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Report No. PTR-111a

APPRAISAL OF  
A RAILWAY PROJECT  
BOLIVIA

November 15, 1972

Latin America and the Caribbean Projects Department

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### Currency Equivalents

Currency Unit	= Pesos (\$b)
\$b 1.00	= US\$0.08
US\$1.00	= \$b 12.0
\$b 1.0 million	= US\$83,000

### Weights and Measures:

#### Metric System

<u>Metric</u>	<u>US Units</u>
1 kilometer (km)	= 0.62 mile (mi)
1 meter (m)	= 3.28 feet (ft)
1 liter (l)	= 0.22 imp. gallons = 0.26 US gallons
1 kilogram (kg)	= 2.20 pounds (lb)
1 ton	= 2,205 pounds

### Fiscal Year

January 1 to December 31

### Abbreviations and Acronyms

ALALC	- Latin America Free Trade Association
COMIBOL	- Government Mining Company
CONAVI	- National Housing Council
DMJM	- Daniel, Mann, Johnson & Mendenhall - Consulting Firm, Los Angeles (USA)
ENFE	- National Railway Enterprise of Bolivia, Bolivian Railways
IDB	- Interamerican Development Bank
MTCCA	- Ministry of Transport, Communication and Civil Aviation
SOFREERAIL	- Societe Francaise d'Etudes et de Realisations Ferroviaires - Consulting Firm, Paris (France)
UNDP	- United Nations Development Program
USAID	- United States Agency for International Development
YPFB	- Yacimientos Petroliferos Fiscales Bolivianos

### Note

Under the Government's "Stabilization and Development Plan", the Bolivian peso was devalued to \$b 20.0 per U.S. dollar on October 27, 1972. The effect of the devaluation, and of related measures, including a wage increase, has not been reflected in the financial figures quoted in this report.

BOLIVIA

APPRAISAL OF A RAILWAY PROJECT

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This Appraisal Report has been prepared by Messrs. J. Blumstein (railway engineer), F. Chapman (financial analyst) and J. Martinez and A. Mates (economists).

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MAP

Bolivian Railways - IBRD 3716

## BOLIVIA

### APPRAISAL OF A RAILWAY PROJECT

#### SUMMARY AND CONCLUSIONS

- i. This report appraises a project consisting of the first stage (1973-1974) of a plan for the technical and financial rehabilitation of the National Railway Enterprise of Bolivia (ENFE). The objectives of the plan are to enable the railways to fulfill their essential role in the economy and to establish ENFE's financial and technical viability. The proposed credit of US\$8 million equivalent would be the first credit to Bolivia for development of its transport infrastructure (a Bank Loan 635-BO of US\$23.25 million was made in 1971 for a gas pipeline).
- ii. Transportation in Bolivia has developed piecemeal and in an uncoordinated manner. The railways were established in the west by various enterprises to transport mining products to Pacific ports for export. The east, with Santa Cruz as its commercial center, has only recently been connected to the Argentine and Brazilian railways. The only rail connection between the east and west Bolivian railway systems is by a 600-km detour through Argentina. The highway system, while connecting major cities in the west and providing the only land link in Bolivia between west and east, has no adequate connection with any ports. Thus, for export and import freight traffic, the railways are an essential transportation link for the Bolivian economy.
- iii. Highway competition for internal traffic has grown considerably over recent years; in face of this, ENFE's tariffs have changed little since 1959, and the railways' revenues per ton-km have, in real terms, deteriorated. Compounded by rising costs and poor operating performance, ENFE's annual cash deficits rose to almost US\$4 million equivalent in 1971, only partly covered by Government subvention, leading to a steady erosion of ENFE's financial condition. The shortfalls in Government subventions reflect the difficult situation of Government finances; thus, the provision of adequate local currency funds for ENFE over the project period and, on a declining scale, over the remainder of the plan, will be crucial for ENFE's rehabilitation.
- iv. ENFE has combined virtually all the difficulties frequently encountered in many of our railway projects: poor operations with a low traffic density, poorly maintained and over-aged equipment, lack of experienced management and a low standard of staff training, lack of commercial policy, an inadequate level and structure of tariffs, uneconomic lines and services, and excess staff. All of these factors have led to a difficult financial situation, aggravated in the past by inadequate financial assistance from the Government.
- v. The project forms the first part of ENFE's Five-Year Investment Plan, 1973-1977, which, together with interrelated and most essential action programs, is designed to carry out the physical rehabilitation of ENFE's equipment and improve its management, operations and finances. The equipment and works to be

financed by the proposed IDA credit are, in conjunction with technical assistance financed by the United Nations Development Program (UNDP), an essential first step, leading to full dieselization and to better use of existing and new facilities. They include freight cars to replace over-aged, small capacity cars, rail tractors to replace large locomotives for shunting operations, diesel rail cars to carry increased passenger traffic, spares and components to rehabilitate and improve diesel locomotives and rolling stock, modernization of workshops and the carrying out of essential track works and improvements to structures and telecommunications. The project includes all works to be committed in the years 1973-1974, at a total estimated cost of about US\$11.6 million equivalent. The proposed IDA credit of US\$8 million equivalent would cover the cost of the foreign exchange component of all works and would provide US\$0.8 million toward the local currency costs of essential track materials. In order to secure the maximum benefits from the rehabilitation and modernization program, ENFE will need continued technical assistance. The UNDP has agreed to provide about US\$1 million to help finance this assistance.

vi. The appraisal has established that continuation of railway service is vital to the economy and has identified means of fulfilling this role by enabling ENFE to become more efficient in its management and operations and to improve its finances.

vii. On a conservative basis, the economic rate of return on the total investment in rehabilitation, dieselization and modernization is estimated at 21%. The financial benefits will also be substantial and it should be possible for ENFE to become financially viable by about 1978. Due to accounting deficiencies, including the absence of a realistic valuation of fixed assets, it is not possible to determine a rate of return on net fixed assets. The achievement of working and operating ratios of about 79% and 92% respectively by 1977, which would almost eliminate ENFE's reliance on Government for financial support, is considered to be an appropriate target for future financial performance.

viii. The recovery of ENFE will take many years and the success of the Plan will depend on (a) strong financial and political support from the Government, (b) the ability of ENFE's management to carry out successfully the various time-phased plans of action and (c) ENFE's traffic increasing as forecast. In view of the strong resolve to support ENFE expressed by the present and previous Governments and of the considerable measure of technical support being given to ENFE's management under the UNDP financed project, the chances of success are reasonable provided the future brings no radical change in policies. Traffic prospects are difficult to assess in view of the heavy reliance on exports and imports, which vary with world trade conditions, and on domestic agricultural production; the forecasts are the best estimates in the light of present conditions, but the possibility of variations (both upwards and downwards) must always be recognized.

ix. The project is suitable for an IDA credit to Bolivia of US\$8 million equivalent, to be made available to ENFE at 7-1/4% interest for a term of 25 years, including a five-year period of grace.

## BOLIVIA

### APPRAISAL OF A RAILWAY PROJECT

#### 1. INTRODUCTION

1.01 The Government of the Republic of Bolivia and the National Railway Enterprise of Bolivia (ENFE) have asked the Bank Group for assistance in the financing of the 1973-1977 Investment and Rehabilitation Plan for the Railways, prepared by ENFE with the assistance of SOFRERAIL 1/, a French consulting firm. The proposed five-year investment is estimated at US\$37 million equivalent. Investments during the first two years are estimated at \$b 139 million (US\$11.6 million equivalent), with a foreign exchange component of US\$8 million, including US\$1 million for technical assistance which is expected to be financed by a grant from the United Nations Development Program (UNDP).

1.02 Since its creation in 1964, ENFE has faced severe financial and managerial problems, aggravated by Government and labor interference. Although it manages the majority of railway operations and has a virtual monopoly on many routes, ENFE has been unable to integrate and rationalize operations or to fulfill satisfactorily the important role that railways should play in Bolivia. The proposed project is a three-fold approach to solving these problems: (a) investment to rehabilitate the railways' equipment and facilities; (b) improvement in operations, carrying of more traffic and reduction in unit costs; and (c) training of railway personnel (both labor and supervisors) through the implementation of sound railway management programs. Scarcity of resources in Bolivia has long been a problem, particularly affecting ENFE in that Government has not been able to supply needed finances (para. 6.01). In 1970, Government enterprises accounted for about \$b 205 million of the \$b 700 million overall Government deficit; this included \$b 38 million for ENFE (working loss plus debt service), against which Government provided only \$b 20 million. During the first two years (1973-1974) of ENFE's Plan, the local currency requirements for investment, operations, debt service and working capital (including funds for retirement benefits) amount to \$b 100 million (US\$8 million equivalent), a significant sum in the Bolivian context. Apart from financing the foreign exchange requirements for the first two years, the proposed credit can contribute US\$0.8 million toward local financing.

1.03 An overall transport survey 2/ of Bolivia was completed in 1969, financed by the UNDP with the Bank as executing agency. The study proposed a program for integrated transport development over the next ten years. In early 1969, the UNDP agreed to finance consultants to assist ENFE personnel in the implementation of modern operational and administrative methods and in the planning of future investments. The consultants, SOFRERAIL, who were

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1/ SOFRERAIL: Societe Francaise d'Etudes et de Realisations Ferroviaires.

2/ Bolivia Transport Survey, prepared by Daniel, Mann, Johnson and Mendenhall, the Stanford Research Institute, and Alan M. Voorhees and Associates, Inc. during the period March 1967-July 1969.

selected and began work in October 1970 with the Bank as the executing agency, have established an excellent working relationship with ENFE management and the labor unions, and are successfully completing their terms of reference. Their present contract was extended to September 30, 1972. A request made by the Government for a further extension of their services has been accepted by the UNDP.

1.04 Except for helping to finance a gas pipeline in 1971 (Loan 635-BO, US\$23.25 million), the Bank Group has not yet lent to the transportation sector of Bolivia. In the past, USAID has financed highways. The Inter-American Development Bank (IDB) has been requested to finance the Oruro-Cochabamba highway and has recently lent US\$530,000 for a feasibility study.

1.05 This report is based on (a) the five-year Investment and Rehabilitation Plan, 1973-1977, prepared by ENFE with the assistance of SOFRERAIL, and updated in agreement with the Association; (b) data supplied by the Government of Bolivia; (c) findings of an appraisal mission in September/October 1971 comprising Messrs. J. Blumstein (railway engineer), F. Chapman (financial analyst) and J. Martinez and A. Mates (economists); and (d) further updating by brief missions to Bolivia in January and February 1972 and by a Bolivian delegation to Washington in October 1972.

## 2. BACKGROUND

### A. General

2.01 Bolivia has a land area of about one million square km and a population of 5.0 million. It is a landlocked country, with only sparse settlements in the tropical plains that constitute two-thirds of its territory; it is more heavily populated in the barren and mountainous southwest. The need to open the rich eastern plains to migration while maintaining the existing communication links among the highland cities poses a difficult transport problem.

2.02 Between 1964 and 1968, GDP grew, in real terms, at an annual rate of 7%, slowing down to some 5% in 1969 and 4% in 1970 because of a decline in overall investment activity. The economy is now expected to grow by about 6% annually during 1973-1977. The forecast growth will be concentrated in commodities produced mostly in the eastern plains, as well as in mineral exports. Little growth is forecast for the highlands. A detailed discussion of general economic conditions and outlook is contained in the most recent economic report on Bolivia, No. WH213(a), dated November 9, 1972.



B. The Transport Sector

(i) General

2.03 The railways of western Bolivia (2,302 km), built in the late 19th and early 20th centuries, were developed largely in response to the needs of the mining industry; their routes were selected to provide the most direct and least expensive transport from the mines to Pacific ports. Most of the lines were built with private capital backed by Government guarantees. The railways of eastern Bolivia were built in the early 1960's as a means of developing the Santa Cruz region and providing it with connections to Atlantic ports. In addition to the railways administered by ENFE are the Guaqui-La Paz line (96 km), operated by the Peruvian Corporation (para 2.07), and the Machacamarca-Uncia line (105 km), operated by the Government mining company, COMIBOL.

2.04 The present highway system, almost entirely confined to the southwestern third of the country and connecting the major cities through extremely difficult mountainous terrain, consists of 4,000 km of primary roads, of which only 800 km are paved; 2,700 km of secondary roads; and over 12,000 km of tertiary roads. A tentative 1970-1979 Highway Plan envisages the construction of 3,600 km of new roads together with the improvement of 2,600 km of existing roads and an improved road maintenance program.

2.05 Inland waterways are no more than a series of isolated systems with primitive facilities and slight traffic. Petroleum pipelines transport all crude oil for Bolivian refineries and for export. A 530-km gas pipeline to the Argentine border, partially financed by the Bank, was completed and placed in operation in 1972. Air passenger transport plays an important role because of the rugged geography of the mountainous region and the lack of other means of communication in most of the plains. Air services link La Paz and Santa Cruz with neighboring countries.

(ii) Role of Railways in the Transport Sector: Present and Future

2.06 The meter gauge railway system administered by ENFE, about 2,100 km in the west and about 1,200 km in the east, is the only mode of transport in several areas. Traffic density is low on many of ENFE's routes, as illustrated in Annex 1. The major freight traffic flows are between La Paz and Charana (then going on to the port of Arica), La Paz-Oruro-Uyuni and Oruro-Cochabamba. All other lines are of very low density.

2.07 In the west, the railway provides an access to several ports: Matarani in Peru, Arica and Antofagasta in Chile, and Argentine ports via Villazon. The access to Matarani is via the Peruvian Corporation standard gauge line, with trans-shipments on to steamer services over Lake Titicaca; there is only an unpaved mountain road to Matarani. In 1969, over 55% of all traffic on the Western System consisted of exports or imports, including 90% of all mineral transportation, representing about 80% of the total value of exports from Bolivia.

2.08 Most new exports (cotton, timber, fruits) are expected to be generated in the east, where the railway is the only mode of transport to Argentina and Brazil and to Atlantic ports. In 1971, over 70% of all traffic by rail in the east was export/import traffic. This percentage is expected to rise to at least 75% by 1977, with exports of timber and cotton accounting for 47% of the total traffic. The high cost of road construction assures that the railways' monopoly for transport in this area is likely to continue for many years.

2.09 The crucial element in the analysis of the role of the railways is the cost of transportation. Comparisons of marginal costs by road in the west (excluding road infrastructure) with those by railway show that road costs are considerably higher for freight and also for most passenger services (Annexes 2 and 3). Although shippers consider other elements, particularly quality of service, analysis of ENFE's freight traffic shows that a large proportion consists of bulky, relatively low value products, with long hauls, for which transportation cost is a prime factor. The conclusion is that the railway system plays an important role in transportation in Bolivia, and should be given assistance in improving its services and operations, thus promoting the overall economy.

### C. Transport Investment Planning and Coordination

2.10 Much of the present transport system grew in response to the need to export western mineral products. Some transportation facilities have been and are being built without adequate economic justification, in the hope that once completed they will generate sufficient traffic (para 3.10 and Annex 7). Also, the 1969 Transport Survey concluded that, except for pipelines, the economic costs of providing transport services are not covered by collected user charges, due not only to inadequate charges but also to evasions of them. The poor quality of the statistics available precludes an accurate estimation of the real subsidy provided by the Government to the various transport modes. A detailed user charges study is necessary to determine the appropriate level of charges for each mode. Given the fiscal limitations, and the high cost of road and rail building in Bolivia, transport coordination must play an important part in the allocation of scarce economic resources.

2.11 Under the new Administrative Reorganization Law (September 1972), the Ministry of Transport, Communication and Civil Aviation (MTCOA) has been made responsible for formulating, directing and executing the transport policy. It will, therefore, receive the proposals of the various transport agencies and will develop, evaluate and adjust them to the transport sector requirements. The Government proposes to augment the staff in this ministry to undertake the required studies and to prepare investment programs. Technical assistance is expected to be provided for this by the UNDP. The investment proposals of the MTCOA will be finally reviewed by a National Economic and Planning Council to determine the level of investment in light of national priorities.

### 3. THE NATIONAL RAILWAY ENTERPRISE OF BOLIVIA (ENFE)

#### A. General

3.01 ENFE was created in 1964 to take over (a) the former British owned "Bolivia Railway Company" (BRC) main trunk lines of the Western System (1,199 km) and (b) the Government branch lines (992 km) radiating from the BRC lines. In 1967, the Eastern Lines, completed in 1964, were also transferred to ENFE and operated as the Eastern System. The only rail connection between the two systems is via a 600-km detour through Argentina, over the Belgrano railway.

#### B. Organization and Management

3.02 The National Directorate of Railways, under the Ministry of Transport and Communications, has final technical, financial, regulatory and administrative control of railways.

3.03 A new Enterprise Law defining the functions, organization and responsibilities of ENFE became effective on July 31, 1970. The membership of the ENFE board and the senior management organization are shown in Annex 4. The board, with the Minister of Transport as Chairman, has six members: three Government, two labor representatives and the General Manager of ENFE (non-voting). The General Manager, appointed by the President of Bolivia, acts as chief executive and refers most policy decisions to the board. The autonomy of ENFE is satisfactory and no major changes in ENFE's organization are necessary. Agreement was reached during negotiations that amendments to the Enterprise Law would be made only after prior approval by the Association. Action programs have been prepared to carry out essential improvements in commercial operations, planning, personnel management and unification of procedures between the Western and Eastern Systems (Annex 5). Full implementation of these time-phased programs, which also cover improvements to operations and maintenance facilities, rehabilitation of track and equipment, staff reductions and redeployment, and financial targets, is a vital element of ENFE's recovery plan, and was agreed upon during negotiations.

3.04 Largely as a result of action by the unions, about 100 senior staff were retired in 1970 under a reorganization scheme. This left a serious gap, filled only partially by inexperienced and poorly trained personnel. Technical assistance to train and provide support for management staff as well as at the working level has been planned as an important part of the project. The rehabilitation program has been fully explained to the workers by the railway management and the consultants, and the cooperation of the unions has apparently been won.

3.05 The General Manager is capable but has lacked support from good quality trained and experienced senior staff. Much of his time has been devoted to personnel problems, including the timely provision of funds for salaries. Implementation of the rehabilitation plan is a full-time job, and it was agreed during negotiations that a senior officer would be appointed to be solely responsible for this task.

### C. Staff

3.06 The number of employees on ENFE's West Lines decreased from 6,805 in 1957 to 5,614 in 1962, and 5,200 in 1971. The combined West and East Lines had a total of approximately 6,250 permanent employees in mid-1972. This figure is still excessive, but it includes about 900 waiting to be retired because of age, illness or partial disabilities. As agreed during negotiations, the total will progressively decline by attrition to a more satisfactory level of 5,500 by 1977 (Annex 5, Section C).

3.07 In addition to a pension from the Caja Social Ferroviaria, an employee on retirement receives from ENFE a lump sum ("indemnizacion") consisting of (a) one month's pay for each year of service plus (b) three months' pay. Shortage of funds to pay the lump sums prevents ENFE from retiring staff.

3.08 Salaries for management and professional staff, scaled down from the salary of the General Manager, which by law cannot be higher than that of a Minister of State, appear to be competitive with those of other Government-owned enterprises or agencies. The salary structure for non-managerial and non-professional employees remains a chaotic mix of the salary systems of the railways that were merged into ENFE. The basic salaries have not changed since 1958. A National Commission consisting of six representatives -- two Government, two ENFE and two labor -- has been created to formulate a new rational wage structure. During negotiations, agreement was reached that a revised salary structure would be prepared and submitted to the Association by December 1973, and that the new structure would be implemented in consultation with the Association.

### D. Railway Property

3.09 ENFE's track and structures would be adequate if essential renewals of material were carried out, particularly sleepers, track fittings and some rails, together with strengthening of some wooden bridges; however, rolling stock and equipment are in very poor condition. A brief description of the property is given in Annex 6.

### E. New Lines

3.10 Annex 7 gives details of new lines under construction or being proposed. An Argentine/Bolivian joint commission, which constructed the Yacuiba-Santa Cruz line, has been building a 310-km extension northward from Santa Cruz to Puerto Mamore. This extension has not been justified economically and is likely to operate at a loss for many years. A further 140-km extension to Trinidad is now being studied. There are no commercial operations yet on the completed 102-km section ending at Santa Rosa. The Government is studying the construction of a line to link the West and East Lines, although the DMJM Transport Survey reported unfavorably on this project. At negotiations, agreement was reached that (a) the Puerto Mamore-Trinidad section would be implemented only after economic studies had been carried out and the Association had been afforded a reasonable opportunity to exchange views with the Government; (b) the finances of the new Santa Cruz-Puerto Mamore line

(or any extension) would be separated from those of ENFE until such time as the line becomes viable; (c) once ENFE is required to manage operations on the line, any resulting losses would be compensated by specific reimbursement; and (d) construction of the East-West link would be undertaken only if justified by economic analysis satisfactory to the Government and to the Association.

F. Traffic and Operations

(i) Freight Traffic

3.11 Total freight transport, accounting for about 75% of all railway revenues, increased steadily in the period 1960-1971. In the west, ton-km rose by 5% per annum from 155 million in 1960 to 261 million in 1971, and in the east from 41 million in 1967 to 86 million in 1971. Freight traffic declined only in 1964, because of difficulties resulting from nationalization of the network, and in 1970/71, because of a general slowdown in the economy and a deterioration of ENFE's equipment.

