REGIONAL RAIL SUPPORT PROJECT

690-0247.56

MOZAMBIQUE COMPONENT SUPPLEMENT

PURCHASE OF LOCOMOTIVES

VOLUME I - PPS TEXT

FINAL DRAFT - MAY 9, 1990

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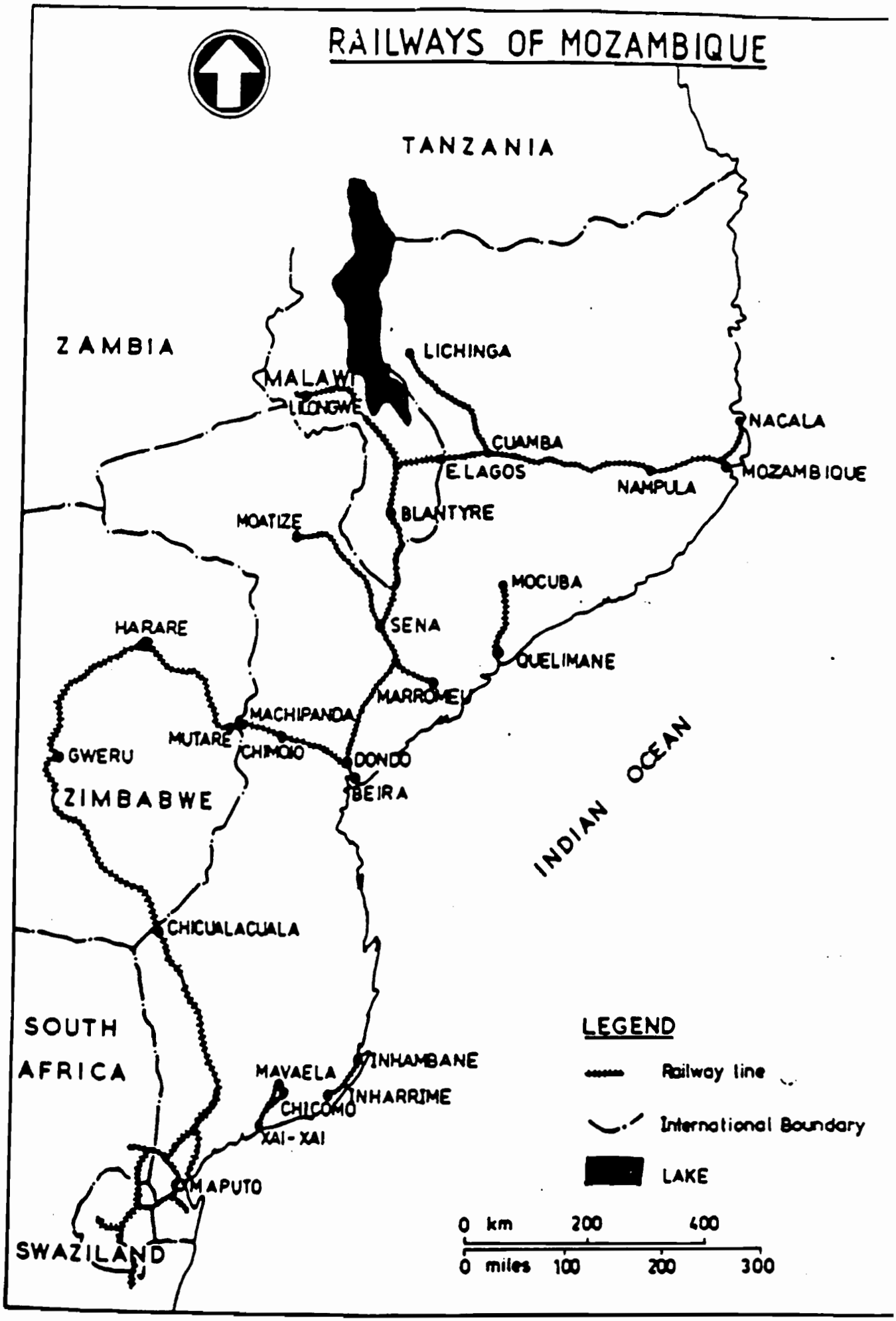
RAILWAYS OF MOZAMBIQUE
TANZANIA
ZAMBIA
MALAWI
LONGWE
LICHINGA
NACALA
CUAMBA
ELAGOS
NAMPULA
MOZAMBIQUE
MOATIZE
BLANTYRE
MOCUBA
SENA
HARARE
QUELIMANE
MARROMEU
MACHIPANDA
MUTARE
CHIMOIO
GWERU
DONDO
BEIRA
ZIMBABWE
INDIAN OCEAN
CHICUALACUALA
SOUTH AFRICA
INHAMBANE
MAVAELA
INHARRIME
CHICOMO
XAI-XAI
MAPUTO
SWAZILAND
LEGEND
Railway line
International Boundary
LAKE
0 km 200 400
0 miles 100 200 300

I. PROJECT SETTING

The Mozambique Railway and Port system (CFM) consists of 1) six distinct rail lines linking the landlocked countries within SADCC to the ports of Nacala, Beira, and Maputo in Mozambique and 2) an additional three short domestic lines and six ports. The important corridors, from the regional point of view, are CFM-North (one line serving mostly Malawi), CFM-Central (two lines serving Zimbabwe, Malawi and Zambia), and CFM-South (three lines serving Swaziland, Botswana, Zimbabwe and South Africa).

Before the outbreak of regional tensions, these rail lines provided direct and low-cost access to ports for several landlocked countries that are now members of SADCC. In the early 1970's, the Mozambique rail system carried over 90 per cent of Zimbabwe's (then Rhodesia) and Swaziland's trade, 80 per cent of Zambia's copper, and nearly 100 per cent of Malawi's trade. At that time the use of South African routes was insignificant. After Mozambique's independence, however, civil war, the flight of key managers and the application of sanctions against Rhodesia contributed to a marked decline in the CFM rail lines. As a result, the landlocked countries grew increasingly dependent on the longer and more costly rail services provided to ports in the Republic of South Africa. The transport distance from Harare to a seaport increased from 605 kilometers (Beira) to 2,027 kilometers (Durban), and costs increased proportionately. The foreign exchange spent by Malawi on excess transport costs in 1988 was greater than 30 per cent of its earnings from the exports. In 1973, the last year in which operation was uninhibited by political or security problems, the three corridors carried total freight of over 20 million tons. Of this, 17.5 million (78 percent)

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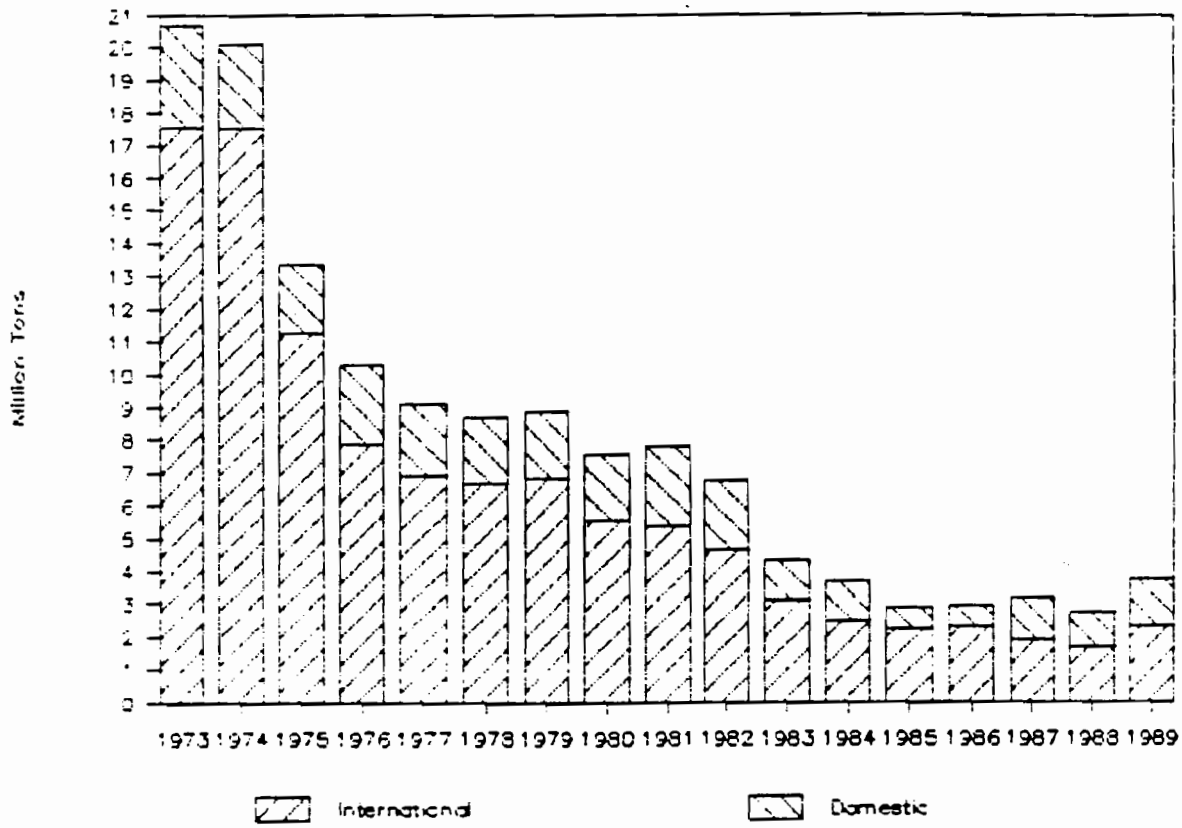
was international. In 1981, a year that probably best represents CFM's medium-term potential, the railroad hauled a total of 8 million tons, 68 percent of which was international.

Table 1
Mozambique Rail Freight Carried
Total Tons



The extent of trade diversion to South Africa caused by Mozambique's problems has been significant. The annual tonnage of Zimbabwe commodities re-routed through South Africa amounts to 200,000 tons of ferro-alloys, 180,000 tons of steel, 100,000 tons of asbestos, 100,000 tons of tobacco, and 130,000 tons of maize. Traffic through the port of Maputo is only about half of its 1981 level and one sixth of its 1973 level.

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The rehabilitation programs started by the donors in the mid-80's are beginning to help. Traffic through Beira has increased from a 20-year low of 296,000 tons in 1984 to 632,000 in 1989, an increase of 113 per cent. Traffic through Maputo increased from a low of 2.7 million tons in 1988 to 3.8 million in 1989. And, although rehabilitation of the CFM(N) rail line from Malawi to Nacala is not yet complete, grains and other commodities that are not time-sensitive are being imported to Malawi via Nacala.

The Government's efforts to reform the economy have, at a macro level, complemented the improved capacity and incentives created by donor assistance programs and decreasing insecurity. In 1987 the Government began implementing, with World Bank and IMF support, a comprehensive Economic Rehabilitation Program (ERP). Key measures taken that directly affect CFM include exchange rate reform, increased fiscal and monetary discipline, and improved allocation of foreign exchange. All of these measures, particularly the reduction of subsidies, control over money supply and restrictions on government recourse to bank credit, have helped bring inflation down from 157 percent in 1987 to about 20 percent targeted for 1990. This reduction in inflation alone is critical to helping CFM reduce its costs and achieve financial viability.

The Government's consistent devaluation of the exchange rate since 1987 must be considered, together with security improvements and the geographical advantages of Mozambique, as one of the principal factors enhancing the attractiveness of utilizing CFM. Mozambique's currency, the metical, has depreciated more than 95 percent in U.S. dollar terms. The real effective exchange rate has depreciated by two thirds since 1987, indicating

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substantial real adjustment. For the economy as a whole, this real depreciation has increased the attractiveness of Mozambican exports. For CFM in particular, it has allowed tariff rates to be adjusted realistically upwards in metical terms, while allowing regional/international rates to remain competitive when converted from meticais to dollars.

Fiscal and monetary policy under the ERP have intensified the pressure on CFM to improve its management capacity and become financially viable. A massive reduction in subsidies throughout the economy has reduced the fiscal deficit including grants from over 13.5 percent of GDP in 1985/1986 to an estimated 4.8 percent in 1989. This has forced all government enterprises to become more efficient and many have closed down. For CFM, the reduction of subsidies and the Government's strong adherence to all targets set with the IMF has sent a clear signal that management reforms must be serious and sustained. When one considers that government recourse to bank financing has declined from over 12 percent of GDP in 1986 to under 2 percent in 1989, the capacity for even emergency assistance from the central government has been drastically reduced, thus adding to the long-term pressures on state enterprises to become fiscally responsible.

Finally, consideration must be given to measures to increase the access of productive enterprises, both public and private, to foreign exchange. Under the ERP, the GOM has made provision for foreign exchange earning enterprises to retain control over a percentage of their hard currency receipts, thereby allowing them to finance imports as circumstances require. CFM has been authorized to retain 40 percent of its foreign exchange earnings. This has replaced an archaic and completely

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inefficient system where all enterprises received their foreign exchange allocations through a comprehensive national plan, with foreign exchange actually disbursed in small amounts as it became available to the Government, not as enterprises required it. Foreign exchange allocation is being further reformed to reduce the degree of administrative discretion in favor of market-based allocation. CFM's capacity to generate revenue will thus become, over time, the key determinant of its access to foreign exchange. This adds to the healthy market pressures to run an efficient organization, while guaranteeing that entities which are effectively managed have the flexibility to make import decisions based on their needs and are not subject to the inefficiencies of central planning mechanisms.

II. RELATIONSHIP TO A.I.D. STRATEGY

RRSS contributes to A.I.D.'s regional strategy and to the U.S. economic strategy for southern Africa. These emphasize that a development effort led by private sector initiatives cannot succeed as long as the basic regional transport infrastructure is not efficient and cost-effective. Without Mozambique's rail system, Malawi's potential for increasing exports is severely constrained, and Zimbabwe, Swaziland and Zambia all suffer to lesser but significant degrees. Although the RRSS project falls outside of USAID/Mozambique's food security core strategy, improved rail links may, in the medium to long term, encourage private agricultural production and marketing by providing an efficient transport link between rural producers, urban consumers and export outlets.

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USAID/Mozambique's recently approved Country Program Strategic Plan (CPSP) for FY 1990 identifies the Regional Rail Systems Support Project as an important target of opportunity to be pursued in support of A.I.D.'s regional development efforts. The CPSP identifies the need to procure additional locomotives to meet regional traffic demand. It also proposes to assess the feasibility of providing assistance to CFM to complete the rehabilitation of the Nacala Corridor. These proposed activities, moreover, helped focus attention on CFM's importance to achieving the economic objectives of A.I.D.'s regional transport activitites.

AID/W expressed its current thinking on southern Africa's regional rail network in 90 State 114919. This cable emphasized "the need to apply resources to those railway lines which are most likely to lead the region...towards cost effective solutions to its rail transport problems." Specifically regarding CFM, the cable concludes that "given the importance of Mozambique's three major rail corridors for the region's trade and economy, it would seem appropriate to investigate the institutional capacity of CFM and to plan a comprehensive, systems approach to resolving institutional bottlenecks, bad organizational policies, structural problems and poorly functioning procedures." In this light, the cable stressed the importance of linking the procurement of locomotives with assurances from the Government to cooperate in an institutional analysis and restructuring as needed.

This PP Suppplement is consistent with the guidance set forth in 90 State 114919. As a condition of assistance, CFM must participate in a comprehensive management analysis intended to lead to organizational and financial restructuring (see Section XIII, 'Covenants'). Funds for

this assessment are included in the PP Supplement budget (see Section VII, 'Financial Plan'). At a policy level, the proposed support for CFM reinforces the general conclusion in State 114919: "right now, ...priority has to be placed on CFM. Second are the investments beyond Mozambique's borders to ensure efficient corridor operations; i.e. in Zimbabwe and Malawi."

III. RELATIONSHIP TO THE RRSS PROJECT PAPER

This subproject is a natural extension to the original RRSS project, authorized on August 16, 1988. The project paper noted that the Maputo Corridor was SADCC'S main alternative to South African routes and that a deficit of locomotives was expected in Mozambique by 1991. It then outlined the project strategy, which is to increase the effective number of locomotives by improving maintenance and by rehabilitating eight locomotives presently out of service.

Although the project initially suffered some delay, largely because of the decision of the Kuwait Fund to not extend the RITES technical assistance team, implementation is now proceeding at an acceptable pace. The first order of GE U20C spare parts was made in January, 11 of the foreman/technician level technical assistance team of 19 arrived in April, 1990, and the management level technical assistance team will arrive in June. The project will be fully operational by mid-1990.

The design team critically reviewed and revalidated the expected outputs of the project; rehabilitation of eight locomotives, raising availability rates from their present 55 percent to 75 percent, and improving financial management, accounting, and stocking and inventory control.

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It should be noted that the present project may suffer some cost overruns because the original project paper underestimated the unit costs of spares for rehabilitation and maintenance. It is, however, too early at this point to quantify these costs or even to be sure they will exceed the present budget. The two TA teams will take stock of present inventory, parts on order, and future needs during their first year of activity. At that point, in late 1990 or early 1991, USAID will be in a position to make a good estimate of total project spare parts requirements and costs.

Specifically, RRSS's Mozambique component aims to 1) increase CFM's tractive capacity and 2) improve its accounting, financial management, and planning systems. This amendment is directed primarily at the first of these, and is justified by projections which show that, given the imminent reopening of the Limpopo Line, increased traffic on the Beira Corridor, and increased use of the Ressano Garcia line, CFM faces a critical shortage of locomotives through 1995 and beyond.

RRSS is financing two technical assistance teams (foreman/technician level and management level), which together will provide 15 long-term expatriates and 75 months of short-term training assistance to the workshop, and nine long-term financial management experts, 72 months of short-term expertise, and 50 months of training assistance to CFM's financial operations. These teams will ensure that the locomotives are properly maintained and also expand our understanding of CFM's problems and possible solutions. While the spares and technical assistance thus provided are necessary and important, a systems approach that also covers CFM(N), CFM(S), and overall coordination between the three corridors is lacking. To address this problem, this supplement provides for a

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comprehensive review of CFM beginning in 1990, a few months after both teams are in place, and after the June completion of the World Bank-funded 'Organization and Manpower Development Study,' which is reviewing the structural and manpower problems facing CFM(S) and CFM(N). The team, which should combine railroad and institutional development expertise, will coordinate with the PRSS team and other donors, and, based on work completed to date, develop terms of reference for the preparation of a strategic plan for all of CFM.

IV. STATEMENT OF THE PROBLEM

A major contributing factor to the regional problem -- the significant added cost of shipping through South African ports -- is that CFM suffers from most or all of the operational, management, and financial problems typical of African railroads. In the case of Mozambique, however, many of these problems are exacerbated by war. They include:

- Serious gaps in management. CFM's very few qualified and experienced managers are concentrated at the senior staff level. This small group is overwhelmed by day-to-day problems that would normally be handled by middle management, which is virtually non-existent.

- Serious gaps in critical technical areas, such as mechanics and electricians.

- Overstaffing at the 'helper' level, by an ill-educated, and therefore difficult to train, staff.

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- Financial difficulties, the result of overstaffing, poor performance, and security problems, that make it impossible to develop an incentive package to attract qualified personnel.

- Shortages of locomotives, wagons, spare parts, and other commodities essential to running the railroad.

- Inability to put together information and interpret it in a way that improves performance. While the meticulous recordkeeping introduced under the Portuguese remains in place, there is no capacity to transform the raw data into reports that indicate the problems to senior management. This results in an awareness of symptoms but does not illuminate causes or solutions.

These fundamental problems have a devastating effect on overall performance, as reflected in various indicators:

- Availability rates for GE U20C locomotives are about 55 percent. This compares with rates of better than 80 percent for developed country railroads, about 68 percent for National Railroads of Zimbabwe (NRZ), and 51 percent for Tanzania.

- Utilization rates for the available CFM(S) locomotives average under 100 kilometers a day, compared with 400 a day for NRZ's similar GM locos. This low utilization rate is the result of both poor operational coordination and exogenous factors -- the daylight only travel

restriction, the short length of the two open CFM(S) lines (Goba, 67 kilometers; Ressano Garcia, 88 kilometers), and the poor condition of the track on much of the system.

- Fourteen percent of CFM(S)'s budget is devoted to the rental of wagons from South Africa Railways (SAR). This is caused in part by SAR's refusal to allow CFM wagons onto its system, because of high 'fair wear and tear' costs, but also by long turnaround times for the wagons on the CFM system.

- CFM now carries almost no time-sensitive freight, such as citrus fruits, which were once an important, although seasonal cargo. This is because of long and unpredictable transit times, caused in part by port/rail interface problems.

The list can be extended. The basic constraint facing CFM is that it does not have the staff, equipment, or financial resources to run an efficient railroad, nor any way of acquiring such resources without substantial external assistance.

The original RRSS Project Paper focuses principally on increasing technical and financial management capacity in CFM(S). The major problem that this Project Paper Supplement addresses is the shortage of locomotives, but it also stresses the importance of expanding management capacity and allocates funds for an early and thorough review of the management of CFM. USAID and other donors are making a concerted effort in several areas, discussed below, to alleviate operational bottlenecks to the smooth functioning of the three Mozambique corridors. Thus far,

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only the Beira Corridor initiative deals comprehensively with CFM's problems and no single project systematically addresses the overall coordination between the three main corridors or the smaller lines and ports.

CFM and USAID projections show that, without the acquisition of any new units, CFM would have a deficit of at least 55 locomotives by 1995. When the project paper was prepared a rough analysis indicated that the shortfall would be 22 in 1995, rising to 34 by 2000. Since then, these initial forecasts have been refined considerably, first by a Rail India Technical Services (RITES) team in late 1988, further by the World Bank as part of the Beira Corridor project design in 1989, and finally by USAID in December 1989 and January 1990.

USAID's analysis and the results of the locomotive requirements model derived from it are presented in detail in Annexes C and D. In short, it found that while the original traffic projections have proved to be fairly accurate, the size of the locomotive deficit has increased by 33 units. There are several reasons for this: 1) Six locomotives have been destroyed by sabotage since mid-1988; 2) service train requirements have been added to the total; 3) seven GE and two AEI locomotives will have reached the end of their useful lives in 1995 and must be scrapped.

V. DONOR ACTIVITIES

Over the last three or four years, the focus of donor activity has been shifting from reconstruction of the ports and rail lines to the problems of operating CFM efficiently, so that Mozambique can resume its natural role as the pre-eminent transit country for the SADCC region. These activities fall into three main

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categories: 1) those directed at increasing rolling stock and tractive power; 2) technical assistance aimed at filling the skills gaps at CFM; 3) manpower development and training. USAID has factored the full range of donor programs described below into the technical, economic and financial analyses that support the locomotive procurement. We have also taken into account these activities in determining the approach and timing for the proposed study of institutional reform.

Three other donors are providing locomotives: France (Caisse Centrale de Cooperation Economique, CCCE), 15 Alsthoms equipped with Caterpillar engines; Canada, ten GM or GE's; and Japan, five Brazilian-made GE U20C's in 1990, with an additional three to five possible in 1991. The Japanese program is very difficult to predict; it depends on the total package of CIP-like assistance offered by Japan, on the decisions of an inter-ministerial group that debates and approves the final Mozambique request, and finally on a Government of Japan review of the GOM proposal.

In late 1989, Italy completed the rehabilitation of 180 wagons for CFM(S) and Denmark began a program to rehabilitate 300 for CFM(C). In addition, the British have provided a wheel bearing installation machine to Nampula. Italy also plans a new wagon rehabilitation program for CFM(S) to begin in 1990. To improve the efficiency of wagon use, Kuwait has financed a computer tracking system for Maputo and the UNDP (with USAID cofinancing) is extending its pilot shipping information project for Malawi to the Nacala line. CFM should be able to meet its wagon requirements through 1995 by a combination of these donor programs, rehabilitation, and rental from neighboring countries. This issue is discussed more fully in the Project Description (Secton VI, below).

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Directly related to the provision of new locomotives is assistance to the diesel workshops. The major donor in this area has been Kuwait, which since 1983 has provided between 40 and 60 RITES technicians, about 20 of whom were assigned to the diesel workshops in Maputo and Nampula (Nacala Corridor). While this team has been criticized for its failure to transfer skills to the CFM work force, it has also been instrumental in keeping CFM's availability rates from dropping further and in keeping up basic financial accounts. The major lesson of this considerable effort is that while such mid-level expertise is required to keep the railroad afloat, a more comprehensive approach is required to solve CFM's fundamental institutional problems.

Although the termination of RITES technical assistance in late 1990 is of some concern, several planned projects should minimize the disruption to day-to-day rail operations. In Maputo, the RRSS project TA was reconfigured to compensate for this loss and will now provide 15 long-term advisors and 75 person-months of training to the CFM(S) workshop and storehouse. In addition, RRSS is financing spare parts for three years for all 59 of CFM's GE U20C locomotives. British assistance is providing two expatriate managers to CFM(N), and the six RITES personnel scheduled to depart CFM(N) at the end of 1990 may be replaced by Alsthom technicians, at least in the workshop.

The above projects should have a significant impact on the low rates of availability (the average is about 55 percent) for diesel electric (DE) locomotives throughout the system, and also provide CFM staff with needed training.

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In addition to the projects directed at the workshop, rolling stock, and traction, both RRSS and the CCCE have projects to improve CFM's financial management. RRSS provides both long-term (nine expatriates, most of whom are in line positions) and short-term (75 person months, largely for training) assistance. The CCCE is providing short-term assistance to enable CFM to close its accounts to the end of 1988 and thus permit the state enterprise, which was created in 1989, to start with proper books. Kuwait also has provided a senior commercial officer to CFM. The departure of the incumbent in May, 1990 will leave a large gap in a critical area.

On the Beira line, a more comprehensive approach to CFM's fundamental structural and management problems is underway. The World Bank and several other donors are providing over 70 expatriate managers and advisors, many of whom are in senior line positions. The IBRD's Beira Corridor Project was based on in-depth analyses of the operations, manpower and finances of the corridor. Parts of this analysis, particularly those dealing with structure and human resources, are now being extended to Nacala and, more importantly, to Maputo with World Bank assistance. The comprehensive analysis of CFM, to be funded under this supplement, will assess the results of this effort and propose follow-on work to fill analytical gaps and to develop a systems approach to CFM's problems.

