.3	14.2
Japan Commercial Banks	-	-	20.0	9.9
Local Loans	-	-	1.2	0.6
Total Debt	125.2	80.7	171.4	85.1
EQUITY				
St. John D'el Rey	14.7	9.5	14.7	7.3
CAEMI (EBM)	15.3	9.8	15.3	7.6
Total Equity	30.0	19.3	30.0	14.9
TOTAL FINANCING REQUIRED	155.2	100.0	201.4	100.0

1/ US-Exim Bank originally committed US$26.3 million of which 50% came from Exim Bank, and 50% from US Commercial Bank with Exim Bank guarantee.

Annex IV details the status of equity and foreign loan arrangements as at September 30, 1975.

9. Between June 1972 and May 1973 the Bank discussed in detail the financing plan for the enlarged project, and approved new long-term borrowings of up to US$35.88 million to finance the cost of the additional facilities and the cost overrun caused mainly by design improvements. The Bank accepted the new borrowings as senior debt, but obtained an increase of the shareholder's project completion, and cost overrun guarantee by 50%. Corresponding amendments were made to the Loan, Shareholders and Security Agreements, and the Bank's Executive Directors were informed accordingly. Details on terms and conditions of the new long-term funds and the amendments to the legal documents are summarized in Annex V.

Procurement and Allocation of Bank Loan

10. Expenditure categories recommended for Bank finance and actual disbursements are compared below :

Withdrawal of Proceeds of IBRD Loan

Categories	Appraisal US$ Mill.	Appraisal %	Actual US$ Mill.	Actual %
Equipment to be procured by international competitive bidding	25.4	51	27.2	54
Construction materials to be procured by international competitive bidding	4.0	8	7.4	15
Foreign exchange component of civil works undertaken with international competitive bidding	12.6	25	12.3	25
Unallocated	5.0	10	-	-
Interest During Construction	3.0	6	3.0	6
Total	50.0	100	50.0	100

The Bank loan covered US$1.1 million for equipment needed for the expanded project.

11. International competitive bidding according to the Bank's procurement guidelines was followed for all Bank financed items as was the case for the other major equipment that was primarily financed with untied Japanese loans. The breakdown of supplying countries for (i) internationally bid equipment, construction materials and civil works, and (ii) Bank financed items was as follows:

Source 1/	Total Cost Of Bank Financed Items US$ Mill.	%	Total Cost of Items Bid Internationally US$ Mill.	%
Brazil	37.2	66	55.8	56.0
Japan	7.0	12	15.9	16.0
USA	3.7	7	14.0	14.0
Holland	6.5	11	10.8	10.8
Germany	2.5	4	3.0	3.0
UK	0.2	-	0.2	0.2
Total	57.1	100	99.7	100

1/ As at December 31, 1973 with contracts won in conjunction with contractors reflected as if won by the foreign partner.

The Japanese were predominant in winning the larger packages such as the electric shovels ($2.8 million), bucket wheel reclaimers ($1.8 million), and piling for the piers ($2.6 million), however, the two conveyor belts ($3.5 million) and the sizer reclaimer ($3 million) were won by American suppliers or American suppliers in association with Brazilian firms. Brazilian manufacturers were extremely competitive winning 44% of the contracts for internationally bid equipment, and construction materials. A complete tabulation of internationally bid items and IBRD financed items in excess of US$100,000 is detailed in Annex VI.

B. PROJECT OPERATION

Production and Transport Problems

12. The Aguas Claras mine, and Sepetiba Bay terminal provide four qualities of iron ore: sized sinter fines, pellet ore, coarse ore, and pellet feed fines. The shipment schedule at appraisal compared with actual performance was as follows :

Fiscal Year Ending March 31	Shipments (000 tons) 1974	1975	1976
Appraisal Estimate	1.4	8.6	10.0
New Scope Estimate	1.6	9.5	11.5
Actual	1.1	7.5	11.0

13. Although the project was completed on schedule, and a good training program was introduced at the mine, and the terminal (Annex VII) the production target was not reached during the first two years of operation. The sole reason for this shortfall was the delay in completing the RFFSA railway project (Loan 786-BR) which was to supply the necessary haulage capacity from Aguas Claras mine to Sepetiba Bay. The RFFSA railway project was to be

completed in December 1974. By end 1975 track rehabilitation was only 85% complete, and final project completion is not expected before the end of 1978 (Loan No. 786-BR Supervision Summary dated November 6, 1975. See Annex VIII). The transportation of ore according to MBR's contractual arrangements with RFFSA was interrupted, or delayed repeatedly, either due to (i) collapse of bridges, (ii) insufficient numbers of ore carriers, and locomotives, (iii) delays in track rehabilitation, and (iv) the shifting of locomotives assigned to MBR traffic to other priority traffic. MBR hopes that in 1976 and 1977 the technical capabilities of RFFSA will improve sufficiently to provide the agreed haulage capacity.

Financial Results and Return on Investment

14. The delays in completing the railway project were responsible for cumulative losses of US$ 4.9 million for the Aguas Claras mine as of March 31, 1975, which was US$1.5 million higher than forecast. Annex IX details Aguas Claras' Profit and Loss Statements since April 1, 1974 and major operating indicators compared with the appraisal estimates are summarized below :

Financial Performance Indicators
(US$ Million)

Fiscal Year Ending March 31	1974		1975		1976	
	Appraisal	Actual	Appraisal	Actual	Appraisal	Budget
Shipments	1.4	1.1	8.6	7.5	10.0	11.0
Gross Revenues	11.7	8.7	72.1	13.4	83.8	124.5
Cash Operating Costs	10.5	8.5	41.3	50.1	47.5	68.1
Net Profit Before Tax	(10.6)	(5.4)	7.2	0.6	13.5	17.6

Because of the change of project scope these figures are not directly comparable, however, they demonstrate that the relative increase in ore prices did not outweigh the loss in quantities shipped because of RFFSA's non-performance under the transport contract.

15. The financial projections included in the appraisal assumed an average ore price of US$8.38/ton over the life of the project, and a constant price/cost relationship starting in the year ending March 31, 1977. In fact, MBR's achieved average ore price increased to US$11.31/ton in 1975-1976 and is expected to increase further in line with rising prices. The operating cost of the Aguas Claras mine increased from US$4.75/ton estimated for 1976 at appraisal to US$6.2/ton forecast in the present budget. This increase is largely attributable to the cost of rail freight and the 130% higher manpower requirements at the Sepetiba Bay terminal. Annex X compares the operating highlights anticipated at the time of appraisal with the budgeted cost for the 12 months to March 31, 1976. The profit turnaround anticipated in this period

is reflected in the improved operating margin applicable to the Aguas Claras project. In the 12 months to March 31, 1976, it is anticipated that the achieved operating margin for the project, after depreciation and amortization charges, will increase from $2.21 to $3.26 per ton when compared with the 12 months to March 31, 1975, due to a 46% increase in mine output and shipments, a 16% increase in achieved selling prices, offset only by a 12% increase in operating costs during the same period.

16. A recosting of the haulage rates applicable to MBR is currently being undertaken by RFFSA with the objective of renegotiating MBR's freight rates. A 20-30% freight rate increase for the Aguas Claras output will not endanger the project's financial viability as the increased tonnages shipped and higher ore prices will outweigh an increase of this magnitude in the long run.

17. At appraisal it was estimated that the project's financial rate of return before taxes would be 18.8% based on financing of US$155.2 million and a production build-up to an annual 10 million tons of saleable ore.1/ At the time the expanded project was approved in June 1972, the finance requirement was increased to US$188.6 million with a production build up to 11.5 million tons, and it was estimated that the financial rate of return would be 17.3% with high fine prices. The present indications are that the likely financial rate of return for the project will be approximately 19%.1/ Although (i) the project costs were 30% higher than the original estimate, (ii) there was a shortfall in shipments of 1.4 million tons in the 21 months to March 31, 1975, due to railway problems, and (iii) operating costs increased by 43%, the financial rate of return changed insignificantly due to a 49% increase in revenues brought about by the change in project scope, and the 35% increase in achieved selling prices.

18. The Shareholders Agreement limits the guaranteed provision of funds by the shareholders to a compliance date which will not occur before April 1, 1976. As at February 1976, the project meets all conditions of completion, i.e. minimum shipments, and good operation, which defines compliance in the Shareholders Agreement.

Economic Benefits of the Project

19. During the 12 months to March 31, 1976, it is anticipated that the direct net foreign exchange benefits relating to the project (excluding RFFSA) will be in excess of $86 million. This would be US$26 million higher in this period than was estimated at appraisal.

1/ The methodology of the financial rate of return calculation as presented in the appraisal report is not entirely correct. The cost benefit streams are based on (i) investment costs in current value terms and, (ii) operating costs and revenues in current terms until 1976, and in constant terms thereafter. The rates of return for the new project scope and the completed project given above are also calculated on this basis to enable a comparison of the results. The financial rate of return of the completed project is 14% calculated on the basis of cost/benefit streams in real terms.