3.12 The sectoral traffic analysis for 1972-1977 (Annex 8) forecast an increase in ton-km of about 4.5% per annum in the west and 6.5% in the east on the basis of 1971 traffic. Total 1977 traffic is estimated to reach 465 million ton-km. In the west, the largest increases are expected for wheat and ores; in the east, cotton (large developments are in prospect) and timber account for about 60% of the projected traffic increase.

3.13 This analysis was compared with the results of a macro-economic model (Annex 9), which uses GDP estimates in the four main sectors and average revenue per ton-km (all in constant prices) for the period 1960-1969 as explanatory variables of traffic growth in the west. The conclusion indicated that to achieve the results of the commodity analysis, GDP should grow by 5.5% annually; such a rate is within the range forecast for the country.

(ii) Passenger Traffic

3.14 On the Western System, passenger traffic has declined since 1965 in terms of number of passengers, but there has been an upward trend in total pass-km. This is due to the introduction of "Ferrobuses", providing a fast, reliable, railcar service between distant urban centers, which has more than offset the downward trend of passenger traffic in regular trains. Actual and forecast traffic for the period 1965-1977 is given in Annex 10. Traffic growth is affected to a large extent by the speed and the comfort provided. Thus for the fast, comfortable railcars, the rate of growth projected is 4.7% annually while, for regular trains, the increasing competitiveness of road transport should limit growth of passenger traffic to 2.5% annually. In the east where road competition is almost nonexistent, the annual growth rate of total rail pass-km in the period 1965-1971 was about 4%. The projected annual growth in pass-km is 5.2% from 1972 on, shared equally by trains and railcars.

(iii) Operations

3.15 Operations have been poor in general, partly due to the lack of adequate telecommunications, but also to the lack of supervision and training of staff. With the consultants' help, a time-phased program of reorganization has been prepared (Annex 5, section D), and a start has already been made in introducing transportation plans and creating a train control office. Staff productivity, at about 90,000 traffic units (pass-km + ton-km) per employee, is somewhat low when compared to that of other meter gauge railroads (Malagasy: 97,000; East Africa: 125,000; the Belgrano, in Argentina: 115,000) but has to be related to ENFE's light overall traffic density. It should improve with the full implementation of the rehabilitation and modernization schemes, the manpower redeployment plan and the expected traffic increase. Annex 11 summarizes operating statistics from 1967 to 1971. Due to the lack of such basic information, many of the 1969 figures had to be calculated on the basis of a four-month sample. A comprehensive plan to improve production of statistical information, prepared by the consultants, is being implemented, and by end-1972 statistical data will be published on a weekly and monthly basis.

(iv) Commercial Policy

3.16 Until recently, a commercial policy barely existed in ENFE, with tariffs responding more to political pressures than to railway costs and transportation demand. The tendency has been to stress rate discounts in an effort to sell inadequate rail services instead of adjusting ENFE's services to the needs of the client. It is fundamental for ENFE to improve the services offered and to sell them at competitive tariffs which at least cover their marginal costs. A commercial policy that will mold the services of the railway to the needs of the customers, while ensuring that they produce a profit, is crucial to the success of the rehabilitation program and the attainment of the financial targets. Creation of a commercial department and training of its personnel will be completed by the end of 1972.

4. THE INVESTMENT PLAN AND THE PROJECT

A. The Plan

4.01 ENFE, assisted by its consultants, has prepared a five-year Investment and Rehabilitation Plan, 1973-1977, estimated to cost about \$b 440 million (about US\$37 million equivalent), with an estimated foreign exchange component of about US\$28 million. The overall objective of the Plan is to make up heavy arrears in maintenance of track and equipment, and to modernize operations by replacing costly steam traction with diesel motive power, by renewing an over-aged rolling stock fleet, and by modernizing workshops. In conjunction with the proposed investment, and of prime importance to the recovery of ENFE, is the continuation of the existing UNDP financed scheme for assistance to ENFE in all fields of management and, in particular, the training of staff in modern engineering and commercial practices. (Annex 12 gives

details of the second phase.) This assistance is also essential to help ENFE in implementing the parallel interrelated action programs (para 3.03), which have been prepared in conjunction with the consultants and Association staff.

4.02 The Plan has been appraised by the Association and, following some revisions, has been agreed on. The investment is the minimum required to carry out the outlined objectives, and it was agreed during negotiations that the Government and ENFE would implement the full Plan, would periodically review it, and would not make changes without the agreement of the Association. Annexes 13 and 14 give details of the Plan; a summary is given below.

1973-1977 Investment Plan Summary

	\$b million			US\$ million			% of total expenditure
	Local	Foreign	Total	Local	Foreign	Total	
1. Way and Works	83.6	50.2	133.8	7.0	4.2	11.2	30
2. Motive Power	-	68.4	68.4	-	5.7	5.7	15
3. Rolling Stock	-	135.6	135.6	-	11.3	11.3	31
4. Locomotive and Car Maintenance	-	14.4	14.4	-	1.2	1.2	3
5. Workshops	9.0	5.9	14.9	.7	.5	1.2	3
6. Technical Assistance	1.4	11.7	13.1	.1	1.0	1.1	3
7. Total	94.0	286.2	380.2	7.8	23.9	31.7	85
8. Contingencies							
Physical (1%)	<u>4.4</u>	-	4.4	.4	-	.4	1
Price (13%)	<u>8.5</u>	<u>46.5</u>	<u>55.0</u>	<u>.7</u>	<u>3.9</u>	<u>4.6</u>	<u>14</u>
9. Grand Total	106.9	332.7	439.6	8.9	27.8	36.7	100

/1 Physical contingencies amount to 5% of civil engineering works.

4.03 Included in way and works are track renovation material (sleepers, fastenings, rails), maintenance tools and equipment, structural reinforcement of existing wooden bridges, protection against flooding and soil slides on the important Oruro-Cochabamba line, and modernization of telecommunication equipment. Motive power comprises the procurement of 15 diesel units, 13 rail tractors and 3 railcar sets to phase out steam traction; delivery of the 15 main line units is, however, projected for 1975-1976 only, since ENFE will first have to establish adequate maintenance facilities, together with an organized spares supply system and the training of staff. Rolling stock includes the provision of 850 freight cars, 25 passenger coaches and 20 cabooses to replace over-aged equipment. Locomotive and car maintenance includes components to rehabilitate equipment which is still in reasonable condition, and the creation of a basic stock of spare parts. Workshops comprises the modernization of the three workshops remaining after concentration, and the procurement of essential machine tools. Technical assistance is related to the extension of the present scheme in order to pursue basic training of staff and to assist ENFE in carrying out the various rehabilitation programs.

B. The Project and the Credit

4.04 The project, which consists of the items to be committed during the first two years (1973-1974) of ENFE's Investment Plan, is to complete the preliminary stage, already started, of improving the quality of ENFE's management, staff and facilities so as to make the best use of existing equipment. Therefore, the emphasis is primarily on training and on the carrying out of action programs, together with a minimum investment in equipment, spares and components, track and rolling stock rehabilitation and workshops modernization. An important item is the continuation of the technical assistance (para 4.01). The prospects of the increased traffic forecast for the second phase of the Plan, and the consequent investment in additional equipment, are heavily dependent on the satisfactory execution of this first stage. A breakdown of the project and of the expenditure suitable for finance under the proposed credit is given below:

	<u>\$b million</u>			<u>US\$ million</u>			<u>US\$ million</u>	
	<u>Local</u>	<u>Foreign</u>	<u>Total</u>	<u>Local</u>	<u>Foreign</u>	<u>Total</u>	<u>Proposed</u>	<u>Credit</u>
1. Way and Works	30.1	20.5	50.6	2.5	1.7	4.2	2.5	<sup>/1</sup>
2. Motive Power	-	14.4	14.4	-	1.2	1.2	1.2	
3. Rolling Stock	-	28.8	28.8	-	2.4	2.4	2.4	
4. Locomotive and Car Maintenance	-	10.0	10.0	-	.8	.8	.8	
5. Workshops	9.0	5.9	14.9	.8	.5	1.3	.5	
6. Technical Assistance	<u>1.3</u>	<u>7.9</u>	<u>9.2</u>	<u>.1</u>	<u>.7</u>	<u>.8</u>	-	
7. Total	40.4	87.5	127.9	3.4	7.3	10.7	7.4	
8. Contingencies								
Physical (1%)	1.6	-	1.6	.1	-	.1	-	
Price (7%)	<u>1.9</u>	<u>7.6</u>	<u>9.5</u>	<u>.2</u>	<u>.6</u>	<u>.8</u>	<u>.6</u>	
9. Grand Total	43.9	95.1	139.0	3.7	7.9	11.6	8.0	

<sup>/1</sup> See paragraph 4.09.

4.05 Included in way and works are (a) essential track works and material to implement the rehabilitation program and to facilitate the introduction of modern track maintenance practices, (b) the first phase of bridge strengthening and of protection works on the Oruro-Cochabamba line, and (c) improvement in telecommunication equipment. Motive power covers the procurement of 13 rail tractors to replace large locomotives, both steam and diesel, for light shunting operations, and three diesel railcar sets to carry the projected passenger traffic increase between urban centers. Rolling stock includes 200 freight cars intended to replace old, small capacity cars and to ease ENFE's acute shortage of serviceable cars.



4.06 Locomotive and car maintenance relates to the provision of (a) components to rehabilitate existing diesel locomotives and railcars, and to improve existing suitable passenger and freight cars; and (b) a basic stock of spare parts to implement an organized maintenance program. The provision of spares and components will involve negotiated procurement of about US\$500,000 from the original suppliers of the locomotives, railcars and their engines, in Japan and Germany. These components are needed on a one-time basis to restore to service capital assets now out of service due to lack of spares. Suppliers' credits are not normally available for this type of purchase and none are expected in this case; this item has, therefore, been included in the proposed credit. Workshops comprises the modernization of facilities and the procurement of essential machine tools for maintenance of modern equipment.

4.07 Cost estimates are based on 1972 prices, and a total contingency allowance of about 8% has been provided. Physical contingencies have been taken at 5% of the estimated (local currency) costs of civil engineering works while price contingencies are based on the assumptions that (a) local costs will rise at about 3% per annum over the period 1973-1974; and (b) prices for imported material may rise by about 5% per annum.

#### C. Financing of the Project

4.08 The following table summarizes the proposed financing of the project:

	<u>\$b million</u>	<u>US\$ million</u>	<u>%</u>
Proposed IDA Credit	96.0	8.0	69
UNDP Grant	9.8	0.8	7
Government resources	<u>33.2</u>	<u>2.8</u>	<u>24</u>
	<u>139.0</u>	<u>11.6</u>	<u>100</u>

4.09 No financing is expected from railway resources since ENFE will not be able to generate sufficient cash during the project period. The total foreign exchange cost, excluding technical assistance, is US\$7.2 million. With UNDP continuing to finance technical assistance, the balance of US\$0.8 million from the credit can be used as a contribution toward local costs of investment in way and works.

#### D. Execution of the Project, Procurement and Disbursement

4.10 Except for spares and components mentioned in paragraph 4.06, all goods to be financed from the proposed credit would be acquired through international competitive bidding. Disbursements for imported goods would be made on the full CIF cost of all such procurement; disbursements for wooden sleepers and other permanent way material, which are expected to be produced locally, would be on the basis of ex-factory costs of these items.

4.11 Preferential trade agreements exist between Bolivia and members of ALALC. 1/ They are, however, irrelevant for procurement procedures under the project because, according to chapter 86 of the customs code, no duties are payable by ENFE on railway equipment to be financed from the proposed credit.

4.12 The estimated quarterly and annual rates of disbursement of the proposed credit are given in Annex 15; the disbursement will extend until 1975. The project forms part of the continuing Investment Plan 1973-1977, which has been appraised as a whole. It is proposed, therefore, that if there are any savings in IDA-financed items of the project, they be used to finance the foreign exchange costs of continuing items in the Plan, subject to review and agreement with the Association.

## 5. ECONOMIC EVALUATION

### A. General

5.01 The 1973-1977 Investment Plan is a coordinated program of rehabilitation and modernization designed to enable the railways to perform efficiently and to carry the rail traffic forecast for the 1973-1977 period. If the Investment Plan is not implemented, declining quality of service and diminishing capability to move traffic will result partly in diversions to more expensive road traffic and partly in complete loss of traffic in areas where roads do not exist.

5.02 The full benefits of any one item (renovation of track, rolling stock, modernization of workshops, etc.) can be realized only if the whole investment program is carried out; this interdependency precludes computation of benefits for most individual items. An overall economic rate of return was therefore calculated taking into account two alternatives: (a) making no investment in the railway and (b) accepting the Investment Plan. In addition, two parts of the Investment Plan (improvement of the Oruro-Cochabamba line and dieselization), whose benefits can be singled out, were analyzed separately (paras. 5.06 and 5.08). The timing of investments under the Plan takes into consideration the absorptive capacity of the railway in terms of works to be executed and the level of demand for railway services in future years (the purchase of more rolling stock in the project period was considered and did not prove justified on economic grounds). The detailed economic costs under the two alternatives are given in Annex 16, and their comparison assumes no further growth in traffic beyond 1977.

### B. Economic Benefits of the Plan

5.03 The economic evaluation is based on measuring the costs to the economy in the event that the railway Investment Plan is not implemented. The main benefits related to the Investment Plan are the avoidance of (a) the

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1/ ALALC - Latin America Free Trade Association

higher costs of transportation by road and (b) lost traffic (where no alternative roads exist). Costs by road take into account only marginal costs and exclude those of road construction. The marginal road costs for freight are based on using seven-ton trucks, while for passengers the cost of buses is taken. No consideration was given to the high costs involved in providing transport by smaller vehicles. For traffic that is lost to the economy, the loss was measured by the average revenue per unit-km; this assumption is conservative since the value added to freight transported, mainly imports and exports, is higher than the revenues accrued to the mode of transport. Cost savings arising from the Plan include fuel and maintenance savings from the phasing out of steam traction and the elimination of freight car rentals payable to other countries. Analysis of all cost items with the Investment Plan and without it shows an economic rate of return of 21% on the Five-Year Plan (Annex 16).

### C. Sensitivity Analysis

5.04 Two factors which could adversely affect the rate of return - increasing costs and reduced traffic - were considered:

- (a) The first test assumes that railway costs will increase by 15% over the Investment Plan period, while costs of road transport will remain constant. The resulting rate of return on the investment is 18%.
- (b) In the second test, even if the forecast freight traffic growth rates in the period 1973-1977 were considerably reduced, from 4.5% per annum on the West Line and 6.5% per annum on the East Line to 3.5% and 4% respectively (significantly lower than those experienced in the past), the rate of return would still be an acceptable 16%. It is not expected that any lower traffic growth rate is likely.

5.05 Another important factor to examine is the assumption of ENFE's ability to rent foreign cars. If, beyond 1973, ENFE were able to rent only 300 cars instead of the assumed 500-600 cars, the economic rate of return would increase to 29%. The availability of rented freight cars depends on the good will of neighboring countries; in light of the high impact that such availability has on the rate of return, it is clear that ENFE should be provided with an adequate fleet of cars, despite the low rates currently charged by Argentina and Chile for the rented cars.

### D. Improvement of the Oruro-Cochabamba Line

5.06 The improvement of the Oruro-Cochabamba line to be carried out over the Plan period is estimated to cost about US\$2.9 million equivalent. The economic justification of this investment has been examined in the light of the possible construction of the Oruro-Cochabamba highway, an economic study of which is presently being conducted. The benefits of the improvements on the line were quantified; they yield an economic rate of return of 18% over a period of 20 years, and at least 8% on the extreme assumption that all traffic

would be diverted to a new road in 1982. This return, supported by the fact that the highway would not be a complete substitute for the railway (although joining the same cities, the modes will not be parallel), is considered satisfactory to justify the investment.

5.07 The high costs expected in constructing the Oruro-Cochabamba highway (US\$35-45 million) and the possibility that this highway would not generate traffic, but rather would divert it from the railways, require that the Association should be consulted on the conclusions of the economic study of this highway before construction. Agreement on this was reached during negotiations. The economic study is currently under way and is financed by IDB, which has been requested to finance the highway.

#### E. Dieselization

5.08 The program of dieselization will eliminate the use of steam locomotives for main line operations by 1977. The resulting savings in fuel, maintenance and labor yield a rate of return of 18% on the dieselization scheme. This rate of return is computed on the assumption that the alternative to dieselization is carrying all the traffic projected with the existing fleet of locomotives.

#### F. Uneconomic Lines

5.09 The Sucre-Tarabuco Line, 77 km, has no freight traffic and carries only about 20 passengers a week, requiring expenditures of about \$b 300,000 (US\$25,000) a year. There is a parallel road which can carry all passenger traffic, and it was agreed at negotiations that service on the line will be terminated by June 30, 1973.

5.10 The Cochabamba-Aiquile Line, about 217 km, earned revenues of about \$b 360,000 (US\$30,000) in 1970 against working expenditures of \$b 1,635,000 (US\$ 136,250). Freight traffic has ceased and passenger traffic has been declining. It was agreed at negotiations that (a) the Ministry of Transport would carry out a study of the highway between Cochabamba and Aiquile; (b) the railway line would be closed if the study shows that provision of a 50-km road extension is the more economic alternative; and (c) should the study show that the railway line is a more economic alternative, and ENFE be compelled to continue operations on the line, then ENFE would be given specific subsidies to cover the resulting deficits.

## 6. FINANCES

### A. Introduction

6.01 ENFE's financial position is poor and its cash position has steadily deteriorated over recent years. This has been due to deficits in operations, affected by failure to raise tariff levels to compensate for inflation since 1958, and to the inadequacy of subventions from Government to meet these



6.05 ENFE's liquid position is poor; the cash and bank balance represents only about one-third of average monthly cash requirements. No provision is included for the liability for retirement benefits due to 800-900 staff who should be retired - the exact figure is unknown, but is estimated at about \$b 40 million.

6.06 The long-term debt consists mainly of a loan from Mitsubishi to finance diesel locomotives and freight cars, repayable over 10 years, ending in 1978. The remaining items of debt will be repaid by the end of 1972. Debt service of about \$b 20 million annually is presently met wholly by Government.

6.07 Fixed assets book value, although expressed as gross value, with depreciation reserve shown separately, includes (a) net written-down book values of assets taken over from the previous owners; and (b) an arbitrary, understated value for the Santa Cruz-Corumba line, built by Brazil. It does not yet include the value of the Santa Cruz-Yacuiba line, built by Argentina. The cost of both of these lines is being repaid by Bolivia over a long term; that of the Santa Cruz-Corumba line has been passed on to ENFE as equity, and the outstanding debt does not appear in ENFE's accounts. No inventory of fixed assets, agreeing with accounting records, exists, but ENFE is presently preparing one. During 1971, ENFE commenced revising the book values of fixed assets, and the reduced figures shown in the 1971 balance sheet reflect the preliminary results. Corresponding reductions were made to the book value of "Capital". Further revisions are being made in 1972. At negotiations, agreement was reached that ENFE will clear up and reconstruct its balance sheet, using more realistic values for fixed assets, by the end of 1972.

6.08 Annex 18 illustrates the deterioration in ENFE's financial position over the last six years, caused by operating deficits and by the insufficiency of annual Government subventions to cover such deficits plus debt service and capital investment. Particular deterioration occurred in 1971 due to (a) lower revenues in the first six months; (b) higher costs, affected by the national wage award of January 1; and (c) delays in obtaining funds from the Government. After repeated requests from ENFE management, the Government increased the amount to about \$b 43 million, and these funds have now been made available to ENFE, with about \$b 8 million for debt service being provided in early 1972.

### C. Tariffs and Costs

6.09 ENFE's tariff structure remained basically unchanged between 1959 and 1972. It was based on six commodity classifications varying according to the route of shipment; it failed to reflect the costs of carrying different commodities. Additionally, the stability of rates resulted in a decreasing revenue per unit-km in real terms from \$b 0.237 per ton-km in 1961 to \$b 0.170 in 1970 on the Western System, an annual decrease of about 4%.

6.10 A new freight tariff structure, prepared by ENFE with the help of the consultants, SOFRERAIL, became effective on July 15, 1972. The new rates are based on, and at least cover, marginal costs of transporting each commodity (long-run marginal costs, including depreciation of renewable assets) and take account of competition by other modes of transport.

6.11 Under the new tariff, most commodities bear increased rates, except for basic commodities which affect the cost of living - wheat, flour, potatoes, fruits, vegetables, salt and kerosene - which, at the insistence of Government, bear little or no increase in rates. There is a reasonable margin for reductions to shippers who load cars more productively, thereby improving car loading factors. The overall increase in revenue per ton-km ranges from about 10% to 15%, depending largely on the extent of such reductions. As noted in Annex 20, future revenues have been calculated on the basis of a 10% rise in revenue per ton-km.

