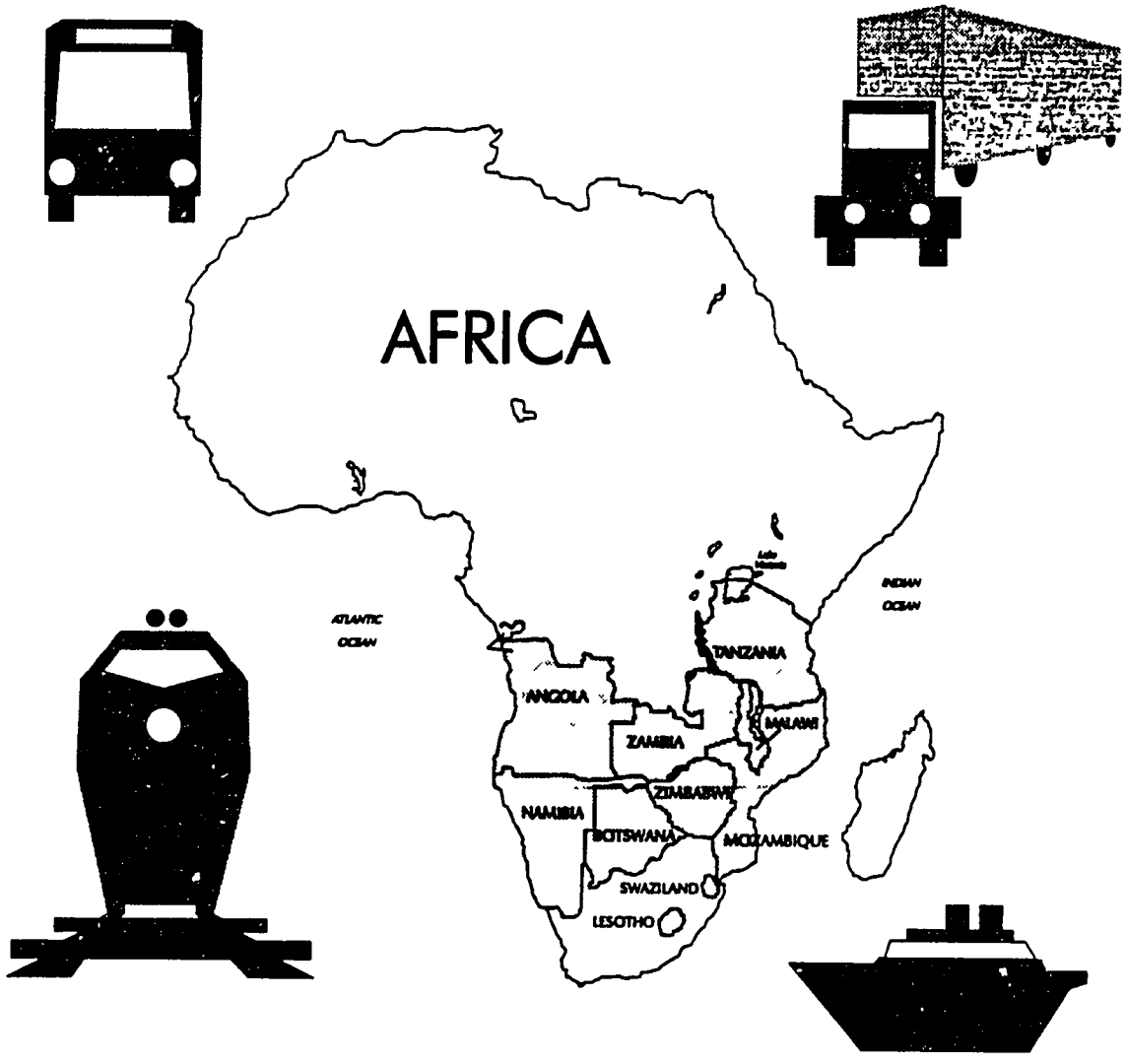
FINAL DRAFT

SADCC Transport Corridors

Study of Financial Strategy

Volume 2



Infrastructure Operations Division
Southern Africa Department
World Bank
Washington, D.C. USA

November 1990

Southern Africa Transportation and
Communications Commission
Maputo,
Mozambique

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and Communications Commission
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November 5, 1990

CURRENCY EQUIVALENT
(as of January 1990)

US$ 1.0 = ZK 8.63
US$ 1.0 = TSh 120
US$ 1.0 = MK 2.67
US$ 1.0 = Mt. 535
US$ 1.0 = Z$ 2.12
US$ 1.0 = P 2.00

WEIGHTS AND MEASURES

1 kilometer (km)	=	0.62 mile (mi)
1 meter (m)	=	3.28 feet (f)
1 millimeter (mm)	=	0.039 inch (in)
1 ton	=	1 tonne

GLOSSARY OF ABBREVIATIONS

BCA	=	Beira Corridor Authority
BEACON	=	British-East African Container Service
BR	=	Botswana Railways
CFB	=	Caminho de Ferro Benguela
CFM-C	=	Caminho de Ferro - Centro
CFM-S	=	Caminho de Ferro - Sul
CFM-N	=	Caminho de Ferro - Norte
EEC	=	European Economic Community
GDP	=	Gross Domestic Product
LMRC	=	Long-Run Marginal Cost
MP	=	Multi-Purpose (Vessel)
MR	=	Malawi Railways
NRZ	=	National Railways of Zimbabwe
ROA	=	Return on Assets
RORA	=	Return on Renewable Assets
RSA	=	Republic of South Africa
SADCC	=	Southern Africa Development Coordination Conference
SAECS	=	Southern Africa-Europe Container Service
SATCC	=	Southern Africa Transport and Communications Commission
SATS	=	South African Transport System
SWR	=	Swaziland Railways
TAZARA	=	Tanzania-Zambia Railways Authority
UNCTAD	=	United Nations Conference on Trade and Development
UNDP	=	United Nations Development Programme
USAID	=	United States Agency for International Development
ZRL	=	Zambia Railways Limited

SADCC TRANSPORT CORRIDORS
STUDY OF FINANCIAL STRATEGY

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SADCC TRANSPORT CORRIDORS

STUDY OF FINANCIAL STRATEGY

I. INTRODUCTION

Background

1.01 During the last decade, a large scale effort has been made by the SADCC countries, supported by the donor community, to rebuild the regional transport network (see Map 1) into a competitive, financially viable system capable of guaranteeing access to the sea for the landlocked SADCC states under all circumstances. Meeting this goal by achieving financially self-sustaining transport operations, and minimizing total transport cost to the region, is a formidable task which is made more complex by the uncertainties of future shifts in transit traffic and the opening of additional transport corridors. Much has been accomplished towards this goal through regional and national projects, but it has now become apparent that key financial and transport policy actions by regional organizations, governmental regulatory authorities and railway operating entities are required in order to attain a viable SADCC transport corridor system.

Organization and Objectives of the Study

1.02 The present study was initiated by SATCC and the World Bank as a first step in identifying these actions. During the SADCC annual conference of February 1989 in Lobito, SATCC and World Bank staff agreed upon Terms of Reference focussing on short- and long-term financial planning strategies for the SADCC corridors, with special attention to the financial position of the regional railways.

1.03 The major objectives of the study are:

(a) to establish an analytic framework for the analysis of SADCC transport corridor financial strategies related to transit traffic and the impact of future transit flows;

(b) to estimate present and future financial transport costs in the region and relate these to the economic costs of transport;

(c) to determine the revenue potential of present and future transit traffic and the tariff strategies needed to support the assets involved on a long term sustainable basis; and

(d) to identify the potential improvements to regional operating policies that would have a significant impact on transit costs.

Study Procedures

1.04 The study was organized by the World Bank in May 1989, with the support of USAID, the Netherlands, EEC, and a consultant team was formed to work with SATCC technical staff and

the transport organizations in the member states.[1/] The study included a first phase for data collection and analysis of issues. This phase culminated in a workshop organized by SATCC in Maputo in December of 1989 attended by representatives of SADCC governments and railway operating agencies. The participants reviewed a set of issue papers prepared by the study team and recommended a set of actions to deal with the issues and to further refine the study results.

1.05 The recommendations of the workshop were reviewed by the Committee of SADCC Ministers in their January 1990 meeting and the Committee recommended continuation of Phase 2 of the study. This second phase consisted of gathering additional data as identified during the workshop, and preparing the following report to summarize the findings and conclusions of the study. During this phase the additional data findings (concerning railway financial data) were presented to the SATCC Railway General Managers in their meeting of April 1990 in Gaborone.

1.06 The study team then consolidated and further analyzed the data in order to prepare a detailed report. The preliminary results of this analysis were distributed for comment by World Bank staff, SATCC Technical Unit staff, SADCC government representatives and railway managers. Finally, the findings and recommendations were combined with the comments into the present report.

Study Limitations

1.07 Although the data analysis in this report represents a significant effort by the SADCC railway operating entities, government policy makers and the consultant team, the study effort was concentrated in the period from May 1989 to April 1990 and therefore does not analyze variation in base data from year to year. Also, the years involved are not normal years for five railways (CFM-N,C,S; Malawi Railways and CFB), and the effects of constrained operations on these railways have increased the traffic on other routes in the SADCC region. These distortions have been analyzed and taken into account to some extent in the scenario definitions used for traffic forecasts. Their effects on costs are more difficult to determine; however, some estimates have been made of the variable and fixed costs of these railways.

Report Contents

1.08 This report presents the findings of the technical and economic studies by the consultant team, and draws conclusions concerning the appropriate financial and operating strategies that could be adopted by the SADCC countries in order to improve the economic and financial viability of the transport corridors and the railway operating agencies in particular. It also assesses the probable economic and financial impacts of these strategies. Finally it presents a list of prioritized actions that would be necessary for the implementation of the above strategies if the SADCC railway corridors are to become financially sustainable.

1/ The study team consisted of: P. Cook, Project Coordinator for the World Bank; M. de Langen, Project Manager, Netherlands Economics Institute (NEI); W. Spit, Transport Economist (NEI); H. Maters, Financial Analyst (NEI); D. Hayten, Ports Specialist (NEI); R. Cogswell, Rail Operations Specialist (USDOT); C. Vandervoort, Road Transport (USDOT); R. Jacobs, Rail Costing Specialist; D. Rasbash, Rail Costing; and Bank staff participants included I. Sam, D. Graham, J. Rebelo, Y. Kedia, J. de Weille, L. Thompson and Y. Crookes.