20. In 1976 MBR anticipates that they will pay RFFSA in excess of $40 million for iron ore hauled from Aguas Claras mine to the Sepetiba Bay terminal. This will increase with the higher freight rates, and production levels anticipated by MBR. Indirect benefits have accrued to the Brazilian economy through the physical, and operational improvements made to the railway to accommodate the MBR project.

21. New employment generated by this project is significant with the company now employing an additional 1,134 people. Considerable effort has been applied in conducting staff and management training programs. A significant transfer of technology occured over the project implementation phase, with Bechtel Engineering and Hanna Mining providing project management, and technical assistance. During the operating phase only minimal technical assistance from the foreign sponsor was necessary due to CAEMI's existing mining skills.

Environmental Aspects

22. At all stages of the project cycle, particular attention was given to the pollution and environmental aspects of the mine and terminal development such as (i) deforestation and water pollution at Aguas Claras, (ii) oil and other slops from ships calling at the terminal, (iii) sewerage at the terminal, and (iv) dealing with accidental oil spills. MBR has fully complied with the Bank's requirements and is making continued conscientious efforts to maintain, or improve the ecological conditions at Sepetiba Bay and the mine. To this effect, MBR has created an environmental control division headed by a qualified engineer to supervise the rejuvenation of the local forests around Aguas Claras, and other areas affected by mining operations, while monitoring water, dust and other environmental procedure standards.

C. THE IRON ORE MARKET

23. While the world steel industry has experienced significantly depressed conditions during 1975, iron ore prices have moved up strongly over the last 12 months. MBR's achieved average selling prices for the 12 months to March 31, 1976 are expected to be up 16% on the previous year's results. The depressed conditions in the steel industry have resulted in MBR's Japanese customers only taking 82% of their contractual obligations in the current period, and other end users performing even less satisfactorily. 1/ However, with 95% of its sales under long term contracts (including price revision clauses) mainly with Japan, Argentina and the United Kingdom, with a growing domestic market, and with its ore having comparatively high iron and low sulphur content, it is not anticipated that MBR will experience any major problems meeting its sales targets in the short, medium, or long-term.

1/ It is difficult to establish, if MBR's customers would have taken the contractual quantities if MBR had been able to deliver. Under the prevailing market conditions MBR did not pay any penalties in addition to the revenue loss.

D. MBR - THE COMPANY

Ownership and Control

24. MBR is 51% owned by Empreendimentos Brasileiros de Mineracao S.A. (EBM) and 49% by St. John d'el Rey Mining Company, a British company controlled by the U.S. Hanna Mining Company. Since appraisal (i) Hanna Mining Company increased its shareholding in St. John d'el Rey from 52% to 66.31%, and (ii) CAEMI (Companhia Auxiliar de Empresas de Mineracao) who owned directly 40.8% of EBM's share and another 20.20% through a wholly owned holding company ICOMI, decreased its interests in ICOMI and thus MBR by selling 49% of the ICOMI shares to Bethlehem steel. The change in indirect ownership of MBR is not expected to influence adversely the company's management. Details of MBR's direct and indirect ownership are given in Annex XI.

Organization and Management

25. MBR is managed by Brazilians. The Company benefited from the management and mining experience of its Brazilian sponsors EBM - CAEMI within the Antunes group. Minor organizational improvements were affected after appraisal, such as the appointment of a Director for long-term planning, and the re-organization of the Production Department. MBR's organizational set-up after project completion is satisfactory, and its management team is well-qualified and highly motivated.

26. Financial and management controls established by MBR are exemplary. They are keyed to profit and cost centers and a comprehensive budgetary process. Detailed performance statements are prepared within 15 days of the end of each month with highlight data distributed to management in the intervening period. The first-rate reporting system has facilitated timely project completion, and supervision by the sponsors and the Bank.

Consolidated Financial Results

27. MBR's consolidated Balance Sheet Statements for the five years to 1976 and Operating Statements since project completion are given in Annex XII and the following table compares selected financial indicators with those anticipated at the time of appraisal.

MBR - Selected Financial Indicators
(US$ Million)

Fiscal Year Ending March 31	1975		1976	
	Appraisal	Actual	Appraisal	Budget
Revenues	91.4	92.4	102.4	155.2
Operating Costs 1/	57.6	52.8	63.2	83.4
Net Income Before Taxes	9.3	2.3	15.5	25.1
Current Ratio	1.0	1.9	1.0	1.9
Debt/Equity Ratio	60:40	64:36	57:43	57:43
Debt/Service Coverage	1.7	1.0	1.9	1.9

1/ Before income taxes exchange variations and depletion allowances.

28. In addition to the project (Aguas Claras mine), MBR operates other iron ore mines in the Belo Horizonte area. As indicated in Annex X, Table 3, the other mines are expected to account for 20.5% of MBR's ore shipments of about 13,800 tons and 19.7% of total sales revenues. The consolidated financial results thus reflect primarily the performance of the project. As discussed in paras. 14-15, transport constraints restricted shipments from all mines from approximately 12.4 million tons to 10.9 million tons during the two years to March 31, 1975. As a result, the consolidated net profit before taxes was reduced to US$2.3 million in the 12 months to March 31, 1975. However, it is anticipated that consolidated net profits before taxes will rise to US$25.1 million in the current fiscal year. As it is anticipated (i) that the transport bottleneck will be overcome within the next 12 months and (ii) that the project will continue to benefit from the higher prices and added capacity provided by the pellet feed fines plant which has improved the group's profitability and liquidity, it is considered that MBR's short and long term financial prospects are excellent.

E. THE BANK'S ROLE

Project Formulation and Supervision

29. MBR, its sponsors and the Bank have been engaged in a continuing constructive dialogue on the Aguas Claras project from the first contacts in the late sixties until the present time. On technical, managerial, financial control and operational matters, the Bank acted as a stimulus, but - with the exception of environmental control aspects - the Bank did not help formulate or influence detailed project design and implementation. This emphasis on appraisal and supervision was possible because of the Borrower's willingness to employ first-rate consultants, its dedication to the project, and the advisory role of the two sponsors EBM and Hanna Mining Company. The Bank's important technical input was the insistence on adequate ecological standards at Sepetiba Bay and the minesite. As a result of MBR's willingness to implement the Bank's conditions conscientiously, Sepetiba Bay remains an attractive tourist resort, and the national forest around the Aguas Claras mine is being deforested.

30. Staff time required for supervising the project was minimal, with full supervision missions visiting Brazil every 12 months. Nevertheless, the Bank was very well informed about project progress and problems. First, MBR and its consultants, Bechtel Overseas Corporation, issued concise and complete quarterly financial and technical project reports, secondly, representatives of MBR and the sponsors visited the Bank regularly for informative briefings, and thirdly, they contacted the Bank promptly to comply with covenants under the legal arrangements.

Lessons to be Learned

31. The results of the MBR - Iron Ore Project confirms the importance of 4 critical areas for successful mining projects. They are: (i) good project management, (ii) adequate operating and management controls,

(iii) long-term sales contracts with price variation clauses, and (iv) satisfactory transport arrangements. All four aspects were covered adequately during appraisal, however, at the time of project completion, the freight services of RFFSA were insufficient to meet the project's needs. In theory, the Bank had substantial leverage to ensure the timely availability of transport services since a loan was provided to finance them (Loan No. 789-BR). In practice, however, Bank supervision and leverage was insufficient to achieve the coordination required between the iron ore and transport projects. Certainly it can be agreed that the situation might have been worse if the Bank had not financed the RFFSA railway project; however, this rationale does not excuse the lack of effective coordination between the two projects.

32. The financial covenants stipulated in the Loan Agreement are very detailed and specific, and thus constitute a departure from such global requirements as the maintenance of certain debt service coverage, debt/equity or current ratios. In the case of the MBR - Iron Ore Project, the more specific covenants worked well, but it is doubtful if the results would have been as satisfactory in the case of a less sophisticated and conscientious Borrower.