6.12 Passenger fares are sufficient to cover marginal costs on second class traffic; those for "Ferrobuses" are even more profitable (Annex 2). For first class passenger services, revenues are well below marginal cost. However, first class travel is being discontinued in 1972 except on international trains. Any substantial overall increase in passenger fares between the major cities in the west seems unfeasible in view of road competition but, with the planned improvement in passenger services, the commercial department should undertake a study to determine where selective fare increases can be introduced. The most likely areas are (a) second class services in the east where, in many places, no competing road exists and where tariffs do not cover average total costs; and (b) "Ferrobuses" services in the west, which provide a more comfortable ride than buses but charge much lower fares per pass-km than equivalent services in the east. At negotiations, agreement was reached that this study would be completed by March 1973 and, thereafter, any proposed tariff changes would be promptly implemented in consultation with the Association.

#### D. Past and Future Earnings

##### (i) Past Earnings

6.13 ENFE has faced financial difficulties since its creation in 1964. By nature of the difficult terrain traversed by some railway lines, and the low level of traffic on most of these lines (averaging 92,000 pass-km and 134,000 ton-km per route-km on the West Line and 52,000 pass-km and 75,000 ton-km on the East Line in 1969, Annex 1), it is a high cost railway. Recurring annual deficits can be reduced or eliminated only by reducing costs, increasing traffic and charging realistic tariffs - matters over which ENFE has only limited influence. However, there is scope for reductions in unit costs through increasing efficiency of operations, the prospects of increased traffic are favorable and, with the introduction of a new, cost-based tariff, realistic rates should be charged.

6.14 Annex 19 shows the income accounts of ENFE for the years 1966-1970, for West and East Lines separately. Results for ENFE as a whole are summarized on the following page:

Year	Operating Revenue	Working Expenses	Operating Expenses	Net Working Revenue (Loss)	Net Operating Revenue (Loss)	Interest Charges	Net Deficit	Working Ratio %
----- (\$b million) -----								
1966	105.6	120.8	120.8	(15.2)	(15.2)	-	15.1	114
1967	115.8	123.4	123.4	( 7.6)	( 7.6)	0.3	8.6	106
1968	125.9	139.9	140.1	(14.0)	(14.2)	3.6	17.5	111
1969	147.7	136.8	144.5	10.9	3.2	6.8	0.2	93
1970	138.9	142.5	150.0	( 3.6)	(11.1)	6.1	20.6	103
1971	139.1	162.6	169.6	(23.5)	(30.5)/1	5.5	36.9	117

/1 About US\$2.5 million equivalent.

Between 1966 and 1969, traffic and revenues rose steadily by 40% and, with expenses rising by only 27%, the working ratio improved from 114 to 93. In 1970, traffic declined slightly, affected by the slowdown in economic growth discussed in paragraph 2.02, but expenses rose, and the working ratio deteriorated to 103. In 1971, traffic and revenues were similar to those of 1970, but with a wage award effective January 1, 1971, costing about \$b 8 million, working expenses rose to about \$b 163 million and the working ratio deteriorated to 117.

6.15 Freight is the dominant traffic, providing about 75% of the operating revenues, with passengers accounting for about 20%. The average revenue per ton-km rose slightly, from \$b 0.298 in 1967 to \$b 0.301 in 1971 (US¢ 4.1 per ton-mile). Average revenue per pass-km rose between 1967 and 1971, from \$b 0.089 (US¢ 1.19 per pass-mile) to \$b 0.103 (US¢ 1.38 per pass-mile), due mainly to the introduction of better paying ferrobuses services. These average unit revenues are higher than in some other Latin American countries (Argentina, Brazil and Mexico) but are in line with those in Peru and Colombia - countries with similar topography.

6.16 Average total unit costs before depreciation remained fairly steady over the period 1967-1970 (\$b 0.237 per unit-km in 1967, \$b 0.243 in 1970), but rose to \$b 0.264 in 1971.

6.17 Annual depreciation charges are too low - ENFE did not begin charging depreciation until 1968, and then only on newly acquired equipment such as locomotives and rolling stock. For this reason it has not been practicable to quote operating ratios. Interest charges are largely those payable on loans from Japan and Germany for motive power and rolling stock.

6.18 With working costs generally exceeding revenues, ENFE has not been able to provide any funds for debt service or replacement of equipment; therefore, such ratios as times interest earned, debt service and earnings cannot be quoted.



(ii) Future Earnings

6.19 Income projections for the years 1973-1977 illustrating the improvement expected to arise from the proposed investment and technical assistance are given in Annex 20, together with the detailed assumptions used, and are summarized below:

Year	Operating Revenue	Working Expenses	Operating Expenditure	Net		Interest Charges	Net Income (Deficit)	Working Ratio %	Operating Ratio %
				Working Revenue (Deficit)	Net Operating Revenue (Deficit)				
1973	166.0	168.1	192.1	(2.1)	(26.1)	3.7	(32.3)	101	116
1974	172.5	167.7	192.7	4.8	(20.2)	3.0	(25.7)	97	112
1975	181.0	163.3	188.8	17.7	(7.8)	5.8	(16.0)	90	104
1976	190.0	159.5	185.5	30.5	4.5	11.9	(9.8)	84	98
1977	198.5	155.9	182.4	42.6	16.1	16.6	(2.9)	79	92

6.20 The assumptions given in Annex 20 are the best estimates of what is likely to happen; the most critical concerns the traffic forecasts, particularly freight, which depends so heavily on imports and exports. The income projections assume no tariff increases other than the relatively modest increases discussed in paragraph 6.11. During negotiations, agreement was reached that, in addition to the above, ENFE would promptly propose and Government would approve immediate tariff increases sufficient to offset any increased costs which may arise due to inflation or general wage awards.

E. Financial Targets

6.21 The carrying out of the rehabilitation plan is expected to result in a considerable improvement in the railways' financial condition, although ENFE is not expected to become financially viable until about 1978. By 1977, (a) working and operating ratios should improve to 79% and 92% respectively; and (b) as against the present position of complete inability to service debt, the times interest earned ratio should reach 0.8, and the debt service coverage a satisfactory 1.3 provided ENFE incurs no debt substantially greater than that discussed in paragraph 6.24. In the light of ENFE's present position, achievement of these financial ratios would be as good as can be expected.

6.22 As mentioned in paragraph 6.20, the freight traffic forecast is most critical and, with its great dependence on exports and imports, can be affected by world trade conditions. The sensitivity of the financial projections to reductions of 5% and of 10% in the level of this traffic was examined. A 5% fall would reduce ENFE's earnings by \$b 11 million over the project period and by \$b 31 million over the plan period; 10% would result in reductions of \$b 22 million and \$b 62 million respectively. The annual working and operating ratios would deteriorate by about 3% and 6% respectively, and achievement of the agreed targets would be delayed by about one year.

6.23 In view of the unsatisfactory nature of ENFE's current balance sheets and the asset identification and valuation presently under way, it is not possible to project future balance sheets in the normal manner. Instead, an attempt has been made to build up forecast statements on the basis of (a) an estimate of the revised gross values of fixed assets and of accumulated depreciation; (b) the forecast operating results; (c) the annual forecasts of debt; (d) revisions of present figures of current assets and liabilities to eliminate some doubtful items; and (e) the assumption that ENFE's accounts will be rationalized within the next year. These tentative summary balance sheets, given in Annex 21, show the current ratio improving slightly over the period from 1.3 to 1.4 and the debt equity ratio ranging from 7/93 to 29/71, which is reasonably satisfactory and which should improve after 1977. The increase in long-term debt reflects the borrowing required during the period to finance the foreign exchange element of investment. The annual additions to working capital should improve ENFE's liquidity, and cash and bank balances should improve from \$b 4 million at the end of 1971 to about \$b 15 million by the end of 1977 (about five weeks' working expenses), which would be reasonably satisfactory.

6.24 At negotiations, agreement was reached that ENFE (a) would achieve the working and operating ratios referred to above, and detailed in Annex 20; (b) would provide in its accounts annual depreciation of not less than \$b 24 million; and (c) would not incur long-term debt without the Association's agreement unless net cash revenue is at least 1.25 times the maximum future debt service requirements (the financial forecasts indicate ratios of 1.07 in 1976 and 1.30 in 1977).

#### F. The Financing Plan

6.25 The financing plan over the period of ENFE's 1973-1977 Investment Plan is summarized on page 21. More detail is given in Annex 18. The requirement for retirement benefits is spread over the five years to allow ENFE to plan an orderly exodus of staff already qualified to retire and to reduce the financial impact on Government resources.

6.26 In the project period, the proposed credit, together with continued UNDP financing of the technical assistance (about US\$0.8 million), will cover all the foreign exchange requirements. It has been assumed that the proposed credit will be made available to ENFE on repayment terms of about 25 years, at about 7-1/4% annual interest. Although the equipment to be procured by the proposed credit will be in use within three years, a five-year period of grace is recommended for both repayment and interest in view of ENFE's weak financial position, and to enable ENFE to satisfy the requirements of the financing plan. For the remaining three years of the Plan, 1974-1976, foreign exchange requirements of about US\$20 million still have to be secured. Apart from the possibility of further borrowing on soft terms from international finance agencies, it is probable that such items as diesel locomotives and freight cars will have to be financed from suppliers' credits or bilateral finance. UNDP has agreed to help finance the continuation of technical assistance through 1974 and has allocated US\$1 million for this purpose.

<u>Funds Required</u>	<u>Project Period</u> 1973-1974/ <sup>1</sup>			<u>Plan Period</u> 1973-1977		
	<u>\$ b million</u>	<u>US\$ million</u>	<u>%</u>	<u>\$b million</u>	<u>US\$ million</u>	<u>%</u>
(a) For investment: <sup>2</sup>						
Proposed IDA project	129.9	10.8	70.6	129.9	10.8	21.5
Other capital expenditure	<u>-</u>	<u>-</u>	<u>-</u>	<u>309.7</u>	<u>25.8</u>	<u>51.5</u>
Total investment	129.9	10.8	70.6	439.6	36.6	73.0
(b) For debt service:						
Interest	6.7	0.6	3.9	41.0	3.4	6.8
Repayment	<u>31.2</u>	<u>2.6</u>	<u>17.0</u>	<u>74.5</u>	<u>6.2</u>	<u>12.4</u>
Total debt service	37.9	3.2	20.9	115.5	9.6	19.2
(c) Retirement benefits	14.8	1.2	7.9	37.0	3.1	6.2
(d) Additional working capital	<u>1.0</u>	<u>0.1</u>	<u>0.6</u>	<u>10.0</u>	<u>0.8</u>	<u>1.6</u>
Total funds required	<u>183.6</u>	<u>15.3</u>	<u>100.0</u>	<u>602.1</u>	<u>50.1</u>	<u>100.0</u>
<u>Sources of Funds</u>						
(a) Internal generation by ENFE (deficit)	(2.3)	(0.2)	(1.3)	81.3	6.8	13.5
(b) Borrowings:						
Proposed IDA credit	86.9	7.2	47.1	96.0	8.0	15.9
Other borrowings	<u>-</u>	<u>-</u>	<u>-</u>	<u>233.1</u>	<u>19.3</u>	<u>38.7</u>
Total borrowings	86.9	7.2	47.1	329.1	27.3	54.6
(c) UNDP grant	9.8	0.8	5.2	14.3	1.2	2.4
(d) Government equity	<u>89.2</u>	<u>7.5</u>	<u>49.0</u>	<u>177.4</u>	<u>14.8</u>	<u>29.5</u>
Total sources of funds	<u>183.6</u>	<u>15.3</u>	<u>100.0</u>	<u>602.1</u>	<u>50.1</u>	<u>100.0</u>

<sup>1</sup> Figures quoted for investment and borrowing reflect timing of disbursement of the credit, as in Annex 15, and consequently are slightly different from those quoted in paragraph 4.08.

<sup>2</sup> Includes technical assistance to be financed by UNDP grant.

6.27 ENFE's earnings, while improving over the period, will not have reached the point at which, after servicing debt and paying retirement benefits, any contribution could be made to investment until about 1978. Therefore, the local currency financing of the Plan will depend heavily, although on a reducing scale, on Government equity contributions, apart from US\$0.8 million (about \$b 10 million equivalent) which can be made available in the project period from the proposed credit, as discussed in paragraph 4.09.

6.28 Should the traffic forecasts prove optimistic, as discussed in paragraph 6.22, the burden on Government finances would, of course, rise by the shortfalls in revenues given in that paragraph.

6.29 Agreement was reached at negotiations that (a) the Government would promptly provide all funds required to cover the annual deficits resulting from operations and debt service, and to carry out the Plan; and (b) these funds would be provided to ENFE in advance on a revolving fund basis, in accordance with agreed on annual budgets (para. 6.31).

#### G. Budgets, Accounts and Audit

##### (i) Budgets

6.30 ENFE prepares annual budgets for presentation to the Ministry of Finance for approval, by October 30. The budgets are supposed to include requirements for both operations and investment. However, apart from debt service requirements, little or no provision has recently been made for investment. The Ministry of Finance generally adjusts the budget downward depending on the availability of Government funds, as in 1971, discussed in paragraph 6.08.

6.31 At negotiations, it was agreed that future annual railway budgets would be agreed on between ENFE, the Government and IDA.

##### (ii) Accounts

6.32 ENFE's accounting system is not entirely satisfactory. Operating accounts do not present an accurate picture because of the lack of, or inadequacy of, depreciation provisions and the existence of many suspense accounts awaiting clearance (Annex 17); the balance sheets give an inaccurate financial picture due to a lack of proper fixed asset records, both physical and financial, plus the previously mentioned suspense accounts and insufficient depreciation provisions. A small, inadequate computer has been purchased and will soon have to be replaced. There is a need for more adequate training of staff.

6.33 The UNDP-financed technical assistance includes provision for expert advice on computer requirements and for assistance in making the revisions necessary to bring the accounting up to a satisfactory standard, together with training for accounting personnel.

(iii) Audit

6.34 External audit is carried out by the audit section of the "Comptroller General of the Republic". Due largely to a shortage of staff, the audit of ENFE's accounts has been considerably delayed over recent years. However, that for the year 1970 has been completed, and the draft report has recently been received. Many detailed criticisms in the report indicate a lack of training among the accounts staff, with consequent deficiencies in internal control, a situation which should improve with the technical assistance referred to in paragraph 6.33. The audit procedures and scope of work appear satisfactory. The Comptroller General has agreed that, although the audit of 1971 accounts, which is now in process, will be delayed in the process of making up arrears, from then onward annual audited accounts would be submitted to the Association no later than six months after the end of the financial year. This was agreed during negotiations and the undertaking will be incorporated in the credit documents.

7. AGREEMENTS REACHED AND RECOMMENDATION

7.01 During credit negotiations, agreement was reached on the following principal points:

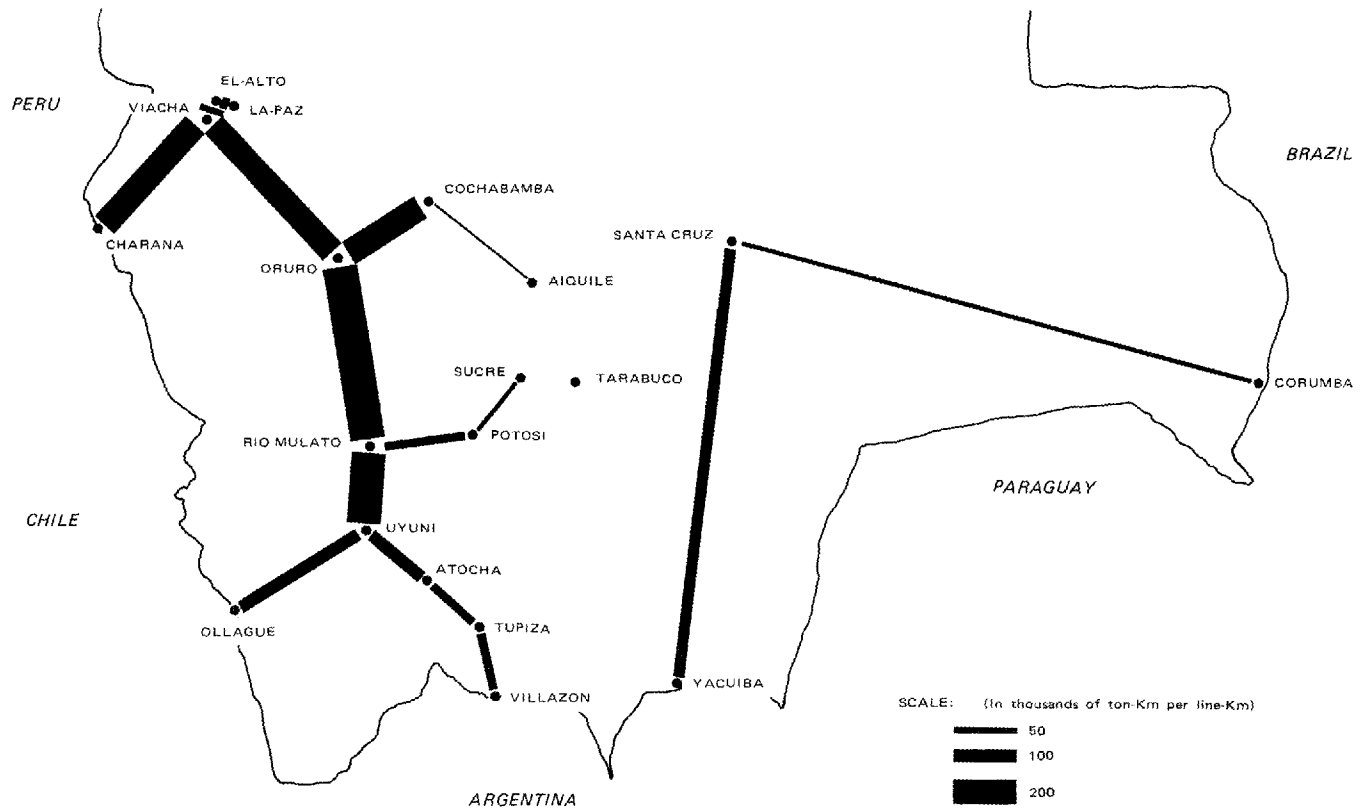
- (a) ENFE will carry out the agreed action program for improving operations, maintenance facilities and practices, and commercial practices; for rehabilitation of track and equipment; and for reduction and redeployment of staff (para. 3.03);
- (b) ENFE will achieve agreed financial targets (para. 6.24);
- (c) ENFE will restrict its long-term debt (para. 6.24);
- (d) Investments for: (i) extension of the Santa Cruz-Puerto Mamore Line to Trinidad will be made only after economic studies have been carried out and the Association has been given a reasonable opportunity to exchange views with the Government; and (ii) interconnecting of ENFE's East and West Lines will be carried out only if justified by economic analysis satisfactory to the Government and the Association (para. 3.10);
- (e) Government will ensure that ENFE will be isolated from any financial implications regarding the Santa Cruz-Puerto Mamore Line (or any extensions) (para. 3.10);
- (f) The Sucre-Tarabuco Line will be closed by June 30, 1973 (para. 5.09);

- (g) The Cochabamba-Aiquile Line will be closed if a study of a road extension, to be carried out by the Government, proves the highway to be the more economic alternative; or, if the study shows that the railway line is more economic, then specific subsidies will be paid to ENFE to cover the losses incurred on that line (para. 5.10);
- (h) Annual budgets, both for operations and investment, will be agreed by ENFE, the Government and the Association, and Government will provide all funds required, in accordance with these budgets, on a revolving fund basis (paras. 6.29 and 6.31).

7.02 The proposed project provides a suitable basis for a credit of US\$8.0 million equivalent to the Government of Bolivia. The proceeds of the proposed credit will be made available by the Government of Bolivia to ENFE, to be repaid over a period of 25 years, including five years of grace, at an annual rate of interest of 7-1/4%. A project agreement has been negotiated and will be concluded between the Association and ENFE.