II. DESCRIPTION OF THE SADCC TRANSPORT CORRIDOR SYSTEM

Description of the Network

2.01 From a regional viewpoint, the SADCC transport system is normally described as a group of ten corridors which are listed in Table 1 and illustrated in Map 1. (A more detailed description of the transport system in each SADCC country is found in Annex A.) These corridors transport virtually all of the international traffic for the SADCC region by connecting the landlocked countries of Zambia, Zimbabwe, Botswana, Malawi and Swaziland to five major SADCC seaports (Dar-es-Salaam, Nacala, Beira, Maputo and Lobito) and several major ports in the Republic of South Africa (principally Durban, Port Elizabeth, and East London).[2] The SADCC corridors are served by rail transport, road transport and, in one case, lake transport, as well as air transport (which is not covered in this report). There are two oil pipelines: one carrying primarily crude oil from Dar-es-Salaam to Zambia's Ndeni refinery at Ndola and the other carrying primarily petroleum products from Beira to Mutare, which also serve as corridor transport modes.[3]

2.02 Railways. The most important mode in terms of international traffic tonnage is rail transport, which is carried out by eleven railway systems: The TAZARA, Zambia Railways Limited (ZRL), Malawi Railways (MR), National Railways of Zimbabwe (NRZ), Caminho de Ferro-Norte (CFM-N), CFM-Centro, CFM-Sul, Swaziland Railways (SWR), Botswana Railways (BR), Caminho de Ferro Benguela (CFB) and the South African Transport System (SATS). Two of these railways (CFM-N and CFB) were not active (as far as regional traffic is concerned) in 1988/89 due to security problems, and two others were severely constrained in their operations for the same reason (CFM-C and CFM-S). Among the SADCC railways, the NRZ, although small compared to SATS, is by far the largest with 26 percent of the SADCC trackage and more than half of the SADCC freight traffic (Table 2).

2.03 The southern African rail system is the largest inter-connected rail system in Africa with 47,574 route-km, of which 11,781 are in the SADCC countries (Table 2). This system has been in operation since the late 1800s with additions in the 1920-50s and finally the construction of the TAZARA in the 1970s. The SATCC program to rehabilitate and upgrade regional railways has been relatively successful in Mozambique, despite the security problems, and plans for the Benguela rail rehabilitation are nearing implementation stage. Other projects to provide locomotives and rolling stock are being implemented for TAZARA, NRZ, and CFM. A start has also been made on a wagon-tracking and shipper information system with UNDP/UNCTAD support.

2/ The Mocamedes railway, which runs between Southern Angola and the port of Namibe, was declared a corridor by SATCC after the study had been initiated and therefore is not included in this report.

3/ For transport network modelling and analysis purposes the SADCC corridor network was defined in terms of a set of nodes and links for the rail and road network. (See Annex A.)

Table 1: SADCC Corridor Groups

Corridors	Modes within the corridor
1. Zambia and Zaire to Dar-es-Salaam	
	TAZARA Railway
	Road via Tanzam Highway
	Road from Malawi to Dar via Mbeya
	Lake and road Malawi to Mbeya then rail
	Road Malawi to Mbeya then rail
	Lake to Chilumba, road to Dar
2. Zambia and Zaire to Lobito	
	Benguela Railway
	Road to Chavuma then railway
	Road to Luena then railway
3. Zambia and Zaire to South African Ports	
	Rail via Botswana to East London
	Rail via Beitbridge to City Deep
	Road via Harare and Beitbridge to City Deep or Durban
	Road via Botswana to Zeerust then rail to City Deep or E. London
4. Malawi and Zambia to Nacala	
	CFM-N
	Road from Zambia to Mchinje & Lilongwe
5. Zimbabwe and Zambia to Beira	
	CFM-C
	Road from Zambia to Bulawayo or Harare then rail
6. Malawi and Zambia to Beira	
	Rail from Lilongwe & Blantyre
	Road from Zambia to Michinje or then rail
	Road from Zambia to Moatize then rail
7. Zimbabwe/Malawi to South African Ports	
	National Railway of Zimbabwe
	Rail via Botswana
	Road via Beitbridge
	Road via Botswana
	Road via Beitbridge to Messina then rail
	Road via Botswana to Messina then rail
8. Zimbabwe to Maputo	
	CFM-S
	Rail from Bulawayo & Harare via Beitbridge and Koomatiport
9. Swaziland to Maputo and South Africa	
	Rail Matsapa to Maputo
	Rail Matsapa to Durban
	Rail Matsapa to Johannesburg
	Road Matsapa to Johannesburg
10. Malawi to Harare	
	Road via Tete, Mozambique

Source: Southern Africa Regional Transportation Strategy Paper, Final Report, Louis Berger International, March 1985.

Table 2: Characteristics of the SADCC Corridor Railways

	Trackage (km)		Freight Tonnage ('000 tons)(1988)			
	Total	Corridor	Total	Domestic	Imp./Exp.	Transit
Zambia	1,888	848(1)	4,902	3,194	1,177	531
TAZARA	1,860	1,860(1)	1,102	12	-	1,090
Malawi	678	189(1)	372 [a]	372	-	-
CFM-N	625	615(1)	55 [a]	49	6	-
CFM-C	884	650(2)	489 [a]	93	-	396
CFM-S	705	701(3)	2,117 [a]	812	-	1,306
Zimbabwe	2,753	1,754(4)	13,414	(9,968)	(2,500)	956
Botswana	714	640(1)	2,021	423	828	770
Swaziland	371	364(2)	n.a.	n.a.	n.a.	n.a.
CFB	1,303	1,303(1)	n.a.	n.a.	n.a.	n.a.
Total SADCC[b]	11,781	8,109	24,472 [c]	(14,923) [c]	(4,511) [c]	5,049 [c]
South Africa	35,793	n.a.	47,750	n.a.	n.a.	3,848
Total Region	47,574		72,454			8,897

Note: Numbers in parentheses indicate number of corridors served.

[a] At least partially closed due to security problems. Malawi and CFM-C carried more than 750,000 tons of Malawi import/export cargo in 1980.
[b] Excluding Tanzania Railway Corporation, which does not serve SADCC traffic.
[c] Excluding Swaziland and Angola.

Sources: Individual railway statistics; Zambia Program for Transport Sector Investment, 1990-93; Botswana Transport Statistics 1988, MOWC; Malawi Economic Report 1989, Office of the President and Cabinet; SATCC Survey of Merchandized Preventive Track Maintenance, March 1990.

2.04 The SATS railway system has a dominant role in the region at present. It leases locomotives to three of the SADCC railways and much of SADCC's international freight is carried in SATS wagons. In addition, the SATS runs an efficient shipper information system with a highly competitive marketing role.

2.05 Rail Capacity. Each of the major transit traffic rail lines in the network was analyzed to estimate its freight capacity in tons per year. The calculated rail link capacities vary from 6 to 18 million tons per year (Table 3), after adjustment for passenger trains, and this was found to be substantially above the forecast near-term rail traffic requirements. This means that the real capacity constraints for rail systems in the region are determined primarily by rolling stock and locomotive availability and secondarily by operating procedures and border crossing formalities. (See Chapters 4 and 5 for further discussion of these effects.)

Table 3: Major SADCC Corridor Rail Line Capacities

Railway Line	Key Link	Annual Capacity (million tons)
TAZARA	Dar es Salaam-Kapiri Mposhi	6 - 9
CFM-N	Nacala-Nayuci	4.7- 6
CFM-C	Dondo-Machipanda	4.3- 9
	Dondo-V. de Fronteira	4.3-66
CFM-S	Dona Ana-Mpaka	4.4- 6
	Dona Ana-Chicualacuala	4.4-10 [a]
ZR	Ndola-Victoria Falls	13
BR	Remokwebama-Mafeking	8
NRZ	Bulawayo-Harare	18
CFB	Lobito-Dilolo	7
Total All Corridors [b]		61.4-68

Note: Lower capacity values are the sum of SATCC up and down direction capacity estimates for present rail line operations after rehabilitation. Upper limits are based on analysis in Volume 2, Annex A.

[a] Ten million tons if the passing loops are reactivated.
[b] Using only the lowest link capacity for corridors served by two rail lines.

Source: Volume 2, Annex A, Part II.

2.06 Road Transport. Road transport is also a significant carrier of SADCC corridor traffic, representing 20 to 25 percent of SADCC import tonnage and 5 to 10 percent of SADCC export tonnage. Although this mode is presently limited by regulation to only six of the SADCC corridors, it is important for trade between the landlocked states and the RSA (or shipments through RSA ports) and, to a lesser extent, for Zambia-Tanzania trade or imports and exports through Dar-es-Salaam (see Table 4).

2.07 The regional road system in the SADCC corridors is in fair-to-good condition in Zimbabwe and Botswana, and in poor-to-fair condition in Zambia, Malawi and Tanzania. The roads serving these corridors are generally built to two-lane paved standard, with lesser corridors (for example, Zimbabwe-Malawi) using gravel surfaced roads. The roads linking the Mozambique ports to Zimbabwe and Malawi are only used by road transport under special license and are not built to support large trucks. The same is true of the roads in the Benguela corridor.

2.08 Road Capacity. The capacity of the road corridors is rather large in terms of the number of trucks that could travel per day in each direction of even a two-lane paved road in good condition. However, the actual capacity constraints arise when heavy trucks cause road surface deterioration which is not counteracted by road maintenance or rehabilitation. This effectively limits road traffic tonnages in several key corridors (for example, the Tanzam Highway) to effective

capacities of under 1 million tons per year. Zimbabwe road corridors to Beitbridge and Botswana, which are designed for heavy traffic and well maintained, can sustain 2 to 3 million tons per year.

Table 4: Relative Importance of the Corridor Transport Modes

Corridor	Mode	International 1988/99 traffic (000 tons)	percentage
Zambia-Dar-es-Salaam	rail	1,090	16
	road	100 [a]	1
	total	1,190	17
Malawi-Nacala	rail	6	0
Malawi-Beira	rail	0	0
Zimbabwe-Beira	rail	396	6
Zambia-Zimbabwe-Maputo [b]	rail	1,306	19
Zaire-Zambia-Zimbabwe-RSA (via Beitbridge)	rail	1,750 [a]	26
	road	250 [a]	4
	total	1,900	30
Zaire-Zambia-Botswana-RSA	rail	1,598	23
	road	350 [a]	5
	total	1,948	28
Zambia-Zaire-Lobito	rail	0	0
	road	0	0
	total	0	0
Total All SADCC Corridors	rail	6,146	90
	road	700	10
	total	6,846	100

[a] Estimate based on 1985 data.
[b] Resently routed through the RSA.

Source: Table 2 and SATCC, A Scenario Model for Goods Transport Demand in the SADCC Region, September 1988.

2.09 Ports. The most northern port in the corridor system, Dar-es-Salaam, serves traffic originating and terminating in Zambia, Malawi, Burundi, Rwanda, eastern Zaire, and Uganda. The port has been undergoing a series of projects to rehabilitate it and create a container terminal under SATCC auspices. Nevertheless, the port is presently experiencing major constraints due to management difficulties and regional traffic has suffered, especially at the interface between the port and the TAZARA rail line.