In addition to the above, France and Portugal have an ongoing program of assistance to improve CFM's internal training capacity. This program, which began in 1984 and is now entering its third phase, is refurbishing four regional centers and providing them with technical assistance. The training covers all levels of staff, from new entry literacy and numeracy to senior management. These regional centers are expected to serve Angola as well as Mozambique.

SATCC (Southern African Transport and Communications Commission), which is headquartered in Maputo, has done some work on common institutional problems faced by SADCC railways. SATCC's major role to date, however, has been to develop programs for the development of the corridors and to solicit funds for their implementation; these efforts have been directed to the rehabilitation of the physical infrastructure, and have given only limited attention to problems of institutional management. In late 1989 SATCC cosponsored with the World Bank a working group on financial and operational issues facing the railways, but it is fairly clear that the Bank and bilateral donors, not SATCC, must follow up on the institutional issues facing the national railways. While SATCC will pursue issues of standardization and joint training, it is not in a position to address the national political, organizational and economic issues that railway reform entails.

Although the IBRD/SATCC final report on financial issues facing the regional railroads will not be presented to the railway directors in mid-1990, the conclusion is that without an improvement in efficiency of at least 20 percent and tariff increases, the railroads will be a long-term significant drain on the SADCC country governments. USAID believes that while this may lead to a healthy consensus on the problems facing the railways, concrete action on the important issues will require individual governments, supported by external assistance, to make difficult adjustments.

The IBRD is presently also sponsoring an in-depth study of Organization and Manpower for CFM(S) and CFM(N) organization and manpower. The draft is expected in June, 1990, and the paper will be similar to that prepared for the Beira Transport Corridor Project. That

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study examined every facet of the existing structure of CFM(C) and compared it to what was needed to achieve improved service and to carry efficiently the volume of traffic expected in 1995 (assuming Sena open). The areas covered include relations between the various port and rail services, the manpower (both quantity and quality) needed to carry out each operation, and the technical assistance and incentive schemes that would develop CFM(C) into an effective railroad. The new study, which focuses on CFM(S) and CFM(N), will provide vital background to the work on CFM's structure proposed under this project.

The focus of RRSS has been and will continue to be on the Maputo corridor and on CFM's National Directorate, which is based in Maputo and has overall responsibility for CFM. The design team found that at present RRSS and other donor projects do not have the scope necessary to correct the fundamental management deficiencies found everywhere: workshops, dispatching, materials management, upkeep of the buildings, and coordination of the activities of CFM's geographically separate and partially autonomous rail lines and ports. RRSS will, nonetheless, make a significant contribution to achieving sound financial management and to upgrading the diesel workshop and materials control system.

VI. PROJECT DESCRIPTION

A. Goal and Purpose

The original RRSS project had two basic objectives: 1) to increase the tractive power available to CFM and 2) to develop a commercially oriented financial management system for the railway. Most of the financing made available through this amendment addresses the first of

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these objectives by purchasing additional U.S. locomotives and developing a system for monitoring their performance. The provision of new locomotives will increase the freight hauled by CFM from 5.8 million tons to approximately 7 million tons in 1995 and generate a minimum cost savings to the region of $3,600,000 per year. In addition, however, the project will lay the groundwork for other necessary and fundamental changes in CFM by financing an in-depth institutional study of what is required over the next several years to develop CFM into a railroad that performs effectively and profitably. In order to track the locomotives for a minimum of two years, an eight-month extension of the Project Assistance Completion Date, to December 31, 1994, is also required.

The economic and financial analyses prepared for this amendment find that even with modest increases in efficiency (and possibly without any), an improvement in the security situation, and the opening of lines now being reconstructed, the rate of return to new locomotives is high. The primary reason for this is that Mozambique has an overwhelming geographic advantage over alternate routes, particularly for traffic from Zimbabwe and Malawi.

B. Locomotive Procurement

This section covers not only a description of the locomotive component of the project supplement, but also briefly analyzes the rolling stock situation. Without an adequate supply of wagons, the locomotives will not be able to meet increased traffic demand.

The major component of this amendment is the addition of ten 2,000 horsepower diesel electric locomotives to CFM's fleet, to reduce the projected 1995 deficit (after

accounting for other presently planned acquisitions) from 22 to 12. There are several reasons for not planning at this time to meet CFM's total expected demand for locomotives. First, the projections depend on an improvement in the security situation, which, although very likely, may not occur. The effect on locomotive requirements of a deterioration or no improvement in security is mixed. Twelve hour operation would require more locomotives, the closure of lines would require fewer, and sabotage damage would result in a higher replacement rate. A deterioration in security would, in any case, reduce the project's rate of return. Second, while the purchase of locomotives is a good investment, expenditures of similar amounts in other areas, particularly TA, might have equal or better rates of return. Third, and related to the TA, tractive power can be effectively increased by improving efficiency (e.g. reducing turnaround time or raising track speeds). Such opportunities need to be fully explored before closing the gap completely. Fourth, Japan may provide additional GE locomotives in 1991 and beyond.

It is impossible to predict with any confidence what the general security situation will be during the 30-year life of the locomotives. CFM provided USAID with the following estimates of losses to sabotage since 1986:

CFM Losses to Sabotage or Attack
(million $)

	1986	1987	1988	1989
Total	58.0	46.0	35.4	34.9
of which				
Locomotives	12.0	23.6	14.4	23.2

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The above figures may not even be indicative, since it was not made clear how they were arrived at and the depreciation of the metical would overwhelm any apparent trend. A better indicator of risk may be the fact that eight locomotives have been destroyed over the last five years. If this level continues, the chance of one of the A.I.D. funded locomotives being destroyed in a given year, if it is assigned randomly, is about 15 percent. The real chance is considerably less, we believe, for several reasons. The most important is that recent regional and national political developments indicate that the security situation will improve. In addition, risk of attack will be an important consideration in assigning the locomotives, and, finally, the new locomotives will be partially protected by armor if the situation requires.

Where the locomotives are to be deployed within the CFM system depends on the fleet composition, the number of locomotives needed on each corridor, the security situation, and the maintenance capacity of the three major CFM diesel workshops or sheds -- Maputo, Beira, and Nampula. At present, our projections indicate the following requirements and availabilities by corridor in 1995:

TABLE 2:	1995 Requirement	Projected Fleet	Shortfall
Maputo	34	40	-7
Beira	52	23*	29
Nacala	21	6	15
Unassigned		25	-25
TOTAL	107	94	12

*Includes eight Japanese locomotives arriving in 1990 and 1991 and ten Canadian locomotives arriving in 1991 or 1992.

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The 1995 main line fleet composition by type of locomotive is as follows:

GE	59
Alsthom	15
GE or GM	20

The 'GE or GM' are the U.S. and Canadian contributions, both of which will be competed between the two manufacturers.

The repair capacity situation in 1995 should be as follows:

Maputo Workshop	Maintenance, all repairs, engine rebuild, complete overhaul/rehabilitation
Beira Workshop	Maintenance, most repairs, engine rebuild
Nampula Workshop	Maintenance, most repairs, engine rebuild

The workshops in Beira and Maputo will both benefit from ambitious training programs and technical assistance over the next three to five years. Nampula will receive significantly less attention unless the Alsthoms are assigned there.

The locomotives not yet assigned to a specific corridor are the USAID-financed GE or GMs and the CCCE-financed Alsthoms. Where these go will be determined by the application of three principles to the situation that develops over the next two years. These are: 1) new types of locomotive should be concentrated on one line; 2) new types or mixed fleets should be placed where there is the best maintenance

capacity; and 3) new locos of any type should be placed where they are least likely to be destroyed. In addition, the locomotives financed by USAID could be most easily monitored in Maputo, where USAID technical assistance is concentrated.

Because of the unknown fleet composition (GE or GM), security situation, and future capacity of the maintenance facilities, the PP Supplement design team could not recommend a specific destination for the USAID-financed locomotives. The project agreement will, however, stipulate that the placement of the locomotives is subject to USAID concurrence. For purposes of monitoring performance of the locomotives, Maputo is the preferred site, although this will require the transfer of older locomotives from Maputo to Beira. If, however, both USAID and CIDA finance GMs, the USAID locos should follow the Canadian units to Beira, since the CIDA locos are expressly destined there. Of course, both the Canadian and Japanese deeding of locomotives to Beira could be renegotiated.

In addition to the locomotives themselves, the project will procure the complementary technical inputs required both for the procurement and for maintenance during the warranty period. These inputs will be provided either under an IQC (review of specifications and factory inspection) or as part of the price of the locomotive (a service representative for the warranty period).

During the project design, the team reviewed whether adequate rolling stock would be available in 1995 to carry the expected traffic of nearly seven million net tons. In 1984, SATCC sponsored a careful analysis of regional wagon requirements based on each country providing a fair share to

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the common or bilateral pools. That study calculated the following system averages for net tons carried per wagon per year as follows:

System	Net tons carried per wagon
CFM(S)	1,328 - 1,780
CFM(C)	690 - 1,000
CFM(N)	690 - 1,020

These averages were applied to present 1995 traffic projections, with the following results:

	Wagons Needed (1995)	1990 Holding	1990 Available
CFM(S)	3,628 - 2,706	3,696*	2,500
CFM(C)	2,320 - 1,600	3,237	2,424
CFM(N)	704 - 476	892	800
TOTAL	6,652 - 4,782	7,825	6,120

*The CFM(S) figure includes many wagons that cannot be rehabilitated and may, indeed, be exaggerated. Availability figures for all three systems include wagons in very poor condition.

If the high requirement figures are taken (and they are probably the most realistic for all but Beira, since neither CFM(S) nor CFM(N) is receiving external assistance to improve operations), then CFM(S) faces a shortage of over 1,000 wagons in 1995. This potential shortage, however, is not as paralyzing as might appear on the surface. First, South Africa provides all the wagons used for international freight on the Ressano Garcia line, and, in fact, refuses to allow CFM wagons to cross the border. Although CFM provides all the wagons on the less important Goba line, the

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combination results in a much lower than 'fair share' of traffic for CFM(S) rolling stock. The reason for the high cost of rental (amounting to 14 percent of CFM(S) operating budget) is not a lack of wagons, but the failure of CFM to quickly return wagons to South Africa. Second, wagons, unlike locomotives, are pooled and cross borders: this allows CFM to compensate up to a point for a deficit. Third, there is a wagon manufacturing company in Maputo that claims a capacity to rehabilitate 600 wagons per year. This company, a parastatal that may benefit from private investment and management by the end of 1990, is supplying 100 new wagons for Tanzania and has refurbished 500 wagons for CFM over the last two years (complete knockdown and rebuild, including conversion to roller bearings at a cost of Mt 16,000,000, or about $16,000, per wagon in 1990). The company is primarily a manufacturer, however, and would likely abandon repair activities if it received sufficient orders for new wagons. Fourth CFM(S) itself has a wagon shop with the physical plant capacity to rehabilitate 600 additional wagons a year, although it only did about 150 in 1989. The plant may be better utilized if the planned Italian project comes on line in 1990. Fifth, CFM believes that the average net tons per wagon will be significantly higher, at 1,500 - 2,000 tons, than the SATCC estimates, which were based on NRZ figures. CFM's claims are theoretical, however, and will have to be verified on the ground. At present, with the Limpopo line closed, CFM(S) is almost certainly well below 1,000 kilometers a day.

The above analysis neglects some important elements. For example, the rule of thumb average life of a SADCC wagon is 40 years, and by 1990, 665 of CFM's wagons were between 40 and 50 years old. CFM is disregarding the rule, however, and completely rehabilitating and converting to roller bearings wagons over 30 years old. These are expected to have an additional life of forty years. Second, about 2,000 wagons

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are now in need of rehabilitation or scrapping. If all of these, as well as 250 more a year (the working fleet divided by 20 years, the average time between major overhauls), are to be put or kept in service, than CFM must rehabilitate 650 a year, significantly more than the present 350. While this by no means exceeds the national capacity, it will require organization and financing.

In conclusion, the wagon situation appears to be manageable but is in need of further coordinated study. In particular, a true picture of the fleet should be developed through a careful inventory. Such an undertaking would most naturally fall to Denmark, which has an ongoing program for wagon rehabilitation in several SADCC countries. Our present rough analysis indicates that there may be enough wagons and, if there are not, the fleet can be increased fairly quickly through rental, rehabilitation and new purchase. This conclusion bears out CFM's conviction that a shortage of locomotives, not wagons, is the major bottleneck to increasing the freight hauled by CFM over the next five years.

C. Management Information

The second component of the project, management information, is an expansion of the original RRSS monitoring plan to include detailed indicators of the maintenance and performance of the locomotives purchased, as well as of the rest of the diesel electric fleet. During the preparation of this supplement, a railways expert reviewed the records at the shop level and found that detailed performance, maintenance, and repair records are kept for all locomotives, but that this information is not being tapped. He therefore recommended that a simple computerized system be developed to produce reports for each locomotive. Since

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this activity fits naturally into the present project, USAID will request that the present lead (management-level) contractor investigate the feasibility of such a plan and develop a simple computer program to carry it out. The contract may then be amended to add a computer specialist to maintain the system, produce the reports, and train a CFM staff member.

The reports produced will be used by workshop management, including the technical advisors provided by the project and senior CFM staff. They should make it easier to identify problem areas early and take necessary corrective actions. Further, these reports will provide a detailed history of the performance of CFM on locomotive maintenance and repair.

D. Management Analysis

The purpose of the third component of the project, management analysis, is to lay the groundwork for a more comprehensive approach to the problem of creating an economically and operationally efficient CFM. This PP supplement budgets $750,000 for two studies of CFM's management structure and problems. The first study would be under an IQC with a company capable of providing experienced railway personnel. It will build on the extensive Organization and Manpower Study now underway, as well as on the experience of the management-level TA team in its efforts to improve financial and maintenance operations. The present project addresses three important areas of weakness; maintenance and repair, materials management, and financial management. Missing are several other critical areas -- operations, personnel, commercial services, and a systems approach that brings these elements together for the whole of CFM.

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USAID envisages a program loosely based on the railroad reform model prepared by the World Bank for the Union of African Railways (UAR). The model bases restructuring on four 'plans';

- The strategic plan, which defines the railroad's purpose and broad relationship to government;

- the contract plan, which spells out the respective responsibilities of the government and the railroad;

- the management plan, which organizes the railroad so that it can fulfill its contract; and

- the enabling actions plan, which spells out legislative and other legal or administrative changes necessary to performing the contract.

As pointed out in more detail in Section X, Institutional Analysis Update, CFM has established a general framework for a 'strategic plan'; it has a mandate to make a profit and its main purpose is to carry freight (i.e. passenger services are secondary). In addition, some 'enabling actions' have been taken (e.g., CFM has been granted the authority to raise wages by 100 percent over the national scale), and a sketchy management structure has been drawn up, based on the principle that the three main corridors are autonomous profit centers. The manpower study mentioned above will provide further detailed recommendations on how CFM should be structured and staffed to carry out its mandate. This work could form the basis of a more detailed 'management plan.' Finally, CFM is trying to develop a three-year contract with government, to stipulate operational and financial targets and define liabilities, such as duty rates and corporate taxes. USAID believes that significant external assistance will be needed to complete this plan.

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The precise terms of reference for the initial study financed under this supplement must await the presentation of the Organization and Manpower paper to CFM in June. However, Annex H, the Institutional Analysis Update, suggests that overall reform of CFM should be based on the following elements:

1) Physical separation of system segments (i.e. Nacala, Beira and Maputo corridors);

2) system-wide standards of equipment and operational procedures;

3) clearly defined lines of authority and decision-making responsibility delegated to the lowest feasible level;

4) provision of modern communications and data processing;

5) centralization of certain activities (e.g. procurement, heavy repairs, accounting, and training);

6) the level of education of the pool of present and potential and actual employees;

7) a clear separation in practice as well as theory between CFM and the Ministry of Transport;

8) improved techniques for controlling the movement of locomotives and wagons; and,

9) commercial selling of railroad services to industry and trade.

In addition, the USAID study will identify areas where the railroad should contract out or divest.

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Most of the above questions are the subjects of study by one or more donors, but no agreement on an overall approach yet exists. This is not surprising given the deterioration of infrastructure and equipment, the war, and the line closures -- the compelling urgency of these problems has taken precedence over longer term institutional questions. The other important factor is that the Ministry of Transport itself undertook a restructuring of CFM in 1988 and 1989; this led to CFM being spun off from the Ministry and to the establishment of a spare but sound legal and organizational structure for the management of the railways and ports.

CFM understands that the first step, the acceptance of a clear division between CFM and the civil service and the priority of the commercial over public service functions, is not enough, and envisages a contract with Government based on sound strategic and contract plans that will cover finances (including tax liabilities), staffing, operations, social service commitments, and other areas that involve public policy vis-a-vis the railroad. To produce either the strategic plan or contract in sufficient detail is, however, beyond the present capabilities of CFM, because those few able to do so are simply too busy and the knowledge base is too narrow. External resources will be required both to define areas of mutual concern to the GOM and CFM and clearly state joint policy on them (the strategic plan) and to chart a course of action over the next three to five years (the contract plan). (See Section XII, the Institutional Analysis Update, for a fuller discussion of CFM's current legal status and authorities.)

The initial IQC study will have to examine not only what other donors are presently doing, but what they plan, and what vision they have of CFM's future. If a project results from the study, then it will have to embrace ongoing donor programs in several areas and bring together assistance in many different subsectors.

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Most of CFM's senior staff have been with the railroad since before independence, and are well aware that it is not functioning properly and needs substantial assistance and reform. While there will be areas of conflict between individual or corporate interests and efficiency, CFM and the GOM have both demonstrated over the past few years that they are committed to fundamental reform and recognize its benefits. CFM, because of Mozambique's infrastructure and geography is an international rather than a domestic rail service, and can be a major source of foreign exchange if run well in times of peace. Now, however, a combination of external problems and internal inefficiencies is absorbing both the potential profit and several million dollars a year in GOM funds (presently provided by the non-renewal of capital stock, by donors in the form of capital equipment and TA, and by modest subsidies from the GOM).

The results of this first study, for which $225,000 is budgeted, will inform the design of an overall program to restructure CFM. This supplement budgets an additional $525,000 for this purpose.

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E. Project Management

USAID's RRSS management team consists of a direct hire engineer (scheduled to arrive in Maputo in September, 1990), and a project management office with a PSC project manager and a TCN PSC engineer as well as support staff. This core group draws on legal and contracting services from USAID/Swaziland and RCMO assistance from REDSO/ESA. USAID's USDH CMO provides advice and assistance as needed.

As described below in the procurement plan, most contracting will be undertaken under host country procedures by the CFM Purchasing and Supplies department, assisted by USAID/Mozambique, the RCMO and the RLA.

The locomotive purchase and subsequent monitoring can be performed under present administrative arrangements. The management analysis contract will initially be under an IQC and will also not require any additional assistance. If a major new project design is contemplated following this initial study, than additional project development, economics, and possibly human resources support will be needed for several months. It is expected that this assistance will be provided by REDSO/ESA, short-term contracts, USAID/Harare, and possibly AID/W. The terms of reference will be prepared and in-country support will be provided by the present RRSS office.

USAID does not require any further long-term direct hire or project-funded support to manage the RRSS project as amended. This supplement does, however, budget additional funds for the two PSC positions to extend them from their present termination dates (September 1992 for the US PSC and January 1993 for the TCN) to September 1994. This will ensure adequate USAID oversight through the final evaluation and audit of the project.

F. Summary of Inputs and Outputs

The anticipated outputs of the assistance provided under this project component are:

- Ten new locomotives hauling cargo between the ports of Maputo and/or Beira and bordering SADCC states.

- A maintenance tracking system that permits the early identification of problems for all levels of management.

- A comprehensive plan for a systemic approach to CFM's institutional problems.

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To achieve the outputs listed above, A.I.D. will finance the following inputs:

- Ten 2000 horsepower locomotives.

- Two year supply of spare parts for the above.

- Special tools and equipment needed to maintain the above, as needed.

- One local-hire computer specialist for three years.

- Short-term TA, nine person months for review of CFM overall structure.

- Short-term TA, 21 person-months for design of restructuring plan for CFM.

The two project management positions presently funded under RRSS will be extended until 1994. The timing of the inputs and costs are described in more detail below.

G. Implementation Plan

Table 3 on the following page summarizes how the five major pieces of this PP Supplement (pre-implementation activities, locomotive procurement, monitoring, management analysis and contracting for project management services will) be integrated over the life of the project. The current schedule provides for the locomotives to be delivered in late 1992 and early 1993. This will occur after two full years of improved performance monitoring and both of the management analyses, which will provide additional input into the placement of the locomotives, as discussed in section VI-B, above. The second stage of the management

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analysis will be completed by the end of calendar year 1991. This will allow the results to be fully assessed early in 1992. If the analysis warrants further management assistance, the necessary project documentation will be completed for AID/W review in FY 1992.

Concurrent with the implementation plan for this PP Supplement, it is important to note that the foreman/technician-level and management-level teams will arrive in Mozambique in April and June, 1990, respectively. This will provide for over two years of preparation and upgrading of maintenance skills in Maputo before the arrival of the new locomotives should they be based in Maputo. In the event that the locomotives are placed in Beira, technical advisors funded by Spain (under the Beira Transport Corridor Project) will have provided three years of technical assistance in support of maintenance and repair capacity. The arrival of USAID's management-level technical assistance team in June will allow the team to cooperate fully with those selected to complete the management analysis.

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TABLE 3

IMPLEMENTATION PLAN
CALENDAR YEARS
QUARTERS

Activity	1990				1991				1992				1993				1994			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1. Pre-implementation																				
a. Project Paper Submitted to AID/W		X																		
b. PP Authorized			X																	
c. Project Agreement Signed			X																	
2. Locomotive Procurement																				
a. Draft RFP		XXXXX																		
b. IQC Review of specs			XX																	
c. RFP Issued				X																
d. Pre-proposal conference				X																
e. Negotiations with suppliers					XX															
f. Receipt of quotations						X														
g. Review/approval contract						X														
h. Contract issued							X													
i. Inspection services								XXX	XXXXXX											
j. CFM visit to manufacturer									XXXXX											
l. Locomotives delivered												XXX	XXX							
3. Monitoring																				
a. Maintenance tracking system			XXX																	
b. Maintenance tracking implemented				XXX	XXXXXXXXXXXX				XXXXXXXXXXXX				XXXXXXXXXXXX				XXXXXXXXXXXX			
c. Evaluations								X									X			
d. Audit							X								XX					
4. Management Analysis																				
a. Initial study, dev't of SOW				XXX																
b. Follow-on, possible PP design						XXXXXXXXX														
5. Project Management																				
a. Local-hire engineer										XXXXXXXXX			XXXXXXXXXXXX				XXXXXXXXX			
b. PSC Project Coordinator												XX	XXXXXXXXXXXX				XXXXXXXXX			
6. PACD																				X

VII. FINANCIAL PLAN

A. Obligations

Because the project proposes to purchase all ten locomotives at once, the costs of this PP supplement are front-loaded. In order to issue the locomotive tender (as well as to purchase the complementary technical assistance, spare parts, and tools and equipment) approximately $17 million should be obligated in FY 1990. If funds were incrementally obligated, there is a good possibility that the successful bidder would not program production and delivery of the second lot (unfunded at the time of the initial award) until several months to a year after the first lot.

In addition, the first study of CFM's management, budgeted at $250,000, should take place relatively early in the project, since it will be most effective if it follows closely the June completion of the World Bank management study.

Since only $3 million of the $20 million obligation will be committed after the end of CY 1990, the entire amount should be obligated in FY 1990.

B. Financial Tables

Table 4 below summarizes A.I.D.'s contribution to this project supplement. Table 5 provides more detail by Fiscal Year.

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Table 4

Summary of Use of AID Funds ($000)

i.	Locomotives	15,000
ii.	Spare Parts	1,500
iii.	Tools and Equipment	250
iv.	Technical Assistance	1,584
v.	Audit and Evaluation	100
vi.	Contingency	1,566
Total		20,000

TABLE 5 AID EXPENDITURES BY YEAR

	1990	1991	1992	1993	1994	TOTAL
TECHNICAL ASSISTANCE						
Computer Specialist	0	50	52	55	58	215
Short-term	250	649	0	0	0	899
PSC Project Manager	0	0	30	150	130	310
Local-hire PSC	0	0	67	70	53	190
SUBTOTAL	250	699	149	275	241	1,614
COMMODITIES						
Locomotives	0	8,000	7,000	0	0	15,000
Tools and equipment	0	250	0	0	0	250
Spare Parts (two-years)	0	1,500	0	0	0	1,500
SUBTOTAL	0	9,750	7,000	0	0	16,750
EVALUATION/AUDIT			50		50	100
SUBTOTAL	250	10,449	7,199	275	291	18,464
CONTINGENCY						1,536
TOTAL						20,000

C. Cost Estimates

The detailed financial plan by calendar year by accrued expenditures is presented in Table 5 on the preceding page.

The estimate of the major cost item, locomotives, is based on the TAZARA procurement (larger locomotives at $1,500,000) and the September, 1989 purchase, funded by Japan of five GE U20C locomotives at a unit cost of $1,454,600 per unit. This price was also valid for orders placed up to March 1990.

The two-year estimate for spares and for tools and equipment is also based on TAZARA costs. The audit and evaluation line items will cover one additional evaluation of locomotive performance (approximately $50,000), a second audit ($15,000), and possible additional costs of the presently planned evaluations and non-federal audit. TA costs were based on present costs to the project, plus inflation. The TCN PSC and the computer specialist are local hires.

Since the above costs are based on recent contracts for identical services or commodities, it is very unlikely that any line item will increase in cost by more than 10 percent. The contingency, which covers all line items, is therefore adequate at 8 percent.