Industrial Projects Department
February 1976

BRAZIL: MBR IRON ORE PROJECT (LOAN 787-BR)

PROJECT COMPLETION REPORT

ACTUAL PROJECT IMPLEMENTATION SCHEDULE

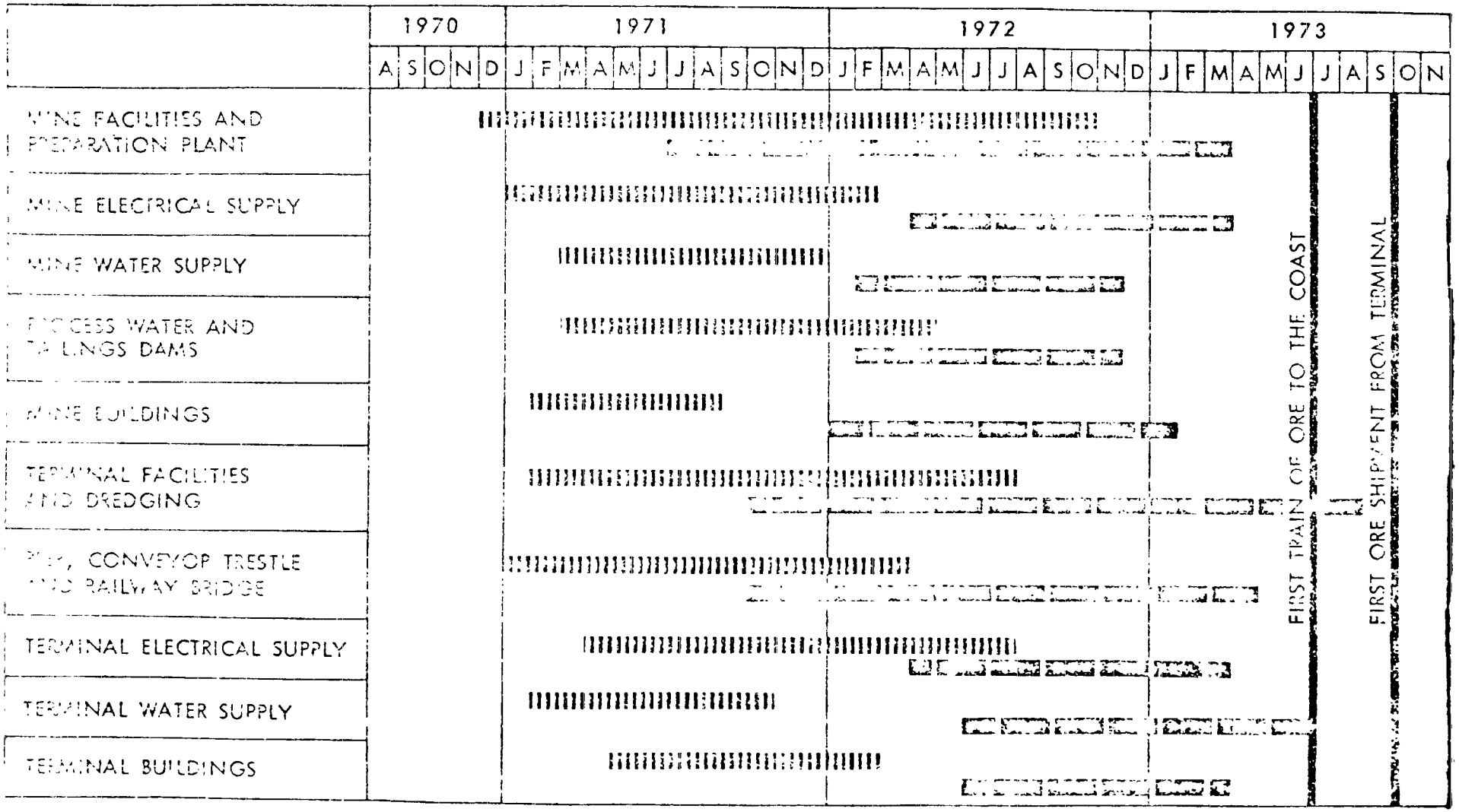
July 1970	Project feasibility study report completed.
November 1970	Authorization given to proceed with engineering, procurement and construction management.
December 1970	First purchase commitment made for advance mining equipment (6 cu. yd. electric shovels).
February 1971	Engineering established in Rio for Brazilian design scope.
March 1971	Construction field personnel assigned to Mine, and detailed field surveys started for the Terminal.
April 1971	Contract awarded for erection of the temporary office building to be used for construction at the Mine.
April 1971	First construction package for Minesite mass earthworks and rough grading issued for bid.
May 1971	Organization and establishment of the project office in Rio completed.
June 1971	Temporary construction office completed at the Mine.
August 1971	Contract awarded for the mass earthworks at the Mine.
November 1971	Contract awarded for the mass earthworks at the Terminal.
December 1971	Contract awarded for the structural earthwork and concrete at the Mine.
December 1971	Letter of intent issued for the railroad trestle construction at the Terminal.
February 1972	Contract awarded for the railroad trestle construction at the Terminal.
February 1972	Contract awarded for the channel dredging and the placing of sandfill.
April 1972	Contract awarded for pier, dolphin and conveyor trestle construction.
December 1972	The Mine Mass Earthworks contract was completed.
December 1972	The last span of the Terminal railroad trestle was set.
March 1973	The railroad trestle was opened to traffic.
April 1973	The Mine substation was energized.
May 1973	The primary crusher was completed and turned over to MBR.

June 28, 1973	The first ore was stockpiled at the Mine.
June 30, 1973	The loadout facility was turned over to MBR.
July 2, 1973	The first train arrived at Aguas Claras and ore cars were loaded.
July 19, 1973	Shipment of ore from the Mine and stockpiling at the Terminal started on a production basis.
September 1973	With the exception of the boiler, the pellet feed fines plant had been tested and turned over to MBR.
October 26, 1973	The pellet feed fines plant boiler was tested and turned over to MBR.
November 24, 1973	The first ore carrier was loaded with 157,000 tons of iron ore.

Industrial Project Department

February 1976

BRAZIL
CVRD - IRON ORE PROJECT
PROJECT COMPLETION REPORT
IMPLEMENTATION SCHEDULE AT TIME OF APPRAISAL



Industrial Projects Department
February 1976

BRAZIL

MBR - IRON ORE PROJECT

PROJECT COMPLETION REPORT

TECHNICAL CHANGES IN PROJECT DESIGN AND SCOPE

A. GENERAL

1. The components of the project was based on the 1970 Bechtel feasibility study to provide the services outlined in the appraisal report. However, during project implementation they were changed to (i) adapt to site conditions, (ii) reduce capital costs where possible, (iii) allow the terminal to operate under a wider range of operating conditions caused by adverse weather, currents, ship design and operating characteristics, and (iv) to incorporate a pellet feed fines processing plant and screening facility. Engineering and project management services have been expanded commensurate with the revised requirements.

B. DESIGN CHANGES DURING DETAILED ENGINEERING AND CONSTRUCTION

Mine Process Facilities

2. Primary dry screening has been replaced by wet screening. The entire screening, secondary crushing, and classification process has been incorporated into a single building. The capacity of the fine screens and spiral classifiers has been increased. Provision has been made for the addition of a filtering plant adjacent to the ore sizing plant. The additional transformer has been incorporated in the mine substation of the plant to provide standby capacity in case of an equipment failure in the base plant and to allow handling of additional electrical loads required by the Pellet Feed Fines Plant.

Ore Car Loading

3. The feasibility study called for individual loading bins at the railroad for each product. The final design includes a single bin, with steeply sloped sides and a long slot opening to allow handling of the full range of product sizes from coarse ore to the filtered fines that may be produced in the future. The configuration permits future construction of additional bins.

Service Buildings

4. According to the appraisal report, the mine administration office and service buildings were located near the entrance to the property in a level area within the railroad loop. In the final design and construction, the area within the loop is open. The service building has been situated in the vicinity of the process plant to provide the operating benefits such as (i) closer proximity to the mine and process facilities for supervision and handling of maintenance supplies, (ii) reduced traffic across the railroad loop, and (iii) water and electric power services which are more economically confined to a centrally located area.

Mine Water Supply and Water Recyling

5. The original design called for a concrete dam across the Aguas Claras Creek to impound sufficient water for the plant's needs during the dry season. The cost of the structure and the wide seasonal fluctuations in rainfall made it advisable to investigate alternative sources of water for the plant's main supply. It was judged more economical to building a pipeline to Rio Prata in the vicinity of Raposos. A pumphouse on this stream can provide the year-round requirements for the Aguas Claras Mine without a storage dam and allows a reduction in the cost of the water supply system with a relatively moderate increase in operating costs. As mine production increases in the future, additional water can be obtained by increasing the pumping capacity of the Rio Prata pumping station or reclaiming clarified water from tailings ponds at the mine.

Terminal Railroad Trestle

6. The appraisal estimate was based on building a railroad trestle with precast conrete girders on precast concrete piles. Studies revealed that the soil tends to be a plastic sandy clay of varying depth up to 20 meters below the sea bottom. This necessitates driving piles into firm bearing strata overlying rock, which could be to a depth of minus 60 meters. The depth of water required piles one meter in diameter for buckling resistance. The required size of the piles precluded the use of precast concrete bearing piles due to the large inertia and frontal area of an efficient pile. It was, therefore, decided to design a lighter steel structure supported on high capacity steel piles.