2.10 Mozambique plays a major role as a regional transit center with three ports which belong to the regional corridor system. The best of these ports technically is Nacala which has a natural deep water harbor. This port has recently been rehabilitated, with substantial investment capital for container service. The port of Beira has served as a regional port for half a century, but it is situated at the mouth of a river which has an 8.5 m channel, limiting ship size to 30,000 tons. Deepening of the channel as well as rehabilitation of port infrastructure and rail links have been included as part of the on-going Beira Corridor project. Maputo is the capitol of the nation as well as a port, and in the past it has served a regional role as the terminus of three rail lines (from Zimbabwe, Swaziland and RSA). The Matola side of the port has served bulk iron ore shipments from the RSA which are now routed through Richard's Bay, and one key rail line is out of service. Consequently, the port is now functioning well below capacity. A port management improvement project is underway.

2.11 The South African ports of Durban, Port Elizabeth, and East London, and the dry port of City Deep in Johannesburg are all used by SADCC traffic, although Durban is the major link with the region. All of these ports are closely linked with the South Africa Transport System (SATS) which is well organized to handle all of RSA traffic as well as transit and import-export traffic. It is equipped with an efficient shipper information system which allows the customers to know when and where their goods will arrive or leave, and this system is tied into the marine shipping system as well, in order to coordinate with vessel arrivals and departures. This makes RSA ports highly attractive to shippers who must closely control their cargo for contractual reasons, and the system is also relatively reliable in terms of transit time.

2.12 The port of Lobito is the only port in Angola that is considered part of the SADCC transport corridor system. However, it has not functioned in a regional capacity since 1975 due to security problems in the countryside. The port has been functioning in a relatively efficient manner for domestic traffic, and major rehabilitation work is planned in the near future.

2.13 Port Capacity. Large-scale port rehabilitation programs have been executed and are under execution in the SADCC ports of Nacala, Beira, Maputo and Dar es Salaam. Upon completion of the Beira and Dar es Salaam projects in approximately two to three years, all major capacity constraints for cargo handling in SADCC ports will be temporarily resolved. (See Table 5 and Annex A, Part II.) However, further analysis[4/] indicates that capacity constraints may reappear in three SADCC ports starting from the mid 1990s if a significant growth in international cargo demand takes place. For Dar es Salaam such a growth has been forecast to occur by 1995, although this situation may be delayed if the Benguela and Nacala rail lines reopen. Nacala may face capacity constraints from the mid-1990s onwards if the Sena-line (Malawi-Beira) does not reopen by that time and if a significant growth in imports/exports from northern Mozambique takes place. Lobito may also face constraints from the mid 1990s onwards, if the Benguela railway reopens and Zaire decides to use it on a significant scale (at the expense of the Zairian "Voie Nationale" rail cum river corridor to Matadi), and if at the same time Angolan imports/exports through Lobito grow significantly. In all other cases, and especially South African ports (where SADCC transit traffic is a small fraction

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4/ To supplement SATCC estimates of port capacities, a port simulation model was run for those corridor ports potentially facing congestion (Dar es Salaam and Beira), as well as for Durban (RSA). The Beira simulations were performed as part of a recent World Bank study (Beira Transport Corridor Project, April 1989), and new simulations were carried out for Dar es Salaam and Durban.

of total traffic), projected port capacity is substantially higher than projected SADCC import and export traffic through to the year 2000.

2.14 Operational efficiency in SADCC ports has gradually been improved over the last ten years under the ongoing port development programs. By and large satisfactory improvements have been achieved and the process can certainly continue, in response to both efficiency improvements in the ports and further containerization and bulk handling. Capacity problems that might arise will relate more to port productivity problems than to physical berth infrastructure constraints. These are operational rather than investment problems. Therefore, if all rail corridors are reopened before the mid 1990s, physical capacity constraints in SADCC ports will not have a significant impact transit traffic routing.

2.15 Shipping Services. Maputo, Beira and Durban belong to the Southern Africa-Europe Container Service (SAECS) Conference which presently represents both European and RSA shipping companies with 6 to 8 large vessels in the Europe-Southern Africa trade. This conference includes a cellular container service turning round in Durban with one ship every 9 days as well as a Ro-Ro service (once every 4 to 5 weeks), linking Durban with Maputo and Beira. Some non-conference container vessels and multi-purpose (MP) vessels, able to take containers, call in Maputo and Beira approximately once a week. Dar-es-Salaam presently is the southernmost port of call of the British-East Africa Container Service (BEACON), plus a number of non-conference independents with Indian Ocean services. In this conference one fully cellular container vessel is presently operated, and a shipment of containers on multi-purpose vessels is possible approximately once every week.[5/] Lobito is the most southern port of the West Africa Conference, but at present, due to the low traffic volumes, only a limited number of liner vessels call there. All southern African ports are served on a non-scheduled basis by tramp steamers. A few chartered bulk ships call at southern African ports, but only RSA ports have regular calls at the present time.

5/ Nacala was also within the BEACON port call rotation, but, as a result of the Nacala railway line's closure, very few ships presently call there.

Table 5: Port Capacity and Throughput in Southern Africa

	SADCC Ports						RSA
	Maputo and Matola		Beira	Nacala	Dar	Lobito	Durban
Max ship size	30 000/50 000	60.000	20 000/50.000	30 000	30 000/50 000	20.000	60.000
Max throughput capacity							
(10 MT) Gen. Cargo/MP	3.6		1.6	0.7	2.1	1.2	13.0
Containers	0.7		1.0	0.3	1.2	-	9.0
Bulk	2.0	2.0/7.0	1.2	-		0.5	8.0
POL (m^3)	-	4.0	3.0	0.5	3.0	1.0	n.a.
Actual throughput 1987/1988							
(mil. port ton) Gen. Cargo/MP	1.5	-	0.9	0.2	1.3	0.4	11.4
Containers	0.1	-	0.1	0.0	0.7	0.0	7.1
Bulk	0.6	0.3	0.0	-	0.0	0.0	5.5
Pol	-	0.2	0.9	0.1	1.9	0 1	n.a.

Source: NEI, SADCC Transport Corridors Workshop: Policy Issues in Financial Strategy, Working Paper 3, Maputo, 11-14 December 1990.

2.16 Transhipment Capacity. At present the land-port interface, especially the rail-port interface, is the weakest link between maritime shipping and the SADCC transport system. The basic problems found in SADCC ports are:

(a) poor condition of port railways, especially availability and accessibility of loading/unloading tracks for transit sheds and the condition of shunting yards;

(b) lack of shunting locomotives in the ports;

(c) low availability of railway wagons of the required type;

(d) low availability of cargo handling equipment to load/unload trains;

(e) poor organization of work, especially coordination between port and railways; and lengthy customs procedures;

(f) insufficient storage space in ports, resulting in:

(i) congested storage areas and thus much lower cargo handling rates;

(ii) use of mainline railway wagons for storage of cargo, awaiting arrival of ships; and

(iii) use of mainline wagons for direct loading/unloading of ships instead of using transit sheds.

2.17 Inefficient port interface operations affect wagon detention times at terminals which, in turn, have a serious impact on the productivity of corridor railways. Also, performance of the port-rail interface is a major component in the overall level of service a corridor offers to its customers.

Long cargo waiting times, high storage cost and risk of damage, loss or contamination of cargo at the port-rail interface, will have a negative impact on the attractiveness of a corridor and its competitive position vis-à-vis RSA ports.

Freight Rates

2.18 As a consequence of the presently superior level of shipping services in Durban, ocean freight rates are lower from Durban to Europe and other destinations than from SADCC ports, especially in container rates (see Table 6). In other cases, RSA port tariffs are higher than SADCC ports. These differences are a major determinant in the routing of cargo through the RSA/Durban corridor for commodities where they are a significant element in total transport cost, although other considerations may also be important.

2.19 Marine shipping freight rate differentials are much more important for containerized cargos than for bulk as shown in Table 7. It appears the choice of corridor and will make a significant difference in shipping rates for container traffic (up to $500 per TEU) when the remaining SADCC corridors resume regional service, possibly of the same order of magnitude as the inland transport cost.

2.20 Inland transport tariff rates in the SADCC region are much higher (2 to 8 times) for road transport over long distances than for rail transport. However, rail tariffs also vary considerably from one corridor to another (even within the same railway) for similar goods and are much higher in some cases for short distance hauls. For example, the container tariff from Lusaka to Victoria Falls is US$260 for 480 km while the container tariff from Lusaka to Kapiri Mposhi is US$285 for 185 km. This variation is also evident in the tariffs for copper (and other metals) and containers, which are amongst the most important commodities transported in the region. Even adjustments for the lower rail costs at longer distances do not account for most of the variation shown in Table 8. The impact of these differences on financial viability is analyzed in the following chapter.

Table 6: Summary of Port Tariffs for Key Commodities
(US$/MT or TEU)

Commodity	Containers	Metals	Bagged Fertilizer	Ferro Alloys
	US$/TEU	US$/MT		
Maputo	225	11.5	2.55	6.5
Beira	225	12.0	2.55	-
Nacala	225	-	2.55	-
Dar-es-Salaam	214/156	3.6	9.95	-
Lobito	na/(160)	-	12.00	-
Durban/Port Elizabeth	179	20.7(PE)	4.31	6.1

Note: Average container loads are 8-12 tons in the SADCC region.

Source: NEI, SADCC Transport Corridors Workshop: Policy Issues in Financial Strategy, Working Paper 3, Maputo, 11-14 December 1990.

Table 7: Summary of Expected Marine Shipping Rate Differences with All SADCC Ports Open

	Containers US$/TEU	Bulk and Tramps US$/MT
Durban versus Maputo/Beira		
to/from Europe, North America and other	0	0
to/from Far East-Australia	-300	0
Durban versus Dar-es-Salaam		
to/from NW Europe, North America	-150	0
other	0	0
Nacala versus Dar-es-Salaam	+400	0
Lobito versus Beira/Maputo		
to/from Europe, North America	+500	-4 to -6
other	n.a.	n.a.

Note: In Beira the tariff may be higher in practice as long as the new container terminal is not in operation.

Source: NEI, SADCC Transport Corridors Workshop: Policy Issues in Financial Strategy, Working Paper 3, Maputo, 11-14 December 1990.

Table 8: Railway Tariffs for Copper and Containers

Railway	Route	Distance (km)	Road Tariff ($US/tkm)	Rail Tariff ($US/tkm)
Copper				
ZR	Ndola-Kapiri Mposhi	185	0.19	0.08[a]
CFM-C	Machipanda-Beira	320	0.03	n.a.
ZR	Ndola-Victoria Falls	810	0.06	0.07[b]
NRZ	Victoria Falls-Chicualacuala	1009	0.03	0.07
SATS	Mafeking-East London	1510	0.02	0.07[b]
TAZARA	Kapiri Mposhi-Dar-es-Salaam	1860	0.01	0.08[a]
			($US/TEK)	($US/TEK)
Containers				
ZR	Ndola-Kapiri Mposhi	185	0.77	0.96[a]
CFM-C	Machipanda-Beira	320	0.61	1.44
ZR	Lusaka-Victoria Falls	480	0.54	0.84[b]
NRZ	Victoria Falls-Chicualacuala	1009	0.29	0.84
SATS	Beitbridge-Durban	1325	0.41	0.84[b]
TAZARA	Kapiri Mposhi-Dar-es-Salaam	1860	0.22	0.96[a]

Note: Road conditions are worse on the Dar route than on the Durban route.