VIII. PROCUREMENT PLAN

A. Procurement List & Budget:

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The Project will finance the following commodities and services:

Table 6:

Item	Implementation Method	Financing Method	Estimated Cost ($000)
10 DE Locomotives, 2,000 horsepower	HC Contract	Direct L/Comm	15,000
TA for specification review	A.I.D. IQC	Contract	25
Inspection Services, CFM visit	A.I.D. Contract	Contract	124
Tools and equipment for locomotives*	HC Contract	Direct L/Comm	250
Two-year supply of spare parts	HC Contract	Direct L/Comm	1,500
TA -- Nine person month review of CFM	A.I.D. IQC	Work Order	225
TA -- Follow-on to above, design of restructuring plan	A.I.D. Contract	Contract	525
Local-hire PSC engineer	A.I.D. Contract	Contract	190
US-hire PSC Project Manager	A.I.D. Contract	Contract	310
Computer specialist	A.I.D. or HCC Contract	Contract	215
Evaluation/Audit	A.I.D. IQC or Contract	Contract or work order	100
Subtotal			18,474
Contingency			1,536
TOTAL			20,000

* Since the Project has already financed sufficient GE special tools and testing equipment to meet CFM's needs for the term of the Project, and since CFM has commissioned 113 GE Diesel Electric locomotives over the past 22 years (see Annex D), the procurement of the special tools and testing equipment will not be necessary if GE locomotives are purchased.

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B. Responsible Entities:

The Regional Commodity Management Officer has examined the capability of the Mozambique Railways to implement the purchases required by the project and has determined that, with appropriate input and assistance, CFM is capable of conducting the procurement of locomotives, locomotive spare parts and the special tools and equipment in accordance with the guidelines in A.I.D. HB 11 Chapter 3. Sufficient technical expertise will be available to ensure the success of the procurement. Short-term TA (probably under an AID/W IQC for engineering services) to review and finalize the technical specifications for the locomotives and spare parts will be financed by the Project. A full-time PSC contract manager with 8 years A.I.D. experience and a TCN (Portuguese) engineer with over 15 years of experience working on railways in Southern Africa are already under full-time contract for the Project. In addition, a USDH engineer is to be assigned to Maputo in September 1990 and a USDH commodity management officer is on the staff of the USAID. Lastly, regional commodity management and regional legal services are available from REDSO/ESA and from USAID/Swaziland, respectively. It should also be noted that during the last year, CFM has, under A.I.D. financing, successfully purchased spare parts, special tools and testing equipment and technical assistance using HCC procedures.

On August 4, 1989, the USAID Director, on the recommendation of the USAID/Swaziland Controller, approved the use of host country contracting procedures for the purchase of most of the commodities financed under RRSS. This approval was given with the understanding that there would be substantial USAID involvement in the procurement procedures and adequate technical assistance available. Since then, CFM has purchased approximately $5 million in commodities and contracted for

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$4.2 million of services. USAID is confident that CFM, with the levels of A.I.D. involvement and technical assistance now planned, is capable of purchasing the locomotives, spare parts, and tools and equipment financed by this amendment.

The decision to use host country contracting for the locomotive procurement to be financed by the project is also based upon A.I.D.'s recent experience in Tanzania with the TAZARA Project where use of a HCC for a similar procurement not only resulted in a close working relationship between TAZARA, the USAID and the regional officers who advised/assisted with implementation of the Project but also proved a cost effective purchasing mechanism. The CFM Officer in charge of procurement for the Project will be the Railway's Director of Procurement and Supplies. He will be assisted by the engineering and legal staff of CFM, and by three technical advisors funded by the project. The Director of Procurement and Supplies will, with the assistance of the REDSO/RCMO and the Swaziland RLA, be responsible for preparation of the solicitation document including the technical specifications, evaluation of responses from potential suppliers and for the preliminary approval of the award to the contractor on behalf of the CFM. The General Manager of the CFM, after A.I.D. review and concurrence, will make final contract awards. The CFM Director of Procurement and Supplies will also be responsible for receipt and inventory of all items financed by the project and for issuance of receiving reports to USAID.

C. Procurement Procedures:

A single Tender Document will be used to procure the locomotives, locomotive spare parts and the long-term technical assistance related to the operation and maintenance of the locomotives. This request for proposals, building on A.I.D.'s recent experience with financing a similar package of locomotives, spare parts and technical assistance for TAZARA

will be a two-step procurement process, with negotiation on technical and contractual aspects of the proposed contract followed by a price quotation with award made to the lowest priced offeror. Potential offerors will first be asked to submit technical proposals, without price information, in response to the technical specifications and terms and conditions published in the RFP. A pre-proposal conference will be held by CFM in Maputo with all interested potential suppliers. At this conference CFM will hear suggestions for changes to the proposed contract terms and technical specifications directly from the potential suppliers. Prospective suppliers will also have an opportunity to see the Railway's facilities and to discuss with CFM officials the training and technical assistance requirements of CFM. Changes to the proposed contract which result from this pre-proposal conference and any subsequent negotiations with the potential suppliers will be made by addenda to the RFP. Price quotations will then be requested from the potential suppliers and an award will be made to the lowest responsive responsible offeror.

For this complex procurement action, technical assistance for a final review of the specifications prior to publication of the RFP, to assist CFM with negotiations with prospective contractors and with the evaluation of the technical proposals received in response to the RFP will be funded by the project. An AID/W indefinite quantity contract for engineering services will probably be used to obtain these services. A technical services contractor will also be retained to inspect the testing of the locomotives at the plant of the manufacturer and the final road test prior to shipment. The Project will also fund a trip for three CFM officials to the plant of the manufacturer to witness the final testing of the first locomotive.

Included with the new locomotives will be a spare parts package for scheduled maintenance as recommended by the manufacturer for a two-year maintenance period. Also included in the price of the locomotive will be a service manager to oversee the initial start up and commissioning of the locomotives in Mozambique as well as to provide advice, training, and assistance to CFM staff for two years after delivery of the last locomotive.

D. Source/Origin

All funding for the Project will come from the DFA account through the Southern Africa Regional Program. Therefore, the authorized source/origin for commodities and commodity related services is A.I.D. Geographic Code 935. However, since most of the commodities and commodity-related services to be financed under the Project are available in the United States for export to Mozambique at reasonable cost, the bulk of the purchases under this amendment will be of U.S. source/origin/nationality.

E. Shipping

Because of the volume of project commodities funded under this Project, USAID/Mozambique with the assistance of the REDSO/ESA/RCMO will request AID/W MS/OP/TRANS to negotiate with U.S. Flag shipping lines for a concessional project rate for all consignments of locomotives, spare parts and special tools and testing equipment financed under the Project as soon as possible after the authorization of the Project. If OP/TRANS is successful in negotiating a reasonable (competitive with non-U.S. Flag shipping) rate with a U.S. Flag carrier for this Project, all consignments will be shipped by U.S. Flag vessel. If OP/COMS is unsuccessful in obtaining a competitive rate from a U.S. Flag shipping line, at least 50% of the commodities financed by the project

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shipped in each calendar year will be shipped on U.S. Flag vessels and the remaining amount of up to 50% of the equipment will be shipped on other free world carriers.

F. Marking

All equipment financed under the Project must be appropriately marked with the A.I.D. handclasp symbol. Therefore all solicitation documents, and/or contracts for equipment or supplies financed under the Project will contain a requirement for the suppliers to appropriately mark the equipment or supplies prior to shipment.

G. Financing

All contracts for commodities and related services will be financed by A.I.D. direct letters of commitment. Since USAID/Mozambique has its own resident controller and a full time project manager assigned to the Project, sufficient staff to review invoices from suppliers exists at the USAID.

H. Gray Amendment

The locomotives, locomotive spares, and tools and equipment financed will be purchased directly from the locomotive manufacturer, which will not be an 8(a) firm. In addition, much of the TA requires highly specialized institutional experience with railroads, which is probably not available from small or disadvantaged businesses.

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Some of the skills required for the follow-on and as yet undefined structural study of CFM may be available through a small or disadvantaged business. When the terms of reference are known, USAID will consider whether it is feasible to require that an 8(a) firm be subcontracted a portion of the work.

IX. MONITORING, EVALUATION, AND AUDIT

At present two evaluations are scheduled for the RRSS project, for late 1991 (interim) and late 1993 (final). Although the locomotives will not arrive until after the first evaluation, the terms of reference include a review of the performance of the diesel workshops in Beira and Maputo. This review will assess whether these workshops are capable of maintaining the locomotives once they arrive and recommending corrective action where necessary. If it is found at the time of the evaluation that CFM(C) does not have an adequate maintenance program, then USAID may require that the locomotives to be purchased under RRSS be assigned to CFM(S) even though this would require transferring other CFM locomotives to CFM(C).

In addition to the evaluations, a system for monitoring the maintenance of CFM(S) locomotives will be designed by short-term consultants under the management-level TA contract of the present project. The consultants will develop indicators for tracking the adequacy of maintenance for locomotives and establish a simple data entry system based on the comprehensive records now kept by CFM for all locomotives. A computer analyst will be hired to maintain the system, produce reports, and train a CFM staff member. Skilled analysts can be found in Maputo, although usually from within the expatriate community. A good system of maintenance oversight is planned to be introduced to CFM(C) under the Beira Transport Corridor Project.

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During the final evaluation of the present project, an assessment will be made of the effectiveness of the monitoring system and the maintenance program for the locomotives.

A final evaluation of this component will be performed in late 1984 to determine if CFM has the capacity to continue to maintain the locomotives after the PACD of December 31, 1994. The evaluation will also review the historical performance of the locomotives and assess their impact on revenues and regional trade.

All three evaluations will examine CFM's progress on the critical indicators of the project's economic viability, including backhaul ratios, engine kilometers per day, costs per ton kilometer, and availability rates.

The original project plan scheduled one audit for mid-1993. Given the significant additional funds made available under this supplement, as well as the extension of the PACD, a second audit has been scheduled for mid-1994, and the original audit moved up to late 1992, about a year after the project technical assistance and commodities arrive in Mozambique.

X. INSTITUTIONAL ANALYSIS UPDATE

(Also see Annex H)

The institutional analysis prepared in 1988, to which the RRSS project was a response, is still largely valid. Annex H describes the findings of a U.S. railway expert who inspected CFM(S). The two major changes since the original project was designed are 1) CFM's legal status and official mandate were changed in 1989 and 2) the RITES team of mid-level technicians is leaving in 1990 rather than 1993.

1) On May 11, 1989, the Council of Ministers approved a reorganization of the Ministry of Transport that gave CFM much greater autonomy and a mandate to earn a profit, particularly on international traffic. This change took legal effect in August, 1989. As a result, CFM is now able to negotiate and adjust international tariffs according to market conditions, and without inter-ministerial approval. National tariffs must still be approved by the National Commission of Wages and Prices, and this body is slow to act on CFM's requests. Despite this, CFM received permission for a 52 percent increase in national tariffs for 1990/1991 (25 percent in July, 1990, and 25 percent in January 1991). In addition, CFM has been granted the flexibility to offer salaries that exceed the national scale by up to 100 percent.

This legal autonomy from government, while of possible great future importance, has not yet been exploited by CFM for lack of the management skills and the financial means required to do so. CFM is proceeding cautiously, particularly on wage increases, until senior management has a clearer idea of how to effectively apply the new powers to the problems of running the railroad. The next five to ten years should see a gradual lifting of the financial constraint. How CFM uses its freedom of action when it is able will be critical to its long-term development.

CFM is in the process of developing a long-term business plan, which it is hoped will provide the framework for a contract plan with the GOM. This contract plan will cover costs, revenues, management goals, taxes, etc. The purpose of the third component of this project, management analysis, is to assist CFM in the preparation such a plan.

2) The original project paper determined that the success of RRSS depended on the continuation of RITES assistance through 1993. For various reasons, particularly the lack of progress

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made by RITES in the transfer of skills to CFM staff, the Kuwait fund decided to terminate this program in 1990. This required a reorientation in USAID's program to finance mid-level positions as well as the more senior ones, and led to a modest trimming of the planned senior level long-term advisors, of training, and of contingency.

The result of these adjustments has been to more or less restore the mid-1988 status quo. CFM will still need a great deal of expatriate assistance, in line positions as well as advisory roles, and in management as well as technical positions, for the foreseeable future. CFM(C) is covered by the World Bank-led consortium implementing the Beira Corridor Project. Maputo is far less advanced, and the RITES departure will leave gaps in several areas (e.g. the commercial, engineering and operations departments), but the diesel workshop and financial management areas are receiving enough assistance to operate well in the medium term.

During the design, the option of adding more technical assistance in senior management positions was considered and rejected on the grounds that a more comprehensive and long-term approach is required. The groundwork for such an approach is being prepared by the Organization and Manpower Development study that will be drafted by June, 1990. USAID will review the results of this effort and follow up with an assessment of what needs to done over the next five to ten years to achieve economic and financial efficiency for CFM(S). At the same time, if critical deficiencies in the day-to-day functioning of the corridor are discovered, USAID may add one or two positions to the present contract for mid-level technicians, by readjusting line items or drawing on contingency.

It is important that any major new technical assistance effort proceed with caution and after careful analysis. Senior CFM

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officials are beginning to feel that the myriad donor programs are not within their control and that some of them may not be working. For this reason, the present project includes funds for an overall assessment of CFM(S) and CFM directorate for late 1990, after the completion of the World Bank organization study and the return of the CFM Director General from a planned seven-week visit to U.S. railroads and ports. USAID believes that the exposure this trip will offer to efficient private railways will provide valuable insight into how to run CFM as a commercial venture. While CFM is open to and firmly committed to reform, it is important that the development of a program be manageable and as transparent as possible. This will require careful coordination with the several other donor efforts presently planned or underway.

XI. SUMMARY OF ANALYSES

The preparation of the Project Paper Supplement required in-depth economic, financial, and technical analyses, as well as an update to the original project's institutional analysis. The economic analysis was divided into two distinct parts, the projection of traffic and the calculation of the rate of return, presented separately in Annexes C and E.

A. Economic Analysis -- Traffic Projections (Annex C)

Estimates of future traffic determine how many locomotives need to be purchased. The basic approach used in this analysis was to critically examine and modify traffic forecasts by SATCC, the Netherlands Economic Institute (NEI), and CFM. SATCC figures deliberately exclude trade entering Mozambique from South Africa, its scenarios do not include the one that now seems to be most likely (all Mozambique's international lines except Sena open by 1995), and the estimates of local traffic are too optimistic to serve as a solid basis for purchasing locomotives.

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While SATCC estimates total regional trade and then distributes it, the NEI model is basically distributional. The NEI study, prepared for the World Bank's Beira Corridor Project, refined earlier work by RITES, and resulted in substantially higher traffic figures for 1995 than SATCC. NEI distributed SATCC's total traffic according to a user preference model that excluded political considerations and took into account all costs, including poor service, uncertainty, etc. USAID's analysis drew heavily on this method of distributing traffic. Finally, while CFM does not internally derive projections, it has set as its goal to reach 1981 traffic levels by 1995. Given that the commodity mix is essentially the same now as then, and assuming that the security situation permits free circulation, this appears to be a good institutional target. For the purposes of this analysis, it is assumed that traffic will reach the 1981 levels by the year 2000. Traffic levels are then interpolated to 1995. This procedure resulted in more conservative projections for 1995 than SATCC or NEI developed. Any of the three projections results in a requirement for locomotives that is higher than the expected supply.

During the design, interviews were conducted with shipping agents and CFM commercial staff to try to determine if shippers would respond to the increased availability of hauling capacity. The principal draw to utilize CFM is the reduced cost to shippers. As discussed in the Economic Analysis, Annex C, an average shipper will save 52 percent because of the shorter distances to Maputo rather than Durban. It is clear that a major cost of transporting through Mozambique is the additional transit time and administrative burden imposed by system inefficiencies. Most models, including NEI's, factor some of these costs into their projections. It is also clear that increased tractive power will in and of itself reduce the uncertainties that now

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face users of the Mozambique corridors. USAID believes that the recent increases in traffic (40 percent from 1988 to 1989) under very poor operational conditions and the overwhelming geographic and financial advantages of the Mozambique lines make it highly probable that shippers will respond as expected to the increased availability of hauling capacity.

Table 7 below shows the comparative forecasts.

TABLE 7: TOTAL TONS CARRIED BY CFM
1995 AND 2000

	1995	2000
USAID	6,897	9,735
SATCC	7,443	9,391
NEI/IBRD	8,701	N/A

B. Technical Analysis
(Annex D)

The technical analysis also has two parts. The first uses the traffic projections developed in the economic analysis, traffic mix, and operational factors (line gradient, passing loop size, seasonal variations in the commodity mix, etc.) to determine the number of locomotives required by each of CFM's three international corridors. The second part discusses the performance characteristics of locomotives and recommends that CFM purchase additional units of the same general type as those that now dominate the fleet.

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1. Locomotive Requirements

The number of locomotives required is determined by two sorts of technical consideration; a) the physical characteristics of the railroad and commodities and b) the efficiency of the railroad carrying the goods. The physical elements are given and assumed not to change during the life of the project (except for total traffic demand, which rises as described above). The analysis assumes, however, that the RRSS project will meet its efficiency targets, and that fleet availability will increase from its present 55 percent to 75 percent and that locomotive utilization rates (measured in distance covered by available locomotives) will rise from 51 to over 300 kilometers a day (CFM-S). The main contributing factors to a rise in utilization rates are the switch to 24-hour operations and the opening of the long Nacala and Limpopo lines. The model then calculates the total requirement and the expected supply, and concludes that CFM will have a shortfall of 12 locomotives by 1995.

Table 8 below summarizes the situation. It shows that, even including the ten locomotives proposed for financing in this PP supplement, CFM will still be 12 locomotives short in 1995.

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TABLE 8: Summary of CFM Diesel Electric Locomotive Fleet Including Planned Procurement

	1990	91	92	93	94	95	2000
CFM Holding	61	66	84	94	104	104	95
Normal Attrition	-	-	-	-	-	-9	-
Supplied By:							
Japan*	5	3	-	-	-	-	-
France	-	15	-	-	-	-	-
Canada	-	-	10	-	-	-	-
US	-	-	-	10	-	-	-
TOTAL Fleet	66	84	94	104	104	95	95
Requirement	117					107	126
Deficit	51					12	31

* Except for the Japanese second delivery of three locomotives the donor contributions are fairly firm. Japan may also supply additional locomotives in 1991 and 1992, but these are uncertain and have not been included above.

2. Type of locomotive

The basic issue on the type of locomotive is whether it makes sense to purchase larger locomotives than now make up the CFM fleet (2150 horsepower GE U20C's). The argument for for varying locomotive size is to achieve better economy of usage across lines with different characteristics. On those lines with a steeper ruling gradient, for example, it may make be more economical to use larger locomotives. The analysis considered this and concluded the following:

The continued use of vacuum brakes limits the tonnage that can be pulled to between 1500 and 2000. With double heading on a few short sections, a 2000 horsepower locomotive meets the trailing load and operational requirements of all the CFM lines.

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There is a technological threshold between 2000 and 3000 horsepower, and the higher power locomotives require a higher level of skill and more complicated maintenance routines.

Given the above, CFM should capitalize on its experience of the past 30 years and continue to purchase North American locomotives in the 2000 to 2250 horsepower range.

C. Economic Analysis -- Rate of Return (Annex E)

The economic analysis calculated the cost savings of shipping through Mozambique rather than to Durban based on actual long run marginal costs (LRMC) per ton kilometer costs of South African Rail ($0.02) and estimated costs for SADCC railways ($0.05). Critical assumptions were:

a) utilization rates will rise to 200 kilometers per day (a conservative figure);

b) availability rates will rise to 75 percent.

c) CFM will achieve an LRMC of $0.05.

If the first two assumptions hold the third almost certainly will (CFM(S)'s present LRMC is estimated at $0.056). Based on these assumptions and no other improvements in operating efficiency, the internal rate of return was 17.5 percent. The most sensitive

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factors -- engine kilometers (EKM) per day, availability rates, and percentage of traffic carried on the backhaul -- were then adjusted and the rates of return calculated as shown in Table 9:

Table 9: Sensitivity Analysis

Internal Rate of Return

a. Engine kilometers and backhaul rate

	EKM=120	EKM=200	EKM=300
Backhaul 40%	10.07%	19.10%	29.33%
Backhaul 30%	9.00%	17.54%	27.17%
Backhaul 20%	7.91%	15.99%	24.99%

The above table sets the availability rate at 75%. Note that EKM=120 approximates the 12 hour day, or no security improvement, scenario.

b. Availability

Rate	IRR
50%	10.53%
55%	12.01%
60%	13.44%
65%	14.83%
70%	16.20%

c. LRMC

US cents/ton-km	IRR
4	25.03%
5	17.54%
5.6	9.32%
7	-1.71%

The above tables set the backhaul at 30 % and the EKM at 200.

The sensitivity analysis confirms that the very conservative base case is robust at 17.5 percent. The worst case scenario given above, with cost per ton kilometer at $0.07, is provided by way of

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illustration. CFM's average costs per ton kilometer for all three corridors are already well below this and should drop with new line openings, availability rate increases, and 24-hours operations.

D. Financial Analysis
(Annex F)

The financial analysis examines CFM(S) tariff structures, cost accounting, and the financial benefits of the locomotives. It found that significant progress has been made since 1988 in evaluating CFM's assets and in gaining the financial autonomy needed to fulfill its commercial mandate.

Based on present average costs, and assuming some cost reductions, including the continuation of a downward trend in staff levels, better wagon distribution, and improved locomotive utilization, the analysis projected that CFM would face a growing deficit to 1993, and begin to make a profit in 1997. If no additional efficiency in operation is achieved, the deficit is significantly higher, but an operating profit is still realized beginning in 2000. On the foreign exchange account, CFM is expected to lose money only in 1990 and 1991. These calculations are presented graphically on the next page and in detail in Annex F.

The analysis made also several recommendations for improving tariff setting and cost calculations. This report, as well as that prepared with SARP financing in early 1989, will provide valuable background material to the RRSS financial team arriving in mid-1990.

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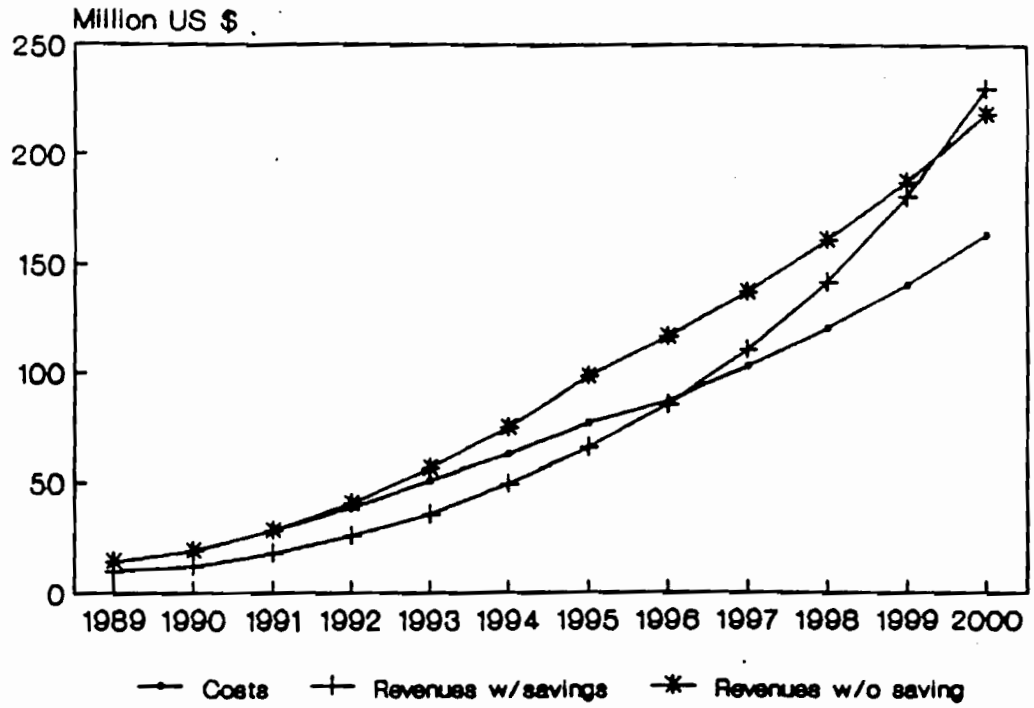
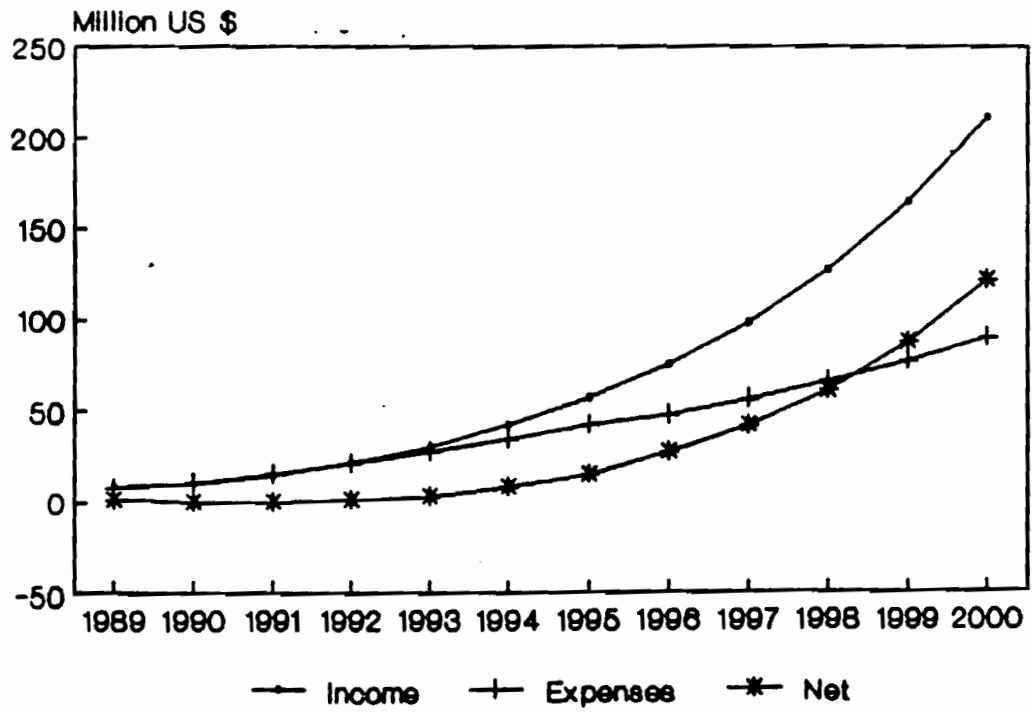
Projected CFM(S) Revenues and Costs 1989 -- 2000



CFM (S) Foreign Exchange Position 1989 -- 2000



XII. COVENANTS

Two covenants will be included in the project agreement amendment. These have been discussed with CFM on several occasions and USAID is satisfied that they will be agreed to and honored.