November 15, 1972

**BOLIVIA**  
**BOLIVIAN RAILWAYS FREIGHT TRAFFIC DENSITY (1969)**  
 (in ton-km per line-km)



SCALE: (In thousands of ton-Km per line-Km)

	50
	100
	200





BOLIVIA

APPRAISAL OF A RAILWAY PROJECT  
Railway Costs and Revenues per Pass-km  
and Ton-km in \$b \*

1US\$ = 12 \$b

Category of Service	COSTS PER TRAFFIC UNIT						Average Revenue Per Traffic Unit		
	Fully Distributed		Marginal Cost				Western	Eastern	
	Western	Eastern	Western		Eastern				
			1/	2/	1/	2/			
a) <u>Passengers</u>									
1st Class	0.760	0.337	0.404	0.260	0.175	0.105	0.146	0.152	
2nd Class	0.158	0.112	0.080	0.058	0.057	0.035	0.076	0.073	
Ferrobuses (Railcars)	0.180	0.148	0.084	0.062	0.069	0.051	0.098	0.177	
Autocarriles	0.674	0.328	0.365	0.358	0.152	0.144	0.097	0.144	
b) <u>Baggage &amp; Parcels</u>	2.066	1.618	1.021	0.833	0.882	0.702	1.085	1.226	
c) <u>Freight</u>									
Complete Car Loads	0.300	0.357	0.153	0.118	0.167	0.128	0.309	0.275	
LCL	0.781	0.517	0.371	0.285	0.242	0.192	0.374	0.204	
Average	0.317	0.364	0.161	0.125	0.171	0.131	0.314	0.271	

1/ With depreciation  
2/ Without depreciation

\* Source: "Costos De Los Transportes" Mision SOFRERAIL en Bolivia, February 1971 (based on 1969 data)

December 1971



BOLIVIA

APPRAISAL OF A RAILWAY PROJECT  
Marginal Cost (in \$b) of Road Transport\*

	FREIGHT **			PASSENGERS ***		
	<u>La-Paz Oruro</u>	<u>Oruro- Cochabamba</u>	<u>Cochabamba- Santa Cruz</u>	<u>La-Paz Oruro</u>	<u>Oruro- Cochabamba</u>	<u>Cochabamba- Santa Cruz</u>
(a) <u>Cost Relating to Vehicle-km</u> (in \$b per km)						
Fuel	0.3339	0.4095	0.2835	0.4410	0.4977	0.3780
Lubricants	0.0642	0.0762	0.0579	0.0768	0.0881	0.0705
Repairs	0.2417	0.3222	0.2124	0.2204	0.2939	0.2571
Tires	0.1954	0.2199	0.1954	0.2513	0.2932	0.2513
Washing	0.0050	0.0050	0.0050	0.0200	0.0200	0.0200
Grease	0.0026	0.0033	0.0028	0.0028	0.0033	0.0028
(b) <u>Annual Vehicle Costs</u> (in \$b per annum)						
Driver & assistants	24,300	24,300	24,300	24,300	24,300	42,300
Amortization & interest	15,457	15,457	16,936	30,528	30,528	30,528
Insurance	9,120	9,120	9,120	14,320	14,320	14,320
Annual run (in km)	45,000	45,000	65,000	70,000	70,000	70,000
Costs per km	1.929	2.122	1.531	2.000	2.184	1.980
Average load (in tons or passengers)	4.9	4.2	3.5	18.0	18.0	16.0
Operational costs per unit-km	0.393	0.505	0.437	0.111	0.121	0.123
Road maintenance costs per unit-km	0.012	0.010	0.014	0.005	0.005	0.007
Marginal costs of road transport	0.405	0.515	0.450	0.116	0.126	0.130

\* Source: Based on SOFRERAIL study on road transport, September 1971 - reviewed by Bank's mission.

\*\* Based on costs for a 7-ton truck.

\*\*\* Based on costs for buses.

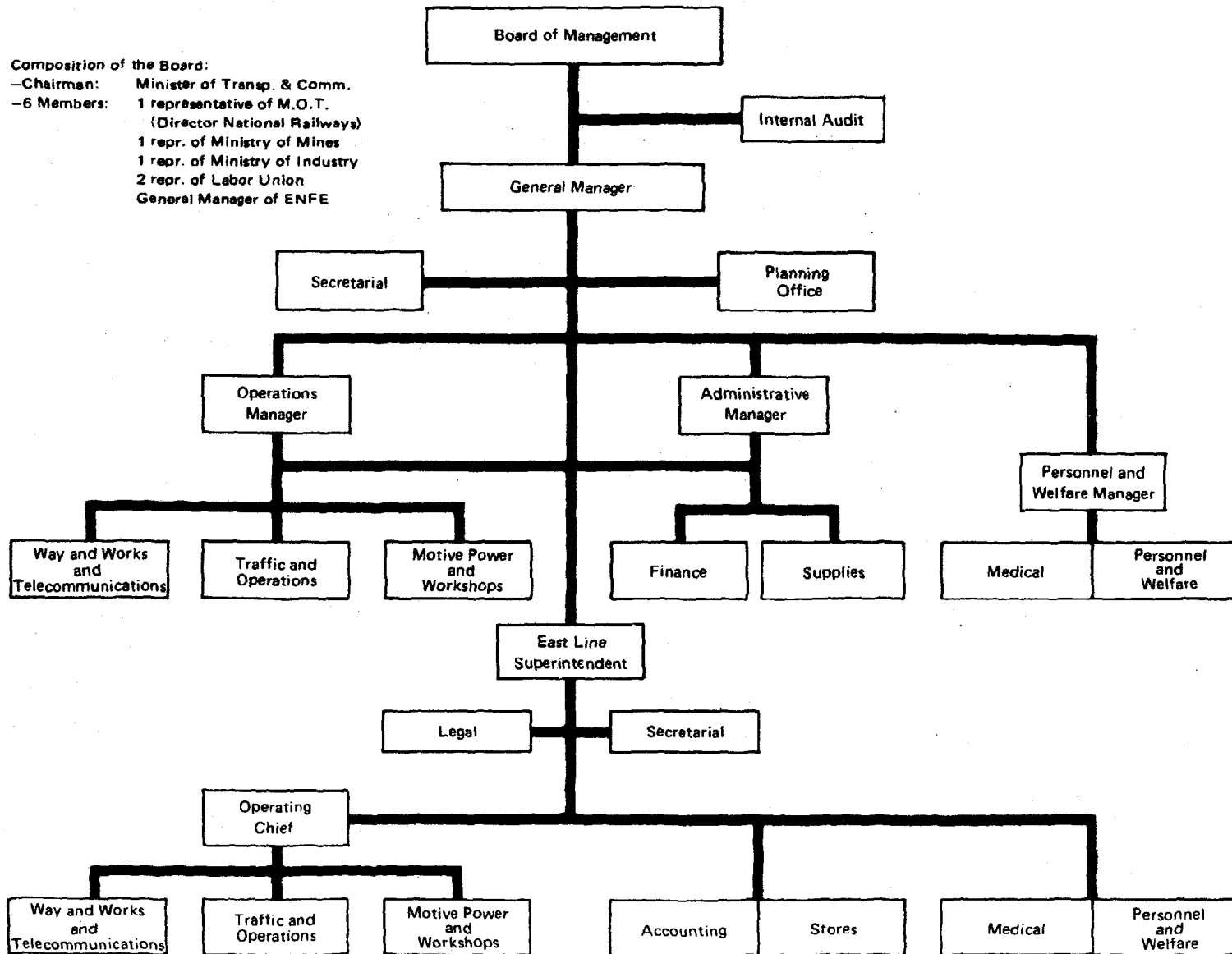
December 1971



**BOLIVIA  
BOLIVIAN RAILWAYS  
ORGANIZATION CHART**

**Composition of the Board:**

- Chairman: Minister of Transp. & Comm.
- 6 Members: 1 representative of M.O.T.  
(Director National Railways)
- 1 repr. of Ministry of Mines
- 1 repr. of Ministry of Industry
- 2 repr. of Labor Union
- General Manager of ENFE





BOLIVIA

APPRAISAL OF A RAILWAY PROJECT

Time-Phased Action Programs

A. Rehabilitation of Track

1. Rehabilitation of track requires (i) the upgrading of the present track conditions to an adequate level, followed by (ii) the execution of periodic maintenance work. Rehabilitation schemes have been developed on this basis and have been implemented since May 1971 on two pilot zones, mainly to serve as on-the-job training.

2. Implementation of the track rehabilitation program is scheduled as follows:

- in 1972: extension of the pilot schemes to 15 zones
- by mid-1974: extension to the whole of ENFE (150 zones).

B. Diesel Motive Power and Rolling Stock

1. Diesel Motive Power

	<u>End 1971</u> <u>in running /1</u> <u>in fleet</u>	<u>Number of locomotives or rail cars:</u> <u>to be in running condition /1 by:</u>				
		<u>end 1972</u>	<u>end 1973</u>	<u>end 1974</u>	<u>end 1975</u>	
Main-line diesel locomotives	25	18	18	22	24	25
Shunting diesel locomotives	4	4	4	4	4	4
Diesel rail cars						
a) ferrobuses	10	6	8	9	10	10
b) automotors	2	0	0	2	2	2

/1 : in running condition means locomotives and rail cars available for service. It includes units undergoing scheduled repair work (but excludes, for instance, units unavailable due to such causes as major accidents and extensive delays in obtaining spares).

2. Rolling Stock

(i) Passenger cars: out of the present total fleet of 121 cars, 73 cars will be scrapped over the next 5 years, leaving 48 cars in running condition but needing rehabilitation, i.e., a major overhaul.

The rehabilitation program is to be carried out as follows:

3 cars in 1972  
 22 cars in 1973  
23 cars in 1974

Total 48 cars

(ii) Freight cars: out of the present total fleet of 1,843 cars, 823 cars will be scrapped over the next 5 years, leaving 1,020 in running condition but needing rehabilitation, namely general overhaul of the running gear, the brake equipment and the flooring.

The rehabilitation program is to be carried out as follows:

60 cars in 1972  
 140 cars in 1973  
 300 cars in 1974  
 300 cars in 1975  
220 cars in 1976

Total 1020 cars

3. Execution of this rehabilitation program requires that action be taken in two related fields:

(i) Spare Parts

- a) ordering of 1973/74 spares by April 1973, in order not to delay the rehabilitation program;
- b) completing the listing of components required for the rest of the plan period by December 1973; and
- c) setting up, by December 1973, of an organized stores and supply system based on a stock control organization placed under the responsibility of the Technical Department, and a centralized supply office.

(ii) Concentration and Modernization of Workshops

- a) Concentration: (1) Repair work to be specialized as follows:

Viacha workshop: repair of diesel motive power, ferrobuses and automotors for both systems (Western and Eastern).

Uyuni workshop: repair of passenger and freight cars for the Western System.



**Robore workshop:** repair of passenger and freight cars for the Eastern System.

(2) arising from the above, closure of Cochabamba, Sucre and Potosi workshops, and conversion of Tupiza, Santa Cruz and Oruro workshops into running sheds;

(3) the above to be fully implemented by December 31, 1976.

(b) Modernization: Modernization and reorganization schemes, now being studied, to be completed and implemented:

- by mid-1974 for the car workshop at Robore and by December 1974 for that at Uyuni

- by mid-1974 for the diesel motive power workshop (Vlacha).

C. Staff Redeployment and Reduction

To keep the labor force commensurate with the improvements gained from modernization resulting from application of the five-year Investment Plan, the rehabilitation of services and the concentration of workshops, staff members should be reduced to 5,500 by end of 1977. The reduction is to be effected in steps, according to the table below, so as to ease the financial burden involved in paying retirement benefits.

Year	:	mid 1972	end 1973	end 1974	end 1975	end 1976	end 1977
ENFE's labor force:		6,250	6,150	6,050	5,900	5,700	5,500

D. Reorganization of Operations

Reorganization of operations is based on the following main actions:

- (i) setting up and implementation of a Transportation Plan, giving the trains required to carry the forecast traffic (composition, routing, time table);
- (ii) creation of train control offices;
- (iii) setting up of a car allocation system adapted to ENFE's requirements;
- (iv) reorganization of marshalling yards.

The timing of the above will be as follows:

1. Transportation Plan

- 1.1 Western System: has been introduced in July 1971.
- 1.2 Eastern System: is to be introduced by mid-1973.

2. Train Control

The main office, located at Oruro, has been effective since July 1971. A sub-office, located at Uyuni, will be made effective by mid-1973.

3. Car Allocation

The new system, now being studied, is to be made effective by March 1973.

4. Marshalling Yards

Instructions covering the new organization were ready for application in July 1972.

E. Commercial Policies

Setting up of commercial policies comprises (i) the introduction of a new tariff structure and (ii) the creation of a Commercial Department responsible for marketing, sales promotion, study of new transport techniques, and tariffication. The timing of the above will be as follows:

1. New tariff structure

Studies for a new tariff structure, based on costs and competition, have been carried out. The new structure for freight traffic was applied on July 15, 1972 and that for passenger traffic is to be ready by March 1973 and introduced by mid-1973.

2. Commercial Department

The organization of this department has been prepared and agreed on, but lack of qualified staff has prevented actual start of operations. Staffing is now in process, mostly by outside recruiting (a Department Head was appointed in October 1971) and training of new recruited staff will require about three months.

The Commercial Department is to be fully operational by March 1973.

F. Planning Unit

ENFE will set up a Planning Unit, to report directly to the General Manager, responsible for (i) the formulation of company policy; (ii) long-range planning, updating and carrying forward of the Investment Plan; (iii) setting up and monitoring management controls; (iv) statistics; and (v) traffic costing. This Planning Unit will be fully operational by the end of 1972.

G. Superintendence of Personnel and Welfare

The organization chart for the reorganized Superintendence of Personnel and Welfare is given on page 7 of this Annex. The Division of Personnel and Welfare will be the executive group, responsible for direct contacts with the employees, the maintenance of adequate personnel records, training, and the administration of fringe benefits. The Rules and Procedures section, with the basic function of preparing, maintaining, and updating the approved regulations, will play a pivotal role in the establishment of unified management procedures for the Western and Eastern Systems. The reorganization is under way and is to be completed by March 1973.

H. Finances and Accounting

1. Operating targets

ENFE will take all measures necessary, including tariff revisions, to improve revenues sufficiently to achieve the following targets:

	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
Working Ratio %	101	97	90	84	79
Operating Ratio %	116	112	104	98	92

In arriving at the operating ratio, adequate provision for depreciation will be made, based on revised values of fixed assets and on realistic asset lives, the annual amount being not less than \$b 24 million.

2. Tariff

New tariffs were introduced in July 1972 for freight and will be introduced in mid-1973 for passengers, both incorporating selective tariff increases, bearing in mind highway competition, which will increase revenues by about 10%.

3. Accounting

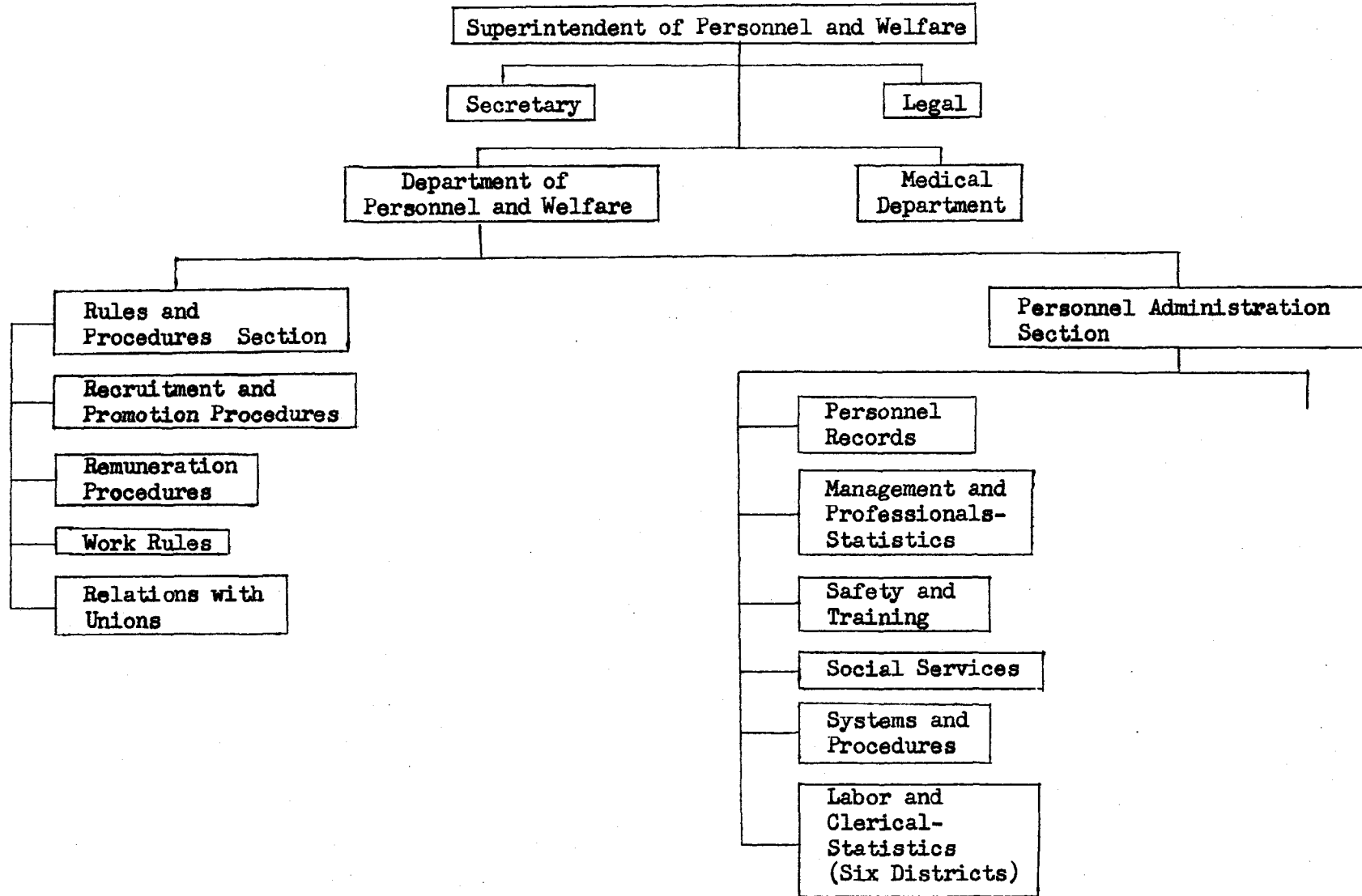
ENFE's balance sheets will be improved by the end of 1972 by:

- (i) clearance of the suspense accounts - "Cargos Diferidos" and "Abonos Diferidos";
- (ii) clearance of old outstanding items in "Activo Transitorio"; and
- (iii) completing the identification and valuation of fixed assets now commenced, together with preparation of proper depreciation schedules, all to be reflected in the 1972 balance sheet.

The accounting system will be revised by the end of 1972 so that not only will the operating expenses be presented in the normally accepted railway form, but such essential information as costs of labor, fuel, materials, contractors, car rentals, loss on "pulperias" etc. be readily available, and the accounting information provided will facilitate the calculation of traffic costs.

October 1972

REORGANIZED SUPERINTENDENCE OF PERSONNEL AND WELFARE





BOLIVIA

APPRAISAL OF A RAILWAY PROJECT

Brief Description of Railway Property

A. Track and Structures

Track, structures and buildings, although not in good condition, are adequate for the levels of traffic. Needs exist, however, for replacement of sleepers and of track fittings, together with considerable arrears in replacement of old, worn, or corroded rail. To avoid the periodic closure of the Oruro-Cochabamba line during wet seasons, a minimum investment is needed for improved protection against flood, soil slides and river erosion. Existing old timber bridges on the Uyuni-Antofagasta section, dating from the time of line construction, have to be replaced by steel structures. Maintenance tools, a minimum of stone ballasting (at present, track is supported by earth ballast) and rail joint welding are also needed to bring about further improvement in maintenance standards and in traffic operations (fewer speed restrictions).

A time-phased program to upgrade the track from the present condition to a level adequate to enable the execution of periodic maintenance has been prepared (Annex 5, section A). Implementation of this program has started with the help of consultants on two pilot schemes, to serve mainly as an on-the-job training, due to the very limited facilities of ENFE in track maintenance equipment and the acute shortage of track material (sleepers and fastenings). Performance should substantially improve when better tools and adequate material and supplies become available.

Train control is made by token system or by line order system; although somewhat primitive, it is adequate for the light level of traffic to be carried. Improvement in ENFE's telecommunication network, which is in extremely poor condition and hampers operations, is fundamental, and should be considered a high priority item.

B. Motive Power - Rolling Stock

The fleet comprises 92 steam locomotives, 29 diesel engines (25 main line and 4 shunter), 12 diesel rail cars, 198 passenger and 1,843 freight cars as detailed on page 3 of this Annex. The diesel equipment and 100 freight wagons were acquired with suppliers' credits, 10 rail car sets from Germany and the rest from Japan, in 1968.

Diesel locomotives and rail cars, although almost new, have a poor availability of 76% and 60% respectively. Passenger and freight cars are generally old and poorly maintained. Because of the lack of serviceable

freight cars, ENFE has to use permanently about 350 to 400 cars from neighboring countries (Argentina, Chile). Although the rental charges are not excessive, reliance on other countries for such a large number of cars inhibits good operational planning with the inherent risk of failure to receive cars when urgently needed. The poor condition of most equipment is due mainly to lack of spares.

C. Workshops

Maintenance of equipment, which is one of the weakest areas of ENFE, is performed in too many shops: four on the Western System and two on the Eastern System. All these workshops are old and the facilities are quite unsuitable to carry out repair of modern equipment. Labor mostly lacks the basic training to carry out maintenance in an efficient and modern way, mainly in the field of diesel locomotives and rail cars.

Rehabilitation of motive power and rolling stock is a key factor in the overall rehabilitation of ENFE, and is fundamental toward improvement of operations. This requires, in addition to the setting up of organized maintenance schemes and the training of qualified staff, the concentration and modernization of workshops and the reorganization of the present stores and supply system.

A time-phased rehabilitation program has been prepared, aiming at: (i) reorganizing the present spares supply system by 1973, (ii) increasing the availability of all equipment to 85-90% by 1975, and (iii) reducing the number of workshops for both systems to three in 1976 (Annex 5, section B). With the help of consultants, implementation has already started.