[a] Ndola to Dar-es-Salaam route.
[b] Ndola to Durban route.

Source: NEI, SADCC Transport Corridors Workshop: Policy Issues in Financial Strategy, Working Paper 3, Maputo, 11-14 December 1990.

Organizations Involved in the Transport Sector

2.21 There are five types of organizations involved in the transport Sector in SADCC countries: (i) transport planning and policy units normally housed in the Ministry of Transport, (ii) road transport regulation units also housed in the Ministry of Transport, (iii) railway operating entities, (iv) port operating entities, and (v) a regional transport planning organization, the Southern Africa Transport and Communication Commission (SATCC). Transport planning units are usually involved in investment analysis and in tariff setting, especially for rail transport. Road regulation units are concerned with the issuing of road permits and licenses and the setting of standards for vehicles, although they some times are involved with user charges for transit traffic. Railway operating entities can be directly government controlled (for example, NRZ), parastatal (for example, Zambia Railways) or multinational (TAZARA), with much different latitude to set tariffs and plan investments, although all have operating responsibility. Port operations in the SADCC region are all government agencies with limited tariff setting responsibility (although port tariff increases are much less controversial than rail tariff increases). SATCC, the regional transport planning organization, is

active in working with SADCC government officials to identify, evaluate and promote funding for investment projects, as well as coordinate transport analysis and regional studies. SATCC has recently formed a Transport Operations Planning Committee to foster operational coordination between member states.

Traffic on the Network

2.22 Total import/export traffic from landlocked countries on the SADCC corridor system in 1989 amounted to approximately 6.8 million tons (Table 4). This included fourteen major commodities which account for over 70 percent of the total traffic. These are, in order of importance: petroleum fuels, copper and copper concentrates, sugar and molasses, fertilizers, iron and steel products, coal and coke, maize, asbestos, bulk chemicals, wheat and flour, wood pulp and scrap paper, salt, tobacco, and timber. Domestic traffic, in some cases, is also very heavy. For example, Zimbabwe moves over 2 million tons of coal and over 500,000 tons of maize by rail, internally.

2.23 The international freight tonnages by country are dominated by Zimbabwe which accounts for 30 percent of the border-crossing traffic in the SADCC region (Table 9). Zambia and Zaire are also significant generators of this traffic.

Table 9: Summary of Transit and International Freight Traffic by Country
(for landlocked countries only)
(000 tons)

Country	Imports	Exports	Transit	Total Int'l Traffic
Scenario 0				
Botswana	736 a/	92 a/	770	1,598
Malawi	274	228	0	502
Mozambique	n.a.	n.a.	1,702	1,702
Swaziland	322 a/	855 a/	4,394 b/	5,571 b/
Tanzania	n.a.	n.a.	1,090	1,090
Zaire	210	279	0	489
Zambia	727 b/	450 b/	531	1,708
Zimbabwe	685 b/	2,170 b/	1,106	4,061
Total SADCC	2,692	4,154	9,593	16,539
RSA	n.a.	n.a.	4,203	4,203

a/ Rail only.
b/ Most of Swaziland's transit traffic is from Transvaal to Richard's Bay and does not use the SADCC corridor.

Source: NEI, SADCC Transport Corridors Workshop: Policy Issues in Financial Strategy, Working Paper 3, Maputo, 11-14 December 1989.

Significant Influences on Traffic Routing

2.24 A major part of the international freight traffic of the SADCC countries is sensitive to corridor service levels. In addition to physical capacity constraints and closed rail lines, for example, the copper and metals exporters are extremely sensitive to changes in transport routes and services which affect their ability to market their product at the highest possible net financial return. When service or performance on any particular route or in any port deteriorates due to capacity or management problems, shipments are quickly shifted to another route (usually a South African route) in order to protect their market and earnings. Zaire's copper exports are especially volatile because they can shift between the Voie Nationale (Zaire's internal rail/river/rail route to the port of Matadi), the TAZARA Railway, the Tanzania Railway route via Lake Tanganyika, and the SADCC railway routes south to RSA ports. Also important in some cases are government policies that restrict movements (for example, road regulations) or security problems that make certain links dangerous to travel.

2.25 Even when the constraints and business considerations described above do not apply, freight traffic does not always follow what would appear to be the most logical, least cost routes in southern Africa. Actual cargo routings are determined by the shipper (or consignee) who must take into account both governmental constraints and commercial interests and practices which will determine at what cost, how fast, and with what certainty the cargo will be delivered to its destination. It is estimated that 30 to 40 percent of total tonnage shipped in the region is primarily affected by noncommercial considerations. Another 12 percent would be diverted from South African origins or destinations if trade between SADCC countries and South Africa were severely constrained.[6/]

2.26 Government Allocation. The allocation of traffic to certain corridors or modes by government decision is an element of regional policy in the case of Zambian copper exports via the Beira corridor. This route was chosen despite the uncertainties of travel time and low service frequency compared to RSA ports. Similarly, the maximum use of the TAZARA railway corridor by Zambian cargo has benefited from government decisions in favor of the jointly-owned railway. This type of traffic allocation is often the result of strategic decisions by governments of landlocked countries to keep alternative transport corridors available in case of emergency. For example, Malawi, which is presently under severe pressure due to major interruptions in its traditional import-export routes, has found it desirable to open its Northern Corridor "emergency" route into Tanzania. Zimbabwe, Botswana, and Swaziland are also anxious to maintain alternative routes and services for the same reasons, even though it means they must accept higher costs as a result.

2.27 South African Rail/Port Policy. In order to distribute traffic more evenly over its railway network links, the SATS for many years enforced an obligatory system of traffic routings where all heavy metals and bulk traffic destined to or from Zambia and Zaire were assigned to the route through Botswana via Ramatlabama and traffic destined to and from Zimbabwe is assigned to the Beitbridge route. Overseas container traffic destined to and from the inland countries is normally assigned to the City Deep dry port at Johannesburg and is expected to move via Botswana or Beitbridge according to its origin or destination. This assignment policy has been affected in recent years by the shift of management of the Botswana Railways from NRZ to Botswana control, as well

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6/ Louis Berger International, Inc., Southern African Regional Transport Strategy Evaluation, USAID, September 1986.

as the Zambian decisions described above. The net result appears to be more traffic allocated to the Beitbridge route rather than to the Botswana route into South Africa.

2.28 Mozambiquan Rail/Port Policy. Mozambique has had in the past a similar system of transit traffic assignments for its ports.[7] Under this plan, South Africa and Swaziland were to be the primary transit users at Maputo, plus some specialized cargo from Zimbabwe (principally sugar, molasses, and asbestos which match similar exports from the other transit countries). Zimbabwe was assigned Beira as its primary port, plus some specialized cargo from Malawi. Malawi and Zambia were assigned Nacala. Although these assignments have been superceded by events in the region, it is clear that shippers are not always free to use the port, route, or service of their choice.

2.29 Foreign Exchange Savings. All governments in the region are deeply concerned about their continuing lack of foreign exchange. Since transport service performed outside of a country must be paid for in foreign exchange, there are pressures to find routes and services which will reduce the need for these scarce resources. For example, if Zambia exports copper (or imports wheat) by way of Dar-es-Salaam, only half (the Tanzania half) of the transport charges must be paid in foreign exchange; the balance can be paid in its own currency. (Although there are some foreign exchange costs involved, they are considerably less). For the same shipment moving by way of Zimbabwe and Mozambique ports or via Angola to the port at Lobito if it were operating, 75 percent or more of the transport costs would have to be paid in foreign exchange.

2.30 Port Efficiency and Service Frequency. As mentioned earlier the South African ports have some advantages over other ports in terms of short turn-around times and higher ship call frequencies. Using these ports, ships can enter, dock, off-load, take on essential supplies, reload and depart in remarkably short time compared with other regional ports. Because of this efficiency, maritime operators serving these ports on a regular basis get faster trip turn-arounds and can make more trips per year--a decided advantage with present high ship investment, insurance, and labor costs. The South African ports can also accept the new large container and Roll-on Roll-off ships which cannot operate effectively at other ports in the region. Therefore, the maritime operators endeavor to concentrate as much traffic as possible in these ports in order to maximize the efficiency of their operations. In cases where the shipper controls the routing of cargo (as in many European exports to southern Africa), this has a major impact on the choice of corridor.

2.31 Communications and Uncertainty. On the land side, South African ports are closely linked with the SATS railway, sharing common management and communication systems which make possible close coordination of services. Although port charges are slightly higher than in other regional ports, this is offset by fewer and shorter delay times and more efficient shipping with less loss and damage.

2.32 Special Contract Rates. Due to the conditions described above, the maritime operators serving South African ports can frequently offer their inland customers attractive rates and services which more than offset the higher inland transport costs from South African ports. Shipping conference lines also offer high volume inland shippers attractive contract rates, based upon specific volumes moving on specific sailings, which often result in door-to-door total costs which are less than can be obtained by using closer but less efficient regional ports. Although these contracts put strict time limitations on shippers they have become common in the region. Another facet of this situation is the practice of the non-conference steamship lines serving South African ports to offer extremely

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7/ Louis Berger International, Inc., Ibid.

low "all-in" rates for shipments from the inland countries to overseas destinations in which the steamship company pays the inland transport cost. This is done when a steamship operator finds he has a sailing which is not completely full, and it is applied most often with tobacco and tea shipments using road transport to the port due to the short lead times commonly involved.

2.33 Guaranteed Performance Requirements. Another aspect of present commercial influence is the growing practice in industrial countries of reducing industrial inventories by requiring suppliers to deliver essential commodities in smaller, more frequent lots against performance guarantees. Under this arrangement the supplier must pay a very high penalty in the form of the price of substitute materials purchased on the spot market if the products do not reach the client at the specified time. These types of contracts bring a higher price for the supplier, but put him/her in the difficult position of having to guarantee the performance of the transport system linking him with the customer. Although maritime operators can guarantee sailings from regional ports, any lack of reliability in the inland transport routes serving them eliminates them from consideration for shippers under this type of contract. The South African ports and railway have made a specialty of catering to this kind of traffic.

2.34 Inland Transporter Practice. Transporters within the region have their own commercial practices which influence traffic flows. These include the use of contract and discount rates and the provision of additional services without cost. The South African and Zambian railways are moving away from their traditional "what the traffic will bear" scheme of rates and charges to a more flexible cost-based system which will enable them to tailor their services and charges more closely to the needs of the client. Malawi is already making use of contract services on the South African railways as a means of lowering its transit costs.