7. A second reason for adopting a structural steel trestle was the reduced lead time required for such a structure. Casting yards, a curing plant and heavier equipment would have been required to handle the structural components of the concrete trestle. Alternatively, steel girders can be fabricated in established production shops and lighter, more readily available equipment are required to erect the structure. The more rapid erection for a steel structure benefits the project by providing access to the island at the earliest possible time for rail movement of personnel and materials to the construction site.

Terminal Ore Reclaiming System

8. The appraisal layout included equipment for loading ships at a rate of 6,000 LTPH. In the course of final engineering, it was decided that the bucket wheel reclaimers, conveyors, and shiploaders should be designed to handle lighter bulk products which might be loaded at a rate of at least 5,000 LTPH. Hence, the volumetric capacity of the wheels was increased to permit reclaiming materials as light as iron ore pellets resulting in transporting 7,000 LTPH of the heavier products. To maintain a balance of mechanical and electrical equipment capability as a result of the increased volumetric capacity of the units, the rated capacity was raised from 6,000 LTPH to 7,000 LTPH for the entire system.

Pier

9. The original estimate was based on a pier comprising heavy concrete cells floated into position and ballasted down on a gravel bed. However, the final choice of the type of pier depended on the results of additional foundation borings and detailed comparison of alternatives. Detailed soil boring, hydrographic, and seismic survey data confirmed that the sea bottom was not suitable for a structure with a shallow foundation.

10. The preliminary design criteria called for a maximum design wave of 2 meters based on a history of local observations. Subsequent investigations by consultants studying the meteorological and hydrological potential of the area led to the recommendation that a maximum probable wave of an 8-meter amplitude be considered in the design of the major structures. An 8-meter wave impinging on the solid faces of a cellular pier could overtop the pier deck with sufficient energy to damage the shiploader and conveyors. The open structure of a pile supported pier is transparent to the wave and better suited for service in this location. A reinforced concrete deck using the same steel piles selected for the railroad trestle was determined to be an optimum structure.

11. After a thorough analysis of the site conditions and the problems of handling "super carriers", it was concluded that to allow berthing and shiploading with minimum interference by weather or sea conditions, the design criteria for the pier should be more stringent than indicated in preliminary design. More detailed site investigations and statistical analyses were carried out for a better evaluation of current and wave forces, the maximum wave and other sea conditions. This resulted in major changes in the pier structure and the fender system. The pier structure is open-type with a cast-in-place concrete deck supported on large pipe piles. For example, (i) precast elements were incorporated in the design to reduce forming and stripping costs of complicated elements, (ii) pile bents for the pier were installed with a 10-meter spacing, (iii) transverse batter piles were provided near the center of the pier, (iv) heavy longitudinal girders were added along each edge of the pier to support the travelling shiploader and to distribute lateral forces over several bents, and (v) the concrete deck is constructed for the increased loading requirements.

12. As initially foreseen, tugs and pilots will be used during the docking operation aided by navigation lights at each end of the pier. In addition to the berthing aids included in the appraisal report, radar and sonar type equipment has been provided to measure the approach velocity of both ends of the vessel as it is being berthed.

Channel

13. The original design was based on constructing an approach channel running some 20 miles through the length of the bay north of Ilha Grande. There are a number of rock outcrops in the vicinity of Ilha de Macacos, but it was judged possible to obtain an acceptable alignment requiring rock removal from two small outcrops, which extend less than 0.5 meters above the desired channel depth. The rock had to be cut down by about one meter which involves removal of about 2,000 cubic meters. The estimated dredging volume of other material was 4,000,000 cubic meters.

14. The alignment finally selected for construction passes east of Ilha Grande and is approximately 7 nautical miles long. As the direction of the swell and current are generally parallel to this channel, a width of 280 meters was selected, widening to 600 meters at the bend. It required dredging of a channel over a distance of only 3.4 miles, but had a maximum cut of 6.5 meters. There was also a small amount of dredging necessary along the north side of the approach channel to the pier. The total amount of dredging was approximately 9,000,000 cubic meters. Although greater in volume than the original channel, unit dredging costs were lower due to the greater cut depth, better material, and shorter distances involved. Borings indicate that the material in the channel made satisfactory fill and the amount of material in the cut was more than was required for fill purposes. Wire dredging of the channel and turning basin area had to be performed to assure the absence of rock outcrops and boulders.

Channel Navigation Aids

15. Navigation aids had to be provided along the channel, such as buoys equipped with flashing lights at appropriate locations along the channel and constructed of steel or fiberglass with concrete anchors. Range lights on the two channel alignments at appropriate locations had to be mounted on steel structures located in the water.

Terminal Earthwork

16. Site investigations following the completion of the preliminary design revealed that the hillsides of Guaiba Island, although showing large rock outcrops, had deep overburden cover that would result in excavated slopes exceeding the MBR property limits, and would require a continuing maintenance problem due to erosion of the excavated banks. Relocation increased the quantity of sandfill required to construct the terminal yard and moved the terminal shoreline into deeper water. While some decrease in the amount of rock excavation was achieved by using dredged sand as fill under the rock dike confining the fill, the total quantity of earthwork was increased.

17. The increased design wave criteria developed for the pier necessitated raising the crest of the terminal dike and using 5-ton armor rock to protect it and the railroad trestle approach causeways. This size of rock raised the unit cost of quarrying and placing above previous allowances included in the appraisal estimate.

Electric Power System

18. The appraisal report was based on the terminal power supply being furnished to MBR at 34.5 kV, with only one step-down voltage transformation being required for 160 volt power. CELF, the local utility, elected to deliver power at 69 kV which required additional transformer equipment at the terminal.

Environmental Protection

19. Features added to the terminal after the completion of original design included the environmental control measures requested by the World Bank as follows:

(a) A system controlling oil accidentally spilled from vessels, with provision for recovery and disposal.

(b) Provisions for receiving sewage from vessels berthed at the pier and pumping it to treatment facilities on shore. Provisions for transporting sewage from the tugs to these shore facilities.

(c) Provisions for burning combustible wastes from terminal facilities and ships.

C. NEW SCOPE INVESTMENTS

20. In early 1972, MBR proposed investments that were outside the original project scope, i. e. (i) the addition of a pellet feed fines plant at the Aguas Claras mine for the recovery of the fines to produce a fourth product, (ii) provision at the terminal for stockpiling this additional product, and (iii) sizing facilities at the terminal on Guaiba Island to provide screening, as may be required for the coarser products prior to shiploading.

Pellet Feed Fines Plant

21. The original facilities planned at the Aguas Claras mine would have produced 10 million long tons per year of course and fine ore products from a crude feed of 11.9 million long tons. With a nominal bottom size of 100 mesh for the sinter fines product, approximately 1.9 million tons would be separated and impounded as tailing. Since these "ultra" fines are saleable as feed for pellet plants, a feasibility study indicated the viability of a pellet feed fines plant. The installation consists of a filter plant and auxiliary equipment to de-water, stockpile, reclaim and ship 1.5 million tons of 100 mesh fines annually. Recovery of saleable ore has thereby been increased from the original 84% to 97% of crude ore mined. Also, the fines plant reduces the amount of tailings that need to be disposed by 79% to 400,000 long ton per year, thus extending the life of the initial tailings pond roughtly five times. The latter criteria is important since the amount of land in the vicinity of the mine that is suitable for tailings disposal is limited.

22. The Bank approved the construction of the pellet feed fines plant which was estimated to cost US$8.3 million. The approval was based on the forecast of good market potential and on estimated 60% financial return on the basis of the net cash flow it will generate over 15 years. Final cost of the plant was US$9.3 million. This 15% cost overrun was more than outweighed by a 35% increase of pellet fine prices.

Terminal Screening Plant

23. Large-scale tests of the Aguas Claras orebody indicated likely degradation in the sizing of the ore from the time it leaves the screening plant until it finally reaches the ocean terminal. The Bank approved the additional installation of a re-screening facility at the terminal (originally estimated at US$7.3 million, but finally costing US$11.3 million), since contractual prices are related to ore quality and the ability to meet tight physical specifications.