The Grantee agrees to seek USAID concurrence in the disposition of the locomotives, and that USAID may determine the corridor to which they are assigned. In addition, the placement of locomotives acquired during the project from other sources will be made only after consultation with USAID.

The Grantee agrees to fully participate in and support a comprehensive review of CFM management and organization, and will work with USAID and other donors to develop and implement a management plan that addresses the recommendations made in this review.

XIII. 611(e) CERTIFICATION SUMMARY (ANNEX G)

The 611(e) certification was reviewed and approved by REDSO Engineering (90 Nairobi 12809), and signed by the USAID/Mozambique Director on May . It was based on the following considerations:

- While CFM does not have the resources to maintain the locomotives without external assistance, its capacity will be improved through ongoing donor training and technical assistance programs, which are in part directed specifically at improving

CFM's capacity to maintain and utilize its locomotives. Examples include: RRSS, which is providing 15 advisors to the Maputo workshop for the next three years; France, which plans to provide a locomotive engineer and two technicians to each of the three corridor centers from 1991 to 1993; Britain, which is providing a workshop chief to Nacala; and Spain, which is providing advisors to the CFM(C) diesel electric workshop under the Beira Transport Corridor Project.

- USAID and other donors have a long-term commitment to improving the regional transport system. Since the Mozambique rail corridors are the key to this system, it is reasonable to project that donor assistance will be forthcoming until CFM is able to operate efficiently using its own resources. In addition to the donors mentioned above, the World Bank, Denmark, Portugal, the EEC, Finland, Sweden, Japan, Canada, Belgium, the Netherlands, African Development Bank, UNDP, and Austria are expected to continue to assist CFM.

- The GOM and CFM are committed to improving CFM's capacity to maintain and utilize its locomotives. GOM policy is that CFM will pay for itself. Its legal structures and the prospect that it can become a major foreign exchange earner make this a credible medium-term goal. If CFM's operational efficiency responds as expected to RRSS and the other donor programs now in place, CFM will be making an overall profit by 1997, according to our financial analysis. Variable costs will be covered by 1991 (international traffic) and 1995 (local traffic). If CFM administers well the 40 percent of its foreign exchange earnings that it

retains, it will, by the year 2000, be able to pay for the spares and skilled labor (expatriate and local) it requires. Until CFM achieves financial self-sufficiency, the shortfall will be covered by donor assistance. Mozambique's long-term dependence on foreign aid has been discussed at several Consultative Group meeting and is analyzed in detail in USAID's Country Program Strategic Plan. The proposed strategy of assisting CFM to become financially viable while phasing down donor assistance has been generally accepted by the donor community and by A.I.D.

- Given recent positive developments toward a negotiated peace settlement, the danger of destruction of locomotives by sabotage is expected to recede by the time the locomotives are commissioned in late 1992 or early 1993. If this does not occur, CFM will armor-plate the locomotives, as has already been done for some of the units on the Beira and Nacala lines. The present cost of this is $30,000 per locomotive; for project locomotives these costs could be borne by the project.

- The project is adding ten units to the existing fleet of 59 locomotives. CFM is familiar with the technology and has the basic structure and skills necessary to maintain such locomotives, although not at optimal efficiency. While recent availability and utilization rates have been low, losses due to negligence or human error are rare.

- By agreeing to and then meeting some of the conditions of the Beira Transport Corridor Project, CFM has demonstrated its serious commitment to reform. These conditions include the promulgation of legislative measures establishing CFM as an autonomous entity, tariff adjustments, investment criteria, and efficiency improvements. The end result of an intelligent reform program would be a railroad that maintains and operates its equipment effectively. USAID's analysis indicates that the political will, prospect for external assistance, and opportunity for profit will conspire to make CFM effective within the next ten to fifteen years.

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PROJECT ANNEXES

A. B/G Request for Assistance
B. Bureau Comments on Initial Proposal
C. Economic Analysis -- Traffic Projections
D. Technical Analysis
E. Economic Analysis -- Rate of Return
F. Financial Analysis
G. 611(e) Certification
H. Institutional Analysis Update
I. Updated Logical Framework

REGIONAL RAIL SUPPORT PROJECT

690-0247.56

MOZAMBIQUE COMPONENT SUPPLEMENT

PURCHASE OF LOCOMOTIVES

VOLUME II - ANNEXES

FINAL REPORT - MAY 9, 1990

Annex A

REPUBLICA POPULAR DE MOCAMBIQUE

DIRECÇÃO NACIONAL DOS PORTOS E CAMINHOS DE FERRO

C. P. .....

YOUR EXCELLENCY
THE AMBASSADOR OF THE UNITED STATES
OF AMERICA

M A P U T O

SUA REFERENCIA	SUA COMUNICAÇÃO DE	NOSSA REFERENCIA	DATA
		237/DNPCF-GAB/89	2/08/198

ASSUNTO:

1 - I have the honnour to submit to Your Excellency the annexed report related with the needs of new diesel main line locomotives for CFM.

A priority of 45 new locomotives is envisaged for 1991, and as can be observed in the conclusion the calculations were made taking in account a careffull aproach on traffic forecasts, availability of locomotives, and operational efficiency.

2 - Till this moment CFM contacts for new locomotives are:

(i) 5 General Electric locomotives will be funded by Japan (the delivery time expected is middle 1990)

(ii) the GPRM sent a letter to Caisse Central (France) requesting a soft loan to purchase 15 ALSTHOM locomotives.

(iii) Canada seems insterested to supply 10 locomotives but not yet gave an official decision.

(iv) CFM is also contacting Japan through the Ministry of Cooperation for a possible future new supply.

3 - Taking in consideration the urgent need of new main line diesel locomotives for CFM, I am requesting Your Excellency of a USA grant to supply 15 locomotives. This amount it is also considered a minimum to introduce a new type of equipment.

Highest Consideration

NATIONAL DIRECTOR OF PORTS AND RAILWAYS

F.FERREIRA MENDES

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ACTION: AID-3 INFO: AMB DCM

VZCZCT00409
PP RUEHTO
DE RUEHC #4778/01 1002140
ZNR UUUUU ZZH
P 102130Z APR 90
FM SECSTATE WASHDC
TO RUEHTO/AMEMBASSY MAPUTO PRIORITY 3541
RUEHSB/AMEMBASSY HARARE PRIORITY 2961
INFO RUEHNR/AMEMBASSY NAIROBI PRIORITY 8148
RUEHMB/AMEMBASSY MBABANE PRIORITY 9010
BT
UNCLAS SECTION 01 OF 02 STATE 114778

AIDAC NAIROBI FOR REDSO/ESA, MBABANE FOR RLA

E.O. 12356: N/A
TAGS:
SUBJECT: MOZAMBIQUE REGIONAL RAIL SYSTEMS SUPPO
(69U-U247) SUBPROJECT AMENDMENT

REF: (A) MAPUTO 00670; (B) 89 MAPUTO 02969

1. INFORMAL BUREAU COMMENTS ON MOZAMBIQUE REGIONAL RAIL SYSTEMS SUPPORT SUBPROJECT AMENDMENT PREPARATION PROPOSAL (REF A) FOLLOW IN PARAGRAPHS 2-4 BELOW. SINCE MOZAMBIQUE IS SUCH CRITICAL LINK IN THE REGIONAL SYSTEM, BUREAU BELIVES THAT NOW IS THE TIME TO APPROACH THE DEVELOPMENT AND STRENGTHENING OF CFM IN A COMPREHENSIVE MANNER. WEILE WE DON'T THINK THAT THIS WILL BE COMPLETELY THOUGET OUT DURING THE DESIGN OF THIS AMENDMENT. WE DO EXPECT THIS EFFORT TO PUT FORTH A PLAN OF ACTION WHICH IS CONDITIONED TO LOCOMOTIVE PROCUREMENT. TO ACHIEVE AN ECONOMICALLY AND OPERATIONALLY EFFICIENT CFM, A COMPREHENSIVE PLANNING EXERCISE IS NECESSARY. THIS EXERCISE WOULD IDENTIFY INSTITUTIONAL, STRUCTURAL AND PHYSICAL PROBLEMS; IDENTIFY A STRATEGY AND COURSE OF ACTION TO REMEDY THOSE PROBLEMS; IDENTIFY EXISTING SOURCES OF U.S. AND OTHER DONOR ASSISTANCE; AND PLAN HOW TO ADDRESS THE

REMAINDER. TO ADDRESS THIS POINT, THE MISSION MAY WISH TO CONSIDER THAT A PLANNING ACTIVITY BE INCLUDED AS PART OF PROJECT (AMENDMENT) IMPLEMENTATION.

2. DELEGATION OF AUTHORITY NO. 404 REQUIRES THAT THE REGIONAL AA TAKE INTO ACCOUNT THE MISSION DIRECTOR'S CERTIFICATION OF 611(E). THIS AUTHORITY CANNOT BE REDELEGATED. TO OPERATIONALIZE THIS THE REVISED PROJECT PAPER, INCLUDING 611(E) CERTIFICATION, SHOULD BE SUBMITTED TO AID/W TO ENABLE US TO PROCESS AN ACTION MEMORANDUM FOR THE ACTING AA/AFR. A CABLED SUMMARY IS NOT SUFFICIENT TO SUPPORT THIS ACTION. TO AVOID SPLITTING RESPONSIBILITY FOR PP AMENDMENT REVIEW AND APPROVAL, THE PP AMENDMENT SHOULD THEREFORE BE APPROVED IN AID/W. GIVEN AID/W PERSONNEL CONSTRAINTS, THAT

SUBMISSION SHOULD BE ACCOMPANIED BY A CONCURRENCE WITH THE 611(E) CERTIFICATION FROM REDSO/ESA USDH.

3. USAID/MOZAMBIQUE AND SARP/HARARE MAY WISH TO CONSIDER INCLUDING IN THIS PP AMENDMENT, NECESSARY FUNDS INCREASE FOR COST OVERRUNS OF SPARE PARTS TO BE PROCURED UNDER ORIGINAL PROJECT UNRELATED TO THE LOCOMOTIVE PROCUREMENT, IF TIMING ON PROVISION OF TECHNICAL ASSISTANCE PERMITS.

4. THE FOLLOWING QUESTIONS AROSE IN OUR REVIEW OF REF A AND SHOULD BE COVERED IN PP AMENDMENT:

A. DEMAND. WHAT ARE THE DEMAND PATTERN CHANGES ASSOCIATED WITH THE REVISED TRAFFIC ASSESSMENTS? IS ROUTNG OF ZIMBABWE COMMODITIES THROUGH SOUTH AFRICA DUE TO CFM ACK OF LOCOMOTIVES, CFM LACK OF WAGONS, MANAGEMENT PROBLEMS, OR CIVIL STRIFE AND RESULTANT UNCERTAINTIES? WE UNDERSTAND INFORMALLY FROM WORLD BANK STAFF THAT NRZ DEPENDENCE ON UP TO 1700 WAGONS FROM SOUTH AFRICA PLAYS AN IMPORTANT ROLE IN DECISION TO ROUTE TRAINS AND COMMODITIES THROUGH DURBAN. SHOULD THE MISSION CONSIDER MOVING FORWARD WITH COMPLEMENTARY WAGON PROCUREMENT? IS THE RELATIONSHIP SO DIRECT BETWEEN THE INCREASE IN FREIGHT TRAFFIC AND NEED FOR LOCOMOTIVE POWER THAT AN EQUAL PERCENTAGE INCREASE IS REQUIRED IN THE NUMBER OF LOCOMOTIVES? DO THE CONSERVATIVE FIGURES FOR TRAFFIC DEMAND FORECASTS OF SATCC AND WORLD BANK STUDIES DIFFER FROM ONE ANOTHER? IF SO WHY? WHAT ASSUMPTIONS ARE MADE ABOUT OTHER RAILROAD COMPANY CAPACITIES AND HOW WILL THIS AFFECT CFM TRANSPORT DEMAND

DATA? IN SHORT, IT APPEARS IN PARA 22 THAT THE CFM WILL MEET ITS NEED FOR LOCOS (ABOUT 97-109) BY 1995 WITH OUR CONTRIBUTION, ASSUMING A 24 HOUR WORKING DAY, BUT THE PPA WILL NEED TO PRESENT HOW THIS NUMBER WAS ARRIVED AT AS WELL AS DISCUSS THE OTHER CONSTRAINTS TO AN EFFICIENT CFM OPERATION THAT PROVISION OF LOCOS ALONE WILL NOT SOLVE. MISSION ALSO MAY WISH TO CONSIDER THE WAGON SITUATION IN PPA.

B. STRENGTHENING MAINTENANCE ADMINISTRATION, MANAGEMENT, OPERATIONAL POLICIES AND PROCEDURES TO INCREASE EFFICIENT USE OF PHYSICAL CAPACITY. HOW DOES CFM MEASURE UP TO OTHER RAIL TRANSPORT SYSTEMS IN TERMS OF IMPROVING ITS MAINTENANCE AND RAIL MANAGEMENT SYSTEM? THIS QUESTION RELATES TO A CONCERN THAT OUR APPROACH TO CFM DEVELOPMENT AND TRANSFORMATION MAY BE TOO PIECE-MEAL; I.E., MAINTENANCE AND SPARE PARTS IN PHASE ONE LOCOMOTIVE PROCUREMENT IN PHASE TWO. WHEN WILL WE BEGIN TO WORRY ABOUT THE WHOLE RAILROAD, INCLUDING ITS ORGANIZATIONAL AND FINANCIAL STRUCTURE,

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PERSONNEL UPGRADING, MANAGEMENT IMPROVEMENTS, UPGRADING OPERATIONS, TARRIFF REVISIONS, ETC? WE WONDER AT THIS TIME IF MISSION WOULDN'T CARE TO INCLUDE ADDITIONAL FUNDING IN THIS PPA FOR A PLANNING ACTIVITY THE EVENTUAL OUTPUT OF WHICH WOULD BE TO PRODUCE A COMPREHENSIVE PLAN FOR THE OVERALL IMPROVEMENT OF CFM. IN THE MEANTIME THE PPA SHOULD ADDRESS THE ISSUES OUTSIDE THE SCOPE OF THE PROJECT AS BEST IT CAN: E.G., WHAT ARE OTHER DONOR PROGRAMS PROVIDING? HOW ARE THE LONG TERM SUSTAINABILITY QUESTIONS BEING ADDRESSED (TRAINING, MANAGEMENT ADMINISTRATIVE REFORMS POLICY DIALOGUE)? IN THE END, THE PPA SHOULD LAYOUT A STRATEGY TO GET A LONG TERM SUSTAINABLE SOLUTION IN PLACE.

C. THE PP AMENDMENT'S ANALYSES SHOULD INCLUDE A BRIEF DISCUSSION OF HOW MACRO LEVEL FINANCIAL, ECONOMIC AND INSTITUTIONAL ENVIRONMENT AND POLICIES AFFECT THE PROJECT. THE MISSION MAY WISH TO INCLUDE SUGGESTIONS FOR PARALLEL DIALOGUE ON MANAGEMENT, ADMINISTRATIVE AND POLICY ACTIONS TO FACILITATE OBTAINING FULL BENEFITS FROM THE INVESTMENTS IN INCREASED PHYSICAL CAPACITY AT THIS TIME, OR UNDERTAKE THIS AS PART OF A PLANNING ACTIVITY, ABOVE.

D. ANALYSES OF PROJECT BENEFITS. WILL DESIGN TEAM ASSUME THAT LEVEL OF SERVICE (PARA 27) REMAINS CONSTANT

FOR TARIFF, TRANSIT TIME AND RELIABILITY? SOME SENSITIVITY ANALYSES MIGHT BE USEFUL IF THEY CAN BE PERFORMED ON A TIMELY BASIS. IF NOT, SOME SHOULD FORM PART OF THE FUTURE PLANNING ACTIVITY. WILL SHIPPERS TAKE THE RISK ON THE SHORTER CFM ROUTES RATHER THAN SOUTH AFRICA? FINANCIAL ANALYSES INDICATE THEY WILL UNDER CERTAIN CONDITIONS RELATED TO RAILROAD MANAGEMENT AND CAPACITY. BUT, THESE SHOULD BE SPELLED OUT.

E. OTHER DONORS. MOZAMBIQUE SYSTEM IS RECEIVING CONSIDERABLE HELP FROM DONORS. WHAT ARE DONORS PROVIDING IN TERMS OF TECHNICAL ASSISTANCE, EQUIPMENT AND RECURRENT COSTS FOR RAIL TRANSPORT SECTOR AND PARALLEL PORT AND OTHER FACILITIES (BROADLY DEFINED)?

F. PROCUREMENT:

(1) THE PP TEAM SHOULD ENSURE THAT THE PP AMENDMENT PROVIDES FULL FINANCING FOR ADEQUATE SPARE PARTS FOR THE LOCOMOTIVES; THE PROPOSED DOLS 2 MILLION LINE ITEM FOR SPARES AND TA COMBINED SEEMS LOW.

(2) REF. A, PARA 30, STATES THAT THE RCMO WILL PREPARE THE BIDDING DOCUMENTS. A MAJOR CONCLUSION OF THE USAID/DAR COMMENTS ON THE TAZARA PROCUREMENT CONCERNED THE IMPORTANCE OF HAVING EXPERT TA (STV ENGINEERS IN THEIR CASE) ASSISTING AT EVERY STAGE OF THE PROCUREMENT PROCESS, WHICH WOULD INCLUDE PREPARATION OF BIDDING DOCUMENTATION AS WELL AS ASSISTING THE PURCHASER IN NEGOTIATIONS. GIVEN THE TECHNICAL COMPLEXITY OF LOCOMOTIVE PROCUREMENT AND THE LIKELIHOOD OF SERIOUS

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PROTESTS TO AID/W IF THERE ARE ANY DIFFICULTIES, IT IS ESSENTIAL THAT THE PROJECT PROVIDE FOR THE SAME DEGREE OF TA IN THE PROCUREMENT HERE. (SEE AID/W COMMENT ON THE LAST SARP PIRS ON THIS POINT.)

(3) THE MISSION SHOULD ENSURE THAT SUFFICIENT FUNDS ARE OBLIGATED TO COVER THE ENTIRE PROCUREMENT BY THE TIME THE CONTRACT WILL BE SIGNED IF NOT EARLIER. IT IS HIGHLY UNLIKELY THAT A MANUFACTURER WILL SIGN A CONTRACT OR COMMENCE MANUFACTURE BEFORE FINANCING IS SECURELY IN PLACE. WLL THE PLAN TO OBLIGATE THE SECOND DOLS 10 MILLION IN FY 1991 ACCOMPLISH THIS?

5. WE REGRET TO INFORM YOU THAT BECAUSE OF THE 611(E) STUATION, THE PP AMENDMENT MUST BE AUTHORIZED IN AID/W. EAGLEBURGER
BT
#4778

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ANNEX C

ECONOMIC ANALYSIS - TRAFFIC PROJECTIONS

TRAFFIC PROJECTIONS

Traffic projections are one of the most important components in the determination of locomotive requirements. The number of freight locomotives needed for a particular year is almost directly proportional to the tonnage of freight traffic projected for that year. This Annex focuses on traffic projections through 1995 and 2000. Annex D translates these traffic projections into locomotive requirements.

The traffic projections used in this PP amendment are an update and improvement of the original traffic projections of the Project Paper which were based on SATCC projections. A weakness of the SATCC projections is that they do not include the very significant freight movements originating in or destined for South Africa, and moving by CFM through Maputo. For example, in 1975 the South African traffic accounted for almost 6 million metric tons, or almost 60 per cent of traffic of the CFM(S). Because of the security problem on the Ressano Garcia line, the South African traffic fell to a low of about 600,000 tons in 1987, but now seems to be recovering.

The omission of the South African traffic was corrected in the traffic projections used for the PP amendment based on information provided by CFM on the historic traffic data. These go back to the year 1973, and before the time of transport system disruptions associated with independence. As such, the historic traffic data give a good indication of what the traffic levels might be after the transport corridors reach "normal" levels of utilization.

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Discussions were also held with CFM officials familiar with historic traffic patterns, and with changes in the type and mix of commodities that are candidates for transport by CFM. A typical example of change in the mix of commodities is the replacement of bulky ferro-chrome ore produced by Zimbabwe by the considerably less bulky ferro-chrome alloy. Another significant change in traffic pattern was caused by the exhaustion, in 1974 of the iron ore mine in Swaziland that once to produced a million tons a year. This lost traffic, however, has been partially been replaced by coal from new mines, growing sugar production, and Swazi ferro-chrome.

Figures 1, 2, 3, and 4 show the historic freight traffic levels for the years 1973 - 1989 and updates of the projections of traffic levels for the years 1990, 1995 and 2000 for the CFM(S), CFM(L), and CFM(N) rail lines, and for total traffic. The data in the figures give both national and international traffic. Detailed data giving the countries of origin and destination of the traffic are presented in Table 1.

The data are for freight only. Passenger traffic is excluded because the projection of locomotive requirements for passenger trains is done exogenously. Also excluded are, of course, the flow of petroleum products by pipeline. Included, however, is "on railway service" (ORS) traffic consisting of materials needed by the railroads for construction and maintenance, and transported by service trains. The exact levels of ORS traffic are not known, but during normal years, i.e., excluding years when there is heavy rehabilitation, ORS is assumed to account for about 5 per cent of total traffic.

The historic traffic data vividly depict the drastic drop in traffic on all lines starting between 1973 and 1975. For example, in 1973 the CFM carried a total of 17.5 million tons of international (85 per cent) and 3.1 million tons of national (15 per cent) freight traffic. The decline halted for a few years

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around 1978. During that year about 6.7 million tons (77 per cent) of international and 2.0 million tons (23 per cent) of national freight traffic were carried. The steep decline started again around 1981 and traffic bottomed out in 1985. During that year about 2.2 million tons of international (76.5 per cent) and 700,000 tons (23.5 per cent) of national freight traffic were carried. By 1989 the latest available [illegible] freight traffic had risen to 2.3 million tons of international (62.4 per cent) and 1.4 million tons (37.6 per cent) of national traffic.

The reason for this decline since 1973 is the combined effect of the disturbances after the various countries in the SADCC region achieved independence. Important factors include: the departure of skilled expatriates in the transport sector, leaving Mozambique and other countries with a shortage of trained personnel to operate the transport system; the resulting steady deterioration of rail and other transport physical facilities; the closure of the border between Mozambique and Rhodesia from 1976 to 1980; and the attacks from bandits on the rail lines which severely disrupted traffic on the Beira, Goba, and Ressano Garcia lines, and forced closure of the Limpopo and Nacala lines.

CFM(C) was one of the first lines to recover, and has shown a steady increase in traffic over the period 1984 - 1989. From a low of 296,000 tons for 1984, the traffic increased steadily to 632,000 tons in 1989. The CFM(S) is also showing improvement. From a level of 2,520,000 tons in 1985 the traffic increased to 3,043,000 tons in 1989. The CFM(N) line is still under rehabilitation and much of its traffic at this time is ORS.

Traffic in Figures 1, 2, 3, and 4 was projected for a scenario based on the following assumptions:

1) By 1995, attacks on all rail lines will have ceased. This assumption implies that regular 24-hour service will be possible on the lines by 1995;

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2) All corridors except possibly the Sena line are open by the year 2000;

3) CFM's efficiency will have been raised so that it is able to compete effectively with the road transport and the South African transport system; and

4) The number of locomotives owned by the National Railways of Zimbabwe will be sufficient to handle the transit traffic from Zaire, Zambia, and Malawi. In addition, the NRZ will have enough tractive power to transport its own considerable import and export traffic.

If one or more of these assumptions are not fulfilled, it may take longer than projected for traffic on the CFM system to reach the forecast traffic levels.

Assumption 4 merits some elaboration. Zimbabwe is located at the heart of the SADCC region and the NRZ therefore plays a key role in providing access to ports for the landlocked member SADCC countries, as well as Zaire. Even products from distant countries, especially the imports of Burundi, Rwanda, and Uganda, transit through Zimbabwe. From June 1988 to June 1989, the NRZ carried 709,000 tons of transit traffic from other SADCC countries. This amounts to 18 per cent of Zaire's, 26 per cent of Zambia's, and 63 per cent of Malawi's total overseas import and export traffic. In addition, the NRZ carried 3,453,200 tons of Zimbabwe's own import and export traffic. In total, therefore, the NRZ provides a very substantial proportion of traffic that could be diverted through Mozambique ports via CFM. Analysis has shown that, even with the opening of other corridors such as Nacala and Lobito, there will be a net gain in transit traffic through Zimbabwe. Traffic from Malawi will, of course, decline because of its easy access to the sea via the Nacala line. But the percentage of Zairian and Zambian traffic will increase.

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At the same time, the NRZ today is suffering from lack of traction. This is brought about by the fact that the NRZ has too many locomotives that are unreliable and that represent too many different models - a by-product of the sanctions that forced the purchase of locomotives from any willing seller - to allow efficient operation. For the past three years, the NRZ has been able to fill the shortage by leasing twenty locomotives from the SATS system. This option, however, may close in the near future because there are indications that SATS surplus of locomotives is gradually disappearing - for example, the SATS locomotives leased to Zambia were withdrawn last year forcing Zambia to purchase ten new locomotives.

Fortunately, the locomotive shortage in Zimbabwe may soon abate. The USAID regional program, under the World Bank Railroads II project for Zimbabwe is planning a project that will provide, inter alia, about 25 main line locomotives for the National Railways of Zimbabwe.

METHODOLOGY

Traffic was projected for the years 1990, 1995, and 2000 by country of origin for each of the three major CFM lines: CFM(S), CFM(C), and CFM(N). Traffic for the same years was also projected for national traffic.