Transport System Redundancy as Insurance

2.35 The SADCC corridor transport system is clearly a system with more freight capacity than it would need for the present level of traffic, if all corridors were open (4 to 6 times as measured by rail line capacity and 2 to 3 times as measured by port capacity, excluding RSA ports). However, three major corridors are not presently open and even the main RSA routes have some risk of interruption. In addition, there are key bottlenecks (rail rolling stock shortages, operating and border-crossing procedures that lead to low productivity and port interface problems) which prevent these lines and ports from reaching even a fraction of their capacity and create uncertainties for shippers. In this environment it is rational to seek insurance in the form of supporting additional access routes which would not be needed in normal, stable circumstances. This insurance, however, has a cost which is the extra investment cost plus any operating subsidies which are needed to support the excess corridor operations after users have paid their share. (This cost is calculated in Chapter 5.) A further cost of this multiple route policy is the lack of focus on key routes for investment and management support, which leads to inefficiencies in corridor operations. This is an opportunity cost which acts as a tax on the shippers who use the less efficient corridors, or on the economies which subsidize them.[8/]

8/ This insurance tax may have different impacts on coastal railways which have to support the rail investment, than on landlocked countries which benefit.

Competitive Position of the SADCC Corridors

2.36 Despite the more than sufficient transport corridor capacity noted above, the bottlenecks in the present system, longer and more uncertain travel times and the lack of shipper information in the SADCC corridors have handicapped these corridors in competition with RSA routes. Measures to counteract these problems, such as the formation of the Beira Corridor Authority (BCA), have not yet made a significant impact. Malawi desperately needs to open its corridors through Mozambique, but, even with additional corridors open, the situation will not improve substantially for other SADCC countries' shippers until the Dar-es-Salaam rail-port interface problem is overcome, regional rail operations have resolved the uncertainty factors, and the UNDP/UNCTAD shipper information system is working. In these circumstances SADCC corridors would be better placed to compete effectively with South African routes, but the financial viability of these routes (and therefore their competitiveness) is still threatened by the SADCC rail operating and management factors described in the following chapters.

III. PRESENT FINANCIAL VIABILITY OF THE RAIL CORRIDORS

3.01 The transport corridors in the SADCC region are composed of many different routes and modes as described in Table 1. However, the major corridor carriers of international traffic are the railways, which are analyzed in detail in this chapter. Ports are also important, but their financial viability is assured by port fees which are set on a competitive international level.[9] Road transport plays a lesser role and is analyzed only on standardized basis for comparison to rail costs for international transit traffic. Lake and river transport are not considered in this analysis due to their insignificant role in SADCC corridor transport.

Railway Financial Viability

3.02 The eight SADCC railways' financial statements together show a net operating loss for 1988/89 which adds to a total of $265.8 million as shown in Table 10 below.[10] By far the largest contributor to this loss (over 60 percent) is NRZ which has had severe constraints on tariff levels, leading to a major subsidy requirement just to cover operating costs. Although both passengers and freight traffic contribute to this loss, only freight transport is significant for long-distance corridor traffic which is analyzed below.

Table 10: 1988/89 Financial Performance of SADCC Railways (Based on Comparable Assets and Interest Evaluation)
(US$ Million)

	ZR	TAZARA	MR	CFM-N	CFM-C	CRM-S	NRZ	BR	Total SADCC
Revenues	72.5	37.1	6.7	0.6	7.1	11.8	127.1	26.5	289.4
Operating Costs	84.9	44.7	15.5	14.5	24.8	35.8	306.0	34.7	560.9
Net Oper. Profit (Loss)	(12.4)	(7.6)	(8.8)	(13.9)	(17.7)	(24.0)	(178.9)	(8.2)	(271.5)

Source: 1988 or 1988/1989 data from Railways as analyzed by NEI in SADCC Transport Corridors, Study on Financial Strategies, Supplementary Report, April 1990 and adjusted in this report. (See Annex C.)

Definition of Cost Categories and Financial Ratios

3.03 Although their cash accounts are relatively accurate, historic railway accounting costs do not tell a consistent and accurate story about railway financial viability due to the inclusion of excess assets, on one hand, and the underestimation of depreciation and interest costs on the other hand. Therefore, four different adjusted cost categories were identified and calculated for use in this report:

9/ NEI has found that the present port tariffs tend to be higher than direct operational cost (maintenance of structures and financing cost included). For new facilities (like container berths) tariffs are basically set to recover all cost, including depreciation on replacement value of the infrastructure as in the case for the new container terminals in Beira and in Dar es Salaam. The financial records of RSA ports show the same pattern.

10/ Not including Benguela and Swaziland Railways. See Annex C.

(a) Total cash costs (variable and fixed)--the subtotal of all costs in the yearly cash flow, (that is, total operating costs minus depreciation);

(b) Long-run marginal costs (LRMC)--the subtotal of all variable costs plus interest and the depreciation of rolling stock;

(c) Total operating costs less track depreciation--this includes long-run marginal costs plus the fixed costs of track maintenance and overhead; and

(d) Total operating costs--all operating cost items, including depreciation of renewable assets.[11]

Three major adjustments were made to the railway accounts for operating costs: (i) only renewable assets were used for depreciation calculations since these represent the investment needed for an ongoing business, (ii) replacement values in hard currency (US$) were used to replace the historic value of assets (in order to adjust for past high rates of domestic inflation and exchange rate changes),[12] and (iii) a standard interest rate of 10 percent of half of the renewable assets replaced actual interest paid. (See Annex C.) These adjustments are intended to create an estimate of the actual financial costs of railway operations in a comparable manner for financial strategy analysis.

3.04 In order to summarize railway financial performance, four financial ratios were calculated for each railway corresponding to these cost categories and the results are shown in Table 11. The definitions of these ratios are:

(a) Working ratio--total cash cost divided by total revenues. The working ratio gives an insight into the liquidity position. If the working ratio is below 100, the company earns sufficient revenue to cover the cash costs;

(b) LRMC recovery--long-run marginal costs divided by revenues. Cargo moved at a tariff above LRMC (thus with a LRMC recovery ratio below 100) is attractive for the railways as all direct costs of moving the cargo is recovered and in addition a contribution is made towards fixed costs;

(c) Ratio of cost recovery without permanent way depreciation--the ratio of all operating costs, excluding depreciation of the permanent way, to revenues. This ratio is a useful cost recovery criterion in case the investment in the permanent way is to be financed by the government without

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11/ Renewable assets are all assets that must be replaced over the life of the railroad. They include rolling stock, rail, sleepers, ballast and most of the buildings, plant and equipment that are used in operations. They do not include earthworks, right of way and other assets that will not need to be replaced during the life of the railroad.

12/ A complete revaluation of railway assets was outside the scope of the study. Instead, an approximation of the replacement value of the assets and the associated depreciation was made. For the companies with a well-established and accessible asset inventory this was done by estimation of the unit costs of the assets. For other companies a broader approach had to be followed. Although the depreciation costs calculated in this way are not 100 percent accurate, they form a better basis for the assessment of the financial position of the companies than the depreciation charges on historic cost basis.

charging the railway company. For a financially viable enterprise operating under this arrangement this ratio should be below 100;

(d) Operating ratio--total operating costs divided by total revenues. When the railway recovers its full costs, the operating ratio is below 100.

Table 11: Financial Ratios for SADCC Railways

	Working ratio	Long-run marginal cost ratio	Total costs without track dep. ratio	Operating ratio
Zambia Railways	98	69	113	117
TAZARA	90	76	111	122
Malawi Railways	161	153	199	233
CFM-Norte	836	1188	1468	1739
CFM-Centro	233	296	326	351
CFM-Sul	197	248	292	303
NRZ	173	160	232	236
Botswana Railways	110	89	126	129

Note: The Benguela Railway is not shown because it is not presently in operation for international traffic. Swaziland Railway ratios were not available.

Source: 1988 or 1988/1989 data from Railways as analyzed by NEI in SADCC Transport Corridors, Study on Financial Strategies, Supplementary Report, April 1990 and adjusted in this report. (See Annex C.)

Comparison of Financial Ratios for Railways in the Corridors

3.05 Based on the above financial ratios, it can be seen that none of the railways covers all costs (no operating ratios below 100), however, the Zambia and TAZARA railways are in the least disturbing financial shape of SADCC corridor railways, with working ratios and LRMC recovery ratios below 100 (that is, their revenues cover total cash costs and LRMC). The Botswana Railway is also covers its long-run marginal costs, but not its total cash costs.

3.06 The CFM lines and Malawi Railways show poor financial performance because they are seriously affected by line closures in their network (as well as management and operational problems). A large part of their costs, especially depreciation of the track and rolling stock, is based on the whole network and fleet, while the revenues are related to only that part of the network and fleet that is able to function.

3.07 The incorporation of the adjustments regarding renewable assets, depreciation and interest leads to a different picture for the financial position of the railways, which, in most cases, is worse than that shown in their regular accounts. This picture, however, creates a more realistic and comparable view of the SADCC railways as a whole, and shows clearly the extent of the present financial crisis:

(a) None of the railway companies is in a position to recover total costs, and

(b) With working ratios of most companies above 100, most railways do not cover their cash costs with rail revenues and are therefore presently dependent upon additional resources from government treasuries, that could otherwise be invested in productive sectors of the economy.

This situation has been recognized as a major problem by SADCC governments, and most are beginning to take active steps to resolve it.

Comparison of Railways for Transit and International Freight

3.08 In order to separate out the costs of transit and international freight from the rest of railways operations, a second method of railway financial analysis was carried out for this study using a standard unit cost approach. The unit costs of rail transport (cost per net ton-kilometer) for each corridor and railway system were calculated starting with standard costs for all cost components and adjusting them for (i) physical corridor differences, (ii) rail productivity and labor cost differences and (iii) differences in operating characteristics related to the commodities hauled by different railways. The specific items taken into account are:

(a) Standard costs were used for the replacement value and maintenance cost of locomotives (a standard 2000 HP DE locomotive has been assumed) and wagons, interest charges, labor (per hour), and fuel (per liter); standard times were also used for shunting of trains and loading/unloading wagons;

(b) Specific characteristics of the railway link or corridor included train transit speed, number of locomotives required per train, maximum number of wagons per train, number of shunting yards along the railroad, factors to account for geographic features which impact the level of maintenance and reconstruction cost of the permanent way (a standard 45 kg/m single rail track on concrete sleepers was used);

(c) Railway-specific items included present labor costs, fuel costs, and the amount of fixed operating cost per ton hauled; the present productivity of locomotives and wagons; and the proportion of gross ton-km for international and transit traffic versus domestic and passenger traffic;

(d) Commodity-specific items--maximum net tonnage per wagon.

The detailed calculations of these costs are given in Annex D.