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ANNEX III

BRAZIL

MBR - IRON ORE PROJECT

PROJECT COMPLETION REPORT

STATUS OF EQUITY AND FOREIGN LOAN ARRANGEMENTS
(US$ million)

Source	Commitment	Draw Down to 9/30/75	Payments to 9/30/75
ORIGINAL LOANS			
IBRD	50,000	50,000	2,730
US Export-Import Bank	11,250	11,244	-
Bankers Trust Company (US Loan)	5,625	5,622	1,687
First National City Bank (US Loan)	5,625	5,622	1,686
Bankers Trust Company (Eurodollar Loan)	1,875	1,850	555
First National City Bank (Eurodollar Loan)	1,875	1,850	555
Japanese Trading Companies	50,000	50,000	6,100
Japanese Export-Import Bank	8,047	8,047	1,610
Subtotal	134,297	134,235	14,923
ADDITIONAL LOANS			
US Export-Import Bank	2,520	1,598	-
Commercial Banks-NCB, etc. (US Loan)	2,520	1,598	355
Commercial Banks-NCB, etc. (Eurodollar Loan)	840	525	117
Commercial Banks-NCB, etc.	10,000	10,000	-
Japanese Commercial Banks	20,000	20,000	-
Subtotal	35,880	33,721	472
Total Loans	170,177	167,956	15,395
EXCHANGE ADJUSTMENT			
IBRD	-	998	-
Japanese Export-Import Bank	-	(468)	-
Total	-	530	-
EQUITY			
EBM	15,300	15,300	-
St. John del Rey	14,700	14,700	-
Total Equity	30,000	30,000	-
GRAND TOTAL	200,177	197,486	15,395

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BRAZIL
MBR - IRON ORE PROJECT
PROJECT COMPLETION REPORT

CONDITIONS OF ADDITIONAL BORROWINGS

A. TERMS AND CONDITIONS

1. The new financing, of up to US$35.88 million, includes the following:

(a) a loan in the aggregate amount not in excess of US$20 million from eleven Japanese commercial banks (headed by the Bank of Tokyo), at 8½ percent interest,[1/] with repayment of principal falling due semi-annually beginning June 30, 1979 and ending December 31, 1986;

(b) a loan in the aggregate amount not in excess of US$10 million from six United States commercial banks (headed by the National City Bank of Cleveland), at 8½ percent interest, with repayment of principal falling due semi-annually beginning December 31, 1976 and ending December 31, 1979; and

(c) an aggregate of up to US$5.88 million in new US Export-Import Bank loans and guarantees including:

(i) a new Eximbank loan of US$2.52 million at 6 percent interest, with repayment of principal falling due semi-annually beginning July 15, 1979 and ending January 15, 1984;

(ii) a credit from five United States commercial banks of US$2.52 million, at a variable interest rate of ½ percent above the prime commercial interest rate, with repayment of principal in 10 semi-annual installments beginning July 15, 1974 or six months after the Completion Date, whichever is earlier; and

(iii) A Eurodollar credit of up to US$840,000 from National City Bank of Cleveland, at a variable interest rate of 3/4 percent above the rates quoted by first-class banks for Eurodollar deposits, with repayment of principal in 10 semi-annual installments beginning July 15, 1974 or six months after the Completion Date, whichever is earlier.

2. All the above loans are guaranteed unconditionally by the Government of Brazil. The US loans rank pari passu with the original IBRD loan, whereas the new indebtedness to Japanese commercial banks rank pari passu except with respect to the mortgage.

1/ Interest rates quoted here are the effective rate to be paid by MBR. Brazilian withholding taxes of up to 25 percent are being absorbed by the new lenders. In addition, each new financing arrangement carries a ½ of 1 percent per annum commitment fee on the unused portion of the commitment.

B. AMENDMENTS TO LEGAL DOCUMENTS

Amendments to Shareholders Agreement

3. In accordance with the June 14, 1972 preliminary understanding, the shareholders Agreement, dated August 25, 1971, with CAEMI and St. John d'el Rey Mining Company was amended to reflect an increase in the cash guarantee provided to MBR by the principal shareholders (if necessary for Project completion or to meet MBR current cash requirements) from US$20 million equivalent to US$30 million equivalent. In addition, other amendments (i) stipulate that the Compliance Date (defined, basically, as completion of the project and the satisfactory initiation of operations) for purposes of the cash guarantee would not occur prior to April 1, 1975, and (ii) reflect the increase in the size of project output from 10 million to 11.5 million tons per annum.

Amendments to Secuirty Agreement

4. The Security Agreement, dated August 25, 1971, among St. John d'el Rey, Hanna and the Bank, was amended to: (i) reflect the increase in Hanna's estimated share ownership, after St. John's rights offering, from 75 percent to 83.5 percent, and (ii) to increase Hanna's cash guarantee to MBR (if St. John is unable to provide the funds under its obligation noted in paragraph 3 above) from US$7.5 million equivalent to US$12.5 million equivalent.

Amendments to Loan Agreement

5. The Bank executed fromal consents allowing MBR to make expenditures and commitments (for additional expenses and new scope items) in addition to the limit permitted in Section 5.03 of the Loan Agreement and to incur new debt, in addition to the debt permitted in Section 5.07(c). The Loan Agreement was amended to: (i) reflect the increase in the size of project output from 10 million to 11.5 million tons per annum, and (ii) add the construction of a pellet feed fines plant and a terminal screening plant to the project description.

Industrial Projects Department
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BRAZIL
MBR - IRON ORE PROJECT
PROJECT COMPLETION REPORT

ANNEX V

PROCUREMENT SUMMARY [1]
(in DM$ 000)