CFM(S) - The national traffic was projected by continuing the average two per cent annual growth manifested over the 1985 - 1989 time period. Traffic from Zimbabwe for the year 1995 was derived from the SATCC projection for total traffic through Mozambique ports, and from information on the split between Beira (49 per cent) and Maputo (51 per cent) estimated by Netherlands Economic Institute (NEI) transport model. This route allocation model uses generalized transport costs - these costs include tariffs for rail, port, and sea voyage as well as inventory

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holding costs and costs of losses from spoilage and pilferage - to estimate the shipper's choice of route. SATCC estimates that, by 1995, a total of 1,448,000 metric tons will cross the Mozambique border. The allocation for Maputo is therefore .51 x 1,445,000 = 738,500 tons. The projection for the year 2000 was obtained from a simple straight line projection.

The CFM traffic experts believe that the best procedure for projecting the freight traffic of South Africa is to assume that, by 1995, the CFM will be able to reestablish the 1981 traffic level. This appears to be a reasonable assumption. However, to guard against an overly optimistic forecast, we decided to move the date up to the year 2000. Thus, our projection for the year 2000 for traffic from or to South Africa is 3,023,900 tons, the level achieved by the CFM(S) in 1981. The traffic levels for the years 1990 and 1995 were derived using linear interpolation.

Traffic for Swaziland was derived using the same method as for South Africa. Historic traffic data suggest that Botswana traffic will remain at very low levels.

CFM(C) - Zimbabwe traffic was projected using the same procedure outlined above, except that the route split percentage was .49 instead of .51.

Malawi traffic through Beira was assumed to gradually drop to zero by the year 2000; all Malawi traffic is assumed to flow via the Nacala and Northern corridor by that year. It should be noted that, as mentioned above, the Sena line is not assumed to be open to international traffic before the year 2000. Zambia traffic through Beira is also assumed to drop to zero by the year 2000 because of the opening of the Lobito corridor. By that year Zambian cargo will move via the Lobito or Tazara rail line.

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CFM(N) - The year 2000 traffic level of Malawi is assumed as the sum of the 1981 traffic through Beira (458,000 tons) via the then open Sena line and Nacala (225,100 tons) which was operating relatively efficiently at that time. With Sena closed, Nacala is by far the closest port to southern Malawi.

TOTAL TRAFFIC - Total traffic was derived as the sum of the individual components for each rail line. The annual growth rate for total and national traffic during the 1990 - 2000 time period is 9.1 and 6.6 per cent respectively. These growth rates are not high considering that the gain in traffic comes mostly from diversion from traffic routed through South Africa, and from revitalization of suppressed demand caused by disruptions of transport and not from growth in the regional economy. Also, to lend perspective, it should be noted that the decline in total and national traffic amounted to 14 and 11 per cent respectively during the 1981 - 1988 time period.

COMPARISON WITH OTHER FORECASTS

Table 2 shows projections of traffic made by SATCC and the World Bank. Comparison with USAID's projections illustrates the difficulty of making forecasts. For the year 2000, the total projection of SATCC's 9,391,000 tons compares well with USAID's forecast of 9,735,000 tons. But individual estimates differ substantially. In general, SATCC is too low in their estimates of traffic through Maputo - 4.3 million tons rather than USAID's 6.4 million tons because SATCC excludes South Africa traffic - and too high for traffic through Beira - their estimate of 4.1 million tons versus USAID's of 2.4 million tons. SATCC total traffic for Beira is high because of SATCC's high national traffic estimate -- 3.3 million tons versus USAID's 1.26 million tons (historic data shows that national traffic through Beira reached a maximum of 1.8 million tons in 1973). Traffic for Nacala is consistent in the USAID and SATCC projections.

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The World Bank in their Beira corridor study uses basic SATCC projections, but makes various adjustments in traffic and flows. In general, for the year 1995 (the Bank did not project for the year 2000) their total forecast is high - 8.7 million tons vs USAID's 7 million tons. This is mainly caused by their high estimate of traffic through Maputo - 6.6 million tons vs USAID's 4.5 million tons. The forecasts for the other two ports agree reasonably well with USAID's.

Use of the higher projections made by the World Bank will tend to increase the number of locomotives required for the CFM.

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Figure 1

Traffic Projections – CFM(N)

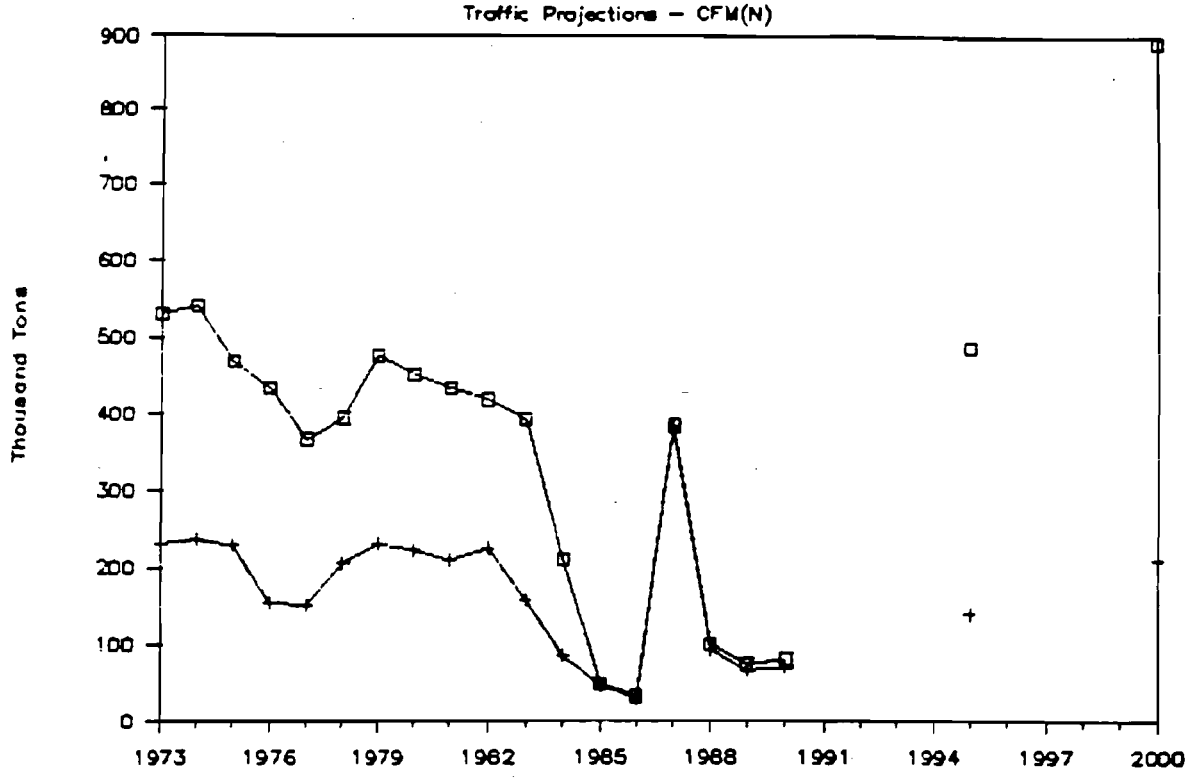

Figure 2

Traffic Projections – CFM(C)

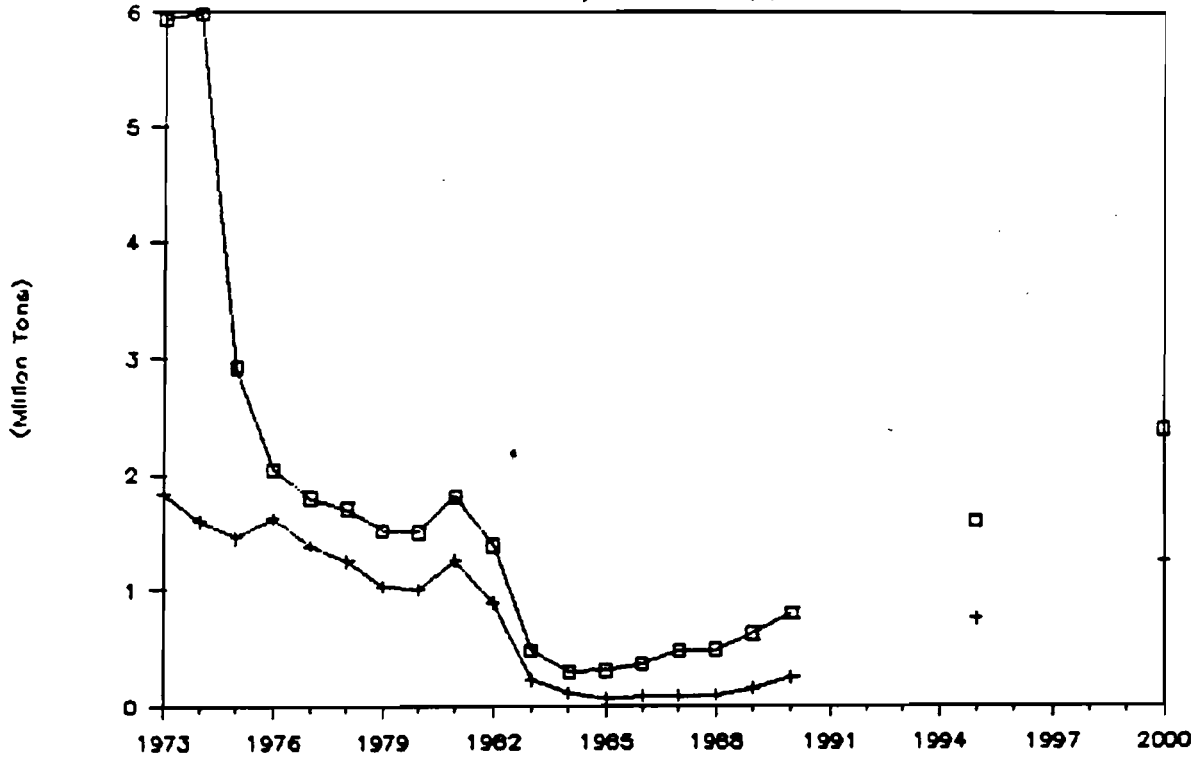

Figure 3

Traffic Projections – CFM(S)

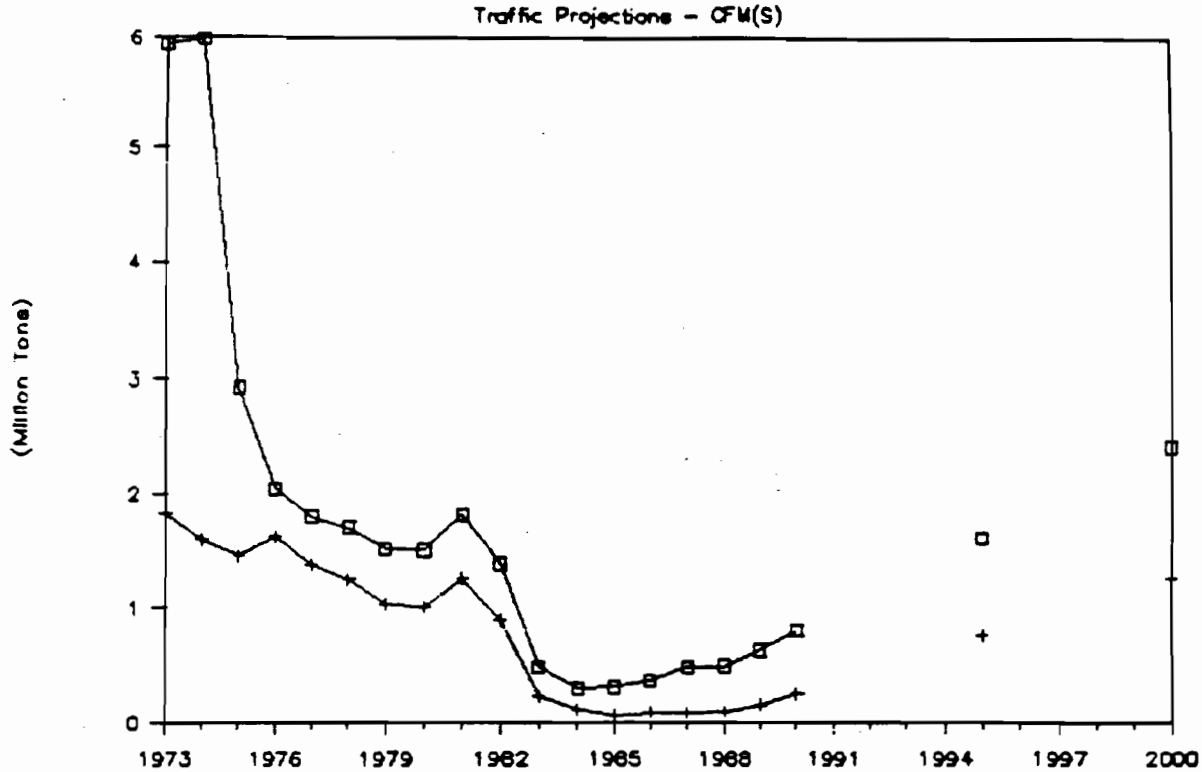

Figure 4

Traffic Projections – CFM Total

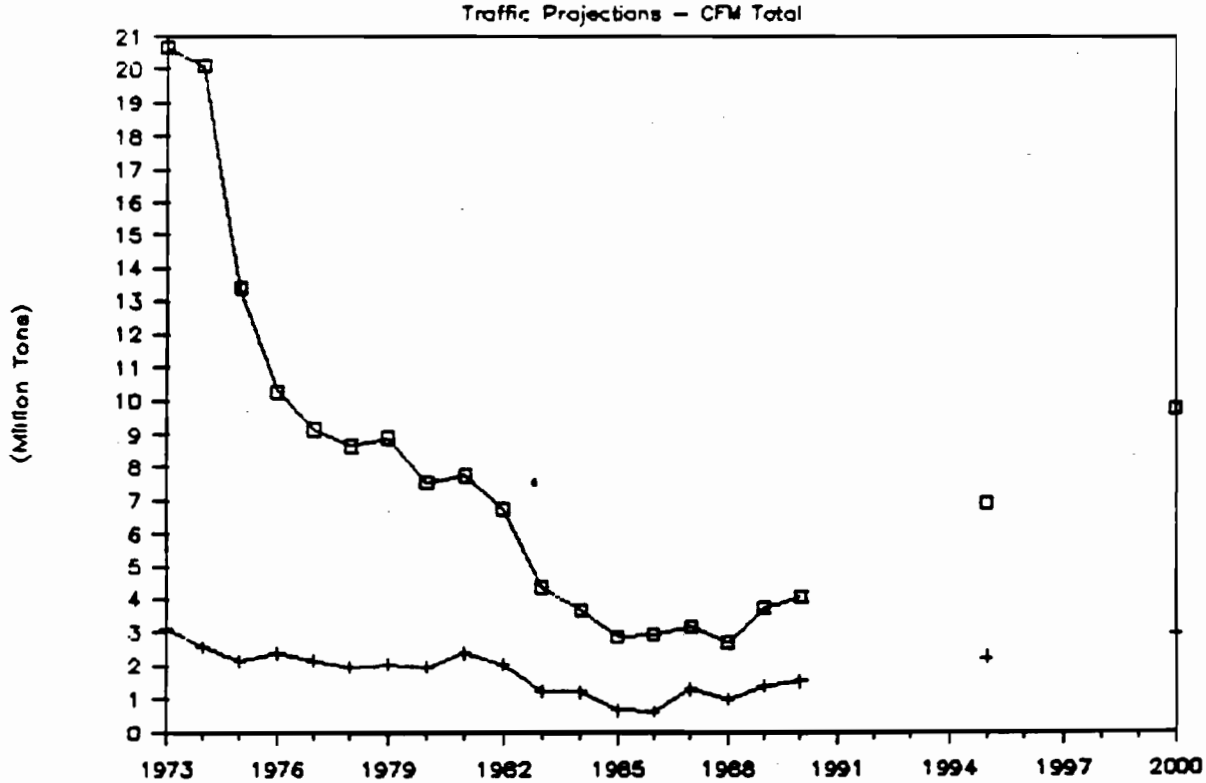

TABLE 1

IT TRAFFIC HISTORIC TRAFFIC AND USAID PROJECTIONS

tons)	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 PROJECTIONS =====>	1995	2000
HES																				
	20672.0	20112.5	13390.2	10265.2	9125.7	8649.9	8879.0	7546.9	7708.7	6742.2	4368.2	3697.9	2890.6	2949.3	3209.5	2718.0	3757.8	4071.9	8897.3	9735.2
al	3132.0	2502.0	2174.1	2402.1	2197.1	1977.7	2070.4	1992.6	2400.6	2071.1	1266.2	1242.8	680.4	649.1	1325.6	1009.9	1413.4	1568.0	2266.3	2976.2
ational	17540.0	17529.9	11216.1	7863.1	6928.0	6672.2	6801.2	5554.3	5358.1	4671.1	3100.0	2455.1	2210.2	2300.2	1883.9	1708.1	2343.6	2503.2	4631.1	6759.0
Zimbabwe			2512.0	88.9	0.0	0.0	0.0	274.0	929.7	1043.5	922.6	625.9	620.9	637.3	666.8	593.0	584.8	672.8	1468.0	2332.0
S. Africa			5630.5	4974.4	4240.2	4064.0	4155.2	3420.0	3023.9	2216.0	1122.4	1122.5	962.6	1154.2	651.0	569.7	1280.6	1344.6	2103.0	3023.0
Swaziland			2300.1	2100.4	2049.0	1960.3	1917.7	1159.2	721.4	097.0	750.0	569.7	623.4	427.2	412.3	430.5	360.5	370.5	549.0	721.0
Malawi				699.4	631.4	039.1	720.3	692.5	603.1	513.0	297.0	137.0	3.3	62.0	69.6	35.9	30.8	39.6	361.3	603.0
Zambia				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.7	04.2	70.2	86.0	68.3	34.2	0.0
Zimbabwe																				
apopo					0.0	0.0	0.0	235.0	.032.1	061.5	300.0	0.0	0.0	0.0	9.9	14.7	0.0			
P					0.0	0.0	0.0	0.0	0.0	0.0	345.2	452.1	307.5	432.5	400.5	290.6	216.5			
==========																				
	14120.0	13500.1	9936.2	7753.0	6930.9	6520.9	6046.0	5547.6	5462.3	4001.4	3465.5	3171.2	2520.5	2542.5	2334.9	2117.0	3043.5	3195.7	4017.0	6440.0
al	994.0	669.0	426.7	590.2	641.7	407.0	773.9	724.6	004.9	906.1	059.9	1026.9	547.0	520.6	052.4	611.5	1105.9	1245.2	1369.7	1506.7
ational	13134.0	12830.3	9509.5	7162.0	6297.2	6033.1	6072.9	4023.0	4577.4	3975.3	2605.6	2144.3	1973.5	2013.9	1402.5	1305.5	1857.6	1950.5	3441.9	4933.3
Zimbabwe			1490.9	00.0	0.0	0.0	0.0	235.9	032.1	061.5	725.2	452.1	307.5	432.5	410.4	305.3	216.5	227.3	730.5	1109.3
S. Africa			5630.5	4974.4	4240.2	4064.0	4155.2	3420.0	3023.9	2216.0	1122.4	1122.5	962.6	1154.2	651.0	569.7	1280.6	1344.6	2103.0	3023.0
Swaziland			2300.1	2100.4	2049.0	1960.3	1917.7	1159.2	721.4	097.0	750.0	569.7	623.4	427.2	412.3	430.5	360.5	370.5	549.0	721.0
Botswana			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
**********																				
	5933.0	5904.1	2920.0	2044.7	1799.2	1705.7	1519.1	1507.6	1016.1	1393.2	404.5	296.2	306.5	360.1	401.5	409.0	631.0	796.2	1599.7	2403.2
al	1026.0	1597.6	1461.2	1023.3	1302.5	1254.0	1034.9	1005.0	1260.5	091.5	224.7	110.7	63.0	04.9	03.5	92.0	153.4	253.6	757.0	1260.5
ational	4106.2	4308.5	1460.0	421.4	416.7	450.9	404.2	501.0	555.0	501.7	259.0	105.5	242.7	203.2	398.0	396.2	470.4	542.7	042.7	1142.7
Zimbabwe			1021.9	0.9	0.0	0.0	0.0	30.0	97.6	102.0	197.4	173.0	241.4	204.0	247.6	200.5	360.3	444.7	709.5	1142.7
Malawi			444.9	420.5	416.7	450.9	404.2	463.0	458.0	319.7	62.4	11.7	1.3	59.7	66.2	29.5	23.2	29.8	14.0	0.0
Zambia			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.7	04.2	70.2	86.9	60.3	34.2	0.0
**********																				
	531.0	542.2	409.4	433.1	368.7	394.4	476.4	451.7	434.3	419.1	392.3	210.7	48.6	32.3	304.9	100.1	73.6	80.0	406.0	092.0
al	231.2	237.1	229.0	154.2	152.0	206.2	232.3	222.2	209.2	225.0	157.7	05.4	46.6	29.2	301.5	93.7	66.0	70.0	139.5	200.0
Malawi	299.0	305.1	239.0	270.9	214.7	100.2	244.1	229.5	225.1	194.1	234.6	125.3	2.0	3.1	3.4	6.4	7.6	10.0	346.5	803.0

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TABLE 2

USAID PROJECTIONS COMPARED WITH SATCC AND WORLD BANK PROJECTIONS (compproj.wk1)

		SATCC PROJECTIONS				USAID PROJ.	% DIFFERENCE
SATCC PROJECTIONS		1990	1992	1995	2000	2000	
CFM (Total)							
	Total	5293.0		7443.0	9391.0	9735.0	3.7%
	National	3422.0		4703.0	5773.0	2976.0	-48.4%
CFM(S)							
	Total	2244.0		3423.0	4356.0	6440.0	47.8%
	National	1150.0		1600.0	1900.0	1506.0	-20.7%
CFM(C)							
	Total	2705.0		3602.0	4107.0	2403.0	-41.5%
	National	2065.0		2853.0	3292.0	1260.0	-61.7%
CFM(N)							
	Total	344.0		418.0	928.0	892.0	-3.9%
	National	207.0		250.0	581.0	209.0	-64.0%

				USAID PROJ.	
N.E.I. PROJECTIONS		1992	1995	1995	
CFM	Total	6784.0	8701.0	7000.0	-19.5%
CFM(S)	Total	5141.0	6604.0	4818.0	-27.0%
CFM(C)	Total	1166.0	1157.0	1600.0	38.3%
CFM(N)	Total	477.0	940.0	486.0	-48.3%

Source:
SATCC - "A Scenario Model for Goods Transport Demand in the SADCC Region: A presentation of the Model and Main Results;" SATCC, September 1988.

World Bank - "Mozambique Transport Corridor Project," World Bank Internal Document 7769-MOZ, July 18, 1989.

APPENDIX D - TECHNICAL ANALYSIS
Determining Mozambique Railways (CFM) Locomotive Requirements

1.0 The Need for Locomotives

The basis for determining the number of locomotives is how many trains must be kept in operation to meet the local and international traffic demand. To achieve this the model must first compute the amount of freight traffic that a single train can move under continuous operation in a given time reference period. Since traffic data are compiled on an annual basis, and to balance out seasonal variations in traffic patterns, this reference period is generally taken to be one year. The annual traffic demand is then divided by the capacity of a single train to project the required number of trains. For the CFM system, each rail line must be considered independently in order to account for various operational constraints. Thus, each rail line, Ressano Garcia, Goba, Machipanda, etc., will have an optimum number of locomotives required to meet its own traffic and operational characteristics.

1.1 Previous Application of the Model

CFM, with the assistance of Rail India Technical and Economic Services (RITES), has identified the most significant factors and variables of the model and applied them to the entire CFM system. While the format of the model is generally acceptable, the traffic forecasts and operating coefficients have been superceeded by more recent studies.

The World Bank adapted this model in their Appraisal Report for the Beira Corridor project. While they looked in depth primarily at the Beira Corridor, they did an analysis of the entire CFM system to determine the overall requirements and optimum placement of the locomotives within the system. The results of the Beira Corridor study reflect directly the choice of traffic demands and scenarios for available traffic corridors within SADCC member states.

On closer study, there were found to be internal inconsistencies in the World Bank model between the results and the operating coefficients used. For instance, while loadability and operating allowance factors (discussed under 1.3 below) are provided for in the discussion, they are not carried through in the final calculations. Therefore, the World Bank Report figures and assumptions are used only as a basis for determining operating coefficients in this analysis.

1.2 Traffic Projections

Traffic projections are the single most important factor within the model. A direct relationship exists between the traffic

demand and the number of locomotives required. For instance, a ten percent increase in freight traffic will result in a requirement of ten percent more traction power. Depending upon operating characteristics, this could result in as many as ten percent more locomotives. Traffic estimates used in this model are those developed in the Traffic Projections, Annex C.

1.3 Factors Reflecting Operating and System Constraints

There are a number of factors that reflect operating and system constraints that prevent each train from achieving the theoretical maximum output. The major factors considered in this model are:

- Passing loop capacity
- Seasonal variations in traffic
- Loadability of wagons to the theoretical capacity
- Operational efficiency
- Required movement of empty wagons with major traffic flow
- Ratio of average gross to net weight per wagon
- Locomotive availability
- Maximum trailing loads permitted per locomotive

The operational characteristics of the model are presented both in a 12-hour and 24-hour working day up to 1995. Under the 12-hour operating rules (imposed for security reasons), terminal detention, fuelling and servicing of the equipment is included in the overnight stop.

Passing loop capacity (Pc) is the maximum number of wagons limited by the passing loop length (or siding) on the line. Each line is different. In some cases, two trains may pass each other only at specified stations or loops.

Seasonality factor (Sf) shows peak demands for all international and domestic traffic in the direction of heavier traffic. This factor is usually only affected by movements of bulk agricultural produce i.e. cotton, tobacco, coffee and tea.

Traction (NT) is the number of locomotives per train.