Fleet of Motive Power and Rolling Stock  
(as of December 31, 1971)

1. Age distribution:

	Total	Age Distribution		
		less than 10 years	from 10 to 30 years	over 30 years
Steam locomotives	92	-	48	44
Diesel main line engines	25	25	-	-
Diesel shunters	4	4	-	-
Diesel rail cars	12	12	-	-
Passenger coaches	198	-	3	195
Freight cars	1,843	100	492	1,251

2. Passenger coach breakdown:

First class and saloon cars	:	33
Second class and mixed cars	:	61
Sleepers	:	15
Dining cars	:	12
Auxiliary cars	:	18
Service coaches	:	17
Cabooses	:	19
Baggage vans	:	<u>23</u>
Total		198

3. Freight car breakdown:

Box cars	:	792
Gondola cars	:	266
Flat cars	:	326
Livestock	:	113
Tank cars	:	191
Refrigerated cars	:	4
Others	:	<u>151</u>
Total		1,843



BOLIVIAAPPRAISAL OF A RAILWAY PROJECTNew Lines Under Construction or ProposedA. Under Construction

1. The Argentine and Bolivian Governments agreed in 1967 to extend the Yacuiba-Santa Cruz line northward to a navigable point on the Rio Mamore in order to encourage the economic development of northeastern Bolivia and strengthen links between Bolivia and Argentina. A joint mixed Argentine-Bolivian commission is supervising the construction. The finance is supplied by Argentina with repayment guaranteed by the sales of Bolivian oil to Argentina. The 102-km section to Santa Rosa has been completed and construction is in progress on the second 104-km section from Santa Rosa to Rio Yacapani. Final design has been completed for the third 104-km section ending at Rio Mamore; this 310-km line is being built to higher standards than most of ENFE's network and its cost is estimated at about US\$30 million. The two Governments have also recently agreed to study an extension of a further 140 km to the town of Trinidad.

2. The potential of the country to be opened up by the line has not been established by any economic study. Further, the possibility of other transport modes, particularly the construction of roads, seems to have been ignored in the decision to promote economic integration of this area. The Government appears determined to proceed with the project as agreed with Argentina.

3. Presently there are no commercial operations on the section that has been completed. However, rather than allowing the track and facilities to deteriorate through lack of use (as happened to much of the Eastern System lines), potential traffic should be sought and operations should start. If ENFE is required to manage these operations, which are likely to result in deficits in the early stages, the resulting losses should be compensated by specific reimbursement and the finances of this line should be separated from those of ENFE, until such time as the line becomes viable.

B. Proposed

4. The linking of the Eastern and Western Systems has often been examined. Three alternative routes can be considered: (a) from Aiquile to La Florida (about 250 km); (b) from Tarabuco to Cuevo (about 200 km), the 50-km section Cuevo-Boyuibe, having already been built for that purpose; and (c) the connection of Cochabamba with the new line under construction from Santa Rosa to Rio Yacapani at a point near the Rio Mamore. It should be noted that the DMJM transport survey concluded that there was no economic

justification for construction of this rail link within the immediate future (the cost estimate of about US\$30 million used seems on the low side when compared with other lines). Construction of such a link should be undertaken only if proved economically feasible.

October 1972

BOLIVIA

APPRAISAL OF A RAILWAY PROJECT

Western System Freight Traffic  
Actual for 1969-1971 and  
Projected for 1972-1977

Products	1969		1970			1971*		Average		1972		1973		1974		1975		1976		1977		Average Haul (km)
	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	Average Haul (km)	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	
<b>Industrial Commodities</b>																						
Orsa	177.3	56.0	171.3	54.1	315.8	159.4	46.7	396.6	160.3	49.7	173.4	52.7	186.9	55.8	201.7	58.9	215.4	62.0	226.9	65.1	286.9	
Steel & tubing for construction	37.3	19.5	24.1	12.6	522.9	30.4	11.2	364.4	30.6	16.0	39.2	20.5	41.1	21.5	43.2	22.6	45.3	23.7	47.2	24.7	522.8	
Petroleum products	42.4	17.2	45.4	18.4	405.7	68.7	19.7	286.7	47.8	13.4	51.6	20.9	55.7	19.9	60.2	21.5	65.0	23.2	70.0	25.0	356.9	
Cement	n.a.	5.7	n.a.	5.9	n.a.	12.6	4.2	333.3	15.7	5.7	32.2	11.0	34.8	11.9	37.6	12.9	40.6	13.9	42.4	14.5	312.3	
Timber	n.a.	7.3	n.a.	6.8	n.a.	25.0	7.3	222.0	16.5	7.3	16.5	7.3	16.5	7.3	16.5	7.3	16.5	7.3	16.5	7.3	16.5	7.3
Chemical products	n.a.	5.5	n.a.	5.2	n.a.	15.1	4.7	311.2	21.7	6.5	21.7	6.5	21.7	6.5	21.7	6.5	21.7	6.5	21.7	6.5	21.7	6.5
Lubricants	4.0	1.7	8.9	3.3	425.0	2.0	0.8	400.0	4.2	1.9	4.4	2.1	4.6	2.3	4.7	2.5	4.7	2.6	4.7	2.6	4.7	2.6
Vehicles	6.7	3.7	3.1	1.6	552.2	10.1	4.0	395.0	6.7	3.7	7.0	3.9	7.4	4.1	7.8	4.3	8.2	4.5	8.5	4.7	553.2	
Paper	8.2	2.4	14.0	4.1	222.7	9.9	2.6	262.6	9.4	2.7	9.8	2.9	10.3	3.0	10.7	3.2	11.2	3.3	11.6	3.4	292.7	
Lines/Planters	n.a.	3.3	n.a.	3.5	n.a.	11.7	3.5	299.2	11.0	3.3	11.7	3.5	12.0	3.6	12.7	3.8	13.3	4.0	14.0	4.2	300.0	
Subtotal*	n.a.	133.3	n.a.	115.3	n.a.	312.9	121.7	345.1	324.9	116.2	367.5	131.3	391.0	135.9	416.8	143.5	441.9	151.0	463.5	158.0	310.8	
<b>Agricultural Products</b>																						
Sugar	n.a.	9.4	n.a.	4.6	n.a.	7.4	2.1	283.7	21.2	9.4	21.9	9.7	23.1	10.0	23.3	10.3	24.3	10.7	25.1	11.1	413.0	
Flour	100.9	48.0	85.1	40.5	475.7	110.9	59.1	419.4	98.0	49.8	96.0	48.8	94.0	47.8	92.0	46.7	90.0	45.7	90.0	45.7	508.3	
Wheat	33.3	20.8	31.5	17.2	621.6	47.8	28.9	604.6	36.8	23.6	42.1	27.5	47.4	31.4	52.7	35.3	58.0	39.3	61.0	41.3	677.6	
Potatoes	n.a.	1.0	n.a.	1.1	n.a.	n.a.	n.a.	n.a.	9.0	1.9	13.2	2.8	17.0	3.6	21.2	4.5	24.9	5.3	28.2	6.0	212.9	
Corn	n.a.	0.4	n.a.	0.4	n.a.	n.a.	n.a.	n.a.	0.9	0.4	0.9	0.4	0.9	0.4	0.9	0.4	0.9	0.4	0.9	0.4	413.0	
Rice	n.a.	0.5	n.a.	0.8	n.a.	1.5	0.4	266.6	2.4	0.8	2.4	0.8	2.7	0.9	2.7	0.9	3.0	1.0	3.0	1.0	333.3	
Coffee	3.3	1.7	3.8	0.9	212.1	1.8	0.5	277.7	3.4	1.3	3.9	1.4	4.4	1.6	4.9	1.8	5.1	1.9	5.4	2.0	370.0	
Fruits	n.a.	5.1	n.a.	5.1	n.a.	16.7	5.5	322.3	12.9	7.0	24.1	8.5	28.4	10.0	33.0	11.6	37.5	13.1	41.8	14.7	352.0	
Cattle	n.a.	0.4	n.a.	0.5	n.a.	1.3	0.6	333.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dairy Products	5.4	2.3	5.2	2.1	425.0	3.7	1.6	340.4	5.4	2.3	5.1	2.1	4.8	1.2	4.6	1.2	4.4	1.1	4.4	1.1	251.0	
Subtotal	n.a.	80.6	n.a.	75.8	n.a.	222.6	99.7	411.3	197.0	96.5	209.5	102.0	222.7	106.9	235.3	112.7	248.1	118.5	259.8	123.3	474.5	
<b>Other Commodities</b>	n.a.	69.0	n.a.	66.6	n.a.	310.3	57.7	169.9	310.3	57.7	310.3	57.7	310.3	57.7	310.3	57.7	310.3	57.7	310.3	57.7	310.3	57.7
<b>TOTAL</b>	n.a.	282.9	n.a.	257.7	n.a.	745.8	261.1	288.2	867.7	270.4	917.4	291.0	954.0	300.5	972.4	313.9	1030.3	327.2	1063.6	339.0	318.7	

\* Tentative

\*\* Estimated traffic based on figures for first 5 months due to statistical discrepancies.

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ANNEX B(a)

BOLIVIA  
APPRAISAL OF A RAILWAY PROJECT  
Eastern System Freight Traffic  
Actual for 1969-1971 and  
Projected for 1972-1976

Commodity	1969			1970			1971			1972		1973		1974		1975		1976		1977		Average Haul (km)
	Ton (000)	Ton-km (millions)	Average Haul (km)	Ton (000)	Ton-km (millions)	Average Haul (km)	Ton (000)	Ton-km (millions)	Average Haul (km)	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	Ton (000)	Ton-km (millions)	
<b>Industrial Commodities</b>																						
Timber	16.8	6.4	381.0	21.7	9.1	417.4	31.3	15.2	485.6	24.7	11.3	27.8	13.9	30.9	16.7	34.0	19.7	37.0	23.0	40.0	24.9	621.6
Cement	21.0	10.7	509.5	3.4	1.4	429.3	1.8	0.6	333.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron & steel for construction	3.8	1.9	500.0	5.7	3.0	516.0	3.7	2.0	540.5	4.5	2.3	4.7	2.4	5.0	2.5	5.2	2.7	5.5	2.8	5.8	3.0	512.0
Tubing	58.3	26.3	451.1	3.6	1.2	337.3	55.4	13.4	241.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum products	-	-	-	-	-	-	3.8	1.3	342.1	1.5	1.0	1.6	1.1	1.8	1.1	1.9	1.2	2.0	1.3	2.2	1.4	661.0
Asphalt	1.4	0.8	539.0	0.8	0.4	539.0	5.2	2.8	538.4	3.0	1.6	3.0	1.6	3.0	1.6	3.0	1.6	3.0	1.6	3.0	1.6	539.0
<b>Total Industrial Commodities</b>	<b>101.3</b>	<b>46.1</b>	<b>455.1</b>	<b>35.2</b>	<b>15.1</b>	<b>429.0</b>	<b>101.2</b>	<b>35.3</b>	<b>348.8</b>	<b>33.7</b>	<b>16.2</b>	<b>37.1</b>	<b>19.0</b>	<b>40.7</b>	<b>21.9</b>	<b>44.1</b>	<b>25.2</b>	<b>47.5</b>	<b>28.7</b>	<b>51.0</b>	<b>30.3</b>	<b>605.9</b>
<b>Agricultural Commodities</b>																						
Cotton	0.5	0.3	539.0	1.0	0.6	539.0	7.1	4.0	563.3	26.4	15.7	35.0	20.8	40.0	23.8	45.0	26.8	50.0	29.8	58.0	34.5	595.0
Fruits	1.9	1.0	539.0	1.8	1.0	539.0	1.4	0.7	500.0	2.0	1.1	4.0	2.2	6.0	3.2	8.0	4.3	10.0	5.4	12.0	6.5	539.0
Flour	15.0	7.8	517.9	13.0	6.4	496.2	24.5	12.8	522.4	15.0	7.5	10.0	5.4	5.0	2.7	-	-	-	-	-	-	-
Sugar	0.5	0.2	427.5	8.3	4.3	523.4	6.8	3.6	529.4	10.0	5.4	10.0	5.4	10.0	5.4	10.0	5.4	10.0	5.4	10.0	5.4	539.0
Cattle	16.7	7.8	467.0	13.2	5.0	377.0	9.4	3.2	340.4	16.7	7.8	18.4	8.6	20.2	9.5	22.2	10.4	24.5	11.4	26.9	12.5	465.3
<b>Total Agricultural Commodities</b>	<b>34.6</b>	<b>17.1</b>	<b>424.2</b>	<b>37.3</b>	<b>17.3</b>	<b>463.9</b>	<b>49.2</b>	<b>24.3</b>	<b>413.1</b>	<b>70.1</b>	<b>37.5</b>	<b>77.4</b>	<b>42.4</b>	<b>81.2</b>	<b>44.6</b>	<b>85.2</b>	<b>46.9</b>	<b>94.5</b>	<b>52.0</b>	<b>106.9</b>	<b>58.9</b>	<b>550.9</b>
<b>Other Products</b>	<b>69.5</b>	<b>28.8</b>	<b>414.4</b>	<b>67.9</b>	<b>27.0</b>	<b>411.5</b>	<b>65.1</b>	<b>26.0</b>	<b>399.3</b>	<b>59.5</b>	<b>28.8</b>	<b>72.6</b>	<b>30.1</b>	<b>75.9</b>	<b>31.5</b>	<b>79.3</b>	<b>32.9</b>	<b>82.9</b>	<b>34.3</b>	<b>86.6</b>	<b>35.9</b>	<b>441.0</b>
<b>GRAND TOTAL</b>	<b>205.4</b>	<b>92.0</b>	<b>447.9</b>	<b>144.3</b>	<b>60.3</b>	<b>429.9</b>	<b>215.5</b>	<b>85.6</b>	<b>397.2</b>	<b>173.3</b>	<b>82.5</b>	<b>187.0</b>	<b>91.5</b>	<b>197.8</b>	<b>98.0</b>	<b>208.6</b>	<b>105.0</b>	<b>224.9</b>	<b>115.0</b>	<b>244.5</b>	<b>125.7</b>	<b>514.1</b>

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BOLIVIA

APPRAISAL OF A RAILWAY PROJECT

Underlying Assumptions for the  
Sectoral Traffic Forecast

1. Western System

1.1 Industrial Commodities

1.1.1 Ores

Ores production was estimated based on the report "Estudio Integral de los Transportas en Bolivia" prepared by Daniel, Mann, Johnson and Mendenhall. An origin and destination matrix for 1977 was prepared. Rail transport of ores amounted to 47 million ton-km in 1971, and is expected to reach 65.1 million ton-km in 1977, 5.7% growth rate per annum. The seven mineral commodities taken into account were tin, lead, antimony, wolfram, copper, zinc and bismuth, of which tin production is by far the most important. Bolivia's mineral deposits occur along the entire length of the Eastern Andes from Lake Titicaca to the Argentine border, and the original railway running the length of the country was developed primarily to serve the major mining districts. The railway carried 90% of total mineral traffic to the ports in 1969.

1.1.2 Steel and Tubing for Construction

Imports of steel and tubes for construction increased from 21,600 tons in 1962 to 63,200 tons in 1969, out of which the railway carried 65% or 41,080 tons on both networks. However, the general slowdown in the construction industry resulted in a decrease in rail transport on the Western System from 19.5 million ton-km in 1969 to an estimated figure of 11.2 million ton-km in 1971. If the economy returns to its normal level of activity (i.e., investments), rail transport of these commodities should reach 47,200 tons (or 24.7 million ton-km) in 1977.

1.1.3 Petroleum Products

Oil fields are located in the region of Santa Cruz. The overall transport of crude oil is handled by pipeline, either toward Argentina and Chile for export, or to the refineries of Sucre, Santa Cruz and Cochabamba. Based on the refineries' production and an origin-destination matrix regarding the products' distribution, rail transport should go up from 19.7 million ton-km in 1971 to 25.0 million ton-km in 1977.

1.1.4 Cement

Forecast of traffic was based on production estimates for the plants of Sucre, Viacha and Coboce (the latter started operation in 1972), and taking into account the fact that only cement to Oruro, Potosi, and La Paz will go by rail. The large increase in transport by rail is due to the start of operations at the Coboce plant, in the vicinity of Cochabamba and virtually on the railway line.

1.1.5 Timber

Traffic for local consumption of timber is handled both by rail and trucks. The difficulty in exercising railway advantages in carrying this type of traffic lies in the lack of rail connection between Santa Cruz -- the production area -- and Cochabamba on the Western System. Despite improvements expected in loading trains in Cochabamba, it was assumed that timber transport by rail will remain constant at its 1971 level.

1.1.6 Chemical Products

In 1969, ENFE handled 6.5 million ton-km of chemical products. Plans for a new phosphate fertilizer plant near Oruro and a magnesite processing plant near Cochabamba were not taken into account and the traffic expected in 1977 is retained at 6.5 million ton-km.

1.1.7 Lubricants

At present, the transport of lubricants is handled mainly by truck. With the improvements to the track, and a more aggressive commercial policy by ENFE, it can be expected that, in 1976, 50% of the traffic between Cochabamba and Oruro and La Paz will be handled by rail. In addition, the import of 2,500 tons of basic oils from Antofagasta to Cochabamba, as anticipated by YPFB (Yacimientos Petroliferos Fiscales Bolivianos), should also be carried by ENFE, thus increasing rail traffic in this category from 0.8 million ton-km in 1971 to 2.6 million ton-km in 1977.

1.1.8 Vehicles

During the period 1969-1971, the average transport by rail was about 6,700 tons. This figure has been assumed for 1972 rail transport with an annual growth rate of about 5% thereafter.

1.1.9 Paper and Office Supplies

The Ministry of Planning anticipates an increase of about 4% per year in demand for these products and this rate was applied to the expected traffic in 1972 assuming that total railway share (90%) and distribution of traffic among ports remain the same.



### 1.1.10 Lime and Plaster

Transport of lime and plaster is expected to grow beyond 1972 at about 5% annually (same rate of growth as that for other construction materials) and reach about 14,000 tons (4.2 million ton-km) in 1977.

## 1.2 Agricultural Products

### 1.2.1 Sugar

Sugar production is concentrated in four plants located in the region of Santa Cruz. Based on the estimates of "Comision Nacional de Estudios de la Cana de Azucar" the consumption of sugar in La Paz area in 1976 should reach about 50,000 tons. The lower rates on the railway between Cochabamba and La Paz, coupled with provision of better loading facilities in Cochabamba, should enable the railway to carry about 50% of sugar transport on this line (equivalent to 10.7 million ton-km). Beyond 1976, rail transport should grow at 4% annually.

### 1.2.2 Flour

Local production, although rising, does not meet the country's needs, and imports of 90,000 tons (and wholly by rail), are anticipated in 1976 according to "Direccion General de Comercio e Integracion". On the basis of various import points and the minimum route to each consumption center, the traffic will amount to 45.7 million ton-km or about 14% of total traffic by rail in that year. This is less than the 1971 level of traffic and is due to the increase expected in flour production, mainly in the Santa Cruz area. In 1977 imports are expected to maintain their 1976 level.

### 1.2.3 Wheat

Wheat production is inadequate to cover the demand, and the Ministry of Agriculture projects imports of about 81,000 tons of wheat by 1977. Should imports via Matarani (Peru) account for 25% of the total and not be transported by ENFE, total rail transport would amount to 61,000 tons or 41.3 million ton-km in 1977 (22,700 tons to La Paz, 18,800 tons to Cochabamba and 19,500 tons to Oruro), comprising about 12% of total rail traffic in the West.

### 1.2.4 Potatoes

The potato production is entirely for consumption within Bolivia. The Ministry of Agriculture intends to increase production in the Cochabamba and Santa Cruz areas where yields are higher, and this will introduce a deficit in La Paz area, making way for an increase in rail transport from 1.1 in 1970 to 6.0 million ton-km in 1977.

1.2.5 Corn

Bolivia's needs are met by domestic corn production, with 35% being marketed commercially, mostly by truck to La Paz region. Since the truck owners take part in the marketing of this commodity, it is unlikely that the railway can capture any additional traffic.

1.2.6 Rice

Most of the rice dealers haul their production with their own trucks. The 1977 forecast assumes that about 3,000 tons will be hauled by rail from Cochabamba (i.e., coming from Santa Cruz) to La Paz and Oruro.

1.2.7 Coffee

In 1970, coffee production reached 11,200 tons with exports of 3,600 tons. The internal transport from the Yungas region to La Paz is done by truck. If the anticipation of an export quota of 5,400 in 1977 materializes, traffic on ENFE lines should reach 2.0 million ton-km.

1.2.8 Fruits

The main fruits to be hauled on the Western System are bananas and oranges for exports. Internal transport of bananas and oranges will continue to be handled by truck. The estimates of banana exports by the Ministry of Agriculture were reduced from 50,000 tons of exports on both systems to 20,000 tons (10,000 on the Western System) as being more realistic; 5,000 tons of oranges are expected to be exported in 1976 via Arica. In addition, the railway should be able, with adequate cars, to handle 50% of the transport of "platanos" between Cochabamba and La Paz. The 1977 forecast assumes 4% growth in exports over 1976.

1.2.9 Cattle

Transport of cattle in 1971 amounted to 0.6 million ton-km on the Western System. Due to the distance from the production areas, mainly the Beni and Santa-Cruz, and to the anticipated decrease in imports by rail from Argentina with the expansion of Bolivia livestock, the traffic forecast does not show any cattle transport on the Western System in 1977.

1.2.10 Dairy Products

At present, the railway hauls about 5,000 tons of imported powdered and condensed milk from Antofagasta to La Paz. In the future, these imports will decrease due to the supply of powdered milk from Cochabamba, and the traffic forecast shows a decrease in transport by rail for dairy products.