Contract No.	Description	Cost as of 9/73 (US$ 000)	Supplier	Country
Mine				
100-BC-103*	Structural Steel	620	CESMEL	Brazil
100-BC-134*	Roofing, Siding and Decking	130	Robertson	USA
100-BC-135*	Rebar		Siderurgica Dedini	Brazil
104-BC-138-BAC*	Structural Steel - PFFP	230	Fichet-Schwartz	Brazil
100-BC-111-BAC*	Wire and Cable	170	Pirelli	Brazil
108-BM-109*	Shop Bridge Cranes	150	Mausa	Brazil
107-BM-110*	Raw Water Supply Pipe	430	Confab	Brazil
100-SE-102*	480 v Load Center with Transformer	115	ABC Telefunken do Brasil	Brazil
100-SE-116*	4160 v Starters	205	Cutler-Hammer	USA
106-SE-201*	Substation - 138 kv	170	Ind. Eletrica Brown-Boveri	Brazil
106-SE-203*	10 & 5 mva Power Transformers	160	ABC Telefunken do Brasil	Brazil
106-SE-207*	4160 v Metalclad Switchgear	140	S.P.I.E.	Brazil
101-SM-101	6 cy. Electric Shovels	1,410	C. Itoh/Mitsui/Kobe	Japan
102-SM-102	Electric Wheel Drive, End Dump Trucks (100-T)	3,760	Unit Rig and Equipment Co.	USA
102-SM-103	Mechanical Drive, End Dump Trucks (50-T)	1,650	Caterpillar Americas	USA
102-SM-104*	Crawler Mounted Pneumatic Blast Hole Drill (6-1/2")	660	Chicago Pneumatic	USA
102-SM-113*	Rotary Blast Hole Drills (9-7/8") - 2	770	Bucyrus	USA
102-SM-106*	Crawler Tractors and Bulldozers	240	C. Itoh Komatsu	Japan
102-SM-107*	Truck Crane (50-T)	130	Morgan/P&H	USA
102-SM-108	Rubber Tired Tractors and Bulldozers	245	Caterpillar Americas	USA
102-SM-110*	Diesel Mining Shovel	185	Geo-Comm./NCK Rapier	UK
102-SM-112	10 cy. Electric Shovels	1,440	Mitsui/Kobe	Japan
105-SM-118	6 cy. Front End Loaders	250	Sotreq S. A.	USA
100-SM-123*	Apron Feeders	280	Stephens-Adamson	USA and Brazil
100-SM-124A*	Conveyors	420	Mitsui/Nippon Conv.	Japan
100-SM-124b*	Conveyors	1,085	Link Belt - Piratininga	Brazil
103-SM-126*	Vibrating Screens	150	Barber-Greene	Brazil
103-SM-127*	Cone Crushers	260	Barber-Greene	Brazil
103-SM-128*	Spiral Classifiers	230	Wemco	USA
103-SM-129*	Desliming Cyclones	110	Krebs Engr.	USA
107-SM-130*	Thickener Mechanism	135	Dorr-Oliver	Brazil and USA
103-SM-131*	Stackers	960	MHI/Weserhutte/Pohlig-Heckel do Brasil	Germany and Brazil
105-SM-132*	Bucket Wheel Reclaimer	1,785	Mitsui/Hitachi Zosen	Japan
100-SM-133*	Bridge Cranes	180	Crane Manufacturing Co	USA
100-SM-148	Steel Cord Conveyor Belting	210	Mitsui/Mitsuboshi	Japan
104-SM-154	Vacuum Filters - PFFP	300	Dorr-Oliver	USA
104-SM-155	Vacuum Pumps	140	Fuller	USA
100-SM-160*	Pellet Feed Fines Stacker	210	MHI/Weserhutte Pohlig-Heckel do Brasil	Germany and Brazil
104-SM-161	Package Boiler	110	Cobrasma S. A.	Brazil
Mineasie				
BC-C01*	Mass Earthworks and Rough Grading	5,735	Enbesa/Setal/Teagasa	Brazil
BC-C01A	Railroad Loop Reconstruction	2,545	Metropolitana	Brazil
BC-C04	Railroad Track Installation	85	C. F. I. E.	Brazil
BC-C05*	Structural Earthwork and Concrete	545	Enbasa	Brazil
BC-C06*	Structural Steel and Tank Erection	580	Techint	Brazil
BC-C09*	Tailings Dam No. 5	1,455	Setal	Brazil
BC-C10*	Drainage Systems	200	Copal	Brazil
BC-C11	Underground Piping and Electrical Raceways	510	Mascarenhas Barbosa Roscoe	Brazil
BC-C13	Supply of Concrete	520	Mascarenhas Barbosa Roscoe	Brazil
BC-C19	Survey	90	Gradus	Brazil
BE-C04	Installation of 13.8 kv Electrical Substation and 13.8 kv Pole Line to Prata river Pump Station	270	Nativa	Brazil
BF-C01	Construction of Prata River Pump Station	170	Construtora Minas Sul	Brazil
BF-C03*	Construction of Auxiliary Buildings	1,000	Etesco S. A.	Brazil
BM-C01	Mechanical and Electrical Equipment Installation	2,400	Tenenge	Brazil
BM-C03	Fire Protection System	110	Resmat	Brazil
BM-C07*	Prata River Pipeline	600	Techint	Brazil
BT-C01	Customs Clearance Service	140	Etapa	Brazil
BT-C02A	Material and Equipment Transport	870	Star	Brazil
BT-C03	Expediting and Inspection	140	Supervise do Brasil	Brazil
BM-C08	City of Baposos Pipeline	90	Mascarenhas Barbosa Roscoe	Brazil
Terminal				
200-BC-505*	Track Material	360	Bethlehem	USA
200-BC-528*	Rebar	750	Siderurgica Dedini	Brazil
200-BE-505*	Conduit & Fittings	130	Peterco S. A.	Brazil
200-BE-509*	600 v Power Control Cables	105	Pirelli, Forest, Atlas Fornecedora	Brazil
200-BM-517*	Platework and Steel Liners	105	Itarlaia, Mario Gianturco	Brazil
202-SC-501*	Railroad Trestle Piling	1,535	C. Itoh, Nippon, Sumitomo	Japan
202-SC-502*	Railroad Trestle Structural Steel	1,564	C. Itoh, Nippon	Japan
205-SC-607	Mooring Hardware	60	A. G. Weser Seebeckwerft	Germany
205-SC-603	Rendering System	610	C. Itoh, Bridgestone	Japan
205-BC-605*	Supply and Deliver Piling for Pierhead	2,615	C. Itoh, Nippon	Japan
200-SE-512*	Wound Rotor Induction Motors	100	Yaskawa Electric Mfg.	Japan
200-SE-516*	4160 v Starters	155	Westinghouse	USA
206-SE-707*	4160 v Metalclad Switchgear	120	S.P.I.E.	Brazil
206-SE-708*	Wire and Cable - 5 kv	180	Pirelli	Brazil
203-SM-501*	Rotary Car Dumper	800	Heyl & Peterson	USA and Brazil
203-SM-502*	Apron Feeders	110	Stephens-Adamson	USA and Brazil
200-SM-503*	Conveyors	2,425	Link Belt - Piratininga	Brazil
200-SM-504	Steel Cord Conveyor Belting	485	Mitsui-Mitsuboshi	Japan
203-SM-505*	Bucket Wheel Stacker/Reclaimers	3,170	C. Itoh, Ihi	Japan
205-SM-507*	Shiploader	1,250	MHI, Pohlig-Heckel, Pohlig-Heckel do Brasil	Germany and Brazil
208-SM-511	Tugboats	3,160	McLaren Shipyard	Brazil
203-SM-520	Sizer/Reclaimer	3,000	Stephens-Adamson	USA
203-SM-522*	Fines Conveyor and Stacker	530	Link-Belt - Piratininga	Brazil
BC-C01*	Mass Earthwork and Car Dumper Concrete	6,120	C. R. Almeida	Brazil
BC-C02	Channel Dredging and Sandfill	5,270	Adriaan Volker/Holen do Brasil	Brazil
BC-C03	Railroad Trestle and Light Towers	4,140	Christiani-Nielsen	Brazil
BC-C06	Field Materials Testing	510	Concremat	Brazil
BC-C15	Preparation of Sai Laydown Area	120	Esusa	Brazil
BC-C09	Underground Piping and Raceways	585	Etesco	Brazil
BC-C18*	Pier, Dolphin and Conveyor Trestle	6,530	Cetenco/Harbourworks	Brazil/Holland
BC-C27	Channel Survey	320	Encal	Brazil
BT-C02A	Pipe Piling Transportation	110	Star	Brazil
BF-C02	69 kv Substation	445	Sade	Brazil
BF-C01	Auxiliary Buildings	390	Etesco	Brazil
BM-C01*	Mechanical and Electrical Equipment Installation	11,000	Christiani-Nielsen	Brazil
Design				
SC-006/009	Building Design - Mine and Termina	270	Serete	Brazil
SC-001/005	Plant Design - Mine and Termina	2,550	Cia. Internacional de Engenharia	Brazil
SC-003	Raw Water System Design - Mine Tailings Dam	475	Hidroservice Engenharia	Brazil
H-019	Cathodic Protection Design - Mine and Terminal	20	Cia. Internacional de Engenharia	Brazil
H-022	Electrical Distribution Line Design	30	Eletroprojetos	Brazil

[1] Internationally bid packages in excess of $100,000

* IBRD financed items. Final Procurement packages are not identical to those given in Annexes 9-1 and 9-2 of the Appraisal report because of approved changes following the results of detailed engineering as indicated in Annex II of this report.

ANNEX VI
Table 1

BRAZIL
NBR - IRON ORE PROJECT
PROJECT COMPLETION REPORT

BELO HORIZONTE TRAINING PROGRAM
(1975)

COURSES	Monthly Average Men Trained	Man Hours	Notes
Basics of Preventive Maintenance	21	198	1 month(s)
Basics of Acid Prevention	51	453	3 "
Basics of Internal Auditing	2	75	1 "
Fire-fighting	23	130	3 "
Defensive Driving	34	248	1 "
Development of Hughs Drill Techniques	4	64	1 "
Reinforced Concrete Design	4	24	1 "
Medium-size Vehicle Driving	1	5	1 "
Statistics applied to Management	1	30	1 "
Balance Sheet Structure and Analysis in Financial Management	2	25	2 "
Mining Economics	2	35	2 "
Industrial Electronics	1	19	5 "
Maintenance Electrician Instruction	2	308	2 "
Metering Instruments	8	78	1 "
English	11	64	1 "
Maintenance of Extinguishers	1	40	1 "
Maintenance of Atlas Copco Compressors	1	24	1 "
Maintenance of off-street tires	2	40	1 "
Heavy-duty tire Maintenance	1	32	1 "
Maintenance of tires for earthworking equipment	2	26	1 "
Maintenance/Repair of Safety Goggles	1	16	1 "
Equipment Operators	4	147	7 "
Plant Operators	4	960	1 "
Bucyros-45R Operator	1	120	1 "
IMT Operators	24	2,880	1 "
CAT 773 Operation	3	30	1 "
Cyclosizer Operation	2	40	1 "
PDP 8M-DE Computer Operation	7	142	2 "
45-R Drill Press (Operation Electrical Part)	14	120	1 "
First Aid	30	72	3 "
Fluid Drilling Technology	1	173	2 "
Trigon. applied to Surveying	2	24	3 "
Seventh Course on Air and Water Pollution	1	40	1 "
CURRICULAR TRAINING SESSIONS			
Higher-level series	13	2,242	
Middle-level series	19	3,505	
SEMINARS			
Leadership Development	23	612	1 "
Fifth Mining Symposium	10	80	1 "
First Compressed Air Symposium	3	12	1 "

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ANNEX VI
Table 2

BRAZIL
MBR - IRON ORE PROJECT
PROJECT COMPLETION REPORT

SEPETIBA TRAINING PROGRAM
(1975)

COURSES	Monthly Average Men Trained	Man Hours	Notes	
Application of Technical Knowledge	6	12	1	Month(s)
Ret. Rectel Batteries	1	32	1	"
Staff and Wages Administration	1	31	3	"
Staff Management	1	49	1	"
Correct Work Instruction	33	330	1	"
Physical Education	23	253	2	"
Mining Economics	1	48	1	"
Shotfiring (practical work)	24	48	1	"
English	12	103	5	"
Switchmans duties	2	208	1	"
Basic Machinery Maintenance	2	48	2	"
Maintenance of PABX UH-200	1	22	3	"
Accident Prevention in Tying up and Casting off Ships	29	58	1	"
Operation, Storage and loading Equipment	55	2,282	9	"
Operation General Maintenance Equipment	9	169	8	"
Xerox Operation	2	8	1	"
Ramal 118 Operation	21	21	1	"
Weather Observations	3	95	5	"
Accident Prevention	24	193	3	"
First Aid	43	106	5	"
Fire-fighting and Prevention	50	242	6	"
Anti-Corrosion Measures	2	60	1	"
Accounts/Administration Planning	6	12	1	"
Labor Relations	33	330	1	"
Belt Repair	4	96	1	"
Recruitment and Selection	1	24	1	"
Supervision Turntable/Stacker	17	80	1	"
Supervision Work Safety	1	39	1	"
Introductory Training	13	40	9	"
Vulcanizing	11	506	1	"
SEMINARS				
Leadership Development	3	72	1	"
Fifth Mining Symposium	1	32	1	"
Seminar National Wages Administration	1	24	1	"
First Convention of Accident-Prevention Technicians	1	8	1	"