Maximum trailing load or tonnage rating (Tr) is the maximum gross weight the train can assume given the profile characteristics of the line and other operating constraints. For the purposes of this analysis, the tractive effort curve of a General Electric model U20C locomotive with 20% adhesion was utilized. This factor reflects the combined effort of the locomotives under traction above (known as a locomotive consist).

Surplus loop capacity (Slc) is the ratio of the number of fully loaded wagons limited by loop capacity to the number of wagons limited by the tonnage rating. That is:

Slc = Pc/(Tr/45 tons)
where the maximum weight of a wagon is 45 tons

A value greater than one means that the length of the train is limited by the traction. In this case, additional traction will permit additional wagons on each train (up to the loop capacity). A value less than one indicates excess tractive effort is applied. It may be possible to reduce the locomotive consist.

Loadability Factor (Lf) is an indication of the portion of freight traffic that is limited by volume and not weight. For example, cotton, tobacco and tea weigh approximately 12 tons per container as opposed to a payload capacity of 18 tons. The result is that wagons are not loaded to maximum weight capacity.

Operating allowance (Oa) indicates the inability to run trains with the ideal composition to satisfy loadability and surplus loop capacity. CFM, RITES and the World Bank assume an operating allowance of 20% in their studies.

Constrained empty movement (CE) - if the regular traffic movement calls for the movement of empty wagons in the heavier demand direction, the train composition to weight ratio will be less than optimum. Due to inefficient use of the wagon fleet, this factor is estimated to be ten percent; it may be significantly more if unit trains are considered for sugar or coal traffic.

The combined adjustment factor per train load (Af) is the product of loadability factor, surplus loop capacity, 1.0 minus the operating allowance, and 1.0 minus the constrained empty movements. That is:

$$Af = (Lf)(Slc)(1.0-Oa)(1.0-CE)$$

The value of Af may be greater than 1.0 when Slc is significantly greater than 1.0. This has the effect of pushing up the average net load per train since all trains are operating at maximum trailing load and unconstrained by limitations on the number of wagons.

The ratio of the average gross weight to net weight per wagon is the Gross/Net load factor (GF). CFM assumes this to be 1.48 for the entire system.

Average net load per train (NL) is the product of Maximum trailing load and the adjustment factor per train load divided by the Gross/Net load per wagon. This value cannot exceed the result of maximum trailing load divided by Gross/Net load per wagon since it would result in a a gross train load greater than the maximum trailing load. If this situation occurs, it

may prove advisable to increase the traction to take advantage of additional loop capacity. Expressed as an equation this is:

$$NL = (Tr)(Af)/GF$$

where

$$NL < Tr/GF$$

The Annual Net Throughput per Train per Day is the product of the average net load per train by 330 working days per year.

1.4 Passenger and Service Train Requirements

Passenger and service train requirements are established by CFM. The numbers depend upon the security situation and track rehabilitation programs under way.

Passenger trains currently run intermittently and over short distances. Prior to the current insurgency problems, CFM had an extensive passenger service in place. It is the intent to reestablish this passenger service once the security situation will permit. Based upon this, the demand for passenger trains included in this analysis increases steadily until 1995 and eventually reflects the situation prior to 1980.

Service trains will always be required to perform the routine and periodic maintenance of the permanent way. During the planned rehabilitation programs for all of the major rail corridors, the numbers of service trains required are substantially higher. Present requirements for service train locomotives up through 1992 are: Nacala line, five; Machipanda line, three; Sena line, three; Limpopo line, seven; CFM-S general, four; and CFM-C general, one. This analysis reflects a declining demand for service trains between 1990 and 1995.

1.5 CFM Locomotive Requirements

TABLE 1. Summary of CFM Locomotive Requirements

YEAR	1990		1995		2000
Locomotive Requirements Considering:					
12 Hour	117	-	-	-	-
24 Hour	-	-	107	-	126

The complete analysis of CFM locomotive requirements is presented in TABLE 2.

The analysis is computed on an average daily utilization of between 75 and 500 kilometers per day for each locomotive available. By 1995, when 24-hour operations will be possible,

the minimum usage is 300 kilometers per day. Zimbabwe Railways currently obtains 400 kilometers per locomotive per day. CFM-S has the worst performance in kilometers per day per locomotive. This is due to the short lines running into Swaziland and South Africa where a significant portion of the locomotive day is spent in terminal time. Performance on the Limpopo, Machipanda and Nacala lines is limited by the anticipated average running speed of 25 kilometers per hour. Improvements to the management and operations will improve this overall performance. In terms of annual ton-kilometers per locomotive, all of the CFM lines will perform between 20 and 90 million tons (refer to Figure 3); as good or better than other railroads in Africa. Recent figures for Kenya, TAZARA and Zambia are 12, 16 and 26 million tons annually.

Assumes Sena Line closed thru 1995		CORA B.	GARCIA	LIMPOPO	CFM-S TOTAL	MACHIP	SENA	TETE	CFM-C TOTAL	BACALA	LICHINGA	CFM-N TOTAL	CFM TOTAL
FREIGHT													
Coefficients													
Loop Capacity		35	50	35		25	20	20		40	20		
Seasonality Factor		1.0	1.0	1.0		1.2	1.2	1.2		1.2	1.2		
Loadability Factor		0.9	0.9	0.9		0.9	0.9	0.9		0.9	0.9		
Surplus Loop Capacity		1.1	1.1	1.4		1.0	0.9	0.0		2.6	1.0		
Operating Allowance		20%	20%	20%		20%	20%	20%		20%	20%		
Constrained Empty Movement		0%	0%	0%		0%	0%	0%		0%	0%		
Adjustment Factor per Train Load		0.76	0.81	1.03		0.71	0.65	0.60		1.85	1.62		
Single/Double Traction		1	2	1		2	1	1		1	1		
Maxim. Trailing Load(GTons)		1500	2000	1100		1140	1400	1500		700	700		
Gross/Net Load of Wagon		1.40	1.40	1.40		1.40	1.40	1.40		1.40	1.40		
Avg. Net Load per Train		766	1095	743		547	613	613		473	473		
Annual Net Throughput per Train per Day(Million tons)		0.25	0.36	0.25		0.18	0.20	0.20		0.16	0.16		
Locomotive Availability	1990	60%	60%	60%		60%	60%	60%		60%	60%		
	1995+	75%	75%	75%		75%	75%	75%		75%	75%		
Heavy Direction Traffic (Million Net Tons)													
	1990	0.99036	0.93377	0.35304		0.494				0.042			
	1995	1.22497	1.44499	0.68143		0.992				0.253			
	2000	1.45789	1.96740	0.97575		1.490				0.464			
Route Length (km)		74	88	534		317	359	254		815	262		
Average Speed (KPH)													
	1990	19	21	19		24	19	19		19	19		
	1995	25	25	25		25	25	25		25	20		
	2000	25	25	25		25	25	25		25	20		
Running Time (up+dn) (hours)													
	1990	7.79	8.38	56.21		26.42	37.79	26.74		64.74	27.50		
	1995	5.92	7.04	42.72		25.36	28.72	20.32		49.20	26.20		
	2000	5.92	7.04	42.72		25.36	28.72	20.32		49.20	26.20		
Terminal dtn(both ends)													
12-hour work	1990	0	0	0		0	0	0		0	0		
24-hour work	1995	5	5	5		5	5	5		5	5		
	2000	5	5	5		5	5	5		5	5		
Fuelling + Servicing													
12-hour work	1990	0	0	0		0	0	0		0	0		
24-hour work	1995	1	1	3		3	3	3		3	3		
	2000	1	1	3		3	3	3		3	3		

Assumes Sena Line closed thru 1995

		GOBA-R.GARCIA	LIMPOPO	CFM-S TOTAL	MACHIP	SENA	TETE	CFM-C TOTAL	MACALA	LICHINGA	CFM-N TOTAL	CFM TOTAL
Turn Around (hours)												
12-hour work	1990	24.00	24.00	120.00	40.00	48.00	40.00		96.00	40.00		
24-hour work	1995	11.92	13.04	50.72	33.36	36.72	28.32		57.20	34.20		
	2000	11.92	13.04	50.72	33.36	36.72	28.32		57.20	34.20		
Turn Around (days)												
12-hour work	1990	1.00	1.00	5.00	2.00	2.00	2.00		4.00	2.00		
24-hour work	1995	0.50	0.54	2.11	1.39	1.53	1.10		2.30	1.43		
	2000	0.50	0.54	2.11	1.39	1.53	1.10		2.30	1.43		
Trains per Day												
12-hour work	1990	3.95	2.59	1.44	3.20	0.00	0.00		0.32	0.00		
24-hour work	1995	4.84	4.00	2.70	6.59	0.00	0.00		1.94	0.00		
	2000	5.77	5.45	3.90	9.90	0.00	0.00		3.57	0.00		
No. of Freight Locomotives (bare)												
12-hour work	1990	3.95	5.17	7.20	13.12	0.00	0.00		1.20	0.00		
24-hour work	1995	2.41	4.35	5.07	18.32	0.00	0.00		4.63	0.00		
	2000	2.06	5.92	8.41	27.52	0.00	0.00		8.50	0.00		
TOTAL FREIGHT LOCOMOTIVES												
12-hour work	1990	6.58	8.62	11.09	27	21.07	0.00	0.00	22	2.13	0.00	2	51
24-hour work	1995	3.21	5.00	7.03	17	24.43	0.00	0.00	24	6.17	0.00	6	47
	2000	3.82	7.09	11.21	23	36.70	0.00	0.00	37	11.33	0.00	11	71
PASSENGER (Bare)	1990	2	2	3	3	0	0		4	0		
	1995	2	2	3	3	3	0		4	1		
	2000	2	2	3	3	3	0		4	1		
TOTAL PASSENGER LOCOMOTIVES	1990	3.33	3.33	5.00	12	5.00	0.00	0.00	5	6.67	0.00	7	24
	1995	2.67	2.67	4.00	9	4.00	4.00	0.00	8	5.33	1.33	7	24
	2000	2.67	2.67	4.00	9	4.00	4.00	0.00	8	5.33	1.33	7	24
SERVICE TRAINS (Bare)	1990	3	1	7	3	3	1		6	1		
	1995	1	1	3	3	6	3		3	2		
	2000	1	1	3	3	6	3		3	2		
TOTAL SERVICE LOCOMOTIVES	1990	5.00	1.67	11.67	10	5.00	5.00	1.67	12	10.00	1.67	12	42
	1995	1.67	1.67	5.00	8	5.00	10.00	5.00	20	5.00	3.33	8	36
	2000	1.33	1.33	4.00	7	4.00	8.00	4.00	16	4.00	2.67	7	30
GRAND TOTALS												
12-hour work	1990	15	14	29	57	32	5	2	39	19	2	21	117
24-hour work	1992	8	10	17	34	33	14	5	52	17	5	21	107
	1995	8	12	19	39	45	12	4	61	21	4	25	125

TABLE 3A - Planned Composition of Present CFM Fleet in 1995 by Year of Acquisition and Type of Locomotive

DATE 03/22/90

Serial Number	Diesel Mainline								Shunter	Steam Shunter and Mainline				
	GE 1st	GE 2nd	GE 3rd	GE 4th	GE 5th	GE 6th	ABI	TOTAL	DH 125	60	90	250	050	070
Year of Delivery	1966	1968	1974	1979	1981	1984	1960		1980	1955	1955	1955	1952	1955
Number delivered	18	10	20	25	20	10	9		32	4	6	22	12	5
Source	USA	USA	Brazil	Brazil	Brazil	Brazil	UK		Romania	FRG	USA	FRG	Belgium	FRG
Power (HP)	2150	2150	2150	2150	2150	2150	1200		1200					
Tractive Effort (kg)	22800	22800	22000	22900	22900	22900	10120		16000	16100	15300	16500	26426	27030
Gross Weight (Tons)	96	96	120	108	108	89	83		69	74	60	86	102	104
Existing Fleet Size														
CFM-South	0	0	17	11	13	0	0	41	14	0	0	0	0	0
CFM-Central	0	0	0	1	1	3	0	5	4	0	0	0	0	0
CFM-North	0	0	0	0	2	4	0	6	11	0	0	9	0	0
TOTAL	0	0	17	12	16	7	0	52	29	0	0	0	0	0

TABLE 3 - Present Composition of CFW Fleet by Year of Acquistion and Type of Locomotive

DATE 03/15/90

	Diesel Mainline								Shunter	Steam Shunter and Mainline				
Serial Number	GE 1st	GE 2nd	GE 3rd	GE 4th	GE 5th	GE 6th	AEI	TOTAL	DH 125	60	90	250	950	978
Year of Delivery	1966	1960	1974	1970	1981	1984	1960		1988	1955	1955	1955	1952	1955
Number delivered	18	10	20	25	20	10	9		32	4	6	22	12	5
Source	USA	USA	Brazil	Brazil	Brazil	Brazil	UK		Romania	FRG	USA	FRG	Belgium	FRG
Power (HP)	2150	2150	2150	2150	2150	2150	1200		1200					
Tractive Effort (kg)	22800	22800	22800	22900	22900	22900	10120		16000	16100	15300	16590	26426	27830
Gross Weight (Tons)	96	96	120	108	108	89	83		69	74	60	86	102	194
Existing Fleet Size														
CFW-South	0	1	17	11	13	0	0	42	14	0	0	0	0	0
CFW-Central	1	1	0	1	1	3	0	7	4	2	4	5	9	3
CFW-North	1	3	0	0	2	4	2	12	11	0	0	0	0	0
TOTAL	2	5	17	12	16	7	2	61	29	2	4	5	9	3

2.0 Status of Existing CFM Locomotive Fleet

2.1 Summary of Diesel Electric Fleet

CFM's present fleet includes 59 Diesel Electric locomotives. The age profile of the fleet is such that a minimum of eight locomotives will be retired by 1995. Table 3 and Table 3A show the present and planned make-up of the fleet in 1990 and 1995 respectively.

Procurement is currently under way for five GE U20C locomotives funded by Japan. The French Caisse Central has also agreed to fund 15 French-built Alsthom locomotives. Canada will provide ten North American locomotives and Japan may add three in 1991. If all the procurements take place in the planned time frame, the CFM fleet will total 94 units by 1992. The addition of ten locomotives under this Project Amendment will bring the total fleet to 104 locomotives in 1993.

TABLE 4. Summary of CFM Diesel Electric Locomotive Fleet Including Planned Procurement

	1990	91	92	93	94	95	2000
CFM Holding	61	66	84	94	104	104	96
Normal Attrition	-	-	-	-	-	-9	-
Supplied By:							
Japan	5	3	-	-	-	-	-
France	-	15	-	-	-	-	-
Canada	-	-	10	-	-	-	-
US	-	-	-	10	-	-	-
TOTAL Fleet	66	84	94	104	104	95	96
Requirement	117					107	126
Deficit	51					12	30

2.2 Use of Steam for CFM Mainline Traction

There are currently 17 steam locomotives in use for mainline service. All are used on the Beira corridor line in CFM-C. The current plan is to have all 17 locomotives phased out of service by 1995. Until that time, they will be used for service, rehabilitation and passenger trains within the CFM-C system.

TABLE 5. Planned Phase-out of Steam Locompotives

YEAR	1990	91	92	93	94	95
Number In Use at Year End	17	16	12	7	2	0

2.3 Availability and Utilization of the Diesel Electric Fleet

Availability of the Diesel Electric fleet is currently 54 percent. This has remained constant over the past year and is slightly down from the Regional Rail Systems Support Project Paper in 1988 of 58 percent. The objective of the Regional Rail System Support project is to increase the availability to 75 percent by 1992. The project has ordered the first lot of spare parts and equipment to be delivered to Maputo and Beira workshops. The project is also in final negotiations for a long-term technical assistance team to support the administration and operations of the workshops in Maputo. Beira workshops are supported by a Spanish technical assistance team that has been in place for more than a year. Because of the infusion of spare parts, technical assistance and the rehabilitation of the Beira and Maputo workshops currently in progress under the RRSS project, availability in the diesel electric locomotive fleet will improve.

Historical data for main line diesel electric locomotive availability and utilization is shown in TABLE 6. FIGURE 1 shows historical data for ton-kilometers moved on each of the three major CFM systems. Utilization has dropped off in recent years because of daylight operating restrictions and sabotage activity. The sound management of motive and operations is important to optimize the utilization of the locomotive fleet. This amendment includes short term technical assistance to review the management and operations department of CFM to determine how additional USAID inputs can improve the overall operations of each CFM line. Technical assistance is already being supplied to CFM-C through the World Bank Beira Corridor Project which will upgrade the management and operations of the Machipanda line. Target locomotive performance criteria for each line for the period 1990 - 2000 are shown in Figures 2 and 3. While this discussion does not specifically cover shunting

locomotives, it must be noted that if they are not available for making up trains in the yards, mainline locomotives will be diverted to this purpose and targets will not be met.

TABLE 6. Historical Average Locomotive Performance

	Daily kms/loco in service (kms)	Daily hrs/loco in service (hours)	monthly availability (percent)	Annual Ton-km per loco in use (millions)
1980				
CFM-S	171	16	85	14.1
1989				
CFM-S	51	6.4	55	9.2
CFM-C	104	9.8	52	21.7
CFM-N	25	3.0	51	2.1

Detailed data for CFM-C and CFM-N not available

3.0 Required Operational Characteristics of CFM Locomotives

3.1 Length of Train is Limited by Vacuum Brakes

Vacuum brakes are the standard for trains operating in Mozambique and many of the neighboring SADCC States. Due to inherent limitations of vacuum brake systems, the maximum length a train can assume is approximately 200 axles. Although NRZ has operated trains of this length, it requires a high level of driver skill and experience to avoid damage to couplers and drawgear delays due to trains separating accidentally. It also requires a high standard of brake maintenance to achieve the vacuum necessary at the rear of the train for safe braking. CFM rules permit maximum trains of 140 axles; this will allow for trains of 34 wagons plus a brake van.

3.2 CFM Tonnage Ratings

Under the prevailing operational characteristics of CFM, the trailing load on level ground permitted by limitations of the vacuum brakes is approximately 1500 tons. The use of unit trains and improved operating efficiencies can increase this load to approximately 2000 tons.

The trailing load that a locomotive can pull, or tonnage rating of a locomotive, varies according to the gradient of the track. The steeper the gradient, the lower the trailing load a locomotive can pull at a constant speed. The type of locomotive that is suitable for a given terrain is dependent on the standard of performance required to be met by the locomotive. The standards of performance required are frequently of the following categories:

Maximum axle load of locomotive permissible. This depends on the standard of track bed, such as base material, ballast type and depth, and weight and configuration of rails and sleepers.

Maximum speeds permissible for optimum train loads. This depends on the condition of the track and the rolling stock.

Minimum speed for optimum train load to prevent overheating of the traction motors.

Ambient temperature over the route concerned in which the locomotive will be operated.

Capacity for starting the maximum trailing load on the ruling grade. This depends on the resistance of the type of rolling stock used on the system.

Minimum required equilibrium speed required.

It is possible, theoretically, to compute the exact power and other characteristics of locomotives that would give optimum results and would ideally suit each type of service and section of the system. But this would necessitate a large variety of locomotives. Even if such large and diverse numbers of locomotives could be obtained, it would entail too many different spare parts and maintenance schedules, and prevent standardization, resulting in very uneconomic operation and maintenance. It is essential, therefore, to make a choice of only one or two types of locomotive in any railway system.

3.3 Horsepower, Tractive Effort and Tonnage Ratings

The amount of power that a locomotive can apply to the wheels (tractive effort) is limited by the conditions of the rails and the wheel adhesion. Wheel slippage occurs when too much power is applied. Locomotives identical except for horsepower outputs will reach the same tractive effort output, but at different speeds (see Figure 4). Horsepower increases alone cannot increase a locomotive tonnage rating. It is often to the advantage of a small railroad to keep a fleet of smaller locomotives in order to maximize flexibility and operational options. The sophistication in locomotive technology also makes a jump between 2000 and 3000 horsepower that requires significantly higher skills in maintenance and differently equipped workshops.

3.4 The Choice of Locomotives for CFM

Given the axle weight limitations in force on the CFM systems, currently 16 tons, the 2000 horsepower locomotives (GE U20C) in use by CFM will meet the trailing load and operational requirements of all the CFM lines (see Figure 5). In some

instances, on steeper gradients, improved performance can be achieved by double heading the U20C locomotives and restricting where passing movements can take place between two trains.

The present CFM fleet of Diesel Electric locomotives consists of 59 GE U20C units of 2150 horsepower each and two British built AEI units of 1200 horsepower each (refer to TABLE 3 and 3A). Both performance and the ability to maintain the GE fleet have proven satisfactory over the past 24 years. CFM can capitalize on their past experience and training and standardize the fleet size on 2000 horsepower locomotives.

Fig 1. CFM Freight Traffic Performance

Ton-kilometers/year

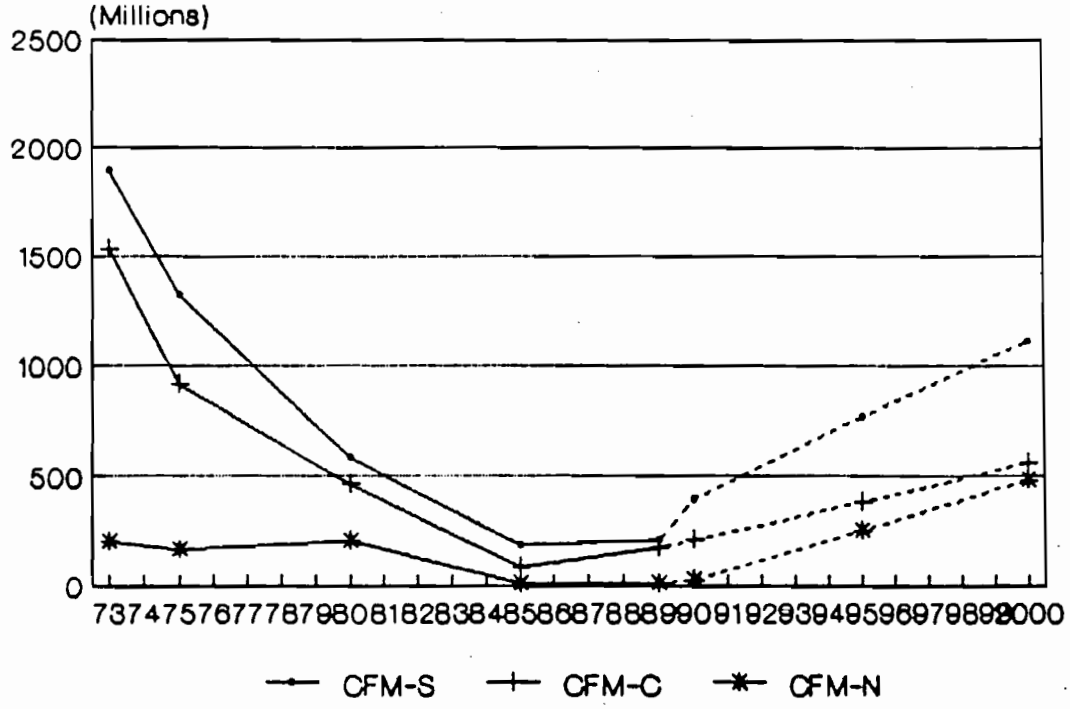


Figure 2. Target Locomotive Performance
Kms/Locomotive/day worked

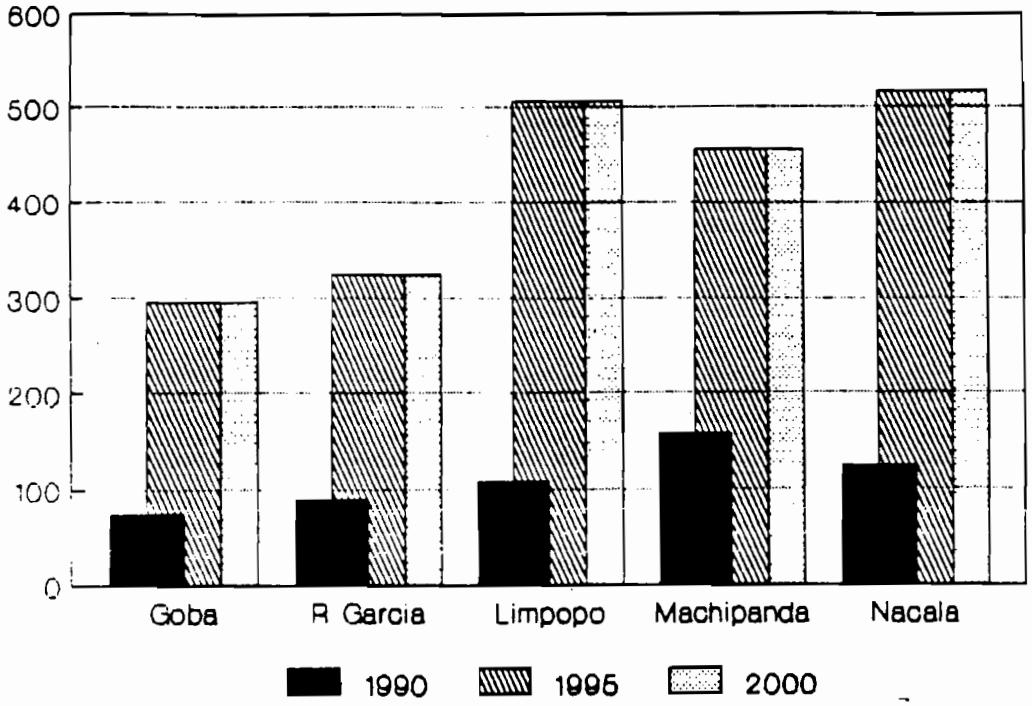
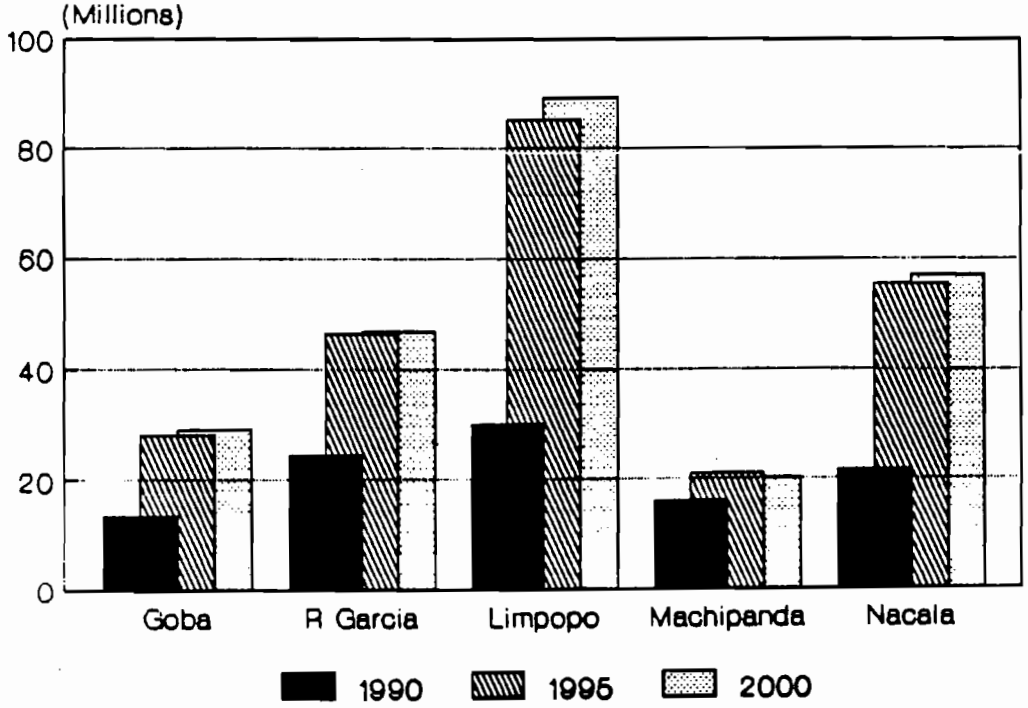