1.2.11 Other Products

Rail transport of all other commodities has declined in the last two years, due to increasing road competition for these commodities. Although better loading facilities and better services are expected on the railways as a result of the investment plan, it is assumed that rail traffic will stay constant at the 1971 level.

2. Eastern System

2.1 Industrial Commodities

2.1.1 Timber

The Santa Cruz area is well forested and timber is one of the most promising export products in Bolivia. Exports of timber from Santa Cruz to Argentina (via Yacuiba) and to Brazil are projected by the Ministry of Agriculture to reach a level of 40,000 tons in 1977, as compared with 22,000 tons in 1970. This gives an overall transport of 23.0 million ton-km, all to be carried by rail, in view of the lack of roads in this part of the country.

2.1.2 Cement

No imported cement traffic is retained for 1976 based on the start of production of the Coboce plant (see cement traffic forecast for the Western System). It is assumed that all consumption in the Santa-Cruz region will be provided by the Sucre plant.

2.1.3 Iron and Steel for Construction

Imports by rail in this category amounted to 3,700 tons (2.0 million ton-km) on the Eastern System in 1971. It is assumed that transport of this product will grow at an average rate of 5% per annum (same growth rate as in the West), reaching a level of 5,800 tons and 3.0 million ton-km in 1977.

2.1.4 Tubing

In 1971, the Eastern System hauled 13.4 million ton-km (55,400 tons) of imported tubing to be used in building the gas pipeline to Argentina. The pipeline has been completed and no traffic in this category is expected in the period 1972-1977.

2.1.5 Petroleum Products

YPFB is building a storage center in Corumba to cater for the consumption of that region. Present annual consumption is estimated at 1,500 tons or 1 million ton-km (distance from Corumba to Santa Cruz is 651 km). An 8% annual increase from 1972 gives 2,200 tons in 1977, corresponding to 1.4 million ton-km.

### 2.1.6 Asphalt

YPFB expects to import 400 tons of asphalt per month to be used mainly in the improvement of the road from Santa Cruz to Cochabamba. Since this figure is not certain, an estimate of 3,000 tons (1.6 million ton-km) was retained for 1977. (Average annual transport in the period 1969-1971 was about 2,500 tons.)

## 2.2 Agricultural Products

### 2.2.1 Cotton

A loan of US\$10 million was recently given by a consortium including First National City Bank and Banco Do Brazil for the development of cotton in the Santa Cruz region. The cotton producing area increased from 6,000 hectares in 1968 to 17,250 hectares in 1970, and is estimated at 45,000 hectares in 1972, and there are no marketing problems (indications are that potential customers are ready to buy at reasonable prices all the production for the next five years). Production will amount to 31,000 tons in 1972, out of which 4,600 tons will be for internal consumption and will be carried by trucks. Export traffic will reach 26,400 tons or 15.7 million ton-km (assuming 50% via Argentina and 50% via Brazil). Although First National estimates a doubling of production by 1973, the following more conservative forecasts for exports were retained: 35,000 tons in 1973 increasing to 58,000 tons (34.5 million ton-km) in 1977.

### 2.2.2 Fruits

The Ministry of Agriculture estimates that, by 1977, 20,000 tons of bananas will be exported to Argentina from the Santa Cruz region. The forecast for rail traffic has been conservatively reduced to 12,000 tons or 6.5 million ton-km. Transport of this produce by rail will require modifications to box-cars to prevent damage to the fruits but this should not present special problems.

### 2.2.3 Flour

At present 25,000 tons of flour are imported by rail from Argentina. The installation of a mill in Santa Cruz and growth of wheat crops in the area will eliminate the need to import flour to the Santa Cruz area, and from 1975 onward no rail traffic is expected in this category.

### 2.2.4 Sugar

A sugar quota of 10,000 tons will be exported in 1977 to the United States via Rosario (Argentina). This transport from Santa Cruz on the Eastern System will result in a traffic of 5.4 million ton-km.

2.2.5 Cattle

Cattle are hauled by rail from the Corumba area to slaughterhouses in Santa Cruz or for further transport to Cochabamba by trucks. The expansion of meat production should increase this traffic on the Eastern System. Estimates of the Ministry of Agriculture are for a 10% annual increase in production over the period 1972-1976. Thus, total tonnage shipped by rail (assuming the same annual rate of increase and 1972 traffic at the 1969 level) will be 27,000 tons in 1977 or 12.5 million ton-km.

2.2.6 Other Products

Traffic is expected to reach a level of 70,000 tons in 1972 and, with the lack of road competition, should grow annually at 4.5%.

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## BOLIVIA

APPRAISAL OF A RAILWAY PROJECTMacro-Economic Model for  
Forecasting Traffic on the  
Western System

The regression used for this analysis relates total ton-km hauled on the Western System to GDP (in 1958 prices) in four main sectors: (agriculture, mining, construction, manufacturing) and to average revenue per ton-km in constant prices in the following form:

$$TK = K (GDP)^J (AR)^{\beta}$$

where: TK = Total ton-km  
 GDP = Gross Domestic Product as defined above  
 J = Elasticity of TK to GDP  
 AR = Average Revenue per ton-km in constant prices  
 β = Elasticity of TK to AR

The data used for the Western System cover the years 1960-1969:

Year	(in millions) TK	(in million \$b) GDP (in 4 main sectors)	(in \$b) AR in 1958 Prices
1960	154.7	2059	0.251
1961	175.4	2094	0.237
1962	190.0	2180	0.215
1963	221.7	2349	0.190
1964	197.2	2446	0.182
1965	246.8	2654	0.181
1966	231.6	2810	0.198
1967	258.0	2966	0.181
1968	268.0	3155	0.163
1969	280.9	3286	0.163

The main results are:

- (1)  $J = 0.69$   
 $\beta = -0.52$
- (2) The coefficients are statistically significant
- (3) The multiple correlation is 0.96

These coefficients were used to predict future freight traffic on the Western System and compare it with the results of the sectoral traffic analysis.

BOLIVIA

APPRAISAL OF A RAILWAY PROJECT

Passenger Traffic by Category of Service

Actual for 1965-1971 and Projections for 1972-1977

	TRAINS									AUTOCARRILES			FERROBUS ES			TOTAL		
	1st Class			2nd Class			Total			P	PK	R	P	PK	R	P	PK	R
	P 1/	PK 2/	R 3/	P	PK	R	P	PK	R									
<b>Western Network</b>																		
1965	144	36	249	1,153	124	108	1,297	160	123	17	6	349	-	-	-	1,314	166	126
1966	112	31	279	852	120	140	964	151	156	268	21	78	-	-	-	1,232	172	140
1967	97	28	290	836	123	147	933	151	162	278	25	90	12	5	423	1,223	181	148
1968	66	16	245	783	112	143	849	128	151	151	11	49	150	60	400	1,213	199	164
1969	82	15	181	622	96	154	704	111	157	83	5	65	177	76	432	964	192	200
1970	79	15	193	642	100	156	721	115	160	75	5	69	206	90	437	1,002	210	210
1971	83	27	325	601	113	187	684	140	204	66	5	81	164	65	397	914	210	230
1972	20	9	449	739	118	160	759	127	168	-	-	-	250	86	343	1,009	213	211
1973	20	9	449	728	119	164	748	128	172	-	-	-	262	90	343	1,010	218	216
1974	20	9	449	718	121	168	738	130	176	-	-	-	274	94	343	1,012	224	221
1975	21	9	449	708	122	172	729	131	180	-	-	-	287	99	343	1,016	230	226
1976	21	9	449	699	123	176	720	132	184	-	-	-	301	103	343	1,021	235	231
1977	21	9	449	699	123	176	720	132	184	-	-	-	315	108	343	1,026	241	235
<b>Eastern Network</b>																		
1965	23	5	234	269	39	145	292	44	152	24	3	122	-	-	-	316	47	150
1966	39	10	264	236	40	170	275	50	184	27	4	126	-	-	-	302	54	178
1967	23	6	278	197	32	159	220	38	171	18	3	180	-	-	-	238	41	172
1968	20	4	177	159	28	180	179	32	180	6	2	311	41	16	380	226	50	219
1969	33	5	165	173	38	218	206	43	210	5	2	365	46	18	390	257	63	245
1970	22	5	245	159	34	215	181	39	218	9	3	392	38	16	415	228	58	258
1971	15	5	344	162	34	211	177	39	222	6	2	385	41	18	458	221	59	265
1972	5	3	539	176	39	220	181	42	230	-	-	-	48	20	416	229	62	270
1973	6	3	539	181	41	225	187	44	234	-	-	-	51	21	416	238	65	273
1974	6	3	539	186	43	230	192	46	240	-	-	-	54	22	416	246	68	278
1975	6	3	539	191	45	235	197	48	245	-	-	-	57	24	416	254	72	283
1976	7	4	539	197	47	240	204	51	250	-	-	-	59	25	416	263	76	287
1977	7	4	539	203	49	246	210	53	252	-	-	-	62	26	415	272	79	290

1/ P : Number of Passengers (thousands)

2/ PK : Number of passenger-km (millions)

3/ R : Average Trip (in km)

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**BOLIVIA**  
**APPRAISAL OF A RAILWAY PROJECT**  
**Selected Operating Statistics**  
(1967 to 1971: actual; 1977: objectives)

	Unit	1967			1968			1969			1970			1971			1977 Objectives			
		W	E	TOTAL	W	E	TOTAL	W	E	TOTAL	W	E	TOTAL	W	E	TOTAL	W	E	TOTAL	
I. SYSTEM <sup>1/</sup>																				
Route-km <sup>2/</sup>	Km	2,101	1,222	3,323	2,101	1,222	3,323	2,101	1,222	3,323	2,101	1,222	3,323	2,101	1,222	3,323	2,024	1,222	3,246	
II. TRAFFIC																				
Passenger Carried	000	1,223	238	1,461	1,213	226	1,439	964	257	1,221	1,002	228	1,230	914	224	1,138	1,024	272	1,296	
Pass-km	million	181	41	222	192	50	242	192	63	255	210	58	268	210	59	269	241	79	320	
Average journey	Km	148	172	152	164	219	173	200	245	209	210	258	218	230	265	237	235	290	247	
Freight net tons carried - Revenue earning <sup>3/</sup>	000	899	108	1,007	933	103	1,036	984	205	1,189	936	140	1,076	906	215	1,121	1,064	244	1,308	
Freight net ton-km - Revenue earning	million	258	41	299	268	39	307	281	92	373	258	60	318	261	86	347	339	126	465	
Average haul	Km	287	380	297	287	379	297	287	448	313	275	430	295	288	400	310	319	514	356	
Traffic units - Total		439	82	521	467	89	556	473	155	628	468	118	586	471	145	616	580	205	785	
III. TRAFFIC DENSITY																				
Pass-km per route-km	000	86	33	66	94	41	75	92	52	77	100	48	81	100	49	81	119	65	99	
Freight ton-km per route-km	000	122	34	90	127	32	92	133	75	109	122	50	96	124	70	104	167	103	143	
IV. TRAIN RUN <sup>4/</sup>																				
Train-km - Passenger	000							630	80	710							560	80	640	
- Freight	000							1,360	670	2,030							1,700	650	2,350	
- Total	000							1,990	750	2,740							2,260	730	2,990	
Gross ton-km - Passenger	million							189	33	222							180	34	214	
- Freight	million							593	256	849							734	322	1,056	
- Total	million							782	289	1,071							914	356	1,270	
Gross load of freight train	ton							435	380	418							432	495	449	
Net load of freight train	ton							208	137	184							199	194	198	
V. PRODUCTIVITY OF STOCK																				
Number of steam locomotives in fleet		89	44	133	89	44	128	84	44	128	55	37	92	55	37	92	-	-	-	
Number of steam locomotives in operation <sup>5/</sup>		51	28	79	32	14	48	36	17	53	32	22	54	32	22	54	-	-	-	
Number of main line diesel locomotives		-	-	-	20	5	25	20	5	25	20	5	25	20	5	25	29	9	38	
Availability %								75	60	72	75	60	72	80	60	76	85	85	85	
Main line diesel engine-km per serviceable engine per year	000							63	96	69	64	71	65				95	110	98	
Number of diesel rail cars		-	-	-	10	2	12	10	2	12	10	2	12	10	2	12	11	3	14	
Availability %								90	100	92	56	56	56	60			85	85	85	
Number of passenger cars <sup>6/</sup>		130	68	198	130	68	198	130	68	198	130	68	198	130	68	198	51	22	73	
Availability %		76	78	77				69	51	63							85	85	85	
Number of revenue earning freight cars		1,264	484	1,748	1,359	484	1,843	1,359	484	1,843	1,359	484	1,843	1,359	484	1,843	1,360	510	1,870	
Number of serviceable freight cars		984	362	1,346				1,056	315	1,371	1,370	1,091	289	1,380	1,240	460	1,700			
Availability %		77	75	77				78	65	75				74	80	75	91	90	91	
Freight net ton-km per serviceable car per year <sup>7/</sup>	000																			
VI. STAFF																				
Number of employees <sup>8/</sup>		4,713	932	6,250	4,735	922	6,252	4,732	1,011	6,205			6,660	5,123	1,334	6,457	4,400	1,100	5,500	
Traffic units per employee - Total	000			83			89			101				109	95				143	

1/ System: W=Western System; E=Eastern System.

2/ Route-km: 1977 figure assumes the closure of Sucre-Tarabuco line (77 km).

3/ Freight net tons: 1967 to 1971 figures include some tonnage vanishing and are therefore not considered reliable.

4/ Train Run: in the absence of statistical data, 1969 figures were calculated by the Consultants using a 4-month sample; the results of this sample have been used in projecting the 1977 figures. Figures do not include service transport.

5/ Steam locomotives: assumes phasing out of steam by 1977.

6/ Passenger cars: 1970 figure includes 12 dining cars, 17 service vehicles, 19 cabooses and 23 baggage vans; 1977 figure concerns only direct passenger carrying vehicles (excluding diesel rail cars).

7/ Productivity of freight cars: 1967 figure assumes that ENFE's serviceable stock has been augmented by about 310 cars rented daily from Chile, Argentina and Brazil; 1977 figure assumes a productivity of 300,000 ton-km per serviceable new car; 250,000 ton-km per rehabilitated car, and no use of rented cars.

8/ Number of employees: 1967 to 1970 figures include, in "Total", the temporary workers.

Note: Any blank space in 1967-1971 data reflects unreliability of the statistical data.



BOLIVIAAPPRAISAL OF A RAILWAY PROJECTScope of Phase II Technical Assistance Services to ENFE

Terms of Reference for Phase II have been agreed on between UNDP, ENFE and the Association; briefly, the purpose of Phase II services is to assist ENFE in the continuation of its efforts to rehabilitate the railways by improving management and operational methods and by training personnel at all levels. In line with this, SOFRERAIL will continue to provide the technical assistance and the Association will continue to be the executing agency.

The duration of the services, 21 months, comprises 178 man-months (as detailed on the bar chart attached), of which 39 man-months are required for the four experts (F, G, H, and I) working on procurement, accounting, computer requirements and personnel management, the need for which was revealed during the Phase I scheme. The remainder is a continuation of the present scheme, but with more emphasis placed on assistance and training at the working level (experts J - R).

The advisory services to be provided in the various fields can be summarized as follows:

1. Maintenance of Rolling Stock

- (a) Maintenance methods: to prepare detailed instructions applicable to the various categories of equipment and to assist in implementing the maintenance operations accordingly;
- (b) Concentration of workshops: to assist ENFE in implementing the concentration of repair work at Viacha (repair of diesel motive power for both the Eastern and Western Systems), Uyuni and Robore (repair of passenger and freight cars, respectively, for the Western and Eastern Systems). Parallel to this concentration of repair work, to assist ENFE in implementing the gradual closing of Cochabamba, Sucre and Potosi workshops, and the conversion of Oruro, Tupiza and Santa Cruz workshop into running sheds;
- (c) Modernization of workshops: to assist ENFE in implementing the modernization, reorganization and re-equipment programs of the three main shops by setting up modern repair lines for each type of equipment.

2. Track Improvement and Maintenance: to assist ENFE in extending track rehabilitation and periodic maintenance schemes to an additional 13 zones during 1973 and to all 150 zones of ENFE by the end of 1974.
3. Operations
  - (a) Train control offices: to assist ENFE in establishing a subtraffic control office at Uyuni;
  - (b) Freight car allocation: to assist ENFE in the operation of car allocation centers, located in the traffic control offices;
  - (c) Diesel traction operations: to assist ENFE in (i) completing the study of driver and engine utilization statistics to obtain a clearer picture of motive power operations; (ii) implementing engine and driver rosters on both systems to obtain a better utilization of motive power and personnel; and (iii) reorganizing the diesel running sheds;
  - (d) Marshalling yards: to assist ENFE in the implementation of the new organization which was recommended.
4. Tariffs - Commercial Policy
  - (a) to assist ENFE in making the relevant decisions regarding the adoption of a simplified tariff structure, and in enforcing the new structure which has been set up;
  - (b) to assist ENFE in organizing the recently created Commercial Department, in determining its policy, in recruiting and training its staff, and in instilling in the staff an adequate and aggressive "commercial spirit".
5. Procurement
  - (a) to assist ENFE in setting up a modern stores and supplies system and an efficient procurement mechanism;
  - (b) to assist ENFE in preparing lists of spare parts and materials required for the rehabilitation and the periodic maintenance programs.
6. Accounting: to assist ENFE in modernizing its balance sheets, in adopting more realistic values for fixed assets and depreciation, in revising the accounting system to present operating expenses in the usually accepted railway form and in training of accounting personnel.

7. Computer: to evaluate ENFE's requirements and make recommendations concerning the continued use of or substitution of ENFE's computer.
8. Personnel Management
  - (a) to study the problems of personnel management, recruitment, social and other benefits and propose a coherent personnel policy;
  - (b) to assist ENFE in implementing the adopted policy.
9. Telecommunications
  - (a) to evaluate ENFE's requirements and make recommendations for the improvement of telecommunications;
  - (b) to prepare specifications for needed equipment.

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**BOLIVIA: TECHNICAL ASSISTANCE TO ENFE – PHASE II  
BAR CHART DIAGRAM**

Experts	Position	1972						1973												1974							Man-Months in Field	Working Days in Home Office	
		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul			
A	Supervision					■																					2	40	
	Home Office Staff																										-	80	
B	Head Mission	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	15			
	Traffic Operations																												
C	Maintenance Rolling Stock	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	20			
D	Tariffs Commercial Policy	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	6			
E	Maintenance and Improvement of Track	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	3			
F	Procurement and Stocks																									12			
G	Accounting																									12			
H	Computer																									7			
I	Personnel Management																									8			
J	Maintenance - Diesel Power	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	14			
K	Maintenance - Cars	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	4			
L	Maintenance - Wagons	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	6			
M	Maintenance - Track	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	18			
N	Maintenance - Track																									16			
O	Maintenance - Track																									16			
P	Diesel Traction Operation																									8			
Q	Station Organization	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	8			
R	Telecommunications																									3			
		Phase I 2nd Amendment																										178	120