Table 12: 1988/89 Financial Analysis of SADCC Railways Using Standard Costs for Border Crossing Traffic Only (mil $US)

	ZR	TAZARA	MR	CFM-N	CFM-C	CFM-S	NRZ	BR	SWR	Total SADCC
Revenues	56.5	36.5	-	-	4.8	9.0	60.3	12.5	8.9	193.3
Operating Costs	35.6	49.2	-	-	9.6	17.3	86.0	16.7	19.3	233.8
Net Operat. Profit (Loss)	20.9	(12.7)	-	-	(4.8)	(8.3)	(20.9)	(4.2)	(10.4)	(40.5)

Source: Unit cost data from NEI in SADCC Transport Corridors Workshop, Policy Issues in Financial Strategy, Working Paper 3, Traffic Allocation and Financial Analysis of Railways, Maputo, 11-14 December 1989 (See Annex D) adjusted in this report (See Annex I, Scenario 0).

3.09 The standard cost analysis for border crossing traffic shows that only one railway (Zambia) is making a net operating profit on border-crossing traffic, while all the others are not profitable when measured by total costs with depreciation at replacement value. In fact, the international traffic tariffs for Zambia railway are set at a high level which subsidizes domestic passengers and domestic freight operations which charge lower tariffs per ton-km. This is partly due to the relatively short haul distances for the TAZARA connection which involve higher costs. Also the impact on total shipping costs of high tariffs per ton-km for this traffic is small, which gives Zambia Railways more leeway for these charges. Other SADCC railways can adopt similar tariff policies and achieve improved financial results for their long distance traffic operations as long as their traffic base is not significantly affected.

Table 13: Financial Ratios for SADCC Railways Using Standard Costs for Border-Crossing Traffic Only
(Scenario 0)

	Working ratio	Long-run marginal cost ratio	Total costs without track dep. ratio	Operating ratio
Zambia Railways	42	38	49	52
TAZARA	115	113	136	147
Malawi Railways	-	-	-	-
CFM-Norte	-	-	-	-
CFM-Centro	111	94	129	140
CFM-Sul	274	166	304	329
NRZ	122	122	143	147
Botswana Railways	115	88	129	135
Swaziland Railways[a]	183	161	216	218

[a] Estimates do not include RSA traffic effects which are significant.

Source: Unit cost data from NEI in SADCC Transport Corridors Workshop, Policy Issues in Financial Strategy, Working Paper 3, Traffic Allocation and Financial Analysis Railways, Maputo, 11-14 December 1989. Labor costs and maintenance costs were calibrated to actual costs (See Annex I.)

Overall Railway Financial Strategy and Breakeven Traffic

3.10 The SADCC railway revenues and costs per net ton-km (in US$cent) for both domestic and border-crossing traffic shown in Table 14 illustrate the main differences in the financial strategy of regional railways. As noted previously, none of the railways' revenues cover their total operating costs for both domestic and international traffic, including replacement costs of rolling stock and track. On the other hand, all railways cover variable operating costs on a ton-km basis despite the fact that these costs vary considerably between railways (due mostly to curtailed operations for security reasons). The picture changes dramatically when rolling stock depreciation and interest are included as part of long run marginal costs: CFM Norte and Sul, and Zimbabwe no longer have revenues sufficient to cover these costs. However, if present low-rolling stock utilization and other factors due to the security situation are eliminated as in Table 14, CFM and Malawi do recover long-run marginal costs for their overall rail operations.

Table 14: Total Revenues and Operating Costs per Ton-km by Railway
(cents US)

	ZR	TZR	MR	CFM-C	CFM-S	NRZ	BR	Avg. Oper. RRs.[a]
Freight Revenues	4.1	2.5	9.2	5.7 [b]	7.3 [b]	2.0	2.7	2.8
Total Freight Operating Costs	4.6	3.0	20.1	15.2	24.8	5.1	4.2	4.2
Long-Run Marginal Costs	2.2	1.2	3.8 [c]	3.8 [c]	3.8 [c]	2.6	2.5	2.1
Fixed Operating Costs (mil. $US)	38.8	27.3	11.9 [c]	16.5 [c]	30.0 [c]	143.6	13.1	n.a.
Percent Fixed Costs (%)	44	66	80	75	53	39	39	
Present Traf.[d] (mil net tkm)	1,776	1,460	73	145	143	5,287	771	n.a.
Breakeven Traffic (mil net tkm)[a]	2,040	2,100	220 [c]	870 [c]	860 [c]	-	1,190	n.a.

Note: Long-Run Marginal Costs include variable costs plus locomotive and rolling stock depreciation.

a/ Average of Zambia, TAZARA, Zimbabwe and Botswana Railways.
b/ Adjusted to reflect normal mix of domestic and border-crossing traffic.
c/ Based on a detailed assessment of fixed and variable costs by Hamburg Port Consulting GMBH in Financial and Tariff Development Plan--CFM-C, April 1990 which was extended to other railways in similar circumstances.
d/ All traffic including passengers prorated as described in Annex F.

Source: Annex C and Annex F.

3.11 The breakeven total freight traffic levels at present tariff rates can be calculated for all SADCC railroads except Zimbabwe whose revenues are lower than LRMC.[13] None of the SADCC railways exceeds breakeven with present traffic and tariffs, and the three fully operating railways, other than NRZ, need 15-54 percent more ton-km to cover total costs at present tariffs.

13/ Recent tariff increases for NRZ of 70% and subsequently 20% have occurred in 1990 after this analysis was completed. These increases will effectively double revenues per ton-km and will more than cover NRZ's LRMC. However, it will not cover total operating costs at present productivity levels.

3.12 Another way to look at the situation is to identify the tariff rate increase that would be necessary to achieve breakeven financial operations.[14/] Zambia and TAZARA would need 12 percent and 20 percent tariff increases respectively to cover full costs. Botswana Railways would need an overall increase of 45 percent to breakeven at full costs. National Railways of Zimbabwe require a 155 percent average freight tariff increase to cover full costs.[15/] This situation, however, changes dramatically when improved productivity is considered (see Chapters 5 and 6) and lower levels of tariff increases can achieve the same goal if they are combined with action programs to increase productivity of existing assets and reduce the unit costs of operations.

3.13 The financial strategies of the Malawi and Mozambique railways require special analyses due to their present operating constraints. CFM-C is the closest to normal operations, but still does not have the benefit of the Sena line. Nevertheless, it could only achieve breakeven on its present operations (at the LRMC plus fixed cost level) with an increase of 167 percent in its present tariffs. Its costs will always be higher per ton-km than other railways due to terrain and short haul distances, but it appears that the present high variable operating costs per ton-km will have to be reduced through improved operations control, as well as attracting more traffic to attain breakeven levels at competitive tariffs. CFM-Sul is in a similar situation, but CFM-Norte and Malawi Railways are in an even more difficult situation as security problems have effectively closed their main operations and turned what are normally low variable costs (for example, fuel costs and rolling stock maintenance per ton-km) into high costs through forced restrictions on rolling stock productivity. With the opening of these closed lines, rolling stock productivity should increase and the variable costs drop. Although normalized conditions for Malawi and Angola are a high priority, even under present constraints the present high operating costs of these lines can be lowered with better management and operating strategies, such as those described in the following chapters.

14/ Determined by the ratio of total freight operating costs to freight revenues in Table 14.

15/ The recent tariff increases of 70% and 20% will make up two thirds of this percentage.

IV. FUTURE RAILWAY FINANCIAL VIABILITY BY SCENARIO

4.01 The two most significant factors which affect the viability of all the railways in the SADCC region are the level of rail tariffs and locomotive and rolling stock productivity, which is closely related to rail capacity, level of service, and operating costs. Actions in all of these areas are crucial to the future financial viability of the SADCC railways. The attraction of additional traffic is also important to some railways such as the Beira Corridor line (CFM-C) and, certainly, the ending of forced closure of the Sena line, the Nacala line and the Limpopo line in Mozambique, as well as the Benguela line in Angola is critical to their viability and to Malawi Railways as well. Retention of traffic by railways in road-rail competition for 200 to 1,000 km haul distances is also a major concern, which can only be assured by increasing rail corridor levels of service.

4.02 The future financial viability of SADCC railways depends on: (i) traffic with open and reliable corridors, (ii) a realistic tariff strategy, (iii) improved operating policy and (iv) improved availability/utilization of locomotives and rolling stock. To determine future viability, short-term traffic forecasts under three scenarios were compared with breakeven traffic for each railway. Of the three scenarios, Scenario 1 reflects the situation with the present seven open corridors and current tariffs, but with improved rolling stock availability and productivity; Scenario 2 reflects a situation with all corridors open, improved rolling stock availability and productivity, and the present rail tariff structure; while Scenario 3 assumes the same corridor and operating improvements as Scenario 2, but also analyzes the impact of applying cost-based tariffs. All three scenarios are based on SATCC traffic figures.

Potential Improvements in Railway Productivity

4.03 Rail rolling stock and locomotive productivity is a multi-faceted problem which involves operational rules and policies, maintenance expenditures and workshop performance, border formalities and organization, terminal and port interface efficiency and management control. All these aspects of the problem must be tackled in order to make significant progress in increasing rail productivity as recommended by the rail management participants at the SADCC/World Bank Maputo Workshop in December 1989.

4.04. The present availability and utilization of the SADCC railways' locomotives and rolling stock is relatively low as shown in Table 15. Even after correcting for statistical distortions, locomotive availabilities range from 50 to 70 percent which is substantially below the normal level of 75 to 85 percent that has been attained in other developing countries with efficient repair and maintenance operations. This higher level was also attained in the past by NRZ with newer locomotives.[16/] Similarly wagon availability could be increased to 90 percent from the present levels of 42 to 64 percent. Wagon utilization in km/available day could also be increased substantially with better wagon control systems, even in the cases of TAZARA and Botswana which have relatively efficient wagon control due to their system configuration.

4.05 From the analysis in Annex I of the present rail situation (Scenario 0) it is apparent that rail expenditures on locomotives and rolling stock maintenance only average 73 percent of

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16/ Recent changes in NRZ operations appear to have raised loco availability back to 80-85 percent for line locos.

expected standard costs after adjustment for wage rate differentials between SADCC countries.[17] This probably reflects budget constraints on spare parts purchases and their effects on workshop performance, which have a direct impact on locomotive and wagon productivity. Additional expenditures in this area are crucial for obtaining the potential productivity increases in Table 15.

17/ CFM and Malawi average only 14-20 percent of standard due to the high number of unutilized wagons in present operations.