Figure 3. Target Locomotive Performance
Ton-kms/Locomotive/year in use



Speed vs Tractive Effort

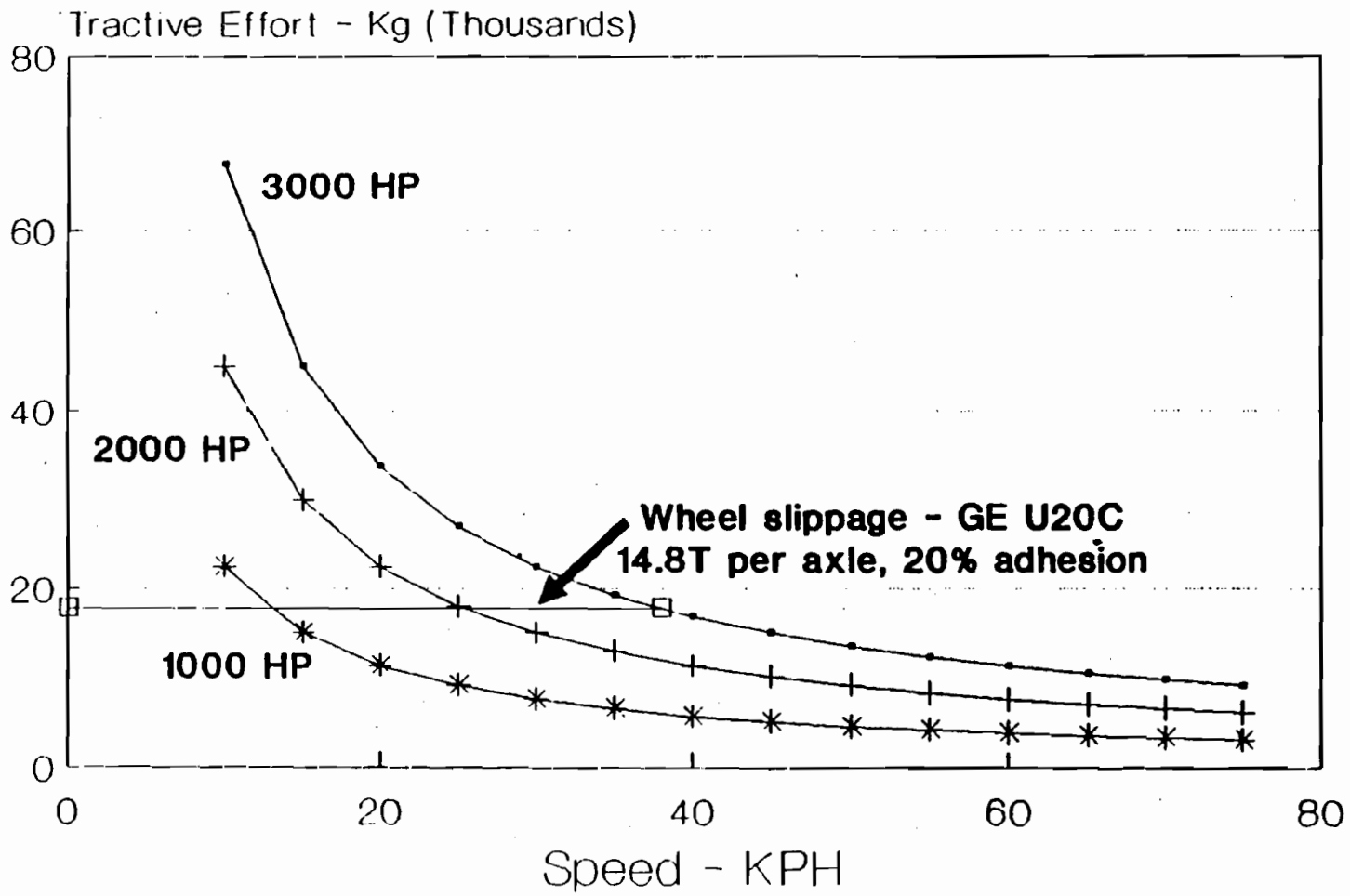
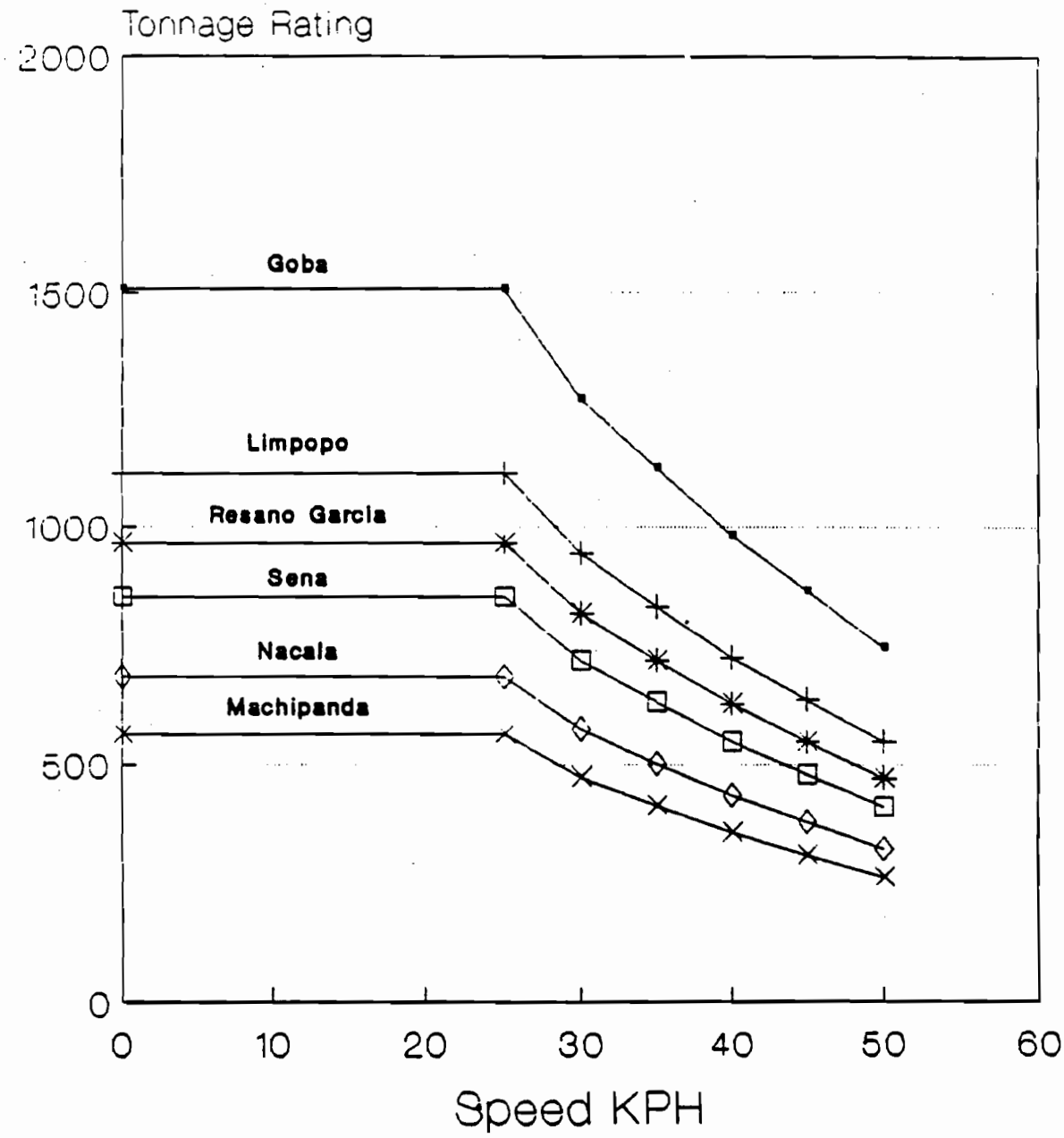


Figure 4

Figure 5

Tonnage Ratings
GE U20C



ANNEX E

ECONOMIC ANALYSIS-RATE OF RETURN

The PP amendment was designed to provide CFM with the additional traction and technical assistance needed to ensure efficient operation of the traction. This assistance will help Mozambique fulfill its role of providing the landlocked SADCC countries with low cost access to ports.

BENEFITS

With the project, CFM's additional tractive capacity will enable Mozambique's ports to attract its traditional overseas trade from the SADCC countries now forced to travel long distances to South African ports. The project benefits will be savings in transport costs resulting from the difference between rail transport costs over the long South African routes and the shorter routes through Mozambique. These benefits will accrue to the region.

Economic benefits will also accrue to Mozambique as a result of better capacity utilization of its rail infrastructure. The higher utilization will lower the long run marginal costs (LRMC) of the railroad because the fixed costs of permanent way and physical facilities are shared by more traffic. The technical assistance proposed by the amendment will also improve the efficiency of operation of the railroad, thereby producing further economic benefits.

As shown below, the regional benefits are more than sufficient to economically justify the investment in locomotives and technical assistance proposed by the PP amendment.

COSTS

INVESTMENT COSTS - Detailed investment costs for the PP amendment are given in the Financial Plan section of the PP Supplement. In total, the project cost is estimated at US$ 20 million. This includes ten diesel electric (DE) locomotives of approximately 2000 - 2200 traction HP, technical assistance, special tools and testing equipment for the new locomotives, and a two year supply of maintenance spare parts for the new locomotives. These costs are in U.S. dollars, and therefore are an adequate approximation to economic costs.

COST DIFFERENCE BETWEEN MOZAMBIQUE AND SOUTH AFRICA ROUTES - There are basically two sets of transport costs: those over the long routes to South African ports, and those over the shorter routes to the ports of Mozambique. Detailed information on rail transport costs is difficult to obtain, but these have been estimated using the unit cost approach in Reference 1: "Policy Issues in Financial Strategy: Working Paper No. 3, Traffic Allocation and Financial Analysis, Railways", presented at the SADCC Transport Corridors Workshop, Maputo 11 - 14 December, 1989.

Reference 1 derives the long run marginal cost for SADCC railroads assuming these operate at the efficiency levels achieved in 1988 by the NRZ railroad system, and for two route lengths: 500 kilometers and 2000 kilometers. While CFM cannot achieve the locomotive utilization rates of Zimbabwe's GM fleet, it can do as well or better in other areas, including NRZ's performance for non-GM locos. For the 500 km route (about average for traffic destined for a port in Mozambique, as shown below) the cost is calculated at about $0.05 per ton-km. For the 2000 km route the cost is estimated at $0.03 dollars per ton-km. Since the average length of haul on SADCC railways for traffic going to Durban is only 1202 kilometers (see below), we estimate the LRMC for that length of haul to be about US$ $0.04 per ton-km.

The LRMC includes the costs of crew, fuel, maintenance (except fixed cost of maintenance for permanent way), terminal costs, the variable portion of overhead costs, and locomotive and wagon depreciation. Depreciation on permanent way and plant is not included in the LRMC.

Costs over the South African portion of the journey for traffic going to Durban are considerably lower then the costs through SADCC countries. The fully allocated cost (including depreci[illegible] permanent way and facilities, and fixed costs) for the SATS system are estimated at about $ 0.028 per ton km, and do not vary much with distance. For SATS, the LRMC is about 70 per cent of the fully allocated cost. LRMC over the SATS system is therefore about .7 x $0.028 = $0.02 US per ton-km. Assuming that, on the average, about 35 per cent of the journey to and from Durban is via the SATS system, the adjusted cost for the haul to Durban will be .35 x $0.02 + .65 x $0.04 = $0.033 per ton-km.

If we assume that tariffs in the future will be cost-based and will therefore approximate or, more likely, somewhat exceed the LRMC, the average transport cost per ton over a route to a Mozambique port will be the average length of haul of 523 kms x $0.05 = US$ 26.15 per ton. For traffic to Durban, the cost will be 1202 kms x $0.033 = US$ 39.67 per ton, or almost US$ 14 per ton more expensive. This calculation shows the marked potential competitive advantage of the Mozambique ports.

<u>RATE OF RETURN CALCULATION</u> - Table 1 presents the work sheet for calculating the various elements of the economic analysis. The weighted average length of haul for traffic going to ports in Mozambique or to Durban is calculated by dividing the total ton kms by the total traffic. For example, the total ton-kms if all international traffic went to Durban is 3,004,000,000 ton-kms per year. Total international traffic in 1990 is 2,500,000 tons. The average weighted (by traffic level) length of haul for transport through Durban is therefore 1202 kilometers. A similar calculation for Mozambique yields an average length of haul of 523 kilometers.

The productivity in terms of net tons per year for a main line locomotive is calculated using the following assumptions: The new locomotives are able to achieve, conservatively, 200 kilometers per day per engine in use (EKM/day in use), the trailing load is 1150 gross tons (a weighted average for the 700 tons on the Beira corridor and the 1300 tons for the other corridors, a conversion factor of 1.45 to convert from gross to net tons, 365 days working per year, locomotive availability of 75 per cent, a 30 per cent backhaul factor (wagons on the return trip are only 30 per cent loaded), a LRMC to Durban ports of US$ $0.033 and to Mozambique ports of US$ $0.05.

Using the above estimates, the productivity of a locomotive operating on the Mozambique lines is calculated as (EKM/Day in use)x(Trailing Load)/(Gross/Net Factor)x(Days per year)x(Utilization)x(1 + Backhaul Factor) x .5 = 21,168,427 net ton-kms per year. The final multiplier of .5 is used to account for the round trip. This adds to the conservatism of the economic analysis since it can be argued that return trips aree already accounted for by utilizing an <u>average</u> length of haul, which factors in the total distance covered throughout the year.

The productivity of a locomotive in Mozambique in terms of tons per year is calculated by dividing the productivity as measured in ton-kms by the average length of haul, or 21,168,427 ton-kms/523 kms = 54,014 tons per year. This calculation is conservative in that 523 is the average weighted length of haul to Mozambique ports including the distance traveled in the SADCC country or Transvaal, and located outside of Mozambique. If we included only the distance travelled within Mozambique, the average weighted length of haul would be slightly smaller. This would increase the annual productivity measured in tons of a Mozambique locomotive.

From the above it follows that, for every locomotive added to the CFM, the capacity of the CFM system is expanded by 54,014 tons per year. The additional locomotive therefore makes it possible to divert, each year, 40,150 tons from Durban to a Mozambique

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port. This diversion will occur because, as pointed out earlier, the Mozambique ports have a cost advantage of about US$ 14 per ton.

The annual economic benefits accruing to the region of adding a locomotive is calculated as {(LRMC to Durban)x(Average length of haul to Durban) - (LRMC to Moz. ports)x(Average length of haul to a Moz. port)}x(Tons per Loco per year)x.5 = US$ 365,240 per year. The factor of one-half is, as indicated above, extremely conservative, since the benefits are already based on the average length of haul. The reduction does however, reflect the fact that the benefits perceived by the shippers will vary, and probably captures hidden costs. The benefits of using some of the Mozambique lines now are clear, yet many shippers are using Durban or Richards Bay and many will continue to do so. The factor of one-half is a crude approximation for estimating the average cost reduction.

The work sheet shows the calculation of the Internal Rate of Return. The initial investment cost in 1991 is US$ 20,000,000. The time stream of benefits extends for twenty years, and the annual benefit for the ten locomotives is 10 x the benefit contributed by one locomotive, or US$ 3,652,401. The IRR works out to 17.5 per cent.

<u>SENSITIVITY ANALYSIS</u> - The IRR is not sensitive to the traffic projections. The traffic projections serve only to determine the need for additional locomotives. The economic analysis assumes that the additional capacity of each new locomotive will be fully used to carry traffic that presently is going through Durban. The benefits of this diversion are a function of the productivity of each locomotive, and the LRMC of transport by the new locomotives.

The most sensitive factors affecting the IRR are the EKM/day in use for the new locomotives (nominally 200 km/day), the percentage of traffic carried on the backhaul (nominally 30 per cent), the availability rate of the locomotives, and the LRMC over the SADCC routes.

Increasing the EKM/day in use from 200 to 250 kms/day increases the IRR to 22.4 per cent. Increasing the backhaul factor from 30 to 40 per cent increases the IRR to 19.1 per cent. And decreasing the LRMC for rail transport through SADCC from $0.05 to $0.045 US cents per ton-km increases the IRR to 21.3 per cent.

It is believed that the nominal values all of these factors except, perhaps the LRMC, are conservative. Should all three of these assume more realistic levels, the IRR would increase to 29.8 per cent. In addition, if the multiplier of one-half is dropped from the calculation of project benefits, the IRR under each scenario the benefits will be significantly higher.

TABLE I

WORKSHEET: ECONOMIC ANALYSIS OF DIVERTING RAIL TRAFFIC FROM S. AFRICAN PORTS TO PORTS IN MOZAMBIQUE (econ4.wk1)

	1990 traffic (000 tons)	down	up	One-way Distance Thru Mozambiq (km)	One-way Distance Thru Sout Africa (km)	Net Ton-kms Through Mozambique (mill)	Net ton-kms Through S. Africa (mill)
MAPUTO							
Zimbabwe (Harare)	227	175	52	1193	2027	270.8	460.1
S. Africa (Middleburg	1344	1034	310	381	846	512.1	1137.0
Swaziland (Matsapha)	378	291	87	230	565	86.9	213.6
Botswana (Gabarone)	0	0	0	1675	1170	0.0	0.0
BEIRA							
Zimbabwe (Harare)	444	342	102	605	2027	268.6	900.0
Malawi (Blantyre)	29	22	7	649	2567	18.8	74.4
Zambia (Lusaka)	68	52	16	2073	2839	141.0	193.1
NACALA							
Malawi (Blantyre)	10	8	2	814	2567	8.1	25.7
tons/year,1000	2500	1923	577		Total	1306	3004
					Avg. loh	523	1202

Annual loco product. (net ton-kms) 28,224,569 Tons loco can haul/year thru Moz 54,014

KM/Day in use	200	kms
Trailing load, Gross	1150	tons,gross
Gross/Net	1.45	
Days/year	365	Benefits per loco$365,240 (Rule of one-half applied)
Utilization	0.75	
Backhaul factor	30%	% loaded on backhaul
LRMC to Durban	0.033	
LRMC to Moz. ports	0.05	

YEAR	COST
	17.5%
1991	(20,000,000)
1992	3,652,401
1993	3,652,401
1994	3,652,401
1995	3,652,401
1996	3,652,401
1997	3,652,401
1998	3,652,401
1999	3,652,401
2000	3,652,401
2001	3,652,401
2002	3,652,401
2003	3,652,401
2004	3,652,401
2005	3,652,401
2006	3,652,401
2007	3,652,401
2008	3,652,401
2009	3,652,401
2010	3,652,401
2011	3,652,401

IRR 17.5%

Table 5: Sensitivity Analysis

	IRR		
	KM=120	KM=200	KM=300
Backhaul 40%	10.07%	19.10%	29.33%
Backhaul 30%	9.00%	17.54%	27.17%
Backhaul 20%	7.91%	15.99%	24.99%
Availability			
50%		10.53%	
55%		12.01%	
60%		13.44%	
65%		14.83%	
70%		16.28%	

ANNEX F FINANCIAL ANALYSIS

CAMINHOS DE FERRO DE MOCAMBIQUE

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1. PURPOSE

The purpose of this financial analysis is to estimate the financial costs and benefits to CFM of the proposed plan to purchase 10 additional U20-C diesel electric locomotives. In addition, this analysis includes an assessment of the capability of CFM to successfully establish a cost-based tariff system as part of the process of evolving into a self- sustaining commercial enterprise, requiring a minimum of government support. The emphasis of this analysis is to evaluate existing CFM systems and to identify a specific program for improvement which could form a part of a future technical assistance effort.

2. METHODOLOGY

Estimates of the viability of CFM are based on the cost, revenue and traffic projections over the ten year evaluation period. These projections include provisions for cost escalation, rate increases, productivity improvements and changes in routing of traffic (i.e., greater use made of the Limpopo line for Zimbabwe traffic).

3. COST ACCOUNTING PRACTICES

3.1 Adequacy of Data

The cost information obtained from the Caminhos de Ferro de Mocambique was for the total CFM (Sul). Cost data were available for the estimation of system average values only, as route cost data or commodity specific information was not available.

A revaluation of assets has since been undertaken by CFM during the latter part of 1989, for assets as at 31 December 1988. For each asset the book value was multiplied by a factor specified by

the Ministry of Finance. The only major assets not yet recorded on the books of the CFM are the cost of reconstruction works in progress.

A problem with the asset valuation system is that each anything valued in excess of Mt 5000 is considered a capital item. This amount is clearly too low and creates an excessive amount of effort expended in undertaking a revaluing effort. Another problem is that assets which have been fully written down, including many that will eventually have to be replaced, were not revalued.

Despite the rather rough approach, the revaluation appears to provide a reasonable estimate of asset values. For example, the annual depreciation amount for each locomotive is US $ 42,000. Over a 25 year period, this amounts to just over US $ 1 million.

3.2 Commodity Costing

CFM does not break costs down by commodities, a requirement for cost based tariff setting, which sets a range of possible tariffs between the rail long-term variable costs and the cost of the competition.

It is possible to roughly estimate commodity specific tariffs using costs per wagon and dividing by the typical net load of the commodity. Any additional handling costs for specific commodities should be identified and added to this movement cost. For CFM, the calculation is as follows. The 1989 total freight rail costs for CFM Sul, US $ 13,833,000, are divided by the total wagon kilometers, 11,422,200. This results in a figure of US $1.21 per wagon kilometer. The cost per ton kilometer for various types of commodities can be estimated by dividing the wagon cost by the net tons loaded, based on the density of each commodity. Examples are shown in Table 1.

TABLE 1 COST PER NET TON KILOMETER
CFM SUL
(US Dollars)

Tons per Wagon	Cost per Ton Kilometer
39	.03103
30	.04033
25	.04840
20	.06050
15	.08067
10	.12100

These amounts reflect the cost of moving a wagon over the average length of haul on CFM Sul. These values should be adjusted before being applied to future traffic which will likely have much longer average lengths of haul (with the reopening of the Limpopo line).

While this method also ignores unique wagon requirements as well as the empty return ratio and wagon utilization characteristics for moving particular commodities, it does provide a quick estimation of commodity related costs and could be used for evaluation of tariff levels.

The other critical element in a cost-based tariff is the cost of the competition, which for Mozambique is road and South African rail services. When evaluating these competitive services, it is important to consider total distribution costs, from the perspective of the user. These costs include transit time, delays in terminals, probability of loss and damage to lading, port tariffs and the general reliability of the route.

The starting point for tariff setting should be the identification of the range between the rail long-term variable costs and the cost of the competition. Knowing this range, and the relative service quality offered by CFM, a good approximation of the appropriate level for the tariff can be established for each commodity.

CFM, in consultation with the Netherlands Economic Institute, has already estimated the percentage variable for most cost elements. While these appear to be reasonable estimates (the percentage variable of total cost in 63 percent) these percentages should be verified through statistical testing during the course of future assistance programs.

4. CFM TARIFF STRUCTURE

4.1 National and International Tariffs

The CFM tariff is based on 14 groups of commodities and is similar to the tariff used by other railways in the southern African region. Commodities are generally classified according to value, with high goods (tariff 1) having the highest rate value and low value goods (tariff 14) moving at lowest rates.

The rates for international traffic are generally developed on the same basis as the tariffs of the connecting railway. For example, the tariffs for the Ressano Garcia line follow the same pattern as the SATS tariff book, the tariff for the Limpopo line are in accordance with the NRZ tariffs.

These rates historically have been developed on an ad valorem basis. Increases have been made generally in accordance with the increases by connecting railways. No specific studies have been made for the profitability of individual commodities as a basis for tariff increases. The tariff for international traffic is significantly higher than for national traffic and the procedures for amending these tariffs are quite different.

In order to amend international tariffs, only approval from the Ministry of Transport is presently sought, although it is not a legal requirement, and this is nearly automatic. Of course, there are competitive constraints which dictate the effective upper limit of increasing international tariffs. Before amending national tariffs, however, permission from the National Committee on Wages and Prices is required. Despite the difficulties involved, CFM has been granted increases of 25 percent in July 1990 and 25 percent [illegible] 1991.

The average revenue per ton kilometer for 1988 is shown in Table 2.

TABLE 2 CFM AVERAGE REVENUE IN METECAIS PER TON KILOMETER (1988)

System	International	National
CFM - SUL	43.24	15.00

source: CFM Commercial Department

To achieve the goal of covering full costs with tariffs, CFM should identify commodity-specific costs and improve service so that significant rate increases can be implemented.