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BRAZIL
MBR - IRON ORE PROJECT
PROJECT COMPLETION REPORT

AGUAS CLARAS: PROFIT AND LOSS STATEMENTS
(US$ 000)

Fiscal Year ending March 31	1975 1/	1976 6 months 2/ Actual	1976 12 months Budget
SHIPMENTS (000 tons)			
Export	7,423	4,666	10,693
Local	107	86	340
Total	7,530	4,752	11,033
OPERATING REVENUE			
Export Sales	72,643	54,164	120,919
Local Sales	1,049	1,105	3,825
Sub-Total	73,692	55,269	124,744
Sales Expenses	319	263	228
TOTAL REVENUE (per/t shipped)	73,373	55,006	124,516
OPERATING COST			
Purchase of Ore	161	-	-
Mining and Beneficiation (p/t produced)	7,216	5,073	12,933
Local Transportation (p/t hauled RR Dock)	-	-	-
Mining Develop. Stripping (p/t produced)	1,315	441	1,121
Sole Tax (p/t hauled)	1,789	1,919	3,438
Railroad Freight (p/t hauled)	23,426	17,208	39,446
RR Cars Maintenance (p/t hauled)	-	-	-
Terminal Expenses (p/t shipped)	6,284	3,892	3,318
Increase (Decrease) of Ore Stockpile	(658)	(1,229)	278
TOTAL COST (p/t shipped)	39,533	27,304	65,546
GROSS MARGIN ON SALES	33,840	27,702	58,970
BHZ Office - Administration	1,060	616	1,885
Development, Research and Common Service-BHZ	-	-	-
Rio Office Administration	3,279	1,945	4,526
Depreciation and Amortization	12,000	7,667	15,185
Mining Rights Amortization	877	538	1,368
OPERATING MARGIN	16,624	16,936	36,006
Interest and Other Financing Expenses	15,610	7,350	14,890
Demurrage (Dispatch) - Net	443	94	1,102
Social Integration Program	399	377	911
Other Expenses	3	499	2,848
Interest from Short Term Investments	346	436	1,240
Other Revenue	87	42	118
PROFIT BEFORE INCOME TAX AND EXCHANGE VARIATION	602	9,094	17,613

1/ Audited results
2/ Six months ending September 30, 1975 - unaudited results

Industrial Projects Department
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BRAZIL
MBR - IRON ORE PROJECT
PROJECT COMPLETION REPORT

AGUAS CLARAS: COMPARISON OF 1976 OPERATING HIGHLIGHTS[1/]

	Appraisal Estimate		Current Estimate	
	Per Annum (US$ million)	Per Ton (US$/ton)	Per Annum (US$ million)	Per Ton (US$/ton)
Total Crude Tons Mined (million tpy)	11.7		11.3	
Total Shipments (million tpy)	10.0		11.0	
Operating Revenue	83.8	8.38	124.5	11.3
Direct Costs				
Mine, preparation and filter plant	11.6	1.16	12.9	1.2
Rail freight	26.2	2.62	39.5	3.6
Terminal	3.1	0.31	8.3	0.8
Mine Development stripping	2.5	0.28	1.1	0.1
Change in inventories	0.1	0.01	0.3	-
Indirect Costs				
Administration	1.5	0.15	1.9	1.7
Taxes - sole and property	1.9	0.19	3.4	0.3
Insurance	0.6	0.06	0.7	0.1
Total Cash Operating Costs	47.5	4.75	68.1	6.2
Cash Operating Profit	36.3	3.63	56.4	5.1

1/ For year ending March 31, 1976

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BRAZIL
MBR - IRON ORE PROJECT
PROJECT COMPLETION REPORT

DIRECT AND INDIRECT OWNERSHIP OF MBR
(November 30, 1975)

DIRECT OWNERSHIP IN MBR	%	UNDERLYING OWNERSHIP IN EBM AND ST. JOHN	%		INDIRECT OWNERSHIP IN MBR	%
EBM	51	CAEMI	40.80		20.808	
				CAEMI - 51%	5.254	
						26.062
		ICOMI	20.20	→Bethlehem - 49%		5.048
		Japanese	20.00			10.200
		Universal Tankship	19.00			9.690
			100.00			51.000
				23.66%		
St. John	49	Hanna	66.31			32.492
		Universal Tankship	28.51			13.970
		Others	5.18			2.538
			100.00			49.000
	100					100.000

Industrial Project Department
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ANNEX X
Table 1

BRAZIL
MBR - IRON ORE PROJECT
PROJECT COMPLETION REPORT

CONSOLIDATED BALANCE SHEET
(US$ million)

Fiscal Year ending March 31	1972	1973	1974	1975	Budget 1976
CURRENT ASSETS					
Cash and marketable securities	5.819	5.022	5.340	6.847	24.049
Receivables	913	1.273	3.281	3.465	7.566
Iron ore inventories	2.682	1.645	5.942	5.939	5.524
Supplies	1.467	1.334	5.774	10.642	15.019
Prepaid expenses	195	178	700	2.027	589
TOTAL CURRENT ASSETS	11.076	9.452	21.037	28.920	52.747
CURRENT LIABILITIES					
Short-term portion of long-term debt	-	-	4.414	15.843	17.284
Accounts payable and accruals	1.911	6.785	6.365	8.537	11.080
TOTAL CURRENT LIABILITIES	1.911	6.785	10.779	24.380	28.364
WORKING CAPITAL	9.165	2.667	10.258	4.540	24.383
NON-CURRENT ASSETS					
Net fixed assets	848	953	1.194	1.880	2.418
Property, plant, equipment and mining rights	80.659	163.944	208.479	204.612	195.888
Deferred charges and other non-current items	1.211	462	25.039	25.287	25.440
TOTAL NON-CURRENT ASSETS	82.718	165.359	234.712	231.779	223.746
NON-CURRENT LIABILITIES					
Long-term debt	18.998	76.981	155.187	149.441	140.406
Accounts payable and accruals	86	77	3.040	620	65
TOTAL NON-CURRENT LIABILITIES	19.084	77.058	158.227	150.061	140.471
NET ASSETS	72.779	90.968	86.743	86.258	107.658
SHAREHOLDER'S FUNDS					
Equity Capital	73.944	93.229	94.920	94.920	94.993
Advances for capital increase	2.287	-	-	-	-
Reserves - Includes depletion	29	1.698	84	207	18.986
Accumulated (LOSS) Profit	(3.461)	(3.959)	(8.261)	(8.869)	(6.326)
	72.799	90.968	86.743	86.258	107.653
CURRENT RATIO	5.8	1.4	2.0	1.9	1.9
LONG TERM DEBT/EQUITY RATIO	20.8:79.2	45.9:54.1	64.6:35.4	63.5:36.5	56.6:43.4

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ANNEX X

Table 2

BRAZIL
MBR - LOT 'A' PROJECT
PROJECT COMPLETION REPORT

MBR: CONSOLIDATED PROFIT AND LOSS STATEMENTS
(US$ 000)