Starting date  
Phase II





**BOLIVIA**  
**APPRAISAL OF A RAILWAY PROJECT**  
**1973-1977 Investment Plan**

Monetary Unit: million  
 US\$1.00 = \$b 12.00

	Total expenditures 1973-1977				1973				1974				1975				1976				1977			
	Local \$b	Foreign US\$	Total \$b	Total US\$	Local \$b	Foreign US\$	Total \$b	Total US\$	Local \$b	Foreign US\$	Total \$b	Total US\$	Local \$b	Foreign US\$	Total \$b	Total US\$	Local \$b	Foreign US\$	Total \$b	Total US\$	Local \$b	Foreign US\$	Total \$b	Total US\$
<b>I. Way and Works</b>																								
1. Track renovation material	31.50	1.31	32.81	3.95	5.30	.14	5.44	.67	6.30	.29	6.59	.82	6.30	.29	6.59	.82	6.30	.29	6.59	.82	6.30	.29	6.59	.82
2. Ballasting	5.63	.33	5.96	.79	-	-	-	-	-	.16	1.92	.16	1.83	.16	1.99	.16	1.90	.16	2.06	.16	1.90	.16	2.06	.16
3. Tools and equipment	-	.23	2.76	.23	-	.03	.35	.03	-	.08	.96	.08	-	.04	.48	.04	-	.04	.48	.04	-	.04	.48	.04
4. Structure reinforcement	2.76	.47	3.23	.70	-	.11	1.77	.11	.18	.12	1.92	.16	.18	.06	1.20	.10	.66	.08	1.62	.11	.76	.10	1.86	.16
5. Improvement of Oruro-Cochabamba line	31.0	.35	31.35	3.41	7.00	.13	7.13	.75	7.00	.19	9.16	.77	9.00	-	9.00	.75	8.00	-	8.00	.66	2.00	-	2.00	.17
6. Station facilities	1.40	.20	1.60	.32	.70	.05	.75	.07	.20	.05	.80	.07	.20	.04	.68	.06	.40	.03	.76	.06	.40	.03	.76	.06
7. Buildings, equipment	4.00	.70	4.70	1.35	1.00	.10	1.10	.18	1.00	.10	2.20	.18	1.00	.10	2.20	.18	2.50	.20	4.90	.41	2.50	.20	4.90	.41
8. Telecommunications	1.32	.59	1.91	.70	-	-	-	-	.23	.12	1.67	.14	.31	.12	1.75	.15	.25	.12	1.69	.14	.53	.23	1.82	.14
<b>Total "Way and Works"</b>	<b>83.71</b>	<b>4.13</b>	<b>87.84</b>	<b>11.16</b>	<b>14.88</b>	<b>.71</b>	<b>15.59</b>	<b>1.85</b>	<b>15.71</b>	<b>1.10</b>	<b>28.11</b>	<b>2.38</b>	<b>19.12</b>	<b>.81</b>	<b>28.84</b>	<b>2.41</b>	<b>20.01</b>	<b>.76</b>	<b>29.13</b>	<b>2.43</b>	<b>14.39</b>	<b>.90</b>	<b>25.19</b>	<b>2.09</b>
<b>II. Motive Power</b>																								
1. Main line diesel locomotives																								
2. Rail tractors																								
3. Diesel rail cars																								
<b>Total "Motive Power"</b>																								
<b>III. Rolling Stock</b>																								
1. Freight cars																								
2. Passenger cars																								
3. Caboose																								
<b>Total "Rolling Stock"</b>																								
<b>IV. Components for Rehabilitation of Motive Power and Rolling Stock</b>																								
<b>V. Spare Parts</b>																								
<b>VI. Workshop Modernization</b>																								
<b>VII. Technical Assistance</b>																								
<b>VIII. Total</b>	<b>94.00</b>	<b>23.83</b>	<b>117.83</b>	<b>14.58</b>	<b>20.63</b>	<b>2.09</b>	<b>22.72</b>	<b>3.81</b>	<b>19.83</b>	<b>5.15</b>	<b>34.98</b>	<b>6.85</b>	<b>19.15</b>	<b>7.32</b>	<b>26.47</b>	<b>8.92</b>	<b>20.02</b>	<b>6.37</b>	<b>26.39</b>	<b>8.04</b>	<b>14.40</b>	<b>2.87</b>	<b>17.27</b>	<b>4.06</b>
<b>IX. Contingencies</b>																								
1. Physical (5% on first engineering works)	4.40		4.40	.37	.80		.80	.07	.80		.80	.07	1.00		1.00	.08	1.00		1.00	.08	.80		.80	.07
2. Price (3% p. year on local, 5% p. year on foreign costs)	8.46	3.37	11.83	4.58	.62	.10	.72	.15	1.26	.54	1.80	.64	1.80	1.08	2.88	1.22	2.48	1.37	3.85	1.58	2.30	.78	3.08	.99
<b>X. GRAND TOTAL</b>	<b>106.86</b>	<b>27.70</b>	<b>134.56</b>	<b>19.16</b>	<b>21.25</b>	<b>2.19</b>	<b>23.44</b>	<b>3.96</b>	<b>21.09</b>	<b>5.72</b>	<b>36.78</b>	<b>7.52</b>	<b>21.95</b>	<b>8.40</b>	<b>30.35</b>	<b>10.22</b>	<b>23.50</b>	<b>7.74</b>	<b>31.24</b>	<b>9.70</b>	<b>17.50</b>	<b>3.65</b>	<b>21.15</b>	<b>5.12</b>



BOLIVIAAPPRAISAL OF A RAILWAY PROJECTMain Items of the 1973-1977 Investment Plan

1. Way and Works (30% of total expenditure). Investment in this category contains the following items:

1.1 Track renovation material: As a result of past inadequate track maintenance and material replacement, there is a large backlog. This item contains track material replacements such as sleepers (timber and metallic), rails mainly for replacement of wornout rail in low radius curvatures), fastenings and turnout components. This material is essential to upgrade the track from the present condition to a level adequate for the traffic to be carried and to enable implementation of periodic maintenance schemes.

1.2 Ballasting works: Application of crushed stone ballast to weak sections of main lines is one of the requirements of the track rehabilitation plan. At present, the track is most often laid directly on the subgrade and is ballasted only with earth or clayed sand. During the plan period, stone ballasting of the high traffic La Paz-Oruro line (225 km) is projected. This item also includes stone crushing equipment to help ENFE modernize its quarries.

1.3 Tools and equipment: comprises gang trollies, measuring devices and tools to carry out the track rehabilitation plan.

1.4 Structure reinforcement: many speed limits are imposed on trains because of bridges in poor condition or of inadequate strength. This item includes: (a) on the Western System, the replacement of 29 old timber bridges on the Oruro-Ollague section (towards Antofagasta) with steel structures; and (b) on the Eastern System, the consolidation of the Rio Grande's river bed, flooding of which at present causes heavy damage to track structures in the vicinity of Puerto Pailas station.

1.5 Improvement of Oruro-Cochabamba line (205 km): this line, which crosses the Eastern Cordillera, has a very difficult layout with exposures to mud, soil and rock slides during the wet season (December to March). Moreover, for about 60 km, the line follows rivers at a level only slightly higher than the river bed, resulting in flooding and washaways of the track. Accidents are frequent, causing considerable delays of trains and often interrupting train service completely for long periods. This item is intended to provide a minimum investment for improving protection against such flooding and soil slides. It includes (a) additions to the existing fleet of bull-dozers and other earthmoving equipment for clearance of the

line in wet seasons and for track reinforcing work in dry seasons; (b) extension of existing stone revetments and stone wallings to protect the railway line from river erosion and soil slides from transverse gullies; and (c) the study, detailing and construction of realignment works required for safety reasons or necessitated by raised river bed levels or major soil slide difficulties.

1.6 Station facilities: includes the installation of small sidings at about 50 major stations and the improvement of handling and weighing facilities.

1.7 Buildings, equipment: includes equipment intended for a vocational training center, to be created in Cochabamba in existing facilities, and miscellaneous office equipment and vehicles.

1.8 Telecommunications: Signalling equipment, although old, is adequate for the level of traffic to be handled, but existing telecommunications are highly inadequate to exercise an effective control of train operations due to the poor condition of present control circuits. This item is intended to provide adequate telecommunications and traffic control equipment to enable the setting up of three train control offices (Oruro, Viacha and Uyuni) and to prepare the installation of the new car allocation system.

2. Motive Power (15% of total expenditures)

2.1 It includes the provision of:

- 15 main line diesel locomotives
- 13 diesel rail tractors, and
- 3 diesel rail car sets (2 units per set).

2.2 To complete the elimination of steam traction by 1977 and to deal with the traffic forecast, 15 main line diesel locomotives will be needed (Attachment A). Delivery of these units, projected in 1975/76, is dependent, however, on ENFE having first established diesel locomotive maintenance on a satisfactory basis, with supply of spares, workshop facilities and trained staff.

2.3 Thirteen diesel rail tractors, to be procured in 1974, are required to replace present steam and diesel locomotives for light shunting operations in stations, private sidings, yards, etc. These tractors will be cheaper to operate than the existing shunting engines.

2.4 Three diesel rail car sets to be delivered, one in 1973 and two in 1974, are to take care of the projected passenger traffic increase between main urban centers.

3. Rolling Stock (31% of total expenditure)

- 3.1 It includes the provision of: - 850 freight cars (650 box cars, 100 flat cars and 100 gondola cars)
- 25 passenger coaches
  - 20 cabooses.

3.2 Out of the present fleet of 1,843 freight cars, only about 1,020 are in reasonable condition and worth undergoing a rehabilitation program; of these, only some 600 are less than 30 years old. Modernization of the freight car fleet is essential to enable ENFE to offer satisfactory service to the customers, to take full advantage of the possibilities offered by dieselization and to reduce operating costs. Many cars are not suited to modern operation (lack of brake equipment) and cause heavy maintenance expenses; they will be scrapped over the next five years. Based on 1977 forecast traffic, the future number of cars should be about 1,870 and, taking into account the rehabilitation program, this results in the procurement of 850 new cars over the plan period (Attachment B). These are to be mostly box cars (650) for general cargo, flat cars (100) for logs and tubes, and gondolas (100) for minerals and building material.

3.3 Except for three recently acquired metallic coaches, all passenger vehicles are over 50 years old and in very poor condition. Out of the present fleet of 121 cars, only 48 are in reasonable condition and worth undergoing rehabilitation; the other cars do not provide satisfactory service and cause heavy maintenance expenses. They will be scrapped over the next five years and will be replaced by 25 new coaches, to be procured in 1975.

4. Locomotive and car maintenance (3% of total expenditure)

This item includes: (a) the procurement of components for rehabilitation of 7 diesel locomotives and 6 rail cars (now out of service), together with the improvement of existing suitable 48 passenger and 1,020 freight cars; and (b) the creation of a basic stock of spare parts, almost totally lacking at present, for diesel locomotives, rail cars, passenger and freight cars. These spares, to be procured in 1973, are required urgently to start an organized maintenance program.

5. Workshop modernization (3% of total expenditure)

This item comprises the modernization of facilities and the procurement of essential machine tools for the maintenance of modern equipment, on the basis of having three main workshops only: Viacha for diesel locomotives and rail cars, Uyuni and Robore for passenger and freight cars.

6. Technical assistance (3% of total expenditure)

ENFE's rehabilitation program requires adequate technical support to assist ENFE in implementing the various action programs which have been prepared. Long-term technical assistance is needed mostly to train staff at management and at execution level in order to assist in carrying out the various rehabilitation programs and to make good use of modern equipment.

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BOLIVIA

APPRAISAL OF A RAILWAY PROJECT

Main Line Locomotive Requirements for 1977 Traffic

I. Basic assumptions

		<u>Western System</u>	<u>Eastern System</u>	<u>Total</u>
(i) Traffic in million units				
Freight	ton-km	339	126	465
Passenger	a) by train: pass-km	133	53	186
	b) by rail-car : pass-km	108	26	134
	Total pass-km	241	79	320

(ii) Locomotive performance

km/yr/ serviceable locomotive    95,000            110,000

This performance, valid for freight and passenger service, is based on the improved results obtained in the second part of 1971, after implementing the consultants' recommendations for reorganization of operations: introduction of transportation plans and rationalization of locomotive utilization, as shown below:

	<u>Western System</u>		<u>Eastern System</u>	
	1970	June 1971	1970	June 1971
a) Steam				
Number of locomotives in service	32	12	22	10
km/yr/serviceable locomotive	36,000	54,000	28,000	44,000
b) Main line diesels				
Number in service	21	18	4	3
km/yr/serviceable engine	64,000	122,000	71,000	138,000
c) Basic assumption (see above)		95,000		110,000
taking into account the effect on overall performance of diesel locomotives when phasing out steam traction.				

II. Train requirements

(i) Freight traffic:

- Western System: 339 million net ton-km amount to 734 million GTKH (gross ton-km hauled). Taking 435 gross tons as an average load of freight trains (the upper limit of single headed trains is 1,000 GT on the Altiplano and 260 GT on all other lines) would require 1,700,000 train-km.
- Eastern System: 126 million net ton-km amount to 322 GTKH. Taking 500 GT as an average load of freight trains (upper limit of single headed train) would require 650,000 train-km.

(ii) Passenger traffic:

Western System: 133 million pass-km would require 560,000 train-km (based on 1969 statistics).

Eastern System: 53 million pass-km would require 80,000 train-km (based on 1969 statistics).

III. Number of main line locomotives required

Western System: Revenue train-km:  $1,700,000 + 560,000 = 2,260,000$   
Number of serviceable locomotives required : 24

Eastern System: Revenue train-km:  $650,000 + 80,000 = 730,000$   
Number of serviceable locomotives required : 7

Number of serviceable locomotives needed for revenue service:  $24+7 = 31$   
Number of locomotives needed for departmental use (156,000 train-km/yr): 2  
Total number of locomotives needed, allowing for 85% availability:

Western System:	29
Eastern System:	<u>9</u>
Total	38

IV. Verification of performance in GTKH/yr/main line diesel locomotive

	1969	1977
Traffic performed (or to be performed)		
by diesel traction	million GTKH	
	608	1,270
Locomotives in service	18	33
Performance by locomotives in service	million GIKH	
	33.8	38.5
Locomotives in fleet	25	38
Performance by locomotives in fleet	million GTKH	
	24.3	33.5



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APPRAISAL OF A RAILWAY PROJECT

Calculation of Freight Car Requirements

	<u>Unit</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
1. Projected revenue traffic for both systems (Western and Eastern)	million ton-km	383	399	419	442	465 <sup>1/</sup>
2. Carrying capacity of present freight car fleet						
a) Evolution of present fleet	cars	1,700	1,620	1,440	1,210	1,020
b) Improvement of availability due to rehabilitation	%	70	75	80	85	87
c) Number of serviceable cars	cars	1,300	1,300	1,200	1,050	900
d) Traffic carried by above cars <sup>2/</sup>	million ton-km	273	273	264	242	225
3. Remaining revenue traffic to be carried	million ton-km	110	126	155	200	240
4. Carrying capacity of new cars						
a) Expected delivery of new cars	cars	0	200	400	650	850
b) Availability	%		100	100	94	94
c) Number of serviceable new cars	cars	0	200	400	610	800
d) Traffic carried by new cars <sup>3/</sup>	million ton-km	0	60	120	183	240
5. Remaining revenue traffic to be carried by rented cars	million ton-km	98	66	35	17	0
Number of rented cars needed <sup>4/</sup>	cars	440	265	140	70	0
6. Scrapping program						
a) Optimal scrapping program (1971 fleet: 1,843 cars)	cars	143	223	403	633	843
b) Number of cars for departmental use (to be taken out of the scrapping program)	cars	90	90	90	75	60
c) Ballasting cars for departmental use (to be taken out of the scrapping program)	cars	45	45	45	45	45
d) Actual scrapping program	cars	8	88	268	513	718
<u>1/ Breakdown of 1977 traffic</u>	<u>million ton-km</u>	<u>% of traffic</u>	<u>number and type of cars required</u>	<u>cars available after rehabilitation</u>	<u>new cars needed</u>	
- general cargo	330	71	box cars: 1,330	680	650	
- timber, tubings, vehicles	63	13.5	flat cars: 250	140	110	
- ores	47	10	gondolas: 190	95	95	
- petroleum products	25	5.5	tank cars: 103	105	-	
Total	465	100	1,873	1,020	855	

<sup>2/</sup> (assumption: 1973/74: 210,000 ton-km/conv. car  
 1974 : 220,000 " " "  
 1975 : 230,000 " " "  
 1976 : 250,000 " " " " )

<sup>3/</sup> (assumption: 300,000 ton-km per new car)

<sup>4/</sup> (assumption: 250,000 ton-km per rented car)

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BOLIVIAAPPRAISAL OF A RAILWAY PROJECTDisbursement Schedule

<u>Year 1973/1974</u>	<u>Cumulative Disbursements</u> US\$ 000
Sept. 30, 1973	630
Dec. 31, 1973	1,080
Mar. 31, 1974	2,060
June 30, 1974	4,260
<u>Year 1974/1975</u>	
Sept. 30, 1974	6,550
Dec. 31, 1974	7,240
Mar. 31, 1975	7,450
June 30, 1975	8,000

Assumptions:

1. Credit signed around December 1972, effective in March 1973.
2. All orders be placed in April/May 1973, with a down payment of 10% at placement of orders.
3. Delivery of diesel rail cars and freight cars in 1974 (calendar year).
4. Procurement of spares, components and equipment to modernize shops commencing in late 1973 and continuing in 1974 (calendar years).
5. Contribution toward local costs of a total amount of US\$760,000 disbursed at the rate of US\$560,000 in 1973 (calendar year) and US\$200,000 in 1974 (calendar year).

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APPRAISAL OF A RAILWAY PROJECT

Economic Costs\* With and Without the Investment Plan

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
<u>Without the Investment Plan</u>																				
Personnel	120.0	118.1	116.3	114.5	112.7	111.0	109.1	107.3	105.5	103.6	101.8	100.0	98.1	96.3	94.5	92.8	90.9	90.4	90.4	90.4
Materials	20.7	20.7	20.3	19.4	18.6	18.0	17.4	16.7	16.1	15.5	15.1	14.7	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Fuel	18.5	16.9	15.4	13.1	10.8	9.1	7.4	5.8	4.1	3.2	2.9	2.6	2.6	2.6	2.6	2.7	2.7	2.7	2.7	2.8
Contracts	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Freight Car Rentals	4.6	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9
Loss of Passengers	-	0.5	1.1	1.8	2.5	2.9	3.3	3.6	4.0	4.3	4.6	4.9	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
Diversion of Passengers	1.1	2.4	5.2	8.4	11.1	12.7	14.2	15.7	17.1	18.5	19.8	21.1	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8
Diversion of Freight	-	4.3	16.6	33.9	51.8	58.0	64.5	70.9	77.3	83.6	90.0	94.9	94.1	93.2	92.3	91.5	90.6	89.8	88.9	88.0
Loss of Freight	-	0.8	3.1	6.5	10.4	11.6	12.9	14.2	15.5	16.7	18.0	19.0	18.8	18.7	18.5	18.3	18.1	18.0	17.8	17.6
<u>Total</u>	<u>171.4</u>	<u>175.2</u>	<u>189.6</u>	<u>209.3</u>	<u>229.7</u>	<u>235.2</u>	<u>240.8</u>	<u>246.3</u>	<u>251.8</u>	<u>257.8</u>	<u>264.7</u>	<u>269.8</u>	<u>267.7</u>	<u>265.0</u>	<u>262.2</u>	<u>259.7</u>	<u>256.8</u>	<u>255.5</u>	<u>254.5</u>	<u>253.6</u>
<u>With the Investment Plan</u>																				
Personnel	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
Renewals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel	18.5	17.5	15.0	11.0	8.00	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Contracts	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Freight Car Rentals	4.6	3.0	1.5	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Materials	18.0	20.2	20.3	20.8	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9
Investment	46.5	83.0	108.0	97.5	49.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<u>Total</u>	<u>202.1</u>	<u>245.2</u>	<u>266.3</u>	<u>251.5</u>	<u>200.0</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>	<u>178.3</u>

\* In constant prices in \$b

## BOLIVIA

## APPRAISAL OF A RAILWAY PROJECT

Summary Balance Sheets (West and East Lines)  
as of December 31, 1965 to 1971

(in \$ millions)

	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>
<u>ASSETS</u>							
Fixed Assets	599.9	604.3	606.2	619.7	762.4	764.2	542.5
Fixed Assets Not Capitalized	-	130.2	130.2	154.2	-	-	-
	<u>599.9</u>	<u>734.5</u>	<u>736.4</u>	<u>773.9</u>	<u>762.4</u>	<u>764.2</u>	<u>542.5</u>
Cash and Bank Balances	6.0	6.6	12.4	5.2	6.4	4.2	4.5
Sundry Debtors	32.0	22.5	31.4	31.7	49.4	64.0	64.6
Stores							
- Railway	29.6	34.9	33.1	38.0	54.6	51.7	38.8
- Pulperias	4.3	4.5	4.6	6.6	6.6	16.7	5.6
Suspense	9.1	10.3	12.2	3.4	-	-	19.6
Cargos Diferidos	-	-	-	13.4	13.3	18.8	5.2
	<u>-</u>	<u>-</u>	<u>-</u>	<u>13.4</u>	<u>13.3</u>	<u>18.8</u>	<u>5.2</u>
TOTAL ASSETS	680.9	813.3	830.1	872.2	892.7	919.6	680.8
<u>LIABILITIES</u>							
Capital	653.4	656.9	660.4	665.8	681.2	665.6	480.0
Long Term Debt	-	128.3	125.6	154.4	141.0	114.6	79.5
Sundry Creditors - Commercial	11.7	16.0	27.3	19.1	21.2	38.4	40.3
"    "    - Social	6.3	8.0	11.9	15.9	20.4	29.6	32.1
Reserves - Social	1.4	.1	.6	3.5	7.8	6.2	10.5
"    - Depreciation	1.3	1.3	1.3	1.8	9.5	17.0	24.1
Suspense	6.8	2.7	3.0	-	-	-	5.1
Abonos Diferidos	-	-	-	11.7	11.6	48.2	9.2
	<u>-</u>	<u>-</u>	<u>-</u>	<u>11.7</u>	<u>11.6</u>	<u>48.2</u>	<u>9.2</u>
TOTAL LIABILITIES	680.9	813.3	830.1	872.2	892.7	919.6	680.8

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BOLIVIA

APPRAISAL OF A RAILWAY PROJECT

Notes on Balance Sheets

1. Fixed Assets: Book value, expressed as gross values with depreciation reserves shown separately, includes (a) net written down book value of assets taken over from the previous owners of the railways and (b) an arbitrary, understated value for the Santa Cruz-Corumba line built by Brazil. It does not include the value of the Santa Cruz-Yacuiba line, built by Argentina. The cost of both of these lines is being repaid by Bolivia over a long term; that of the Santa Cruz-Corumba line has been passed on to ENFE as equity, and the outstanding debt does not appear in ENFE's accounts. The depreciation reserve is also considerably understated, representing only the amounts being provided against the diesel locomotives and rolling stock acquired within the last two or three years. No inventory of fixed assets, agreeing with the accounting records, exists, but ENFE is presently preparing one. The lower figures shown in 1971 result from a preliminary re-assessment of fixed asset values carried out by ENFE, which will be further revised in 1972.
2. Fixed Assets Not Capitalized (in 1966, 1967 and 1968 Balance Sheets): relates to the purchase of 10 ferrobuses from FERROSTAL, Germany, and 29 diesel locomotives, together with rolling stock and spares, from Mitsubishi, Japan. Although the equipment was not obtained and put into service until 1968, ENFE accounted for the equipment on the one hand as assets and on the other hand as debts in 1966, the year in which the contracts were finalized. The value of these assets was not brought into the correct fixed assets accounts until 1969, and depreciation on the equipment also began in this year.
3. Sundry Debtors: The 1971 balance includes \$b 3.2 million debts owing to the East line which date back to 1969 and the receipt of which can be considered doubtful. Also included are: commercial debts \$b 11 million, mines \$b 8 million, COMIBOL (Government operated mines) \$b 3 million, state enterprises \$b 8 million, other railways for hire of cars and freight charges \$b 10 million.
4. Stores: (a) Railways rose sharply from about \$b 33 million in 1967 to over \$b 50 million in 1969 and 1970 but fell to \$b 39 million in 1971. It includes work in progress, material in transit, major spares and maintenance equipment for the Japanese locomotives, and many obsolete and slow moving items which are to be examined for ultimate disposal; (b) Pulperias: shown separately against this heading is the value of stores of foodstuffs held for staff commissaries.