Table 15: Present and Potential Locomotive and Rolling Stock Productivity (Long Distance and Through Trains)

	ZR	TZR	MR	CFM	NRZ	BR
A. Availability (%)						
present locomotives[a]	58	47	69	60	50	70
short term loco potential	75	75	75	75	75	75
long term loco potential	85	85	85	85	85	85
present wagons[a]	n.a.	55	60	42	64	64 [b]
short term wagon potential	90	90	90	90	90	90
long term wagon potential	90	90	90	90	90	90
B. Utilization (km/available day)						
present locomotives	320	350	130	250	400	350
short term loco potential[c]	400	430	300	350-450	500	430
long term loco potential	500	630	400	470-600	550	470
present wagons	40 [b]	150	40	n.a.	80	150 [b]
short term wagon potential[c]	80	200	80	80-100	90	200
long term wagon potential	100	250	100	100-130	100	250
C. Productivity (A x B) (km/calendar day)						
present locomotives	190	160	90	150 [b]	200 [d]	245
short term loco potential[c]	300	320	225	260-330	375	320
long term loco potential	425	535	340	400-510	467	400
present wagons	25 [b]	84	25	n.a.	50	90
short term wagon potential[c]	72	180	72	72-90	80	180
long term wagon potential	90	225	90	90-117	90	225

Note: Productivities for both domestic and international traffic are lower than for international traffic alone as shown in this table. Recent improvements in availability and productivity may not be reflected in the above figures for present operations which are based on 1989 data.

[a] This measure may understate actual availability since locos owned includes those condemned for scrap in some cases.

[b] Estimate.

[c] In the past NRZ has achieved 450 loco-km/calendar day and 80 wagon-km per calendar day for the fleet as a whole, and recent operating results for NRZ show utilzation of the primary line haul locomotives up to 500 km/day, and availabilities in the 80-90% range for some locos.

[d] Diesel and electric only.

Source: Railway data in Annex C and World Bank estimates.

4.06 A series of steps that could be taken by railway management and SATCC, which could improve availability and productivity up to potential levels, were identified by the study team and discussed in the Maputo workshop on SADCC Transport Corridor Financial Strategy of December 11-14, 1989. These concern railway organization and operating procedures, port-rail interface problems, shipper information, transport regulation and human resource development (see Chapter 5 for more details). These steps along with the recommendations of the Brazzaville workshop on developing effective corporate management,[18] are needed to achieve the type of potential productivity increases indicated in Table 15.

Railway Pricing and Regulation

4.07 One of the major implications of the poor present and forecast financial outlook for SADCC railways described in Chapter 3 is that rail tariffs (except for Zambia and TAZARA) are not set at a high enough level to recover total costs or to give an adequate return on assets in SADCC railways, even with improved productivity.

Table 16: Forecast Average Revenues of the SADCC Railways for Border-Crossing Traffic (US$ per ton-km)
(Scenario 2)

	Imports	Exports	Intraregional	Total Cost Recovery[a] (operating ratio)
CFB	0.03	0.02	n.a.	164
ZR	0.06	0.09	0.05	40
TAZARA	0.03	0.02	0.03	101
MR	0.03	0.03	0.02	167
CFM-N	0.05	0.03		116
CFM-C	0.05	0.05	0.07	83
NRZ	0.03	0.03	0.02	106
CFM-S	0.04	0.04	0.03	85
BR	0.07	0.04	0.03	114
SWR	0.05	0.02	0.03	142

[a] After short term improvements in productivity.

Source: NEI, SADCC Transport Corridors Workshop: Policy Issues in Financial Strategy, Working Paper 3, Maputo, 11-14 December 1990 and Annex I, Scenario 2.

4.08 As can been seen from Table 16, average ton-km revenues are strikingly different between railway companies, which is a result of both the commodity mix and differences in tariffs. In most cases the present ton-km tariff is lower for long distance trips than for short hauls. This can be shown, for instance, with Zambia Railways as compared with TAZARA. Zambia Railways handles predominantly short hauls to and from the TAZARA connection point at relatively high tariffs (for

[18] See also Techniques for Railway Restructuring, World Bank and Economic Commission for Africa, Prepared for the Union of African Railways, February 1990.

example, US$0.19/ton for copper and US$0.77/TEU for containers with an average load); whereas the TAZARA is a typical long haul company with relatively low tariffs (US$0.01/ton for copper and US$0.22/TEU for containers).

4.09 From the comparison of tariffs and cost recovery ratios by railway company two major conclusions can be drawn:

(a) present tariff differences for border-crossing traffic between railway companies do not reflect cost differences sufficiently. Tariffs adjustments appear to be of major importance and in order to prevent underpricing; and

(b) the average tariff needed to cover total costs is relatively small in comparison to the existing differences in tariff between railway companies, so that tariff adjustment needed for some individual companies is much larger than the average percent for most railways.[19/]

This situation reflects the present policy differences between countries with respect to cost recovery. However, this difference should be decreasing in the future if the recommendations and observations of this study are carried out.

Future Tariff Policy

4.10 Appropriate tariff levels are critical for future financial viability of the railways. The Maputo workshop participants recommended that the SADCC railways implement a policy of cost-based tariffs in a phased manner, with the aim of achieving financially self-sufficient rail operations. In one case, Zambia Railways, this objective is already being achieved through the means of a semi-autonomous organization (Zambia Railways Limited) which has the authority to set tariffs with relatively limited government regulation, but a clear mandate to recover costs. TAZARA and Botswana Railways are in a somewhat similar position, but have been less successful in implementation. Other railways, such as CFM, are presently negotiating with the government for similar semi-autonomous status, but this is just in the preliminary stages of implementation. Nevertheless, the principle of setting tariffs at sufficient levels to achieve full cost recovery and return on investment should be a key element in strategy towards achieving financial self-sufficiency in railway operations.

Traffic Forecasts

4.11 For the present study short-term forecasts were prepared for the three scenarios described above, using traffic levels by origin and destination. [20/] These traffic flows were assigned to the transport network, based on the present tariffs (for Scenarios 1 and 2) or on the basis of a cost-based tariff (Scenario 3). The results for each major SADCC port are shown by landlocked

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19/ See later discussion of tariff increases required to achieve 10 percent return on renewable assets under future conditions which differ significantly from present conditions.

20/ The forecasts use the "1990" commodity data by origin and destination contained in SATCC, A Scenario Model for Goods Transport Demand in the SADCC Region, September 1988, and allocate the traffic to different corridors and road or rail according to cost of transport and other factors as described in NEI, SADCC Transport Corridor Workshop: Policy Issues in Financial Strategy, Working Paper 3, Maputo, 11-14 December 1989.

country of origin for transit and import/export traffic in Table 17 (see Annex H for more detail). Table 18 shows the traffic forecasts by road and rail for SADCC and RSA ports, and Table 19 summarizes the total net ton-km by railway for total border-crossing traffic.

4.12 These traffic forecasts indicate a range of possible outcomes for each rail line and port. Overall, SADCC corridors would experience an additional demand of 700,000 tons over the present situation with all corridors open (Scenarios 2 and 3 in Table 17), of which 160-290,000 is allocated to Lobito. Road traffic would also increase its share from 9 percent of international traffic to 13 percent with the higher tariffs for cost recovery, but this would not have a major impact on rail tonnage.

Table 17: Short-Term Traffic Forecasts by Scenario for Overseas Trade, by SADCC Port (1000 metric tons)
(landlocked countries only)

		Lobito	Dar-es-Salaam	Nacala	Beira	Maputo	Total
Scenario 1	imports	0	400	0	170	250	820
	exports	0	780	0	600	820	2200
	total	0	1180	0	770	1070	3020
Scenario 2	imports	80	200	80	420	270	1050
	exports	210	570	60	670	1180	2690
	total	290	770	140	1090	1450	3740
Scenario 3	imports	45	180	60	420	300	1005
	exports	115	640	50	660	1200	2665
	total	160	820	110	1080	1500	3670

Source: NEI, SADCC Transport Corridors Workshop: Policy Issues in Financial Strategy, Working Paper 3, Maputo, 11-14 December 1990.

Table 18: Allocation of Overseas Trade by Ports (1990)
(in percentages)

		SADCC ports		RSA ports		Total		
		rail	road	rail	road	rail	road	total
Scenario 1	imports	57	17	22	3	80	20	100
	exports	60	2	35	3	95	5	100
	total	59	6	32	3	91	9	100
Scenario 2	imports	66	17	16	1	81	19	100
	exports	67	9	22	3	89	11	100
	total	66	11	20	2	87	13	100
Scenario 3	imports	69	17	13	1	82	18	100
	expor	67	9	22	2	89	11	100
	total	67	11	20	2	87	13	100

Source: NEI, SADCC Transport Corridors Workshop: Policy Issues in Financial Strategy, Working Paper 3, Maputo, 11-14 December 1990.

Table 19: Comparison of Breakeven Traffic and Short-Term Traffic Forecasts by SADCC Railway (mil. net ton-km)

	Breakevena/ Traffic	Scenario 1		Scenario 2		Scenario 3	
		ntkm	index	ntkm	index	ntkm	index
CF Benguela	n.a.	22	n.a.	397	n.a.	232	n.a.
Zambia Railways	2040	1602	78	1652	81	1772	87
TAZARA	2100	2074	99	1544	74	1674	80
Malawi Railways	220	157	71	257	117	252	115
CFM-Norte	n.a.	28	n.a.	113	n.a.	98	n.a.
CFM-Centro	870	421	48	451	52	451	52
CFM-Sul	860	130	15	545	63	570	66
NR Zimbabwe	n.a.	5700	n.a.	5585	n.a.	5725	n.a.
Swaziland Railways	n.a.	267 b/	n.a.	252 b/	n.a.	242 b/	n.a.
Botswana Railways	1190	959 c/	81	964 c/	81	969 c/	81
Total	-	11,360	-	11,760	-	11,985	-

Note: Traffic forecasts are the sum of border-crossing and local traffic. Border-crossing traffic does not take into account the effect of contract rates. Index equals the ratio of scenario traffic to breakeven traffic.

a/ Breakeven traffic is defined as total traffic needed at present tariffs to cover total variable and fixed costs including depreciation of renewable assets.

b/ Not counting RSA transit traffic (43.9 million in 1988/89) which is very important for Swaziland Railway's financial health.

c/ Including Botswana import/export traffic.

Source: Annex G and Table 14.

4.13 The comparison of breakeven traffic with the short term forecasts by railroad shows that only Malawi Railways (with high unit tariffs for domestic traffic) could achieve total cost recovery at present tariffs with all corridors open (Scenario 2). The other railways will need tariff increases to breakeven at forecast traffic levels.[21] Tariff increases, however, should always be within the framework of efficient use of assets in order to avoid burdening users with the cost of inefficient operations.

21/ See Annex F for further breakeven analysis.

V. MAJOR ISSUES IN CORRIDOR FINANCIAL STRATEGY

Transport Corridor Operational Improvements

5.01 A major conclusion of the study and of the Maputo Workshop was that a number of corridor operational improvements could benefit the SADCC region, and contribute to the financial viability of its transport corridors at the same time. Several of these proposed improvements were analyzed and the following seven, in particular, were found to have a substantial potential for positive financial impact.

5.02 Active system management. Improved management practices were also found to be critical, including: personnel training, improved incentives, implementation of costing systems, monitoring of rolling stock utilization, more strategic and corporate planning and top management training. The benefits for this were harder to quantify and no quantification is attempted in this report, although it should be given the highest priority.