TABLE 3 CFM (S) TRAFFIC PROJECTIONS
(thousands of tons)

Traffic Type	Year 1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total	2117	3043.5	3195.6	3524.8	3854	4183.2	4512.4	4841.8	5161.4	5481	5808.6	6120.2	6440
National	811.5	1185.9	1245.2	1270.1	1295	1319.9	1344.8	1369.7	1397.1	1424.5	1451.9	1479.3	1506.7
International	1305.5	1857.6	1950.4	2254.7	2559	2863.3	3167.6	3472.1	3764.3	4056.5	4348.7	4640.9	4933.3
Zimbabwe	305.3	216.5	227.3	329.5	431.7	533.9	636.1	738.5	828.7	918.9	1009.1	1099.3	1189.3
South Africa	569.7	1280.6	1344.6	1512.4	1680.2	1848	2015.8	2183.8	2351.6	2519.4	2687.2	2855	3023
Swaziland	430.5	360.5	378.5	412.8	447.1	481.4	515.7	549.8	584	618.2	652.4	686.6	721
Average Haul (national)	46	46	46	57	68	79	90	100	100	100	100	100	100
USD Rev/ton km (Zim)	0.05405	0.05405	0.05405	0.04862	0.04319	0.03776	0.03233	0.02703	0.02703	0.02703	0.02703	0.02703	0.02703
Average Haul (Zimbabwe)	88	88	88	177	266	355	444	534	534	534	534	534	534

TABLE 4 CFM (S) TRAFFIC PROJECTIONS
(thousands) Ton Kilometers

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total	213694	224372	295182	384730	493017	620043	765288	833561	901833	970105	1038370	1106576
National	54551	57279	72396	88060	104272	121032	136970	139710	142450	145190	147930	150670
International	159143	167093	222786	296670	388745	499011	628318	693851	759383	824915	890448	955906
Zimbabwe	19052	20002	58322	114832	189535	282428	394359	442526	490693	538859	587026	635086
South Afr	112693	118325	133091	147858	162624	177390	192174	206941	221707	236474	251240	266024
Swaziland	27398	28766	31373	33980	36586	39193	41785	44384	46983	49582	52182	54796

4.2 Cost Allocation

There are two primary tasks involved with the allocation of CFM costs:

- Allocation between the railways and ports;

- Allocation of the railway portion between passenger and freight services.

In neither of these situations has a comprehensive study been conducted to develop a sound basis for allocation.

The costs within the CFM accounting system are combined for both the railways and the ports. While some cost items can be directly attributed to railways or ports, common costs must be allocated. CFM presently allocates 65 percent of common costs to the railways and 35 percent to the ports. This allocation requires empirical confirmation.

The railway costs are further allocated between passenger (30 percent) and freight (70 percent) services. While a detailed study could not be undertaken by the study team, this distribution appears to attribute too large a proportion of costs to passenger services, which are limited to mixed trains and periurban areas.

As noted above, costs are also not allocated among commodities. In order to develop a sound costing system for the purpose of evaluating and establishing tariff levels, an extensive and complex system need not be developed. What is needed is a reasonable estimate of what costs to allocate to what existing account. This should be based on a series of special studies of the major service areas (port/rail, passenger/freight). Once completed the percentages could be updated easily until a major change in the mix occurred. This system could be a PC - based system, using commonly understood computer software packages. Such systems have been successfully undertaken and implemented in other African countries.

Future technical assistance should also include capability within the commercial section, for the specific purpose of liaison with existing clients and potential customers in order to assess existing market share and to develop marketing plans for expansion of CFM's share.

5. CFM EFFICIENCY IMPROVEMENTS

Improvement in several areas of CFM have been identified and cost savings quantified. These cost savings have been incorporated in CFM cash flow analysis, as described further in this section.

5.1 Wagon Hire Savings

Based on an investigation of actual costs incurred in 1988, the net wagon hire payments amounted to nearly Mt 1,642 million, or 14 percent of total costs. The primary reason for this very large amount is the excessive time spent by SATS wagons on CFM property. This is due to a combination of factors, including inadequate mid-level line management in terminals as well as a shortage of motive power to move wagons in an expeditious manner. There needs to be developed specific routing and movement instructions, with clear lines of communications and responsibility, for the expeditious movement of foreign wagons on the CFM system. With additional motive power on the system, as well as increased availability of all units, these wagons should be moved more quickly, thereby reducing the time on CFM.

The new wagon hire system to be implemented by SATS during 1990 is a two-tier system. A certain number of free days will be allowed before a much higher wagon hire charge is levied. The CFM should identify a clear action plan to move towards keeping foreign wagon days on CFM at an absolute minimum, preferably within the free days limit. The increase of suitable CFM wagons for movement over foreign railways, mostly by means of rehabilitation and a higher quality of maintenance, would also help to reduce the net amount payable for wagon hire.

5.2 Locomotive Utilization Improvements

For a number of reasons, including lack of managerial discipline, shortage of spare parts and security restrictions, locomotive availability is only in the region of 58 percent.

With new locomotives, as well as a more effective maintenance system and better supply of spare parts, utilization of locomotives is expected to increase from existing levels of 58 percent to 75 percent. It is likely that the utilization, in terms of kilometers per day, will also improve with the lifting of the daylight only travel and with the longer Limpopo line in full operation, but this has not been included in the savings calculated below.

5.3 Staff Reductions

The CFM is continuing a program of staff reductions, with the goal of 25,000 employees from the existing 30,000. This 16 percent reduction has been incorporated in the savings projected for CFM over the analysis period.

The following efficiency improvements have been incorporated in this financial analysis. Annual savings have been estimated based on 1988 cost levels:

- **a continued reduction in staff levels from 30,000 to 25,000 over the next five years. Estimated annual cost savings of Mt 390 million;**

- **improved locomotive utilization, from the existing levels of 58 percent to 75 percent, resulting in the requirement for fewer locomotives for a given level of traffic, than would be necessary with the existing fleet. Estimated annual cost savings of Mt 703 million;**

- through strict control of wagon distribution and other procedures in Maputo terminal, reductions of 75 percent in the wagon hire account amounts payable. Estimated annual cost savings of Mt 1,200 million.

The sum of these annual cost savings is Mt 2,930 million. This amounts to 24.8 percent of the total costs in 1988 (Mt 11,798 million). In order to reflect the estimated financial impact of these efficiency improvements, a cumulative efficiency improvement of 25 percent has been phased in from 1992 through 1996.

6. SCENARIO ANALYSES

6.1 Development of the Spread Sheet Analysis

A projection has been made of CFM traffic, costs and revenues for a ten year period, and comparisons were made of the financial viability with and without the efficiency improvements. Costs, revenues and traffic figures were taken for 1989 as the base year. Projections of these amounts were made from 1990 to the year 2000.

6.1.1 Changes to Traffic Patterns

The following are the changes to existing CFM traffic patterns incorporated in the analysis:

- a gradually increasing average length of haul for national traffic from the present 46 kilometers (1989) to 100 kilometers, which was the experience in 1980;

- the movement of Zimbabwe traffic is expected to gradually shift from the Ressano Garcia route to the Limpopo route, with total use of the Limpopo route by 1995.

Total tonnages and ton kilometers moved over each route were based on CFM projections and are shown for each year in Tables 3 and 4 respectively, on the following page.

6.1.2 Cost and Revenue Increases

CFM's costs have increased by 34 percent from 1988 to 1989. The tables use a high estimate of inflation, 35 percent in 1991, 25 percent in 1992 and 20 percent by 1993, but actual cost increases experienced by CFM are likely to be slightly lower, since 55 percent of CFM's costs are in foreign currency, and are driven by South African inflation rates (between 15 and 20 percent).

Cost increases at CFM have been assumed to be 30 percent in 1990, 25 percent in 1991, 20 percent in 1992, 15 percent in 1993 and 10 percent thereafter.

Commercial staff at CFM have indicated that the tariff increases from 5 to 15 percent for international traffic have been approved for 1990 over the 1989 levels, on each line of CFM Sul, as shown below:

	Percent Increase
Goba	5
Ressano Garcia	10
Limpopo	15
National traffic	56

For the years beyond 1990, the rates for international traffic are assumed to increase at an annual rate of 15 percent. In 1994, as the Limpopo line is expected to be near to full operation, it is expected that the CFM will have more leverage to support an increase of 20 percent per year in its international rates, in the amounts of 20 percent per year.

Increases in rates for national traffic are estimated at be 25 percent in 1991, with annual increases of 15 percent to the year 2000. The increases in national tariffs are expected to be somewhat greater than those for international traffic in the early years, as the cost coverage of international traffic is greater than for national traffic. Over the long term, however, it is likely that increases for national traffic will lag behind those for international goods, primarily due to pressure from the government to keep domestic inflation as low as possible.

6.2 Expense and Revenue Projections

Projections of expenses and revenues have been made to reflect efficiencies within the CFM system, the increasing traffic levels, the changes to routings, inflation estimates and expected tariff adjustments. The costs have been expressed on a fully allocated and long term variable basis. The variability estimates made by CFM, in consultation with Netherlands Economic Institute, have been incorporated in this analysis.

The base year has been taken as 1989, and total costs of the system are shown for that year. Changes in costs from the base year are quantified using the long term variable cost coefficients multiplied by the changes in ton kilometers.

Revenue forecasts were made by multiplying the tariff rate for each route by the annual traffic forecast over each route. The impact of decreasing yield per ton kilometer has been incorporated in the greater proportion of Zimbabwe traffic using the longer Limpopo route, compared with the existing routing of Zimbabwe traffic via Ressano Garcia.

7. CONCLUSIONS

Based on the analysis incorporated in this report, CFM will continue to operate in a negative profit position until 1997 when a small surplus will be achieved, continuing to grow as traffic increases. These results are shown in Table 5.

TABLE 5 CFM SUL PROJECTED FINANCIAL POSITION
(US Dollars - thousands)

Year	Costs	Revenue	Surplus With Savings	Surplus Without Savings
1989	13,833	9,591	-4,242	-4,242
1990	18,545	11,530	-7,015	-7,015
1991	27,826	17,492	-10,334	-10,334
1992	38,418	25,337	-13,081	-15,103
1993	50,536	35,331	-15,205	-20,976
1994	62,829	49,126	-13,703	-25,459
1995	76,844	65,685	-11,159	-32,268
1996	86,751	85,135	-1,616	-30,838
1997	102,195	109,792	7,597	-26,087
1998	119,859	140,963	21,104	-19,270
1999	140,036	180,300	40,264	-6,907
2000	163,040	229,559	66,519	11,599

The shortfall during the first eight years will have to be financed through government subsidies or by refinancing of loan repayment obligations. This refinancing, or even total removal of the obligation to repay loans, while not a desirable method of encouraging financial discipline within state or parastatal organizations, is often used by governments to enable their railways to improve their financial position without the burden of past debts.

The last two columns in Table 5 shows the surpluses with and without the cost savings to CFM. The Railway is significantly improved with the efficiencies described, as the railway is able to generate a positive surplus four years earlier.

The foreign exchange component of these cash flows has been calculated in Table 6. The foreign exchange component of CFM cost is now traffic is all foreign exchange. These same relationships are projected for future years.

TABLE 6 FOREIGN EXCHANGE CASH FLOWS
CFM SUL
(US Dollars in thousands)

Year	Income	Expenses	Net
1989	8,602	7,608	994
1990	9,991	10,211	-300
1991	14,932	15,304	-372
1992	21,760	21,130	630
1993	30,455	27,795	2,660
1994	42,610	34,556	8,054
1995	57,193	42,264	14,929
1996	75,180	47,713	27,467
1997	98,117	56,207	41,910
1998	127,277	65,922	61,355
1999	164,262	77,020	87,242
2000	210,763	89,672	121,091

The above scenario depends on an improvement of CFM's management over the next several years. Costs by commodity must be developed, tariff increases must be maintained, wagon utilization must improve, staff levels must continue to drop, and shippers' confidence in the Mozambique routes must be restored.

This complex of institutional issues goes beyond the scope of this analysis and will only be partially solved by the present RRSS project.

ANNEX G

611(e) Certification

As the officer serving as the principal representative of the Agency for International Development in Mozambique, I hereby certify, based on the considerations listed below, that the Mozambican Government has the financial and human resources to effectively maintain and utilize the locomotives being provided under this Project Paper Amendment.

- While CFM does not have the resources to maintain the locomotives without external assistance, its capacity will be improved through ongoing donor training and technical assistance programs, which are in part directed specifically at improving CFM's capacity to maintain and utilize its locomotives. Examples include: RRSS, which is providing 15 advisors to the Maputo workshop; France, which plans to provide a locomotive engineer and two technicians to each of the three corridor centers from 1991 to 1993; Britain, which is providing a workshop chief to Nacala; and Spain, which is providing advisors to the CFM(C) diesel electric workshop under the Beira Transport Corridor Project.

- USAID and other donors have a long-term commitment to improving the regional transport system. Since the Mozambique rail corridors are the key to this system, it is reasonable to project that donor assistance will be forthcoming until CFM is able to operate efficiently using its own resources. In addition to the donors mentioned above, the World Bank, Denmark, Portugal, the EEC, Finland, Sweden, Japan, Canada, Belgium, the Netherlands, African Development Bank, UNDP, and Austria are expected to continue to assist CFM.

- The GOM and CFM are committed to improving CFM's capacity to maintain and utilize its locomotives. GOM policy is that CFM will pay for itself. Its legal structures and the prospect that it can become a major foreign exchange earner make this a credible medium-term goal. If CFM's operational efficiency responds as expected to RRSS and the other donor programs now in place, CFM will be making an overall profit by 1997, according to our financial analysis. Variable costs will be covered by 1991

(international traffic) and 1995 (local traffic). If CFM administers well the 40 percent of its foreign exchange earnings that it retains, it will, by the year 2000, be able to pay for the spares and skilled labor (expatriate and local) it requires. Until CFM achieves financial self-sufficiency, the shortfall will be covered by donor assistance. Mozambique's long-term dependence on foreign aid has been discussed at several Consultative Group meetings and is anlyzed in detail in USAID's Country Programs Strategic Plan. The proposed strtategy of assisting CFM to become financially viable while phasing down donor assistance has been generally accepted by the donor community and by A.I.D.

- Given recent positive developments toward a negotiated peace settlement, the danger of destruction of locomotives by sabotage is expected to recede by the time the locomotives are commissioned in late 1992 or early 1993. If this does not occur, CFM will armor-plate the locomotives, as has already been done for some of the units on the Beira and Nacala lines. The present cost of this is $30,000 per locomotive; for project locomotives these costs could be borne by the project.

- The project is adding ten units to the existing fleet of 59 locomotives. CFM is familiar with the technology and has the basic structure and skills necessary to maintain such locomotives, although not at optimal efficiency. While recent availability and utilization rates have been low, losses due to negligence or human error are rare.

- By agreeing to and then meeting some of the conditions of the Beira Transport Corridor Project, CFM has demonstrated its serious commitment to reform. These conditions include the promulgation of legislative measures establishing CFM as an autonomous entity, tariff adjustments, investment criteria, and efficiency improvements. The end result of an intelligent reform program would be a railroad that maintains its equipment effectively. USAID's analysis indicates that the political will, prospect for external assistance, and opportunity for profit will conspire to make CFM effective within the next ten to fifteen years.

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_____
Julius Schlotthauer
Director, USAID/Mozambique

Date: _____

ACTION: AID-3 INFO: AMB DCM

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DEPARTMENT FOR AFR/SA

E.O. 12356: N/A
SUBJECT: MOZAMBIQUE - 611(E) CERTIFICATION FOR RRSS PP SUPPLEMENT, 690-0247

REF: (A) MAPUTO FAX 90/228, (B) STATE 114778

REDSO/ENG HAS REVIEWED THE 611(E) CERTIFICATION AND THE INSTITUTIONAL ANALYSIS FOR THE SUBJECT PP SUPPLEMENT AND CONCUR WITH THEIR ASSESSMENT. HEMPSTONE

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ANNEX H

INSTITUTIONAL ANALYSIS UPDATE

The following report was prepared by a U.S. railways expert. It confirms findings of the original PP analysis but also provides specific suggestions for improvement. This annex will be used in the preparation of the terms of reference for the review of CFM's management and structure. It is divided into two parts; the first reports observations made during a three-day inspection of CFM facilities and the second provides an idea both of the magnitude of the problems facing CFM and a general framework for addressing the problems. As stated in the body of the PP supplement, USAID does not have the information required now to address the overall problems of CFM. This must await the completion of the Organization and Manpower Development Study, the arrival of the RRSS senior financial advisor, and the results of the study proposed for funding under the supplement.

A. OBSERVATIONS AND COMMENTS, CFM(S)

1. Maintenance Data and Information

Basic data are collected on a comprehensive basis for all locomotives, major locomotive components and wagons. These data are recorded and kept manually on card files in the shops. All maintenance actions are recorded on these cards as well as serial numbers, date built or rebuilt, modifications, etc. The amount of data recovered is tremendous, but not easily retrieved for analysis of problems. If this information was entered in a computerized maintenance information system it could be easily sorted to provide management with statistics on why locomotive availability is so low and help address what must be changed

to correct the situation. Likewise, spare parts inventories and usage rates are recorded manually at the storehouse, but there appear to be serious questions on how or if this information is used to order new spares. There are also many questions on how, or if, the CFM(C) and CFM(N) are included in the systemwide spare parts purchase plans.

At major repair shops, like Maputo and Beira, the shop superintendent has no control over spare parts inventories so it is extremely difficult to plan a major overhaul program for a wagon or locomotive series. If the shop superintendent is given the responsibility to handle heavy repairs on a timely basis, then he must have considerable control over spare parts purchase and inventory control required for the programs. This should include budget and funding responsibility.

2. Scrap Equipment

There continue to be mountains of old worn out equipment within and around the maintenance shops that should be cut up and sold as scrap. It is occupying valuable space that can be used more productively for other activities. It also blocks tracks that can be used for revenue equipment.

3. Yard Tracks

Much investment has and is taking place in rebuilding the various main line tracks but yard tracks continue to deteriorate with little if any repairs being done. A derailment was observed on one of the frequently used yard tracks, which totally blocked access to the sugar terminal and container yard for most of one day. Derailments are just as costly and disruptive in a yard as on the main line. Someone must address the problem of poor yard tracks and set up a program to replace rotted sleepers and broken rails. Most of the yard tracks use very old and metallurgically poor 30 kg rail.

4. Train Operation - Performance Reports

Basic documents are kept in the shops for the performance of each locomotive. The locomotive driver is required to fill out a form for each day listing such things as: Kilometers moved, tonnage hauled, hours and minutes in service, wagons hauled, set outs enroute (if any), etc. Maintenance personnel will record such things as; time out of service, time available but not used, fuel consumed (liters), etc. These documents are then given to clerks who file the daily reports by locomotive number and then manually summarize the information at the end of each month. Summaries of locomotive classes are then computed manually. Finally the fleet summaries are manually developed. The manual calculations provide many opportunities for transpositions and basic arithmetic errors, so it is not uncommon to find impossible results; such as a locomotive putting in more than 24 hours in a day. These records should be computerized at the first opportunity in order to provide greater accuracy and more flexibility in report formats.

5. Train Operation - Scheduling Trains

CFM personnel contact Ports and Border points every day to project the train requirements for the next two days. Schedules are prepared two days in advance and drivers advised of their train departure times. If the projected traffic does not arrive, trains are cancelled. If more traffic than anticipated arrives it must wait a day or two for crews and locomotives to be scheduled. Projections and schedules are also hindered by poor communications. Not too much improvement can be expected in this area in the short term.

6. Train Operations - Dispatching

The Dispatching Center for the Maputo area was visited. In colonial times all 3 mainlines were under CTC (Centralized Traffic Control) operations with all passing loops being remotely controlled. Up to 24 trains per day were operated on some lines. The CTC systems are now dead due to lack of maintenance and civil war. Trains are now controlled by trains orders transmitted by radio to the appropriate station where they are written up and handed to the drivers. The procedures being used appear to follow accepted practice in the U.S. and are adequate for existing and anticipated traffic levels.

7. Locomotive Maintenance Procedures

A number of locomotive maintenance log books were checked in the shops to see what was being done. The log books contained signed copies of inspection sheets showing all items checked and notations of any actions taken. Inspections are made for both electrical and mechanical systems daily, bi-weekly, monthly, quarterly, annually, etc. with more and more items being covered by the progressively more complex inspections. The inspection sheets were being provided by the locomotive builder and appeared to be overly conservative. For example, monthly inspections assume about 16,000 kms have been covered; reality is that CFM averages about 3000 kms a month, one fifth of expected. Even under the projected targeted performance levels most locomotives will be significantly below the builders' anticipated figures. The suggested 2, 4 and 8 year overhauls could be probably be extended to 3, 6 and 12 years without damaging the locomotive.

8. First Line Supervision

Throughout the shop and operations complex large numbers of railroad workers were standing around doing nothing. Either there is no work for them to do or the supervisors are not causing the work to be done. It would appear that significant staff reductions can be made without affecting the performance of the railroad. It would be easier to supervise a reduced staff.

B. Asset Management

The new locomotives, rehabilitated maintenance shops, rebuilt freight wagons and other physical assets being provided by USAID and other donors must ultimately be actively and efficiently managed in order to improve overall railroad efficiency. Trips were made to the Maputo shops and operations facilities in order to get a good understanding of the basic data being captured today and what, if anything, is being done with it. There was also an attempt made to assess the basic management structure from the viewpoint of a modern railroad operation.

Efficient asset management will depend on having the necessary information and a good clean organization structure with well defined levels of responsibility and authority. To this end the CFM system organizational requirements should be developed from scratch, a study should be taken to develop the basic CFM organization based on such things as:

a. Physical separation of system segments

b. Systemwide standards of equipment and operational procedures

c. Clearly defined lines of authority and decision making responsibility delegated to the lowest feasible level.

d. Provision of modern communications and data Processing

e. Centralization of certain activities such as:

1. Heavy rolling stock maintenance
2. Engineering and capital project planning
3. Finance and accounting, rate making
4. Spare parts procurement and management
5. Employee training classes

f. Existing and future available education levels

g. Separation of CFM from the Transport Ministry

h. Techniques to control and assign movement of locomotives and wagons

i. Commercial selling of railroad services to industry

ALS	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
support the development a stronger economic undation for growth in uthern Africa	SADCC countries face lower total transport costs.	National and regional statistics	Continued regional cooperation.
	Less FX spent for transport.	National accounts	Investments maintained by SADCC
	Proportion of SADCC external trade using SADCC ports increases.	Investments not destroyed by hostile action.	
	Savings in FX and LC from lower transport costs are available for other priority investments.	FX and other cost savings stimulate economic growth	
RPOSE	**END OF PROJECT STATUS**		
strengthen and expand e capacity and operational ficiency of regional rail ansport in SADCC untries	B. MOZAMBIQUE		
	1. Locomotive availability on CFM-S and CFM-C increase from 58% to 75% by 1992	CFM Reports Project evaluation	Other donors address constraints on track condition.
	2. Total annual carrying capacity of the locomotive fleet of CFM increases from 3.1 million tons/yr in 1988 to 6.3 million tons annually by 1993.	TA Reports	Security and policy enviroments conductive to increased production and international trade
	3. CFM(S) has ongoing capability to do all scheduled maintenance on locomotives.		Other donors provide a total of 33 new locomotives.
	4. CFM accounts are current, reliable and providing useful financial information to management staff.		CFM accepts findings and recommendations of USAID and other donors for organizational reform.
	5. CFM defines and begins a program of restructuring for		Donors help finance restructuring program.

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OUTPUTS	MAGNITUDE	MEANS OF VERIFICATION	ASSUMPTIONS
1. Locomotives rehabilitation.	Rehabilitation of 8 GE U20C locomotives completed.	CFM Reports	Germany and other donors fully fund most formal training.
		TA reports	
		Project evaluation	Qualified TA can be found.
		Site visits	DANIDA, and other donors provide material and Italy provides TA needed for wagon rehab. in CFM-S.
2. Locomotives maintained	Approx. 66 (54 diesel, 12 steam)	Inventory records	
3. Maputo workshop rehabilitated and in use.	Wheel lathe and press rebuilt/replaced. Overhead cranes overhauled. Roof repaired. Compressor, tools and safety equipment provided.		
4. Beira Workshops rehabilitated and in use.	Diesel workshop completed and fully equipped with GE testing and repair equipment, compressor and generator.		

OUTPUTS	MAGNITUDE	MEANS OF VERIFICATION	ASSUMPTIONS
5. Improved workshops purchasing, inventory and stores control in place.	Timely ordering, stocking and disbursement, computerized data base, accurate annual inventory.		
6. Improved financial management and accounting system in place and in condition for a limited scope audit.	Budgets, income statements and fixed assets register and balance sheets current and (incl. allowance for depreciation) and being used as input to management decision-making process. Process begun to design a cost accounting system. The following shall be in such condition that they can be audited firm = (1) fixed assets account; (2) cash transactions and balances; (3) revenues account; (4) inventory account; and (5) procurement and purchasing transactions and procedures.		
7. CFM personnel trained, certified and in position for which trained	192 locomotive repair and maintenance technicians 24 procurement, inventory control and storeroom management staff 12 financial management staff 12 accountants		
8. LocomotiveS provided	10 2000-2150 horsepower diesel electric.		
9. Program of management and organizational restructuring prepared and presented to CFM.	Two or more reports.		

INPUTS	FUNDING TARGETS ($) Pro Ag (8/89)	Suppl.	Total	MEANS OF VERIFICATION	ASSUMPTIONS
1. Commodities	14,952	16,750	31,702	Evaluation Reports	Serviced site for TA housing provided by GPRM.
2. Construction (incl. housing)	2,640	-	2,640	TA Reports	
3. Technical Assistance	15,713	1,584	17,297	CFM Records	
4. Training				Disbursement Docs.	
5. Evaluation and Audit	258	100	358		
6. Inflation and Contingency	937	1,566	2,503		
TOTAL AID	34,500	20,000	54,500		
TOTAL GPRM	2,250		2,250		