5. Cargos Diferidos: These are various suspense accounts which were not cleared at the time ENFE closed the 1971 accounts. Included is \$b 4.8 million East line accounts for which many details are missing.
6. Abonos Diferidos: Many items outstanding at end of 1970 were cleared in 1971.
7. Long term Debt: The 1971 balance consists mainly of the amount owing to Mitsubishi (\$b 77.0 million) and FERROSTAL (\$b 1.7 million).
8. Sundry Creditors - Social: Includes \$b 21.0 million owing to the Caja Social de Ferroviarios for retirement benefits and \$b 7.2 million owing for foodstuffs for the Pulperias.
9. Sundry Creditors - Commercial: Includes \$b 16.6 million owing to Argentina and Chilean railways for freight car rental and freight charges in these countries.
10. Reserves - Social: Includes amounts set aside by ENFE since 1965 for retirement benefits but not yet paid.
11. General: The various remaining suspense items and old outstanding balances are being investigated by ENFE staff, who hope to clear the items during the coming year.

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BOLIVIA

APPRAISAL OF A RAILWAY PROJECT

Cash Flow - (1967-1971 Actual: 1972 (Tentative); 1973-1977 (Projected))  
(\$b million)

	ACTUALS - 1967-71						FORECASTS - 1973-1977						
	1967	1968	1969	1970	1971	1972	Project 1973-74 1973	1974	Total 1973-74	1975	1976	1977	Plan 1973-77
<u>FUNDS REQUIRED</u>													
<u>For Investment:</u>													
Local Currency	7.4	1.4	6.3	2.8	1.1	.5	22.0	21.9	43.9	22.0	23.5	17.5	106.9
Foreign Exchange	-	-	-	-	-	2.6	20.5	65.5	86.0	109.9	93.0	43.8	332.7
Total Investment	<u>7.4</u>	<u>1.4</u>	<u>6.3</u>	<u>2.8</u>	<u>1.1</u>	<u>3.1</u>	<u>42.5</u>	<u>87.4</u>	<u>129.9</u>	<u>131.9</u>	<u>116.5</u>	<u>61.3</u>	<u>439.5</u>
<u>Debt Service</u>													
Loan Interest	0.3	3.7	6.8	6.1	5.5	4.6	3.7	3.0	6.7	5.8	11.9	16.6	41.0
Loan Repayment	3.0	8.2	8.7	21.0	15.1	19.5	16.3	14.9	31.2	14.5	14.4	14.4	74.5
Total Debt Service	<u>3.3</u>	<u>11.9</u>	<u>15.5</u>	<u>27.1</u>	<u>20.6</u>	<u>24.1</u>	<u>20.0</u>	<u>17.9</u>	<u>37.9</u>	<u>20.3</u>	<u>26.3</u>	<u>31.0</u>	<u>115.5</u>
<u>Other</u>													
Additions to working capital	-	-	-	-	-	-	-	1.0	1.0	2.0	3.0	4.0	10.0
Retirement Benefits	<u>1.0</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>7.4</u>	<u>7.4</u>	<u>14.8</u>	<u>7.4</u>	<u>7.4</u>	<u>7.4</u>	<u>37.0</u>
Total Funds Required	<u>11.7</u>	<u>13.3</u>	<u>21.8</u>	<u>29.9</u>	<u>21.7</u>	<u>27.2</u>	<u>69.9</u>	<u>113.7</u>	<u>183.6</u>	<u>161.6</u>	<u>153.2</u>	<u>103.7</u>	<u>602.1</u>
<u>SOURCES OF FUNDS</u>													
Operating Revenues	115.8	125.9	147.7	138.9	133.1	150.9	166.0	172.5	338.5	181.0	190.0	198.5	908.0
Less: Cash Operating Costs	<u>123.3</u>	<u>137.4</u>	<u>138.7</u>	<u>144.1</u>	<u>162.6</u>	<u>168.5</u>	<u>168.1</u>	<u>167.7</u>	<u>335.8</u>	<u>163.3</u>	<u>159.5</u>	<u>155.9</u>	<u>814.5</u>
Cash Generated from Operations (Deficit)	(7.5)	(11.5)	9.0	(5.2)	(23.5)	(17.6)	(2.1)	4.8	2.7	17.7	30.5	42.6	93.5
Less: Net Non-Operating Expenses	<u>0.7</u>	<u>(0.3)</u>	<u>(3.4)</u>	<u>3.4</u>	<u>0.9</u>	<u>2.5</u>	<u>2.5</u>	<u>2.5</u>	<u>5.0</u>	<u>2.4</u>	<u>2.4</u>	<u>2.4</u>	<u>12.2</u>
Net Internally Generated Funds Available(required)	<u>(8.2)</u>	<u>(11.2)</u>	<u>12.4</u>	<u>(8.6)</u>	<u>(24.4)</u>	<u>(20.1)</u>	<u>(4.6)</u>	<u>2.3</u>	<u>(2.3)</u>	<u>15.3</u>	<u>28.1</u>	<u>40.2</u>	<u>81.3</u>
Government Equity Contribution	15.7	17.8	8.8	20.4	34.7	28.0	46.0	43.2	89.2	36.4	32.1	19.7	177.4
UNDP Grant	-	-	-	-	-	3.1	7.9	1.9	9.8	2.3	1.3	0.9	14.3
Borrowings:													
Proposed IDA Credit	-	-	-	-	-	-	20.6	66.3	86.9	9.1	-	-	96.0
Other	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>98.5</u>	<u>91.7</u>	<u>42.9</u>	<u>233.1</u>
Total Borrowings	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>20.6</u>	<u>66.3</u>	<u>86.9</u>	<u>107.6</u>	<u>91.7</u>	<u>42.9</u>	<u>329.1</u>
Decrease in Working Capital	<u>3.2</u>	<u>6.7</u>	<u>0.6</u>	<u>18.1</u>	<u>11.4</u>	<u>16.2</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
Total Sources of Funds	<u>11.7</u>	<u>13.3</u>	<u>21.8</u>	<u>29.9</u>	<u>21.7</u>	<u>27.2</u>	<u>69.9</u>	<u>113.7</u>	<u>183.6</u>	<u>161.6</u>	<u>153.2</u>	<u>103.7</u>	<u>602.1</u>



BOLIVIA  
APPRAISAL OF A RAILWAY PROJECT  
Operating Accounts 1966-1971

(\$ Million)

	WEST LINE						EAST LINE						TOTALS - West plus East Lines					
	1966	1967	1968	1969	1970	1971	1966	1967	1968	1969	1970	1971	1966	1967	1968	1969	1970	1971
<b>Operating Revenue</b>																		
Passengers	16.0	16.5	18.0	17.9	19.8	20.3	3.2	3.2	6.1	7.2	7.1	7.3	19.2	19.7	24.1	25.1	26.9	27.6
Parcels	2.9	3.1	3.0	2.6	2.7	2.5	.3	.8	.5	1.0	1.5	2.1	3.2	3.9	3.5	3.6	4.2	4.6
Freight	75.9	82.0	81.5	88.2	86.3	82.4	5.0	7.2	13.7	25.0	16.8	22.1	80.9	89.2	95.2	113.2	103.1	104.5
Miscellaneous	2.0	2.7	2.4	2.9	3.1	1.4	.3	.3	.7	2.9	1.6	0.9	2.3	3.0	3.1	5.8	4.7	2.3
<b>Total Operating Revenues</b>	<b>96.8</b>	<b>104.3</b>	<b>104.9</b>	<b>111.6</b>	<b>111.9</b>	<b>106.6</b>	<b>8.8</b>	<b>11.5</b>	<b>21.0</b>	<b>36.1</b>	<b>27.0</b>	<b>32.4</b>	<b>105.6</b>	<b>115.8</b>	<b>125.9</b>	<b>117.7</b>	<b>138.9</b>	<b>139.0</b>
<b>Operating Expenses</b>																		
Maintenance of Way	22.3	20.4					3.9	4.2										
Maintenance of Equipment	15.7	18.9					1.8	2.0										
Running Costs	29.5	27.6					2.4	2.9										
Traffic Costs	14.0	14.5					1.3	1.7										
Signals & Telecommunication	1.9	1.7	N/A	N/A	N/A	N/A	.3	.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Miscellaneous	15.4	16.3					1.2	1.5										
Loss on Subsidized Foods	3.3	3.3					.1	.2										
Medical	6.1	6.9					.7	.9										
Schools	.8	-					.1	.2										
<b>Total Working Expenses</b>	<b>109.0</b>	<b>109.6</b>	<b>114.9</b>	<b>110.0</b>	<b>112.1</b>	<b>124.1</b>	<b>11.8</b>	<b>13.8</b>	<b>22.0</b>	<b>28.7</b>	<b>30.4</b>	<b>34.5</b>	<b>120.8</b>	<b>123.4</b>	<b>136.9</b>	<b>138.7</b>	<b>112.5</b>	<b>162.6</b>
Depreciation	-	-	0.5	5.8	7.5	7.0	-	-	-	-	-	-	-	-	5.8	5.8	7.5	7.0
<b>Total Operating Expenses</b>	<b>109.0</b>	<b>109.6</b>	<b>115.4</b>	<b>115.8</b>	<b>119.6</b>	<b>131.1</b>	<b>11.8</b>	<b>13.8</b>	<b>22.0</b>	<b>28.7</b>	<b>30.4</b>	<b>34.5</b>	<b>120.8</b>	<b>123.4</b>	<b>137.4</b>	<b>144.5</b>	<b>150.0</b>	<b>169.6</b>
<b>Net Working Revenue (Loss)</b>	<b>(12.2)</b>	<b>(5.3)</b>	<b>(10.0)</b>	<b>3.5</b>	<b>(0.2)</b>	<b>(21.5)</b>	<b>(3.0)</b>	<b>(2.3)</b>	<b>(1.0)</b>	<b>7.4</b>	<b>(3.4)</b>	<b>(2.1)</b>	<b>(15.2)</b>	<b>(7.6)</b>	<b>(11.0)</b>	<b>10.9</b>	<b>(3.6)</b>	<b>(23.6)</b>
<b>Net Operating Revenue (Loss)</b>	<b>(12.2)</b>	<b>(5.3)</b>	<b>(10.5)</b>	<b>(4.2)</b>	<b>(7.7)</b>	<b>(28.5)</b>	<b>(3.0)</b>	<b>(2.3)</b>	<b>(1.0)</b>	<b>7.4</b>	<b>(3.4)</b>	<b>(2.1)</b>	<b>(15.2)</b>	<b>(7.6)</b>	<b>(11.5)</b>	<b>3.2</b>	<b>(11.1)</b>	<b>(30.6)</b>
<b>Non Operating Revenues (Loss) - Net</b>	<b>-</b>	<b>(0.8)</b>	<b>.4</b>	<b>3.1</b>	<b>(3.7)</b>	<b>0.8</b>	<b>.1</b>	<b>.1</b>	<b>-</b>	<b>.3</b>	<b>.2</b>	<b>(1.6)</b>	<b>.1</b>	<b>(0.7)</b>	<b>.4</b>	<b>3.4</b>	<b>(3.4)</b>	<b>(0.8)</b>
<b>Net Revenue (Loss) Before Interest</b>	<b>(12.2)</b>	<b>(6.1)</b>	<b>(10.1)</b>	<b>(1.1)</b>	<b>(11.4)</b>	<b>(27.7)</b>	<b>(2.9)</b>	<b>(2.2)</b>	<b>(1.0)</b>	<b>7.7</b>	<b>(3.2)</b>	<b>(3.7)</b>	<b>(15.1)</b>	<b>(8.3)</b>	<b>(11.1)</b>	<b>6.6</b>	<b>(14.5)</b>	<b>(31.4)</b>
<b>Interest Charges</b>		.3	3.7	6.8	6.1	5.5								.3	3.7	6.8	6.1	5.5
<b>Net Loss (Surplus)</b>	<b>12.2</b>	<b>6.4</b>	<b>13.8</b>	<b>7.9</b>	<b>17.4</b>	<b>(33.2)</b>	<b>2.9</b>	<b>2.2</b>	<b>1.0</b>	<b>(7.7)</b>	<b>3.2</b>	<b>(3.7)</b>	<b>15.1</b>	<b>8.6</b>	<b>(14.8)</b>	<b>.2</b>	<b>20.6</b>	<b>(36.9)</b>
<b>Working Ratio</b>	<b>112</b>	<b>105</b>	<b>110</b>	<b>97</b>	<b>100</b>	<b>120</b>	<b>134</b>	<b>120</b>	<b>105</b>	<b>80</b>	<b>113</b>	<b>106</b>	<b>114</b>	<b>107</b>	<b>109</b>	<b>93</b>	<b>103</b>	<b>117</b>

## BOLIVIA

## APPRAISAL OF A RAILWAY PROJECT

## Income Projections 1973-1977 (West and East Lines)

(With Actuals 1968-1971 and Tentative Figures 1972 for Comparison)

(in \$ millions)

	1968	1969	1970	1971	1972 <sup>1/</sup>	1973	1974	1975	1976	1977
<b>Operating Revenues</b>										
Passengers	24.1	25.1	26.9	27.7	31.2	31.0	32.0	33.0	34.0	35.0
Freight	95.2	113.2	103.1	104.5	111.9	127.5	133.0	140.0	148.0	155.0
Miscellaneous	6.6	9.4	8.9	6.9	7.8	7.5	7.5	8.0	8.0	8.5
Total Operating Revenues	125.9	147.7	138.9	139.1	150.9	166.0	172.5	181.0	190.0	198.5
<b>Operating Costs</b>										
Labor	89.2	99.7	101.3	114.5	120.0	120.0	120.0	120.0	120.0	120.0
Fuel and Lubricants	18.0	14.5	15.0	19.5	19.5	18.5	17.5	15.0	11.0	8.0
Materials	14.7	13.6	15.8	14.6	15.5	18.0	20.2	20.3	20.8	20.9
Contractors	2.0	1.5	2.1	2.6	2.5	1.5	1.5	1.5	1.5	1.5
Freight Car Rental (Net)	5.3	4.9	5.0	5.8	5.5	4.6	3.0	1.5	0.7	-
Miscellaneous	7.7	4.5	3.3	5.8	5.5	5.5	5.5	5.0	5.5	5.5
Total Working Costs	136.9	138.7	142.5	162.6	168.5	168.1	167.7	163.3	159.5	155.9
Depreciation	0.5	5.8	7.5	7.0	24.0	24.0	25.0	25.5	26.0	26.5
Total Operating Costs	137.4	144.5	150.0	169.6	192.5	192.1	192.7	188.8	185.5	182.4
Net Operating Revenue (Loss)	(11.5)	3.2	(11.1)	(30.5)	(41.6)	(26.1)	(20.2)	(7.8)	4.5	16.1
Non-operating Receipts	4.2	7.4	5.2	3.9	1.1	1.1	1.4	1.4	1.4	1.4
Non-operating Expenses	3.9	4.0	8.6	4.8	3.9	3.9	3.9	3.8	3.8	3.8
Net Revenue (Loss) before interest	(11.2)	6.6	(14.5)	(31.4)	(44.1)	(28.6)	(22.7)	(10.2)	2.1	13.7
Loan Interest	3.6	6.8	6.1	5.5	4.6	3.7	3.0	5.8	11.9	16.6
Net Revenue	(14.8)	(0.2)	(20.6)	(36.9)	(48.7)	(32.3)	(25.7)	(16.0)	(9.8)	(2.9)
<b>Ratios:</b>										
Working ratio %	109	93	103	117	112	101	97	90	84	79
Operating ratio %	-	-	-	-	128	116	112	104	98	92
Times interest earned	-	-	-	-	-	-	-	-	.2	.8
Debt Service Coverage	-	-	-	-	-	-	.1	.8	1.1	1.3

<sup>1/</sup> Revised estimate based on actual figures for first six months.

BOLIVIA

APPRAISAL OF A RAILWAY PROJECT

Forecast Operating Accounts 1972-1976 - Notes and Assumptions

1) Traffic

Assumed that the fall in 1970 and 1971 was only temporary, mainly due to the unsettled political situation and that traffic will rise as follows:

Freight: West line 4.5% per annum; East line 6.5% per annum.

Passengers: West line 2.5%; East line 5% per annum (as discussed in Annexes 8 and 10).

2) Tariffs: Assumed that ENFE's new freight tariff structure, introduced in July 1972, will raise average revenue per ton-km by about 10%, and that the new passenger fare structure, to be introduced in mid-1973, will raise average revenue per pass-km by about 10%.

3) Average Revenue per Unit Kilometer: Past performance is:

	<u>Ton/km</u>	<u>Pass/km</u>
1966	.300	.097
1969	.303	.098
1970	.324	.100
1971	<u>.301</u>	<u>.103</u>
Average	.302	.099
Add: 10% rate increase, 1972	.030	
Add: 10% fare increase, 1973	<u>-</u>	<u>.010</u>
For forecasting used	<u>.332</u>	<u>.109</u>

Assumed unit revenues will then remain at this level on a constant price basis.

4) Labor Costs: Total annual costs should remain at substantially the 1971 level. Any savings arising due to reduction in numbers, resulting from retirement of over-age staff, will be passed as selective improvements to workers' salaries.

- 5) Fuel, Materials and Other Working Costs: These costs will remain reasonably level until dieselization is completed; then fuel and locomotive repair costs should decline.
- 6) Inflationary Effects: As revenues and costs are expressed in constant prices, it is assumed that any inflationary rises in costs, particularly labor, will be met promptly by tariff increases. Staff retirements will be made progressively as in the agreed plan of action and Government will provide finance to cover the retirement benefits.
- 7) Action Plan: The Action Plan will be carried out according to schedule and, in conjunction with this, the technical assistance will also be continued.
- 8) Operations on New Lines: No allowance has been made for possible deficits arising from any operations on the Santa Cruz-Santa Rosa line (or on any extensions), on the assumption that ENFE will be isolated from such deficits, including debt service, and from the capital costs of this line.
- 9) Rented Freight Cars: Until ENFE's stock of serviceable freight cars has been brought up to the required level, it is assumed that ENFE will be able to continue to rent cars as required from Argentina, Brazil and Chile, at approximately the current level of rentals.
- 10) Depreciation: Annual forecasts are based on fixed asset replacement costs as assessed by the consultants, SOFRERAIL, and will be adjusted in the light of the asset identification and valuation study now being undertaken by ENFE.

October 1972

BOLIVIA  
APPRAISAL OF A RAILWAY PROJECT  
Forecast Summary Balance Sheets  
(\$ millions)

	<u>1971</u> (Recast)	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>
		----- (Forecasts) -----					
<b><u>ASSETS</u></b>							
Fixed Assets - Gross	1,700	1,700	1,700	1,710	1,740	1,790	1,810
Less: Accumulated depreciation	<u>880</u>	<u>904</u>	<u>893</u>	<u>843</u>	<u>768</u>	<u>728</u>	<u>714</u>
Net Fixed Assets	820	796	807	867	972	1,062	1,096
Current Assets	<u>114</u>	<u>108</u>	<u>110</u>	<u>113</u>	<u>118</u>	<u>125</u>	<u>130</u>
Total Assets	<u>934</u>	<u>904</u>	<u>917</u>	<u>980</u>	<u>1,090</u>	<u>1,187</u>	<u>1,226</u>
<b><u>LIABILITIES</u></b>							
Capital	771	750	757	766	779	788	797
Long-term Debt	80	60	65	116	208	292	321
Current Liabilities	72	82	83	86	89	93	94
Reserves	<u>11</u>	<u>12</u>	<u>12</u>	<u>12</u>	<u>14</u>	<u>14</u>	<u>14</u>
Total Liabilities	<u>934</u>	<u>904</u>	<u>917</u>	<u>980</u>	<u>1,090</u>	<u>1,187</u>	<u>1,226</u>
Current Ratio	1.6	1.3	1.3	1.3	1.3	1.3	1.4
Debt/Equity Ratio	11/89	7/93	8/92	14/66	21/79	27/73	29/71

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