Fiscal Year ending March 31	1975 1/	1976 6 months 1/ Actual	1976 12 months Budget
SHIPMENTS (000 tons)			
Export	8,565	5,218	11,733
Local	1,334	686	2,091
Total	9,899	5,904	13,874
OPERATING REVENUE			
Export Sales	85,367	63,478	139,188
Local Sales	7,616	5,587	16,364
Sub-Total	92,983	69,065	155,552
Sales Expenses	598	338	402
TOTAL REVENUE (per/t shipped)	92,385	68,727	155,150
OPERATING COST			
Purchase of Ore	223	-	-
Mining and Beneficiation (p/t produced)	12,899	8,746	19,733
Local Transportation (p/t hauled RR Dock)	1,142	535	1,354
Mining Develop. Stripping (p/t produced)	2,292	1,348	2,885
Sole Tax (p/t hauled)	2,631	2,641	4,745
Railroad Freight (p/t hauled)	27,992	19,842	45,546
RR Cars Maintenance (p/t hauled)	213	201	411
Terminal Expenses (p/t shipped)	7,012	4,292	9,123
Increase (Decrease) of Ore Stockpile	(1,559)	(2,715)	(440)
TOTAL COST (p/t shipped)	52,845	34,890	83,357
GROSS MARGIN ON SALES	39,540	33,837	71,793
BHZ Office - Administration	1,704	916	2,904
Development, Research and Common Service-BHZ	-	94	522
Rio Office Administration	4,259	2,431	5,657
Depreciation and Amortization	12,678	7,905	16,101
Mining Rights Amortization	877	538	1,368
OPERATING MARGIN	20,022	21,953	45,241
Interest and Other Financing Expenses	15,723	7,408	15,029
Demurrage (Dispatch) - Net	2,326	688	2,192
Social Integration Program	504	464	1,136
Other Expenses	26	522	3,560
Interest from Short Term Investments	457	561	1,550
Other Revenue	374	145	262
PROFIT BEFORE INCOME TAX AND EXCHANGE VARIATIONS	2,274	13,577	25,134
Income Tax Provision	27	-	-
PROFIT BEFORE EXCHANGE VARIATIONS	2,247	-	25,134
Exchange Loss	(2,247	-	(3,577)
PROFIT (LOSS) BEFORE SUBSIDIARIES	(398)		21,557
Loss - Subsidiaries	(210)		(222)
CONSOLIDATED PROFIT (LOSS) BEFORE DEPLETION ALLOWANCE	(608)		21,335
Depletion Allowance	-		18,844
CONSOLIDATED PROFIT (LOSS	(608)		2,491

1/ Audited results
2/ Six months ending September 30, 1975 - unaudited results

Industrial Projects Department
February 1976

ANNEX X
Table 3

BRAZIL
MBR - IRON ORE PROJECT
PROJECT COMPLETION REPORT

MBR-AGUAS CLARAS: PROFIT AND LOSS STATEMENTS
(US$ million)

	Actual April 1974 to March 1975					Budget April 1975 to March 1976				
	Aguas Claras		Other Mines		Total	Aguas Claras		Other Mines		Total
SHIPMENTS										
Export Sales	7,423		1,142		8,565	10,693		1,090		11,783
Local Sales	107		1,227		1,334	340		1,751		2,091
Total	7,530		2,369		9,899	11,033		2,841		13,874
	US$ 000	US$/t	US$ 000	US$/t	US$ 000	US$ 000	US$/t	US$ 000	US$/t	US$ 000
OPERATING REVENUE										
Export Sales	72,643	9.79	12,724	11.14	85,367	120,919	11.31	18,269	16.76	139,188
Local Sales	1,049	9.80	6,567	5.36	7,616	3,825	11.25	13,539	7.16	16,364
Subtotal	73,692	9.79	19,291	8.14	92,983	124,744	11.31	30,808	10.84	155,552
Sales Expenses	319	.05	279	.11	598	228	.02	174	.06	402
Total Revenue (per/t shipped)	73,373	9.74	19,012	8.03	92,385	124,516	11.29	30,634	10.78	155,150
OPERATING COST										
Purchase of Ore	161	5.36	62	8.85	223	-	-	-	-	-
Mining and Beneficiation (p/t produced)	7,216	.93	5,683	2.33	12,899	12,933	1.12	6,800	2.29	19,733
Local Transporation (p/t hauled RR Dock)	-	-	1,142	.69	1,142	-	-	1,354	.84	1,354
Mining Develop. Stripping (p/t produced)	1,315	.17	977	.40	2,292	1,121	.10	1,764	.59	2,885
Sole Tax (p/t hauled)	1,789	.24	842	.35	2,631	3,438	.31	1,307	.52	4,745
Railroad Freight (p/5 hauled)	23,426	3.14	4,566	3.95	27,992	39,466	3.58	6,080	5.58	45,546
RR Cars Maintenance (p/t hauled)	-	-	213	.18	213	-	-	411	.38	411
Terminal Expenses (p/t shipped)	6,284	.83	728	.64	7,012	3,318	.75	805	.74	9,123
Increase (Decrease) of Ore Stockpile	(658)	-	(901)	-	(1,559)	270	-	(710)	-	(440)
Total Cost (p/t shipped)	39,533	5.25	13,312	5.62	52,845	65,546	5.94	17,811	6.27	83,357
GROSS MARGIN ON SALES	33,840	4.49	5,700	2.41	39,540	58,970	5.34	12,823	4.51	71,793
BHZ Office - Administration	1,060	.14	644	.27	1,704	1,885	.17	1,019	.36	2,904
Development, Research and Common Service - BHZ	-	-	-	-	-	-	-	522	.18	522
Rio Office Administration	3,279	.43	980	.42	4,259	4,526	.41	1,131	.40	5,657
Depreciation and Amortization	12,000	1.59	678	.29	12,678	15,185	1.38	916	.32	16,101
Mining Rights Amortization	877	.12	-	-	877	1,368	.12	-	-	1,368
OPERATING MARGIN	16,624	2.21	3,398	1.43	20,022	36,006	3.26	9,235	3.25	45,241
Interest and Other Financing Expenses	15,610	2.08	113	.05	15,723	14,890	1.35	139	.05	15,029
Demurrage (Dispatch) - Net	443	.06	1,883	1.65	2,326	1,102	.10	1,090	1.00	2,192
Social Integration Program	399	.05	105	.04	504	911	.08	227	.08	1,138
Other Expenses	3	-	23	.01	26	2,848	.26	712	.25	3,560
Interest from Short-Term Investments	346	.05	111	.05	457	1,240	.11	310	.11	1,550
Other Revenue	87	.01	287	.12	374	118	.01	144	.05	262
PROFIT BEFORE EXCHANGE VARIATION - CRS	602	.08	1,672	.71	2,274	17,613	1.60	7,521	2.64	25,134
Exchange Variation from Loans for Work Capital	-	-	-	-	-	-	-	-	-	-
Exchange-Variation Loans for Fixed Assets	-	-	-	-	-	-	-	-	-	-
Negative Working Capital	-	-	-	-	-	-	-	-	-	-
PROFIT BEFORE INCOME TAX	602	.08	1,672	.71	2,274	17,613	1.60	7,521	2.64	25,134
Income Tax Provision					27					-
PROFIT BEFORE EXCHANGE VARIATION - US$					2,247					25,134
Exchange Variation on Foreign Loans					30					-
Exchange Loss on Translation					(2,675)					(3,577)
PROFIT (LOSS) BEFORE SUBSIDIARIES					(398)					21,557
Loss - Subsidiaries					(210)					(222)
CONSOLIDATED PROFIT (LOSS) BEFORE DEPLETION ALLOWANCE					(608)					21,335
Depletion Allowance					-					18,844
CONSOLIDATED PROFIT (LOSS) AVAILABLE - CURRENT YEAR					(608)					2,491

Industrial Projects Department
February 1976

Supplement

SUBJECT: BRAZIL: Loan 787-BR MBR Iron Ore Project
Project Completion Report
Economic Rate of Return

1. At appraisal, the combined internal economic rate of return of the MBR (Aguas Claras) Iron Ore (Loan 787-BR) and RFFSA Railway (Loan 786-BR) Projects were estimated at 18.3% per annum with a minimum sales build-up to the base level of 10 million tons per annum, and 22.8% build-up to 15 million tons.

2. While some of the direct and indirect benefits to Brazil were highlighted in the Project Completion Report dated February 1976, an economic rate of return was not included as the RFFSA Railway Project is not yet completed. The railway project was designed to supply the necessary haulage capacity from the Aguas Claras mine to the ocean terminal at Sepitiba Bay and is estimated to account for about 40% of the combined investment costs.

3. Following your request, we calculated the internal economic rate of return for the MBR Project alone. This can only be considered as an approximation of the economic rate of return for the combined MBR-RFFSA Project. It is assumed that railway costs are truly reflected in MBR's tariff and are an approximation of the economic cost of transporting ore. These tariffs were in fact renegotiated two months ago to reflect cost increases incurred by the RFFSA Railway Project.

4. Reviewing the methodology and assumptions used at appraisal for the economic rate of return calculation, it was noted that the appraisal did not shadow price the foreign exchange elements of the project. At present, all economic analysis of projects in Brazil take into account a shadow foreign exchange rate of 1.29. To allow for a better comparison of the economic rates of return at appraisal and project completion MBR's economic rate of return with and without shadow pricing has been calculated as follows:

	Appraisal	Completion
MBR-RFFSA Combined Economic Rate of Return		
- at 10 mtpy	18.3%	N/A
- at 15 mtpy	22.8%	N/A
MBR Economic Rate of Return (11.5 mtpy)		
- shadow pricing foreign exchange	-	23.5
- no shadow pricing foreign exchange	-	18.5

5. The economic rates of return at completion took into consideration, (1) the new railway tariff agreed between MBR and RFFSA (2) excluded all direct capital and revenue taxes paid to or payable to the Brazilian Government and (3) assumed as was the case at the time of appraisal that "25% of the cost of manufactured, operating and maintenance supplies was the minimum level of indirect taxation".