5.03 Through Blocking and Unit Trains. The main benefit of through blocking and unit train operation is the elimination of intermediate stops in yards for reclassification of wagons; This would reduce travel time by at least one day per yard on the average. This reduction in travel times leads to faster turn-around times for wagons and locomotives and higher productivity. If a typical 42 day turnaround time could be reduced to 20 days (including terminal detention time), the number of trips could be doubled, and wagon productivity increased between 50 percent and 80 percent (depending on repair and maintenance time) for transit wagons. This would yield a reduction in total railway long term marginal costs of 10-20 percent (depending on the proportion of long distance traffic), as well as increase the speed of service for the shippers. The fewer shunting movements would also reduce terminal costs and free up yard capacity for domestic movements.

5.04 Specialized Wagons. From the review of present commodity flows, it was projected that 9 commodities representing 43 percent of the export/import traffic could be more efficiently handled in specialized high-capacity wagons. It was also noted that the tariffs for these 9 commodities are at the lower end of the rate schedule, so that increasing the tons per car should improve the revenue/expense ratio for the railroad. The following table summarizes the resulting reduction in wagon loads required for the base year of the commodity demand study.

Table 20: Potential Transit Traffic Demand for Specialized Wagons

Commodity	Export/Import Total Tons	Existing/Tons Wagon Type	Potential Tons/ Wagon Type	Wagon Loads Existing/ Proposed
Copper	992,000	40/DS	60/DS	24,800/16,500
Salt	123,000	37/HS	60/CH	3,300/ 2,100
Coal	886,000	38/HS	60/H	23,300/14,800
Cement	343,000	40/DS	60/CH	8,600/ 5,700
Sugar	762,000	39/HS	60/CH	19,500/12,700
Steel	683,000	39/DS	60/DS	17,500/11,400
Maize	533,000	23/COV	60/CH	23,200/ 8,900
Fertilizer	507,000	39/HS	60/CH	13,000/ 8,500
Wheat	153,000	39/HS	60/CH	3,900/ 2,600
Total	4,982,000			137,100/93,200

Note: HS = High Side Wagon, DS = Drop Side Wagon
COV = Covered Wagon, H = Hopper, CH = Covered Hopper

Source: World Bank, SADCC Transport Corridors Study of Financial Strategy, Issue Paper No. 2: Potential Improvements in Railway Operations, September 27, 1989.

5.05 The reduction of 43,900 wagon loads, a 32 percent drop, to haul the same total tonnage of freight translates into fewer trains and fewer wagons to be owned, with a resulting lower ownership cost.[22] For example, increasing the wagon capacity from 40 to 60 tons (a 50 percent increase) causes the cost of a wagon to increase by 10-15 percent. Therefore the ownership cost per ton capacity decreases by 20-25 percent.[23]

5.06 Wagon Tracking and Shipper Information System. If a real time freight wagon tracking and control system were in place for the entire SATCC region that would provide daily listings by wagon number and location of empty or non-moving wagons, it would permit fleet controllers to monitor and direct in the most efficient manner the movement of loaded and empty wagons to their destinations. Train configurations could easily be sent ahead to a receiving location in order to permit local managers to plan their work more efficiently. At the same time, the system would provide better information to shippers regarding the location of their shipments. The main benefit for railway managers would be the reduction in wagons needed to operate the system, and higher productivity for the rest of the fleet. The problems with lost wagons would be reduced if not

[22] This substantial reduction in wagon loads could be even greater if domestic shipments were included.

[23] Axle loads for 60 ton wagons currently in use do not exceed the 20 ton limit assumed for 45kg rail on concrete sleepers. This limit is not available for all corridor links, and careful planning is needed to determine where specialized wagons can, in practice, be used.

eliminated. In the case of Zimbabwe it is estimated that an appropriate system would cost about US$1 million (the equivalent of thirty wagons), with the expectation of saving hundreds of wagons of new investment. The UNCTAD/UNDP project to implement such a system, estimates a payback period of less than a year to railways, not counting the extensive benefits to shippers.

5.07 Scrapping Policy. There are two types of benefits for scrapping obsolete rolling stock: financial and operational. If properly handled by governments, the sale of scrap metal can generate much needed foreign exchange for the railroad to help pay for critically needed spare parts to maintain locomotives, electronic systems, computers, etc. One of the regional railroads (CFM-C) recently sold 43,000 tons of scrap steel and iron for US$68 a ton. This generated almost US$3 million in hard currency for the railroad and there was still a lot of scrap left to be sold. With new wagons and locomotives being procured, every effort must now be made to sell and get rid of scrap of all kinds. The operational benefit for scrapping is the use of yard and terminal space which is now blocked by scrap, thus creating additional capacity for shunting and for workshop operations. This will decrease the number of shunting moves and therefore lower terminal costs.

5.08 Border Crossing Improvements. The main benefits of making border crossings more efficient are savings of transit time at the borders (as well as at the ports). These times are significant for transit freight, and their elimination would result in faster turn-around times as described previously. Major improvements can be obtained through proper coordination by the customs authorities as illustrated by the 48-hour transit time from Beira Port to Mutare now guaranteed by the Beira Port Authority with Zimbabwe customs clearance in the port. This type of action will clearly lead to higher rolling stock productivity and lower ownership costs.

5.09 Workshop, Spare Parts and Maintenance Improvements. The benefits of increased spare parts availability and more efficient maintenance can be calculated in several ways, but the most pertinent way for most SADCC railways is to calculate the reduction in the amount paid for locomotives leased from SATS, and SATS wagon costs. This increased availability will also result in lower rolling stock replacement costs which can save millions of dollars in foreign exchange and lower operating costs. This position can be made clear to the financial decision-makers in government, by estimating the number of locomotive-days or wagon-days that could be provided with a given addition of spare parts, and comparing this with the equivalent number of days leasing charges (R1500/day for locomotives and Z$48/day for wagons, with insurance). The cost to the economy is even greater when neither is available and road transport costs must be paid, especially for long distance or transit traffic, which earns foreign exchange.

5.10 System Management and Human Resources. In order to successfully implement many of the above programs it will be necessary to overcome a variety of railway institutional constraints. These constraints include: lack of authority to deal with the key problems, incentives and motivation to perform, and a need for sustained human resource development.

5.11 The authority to deal with key problems is an issue that several railroads in the region have faced, and Zambia and Mozambique have acted by creating separate authorities to run rail operations which are somewhat financially autonomous and have the ability to set tariffs to recover costs. TAZARA has always been independent (although jointly government owned by two governments). The National Railways of Zimbabwe, however, is still part of the government without this authority. A further aspect of this problem concerns the ability to raise foreign exchange to cover needed imports. This is still a major problem for each railway.

5.12 Incentives and motivation to perform are still key issues, as the pay scales are fixed in all railroads (except Benguela) in relation to the civil service pay scales. These are normally inadequate to keep rail staff with skilled positions. An example is the crewing of trains where existing operations use 2 to 3 man crews who are paid on the basis of an eight-hour day. Since the railroad wage rates are frequently on the lower end of the economic scale, train crews have an incentive to make sure their trip takes more than eight hours in order to supplement their incomes with overtime pay. This further slows down an already slow service. Some form of incentive pay for performance has been successful in changing this situation in Mozambique and should be generally examined for other situations.

5.13 The most fundamental problem facing railroads in the SADCC Region is the lack of trained manpower at all levels, but most especially in the supervisory and managerial positions. Permanent solutions will take many years to implement and will require some fundamental changes in the way some national governments view railway employees. After investing time, money, and effort to train a person, the railroad frequently is faced with government-mandated wage scales that are not comparable to pay scales for similar skills and responsibilities in the private sector. The result is that the newly trained person sees the greener grass on the other side of the fence and leaves. The railroad then has to train a replacement. The problem gets worse as skill levels increase. In other cases where railroad jobs have no direct counterpart in other industries (locomotive drivers, train guards, dispatchers, etc.), low pay often forces railway employees to obtain second jobs on a part-time basis or simply to quit the railroad industry, neither of which is desirable from the railroad's viewpoint. This is a major contributor to the past declines in productivity. This lack of experience and training at the middle and lower management levels resulting from this paralyzing combination of low wages and lack of skilled manpower in sufficient numbers leads to situations where positive actions (such as inspections, failure analysis, preventive maintenance and fleet planning) are not taken in a timely manner to correct problems as they arise or before they arise. Without a coherent training program linked to competitive wage scales and a management environment that promotes motivation for high performance, no railway can not achieve its potential.

Road Transport Issues

5.14 The efficiency of the road transport sector is presently constrained by the permit system and the security situation. The permit system causes both delays in transit in some cases and longer routing in other cases as trucking companies are forced onto longer routes than necessary to reach their destination, thus leading to increases in total transport cost. The security constraints in some corridors presently cause increased waiting times at border/convoy assembling points. The road transport market is rather well organized with demand and supply being centralized by transport brokers and/or large operators. In a normalized situation a less concentrated market for road transport would be expected. The result of the actual situation is a level of production and efficiency (for example, annual kilometrage, load factor, transit times) which is comparable with the performance of road sectors in other parts of the world, despite the higher overall transport costs. In any case, the impact of the application of present permitting rules on total transport costs is a matter of concern that should be studied.

5.15 In addition to permit restrictions the banning of large trucks on certain corridor roads (for example, in Mozambique) should eventually be phased out in order to permit the transport to

Mozambique ports of goods with high sensitivity to time.[24] This will require further investment in road infrastructure and higher maintenance costs which should be carefully analyzed for economic feasibility when the decision is under consideration. Also the issue of user charges for additional road maintenance costs should be addressed to ensure that maintenance costs are adequately financed. (See Annex A for an analysis of user charges and costs.)

Port and Shipping Issues

5.16 The present pattern of shipping service to SADCC ports is not optimal from a regional viewpoint. However, as soon as the access channel to Beira is deepened and the new container terminal ready, the fully cellular SAECS service could in principle be extended beyond Durban to Beira. The same is true for Maputo, if after reopening of the Limpopo line the volume of traffic rises to a sufficiently attractive level for the shipping companies. It is a major challenge to SATCC to achieve this change in shipping pattern in practice since it requires serious negotiations with the conference lines well in advance.

5.17 Expected Future Shipping Tariff Levels. The present tariff differentials between Lobito, Dar es Salaam and Durban will probably remain unchanged with discount margins for the SAECS conference larger than for Lobito and Dar es Salaam. Lobito rates may come down a bit if the total Angolan container traffic rises substantially, but this is unlikely in the near future.

5.18 The future tariff for Maputo and Beira traffic depends on the amount of containers offered for shipment. If the volume of trade increases enough to extend the fully cellular services (or at least some vessels from it) to Maputo and Beira, their tariffs could become competitive with the Durban tariff. This will require about 500 TEU in or out per call, that is, 250,000 MT/year, for Maputo and Beira to and from northwest Europe.

5.19 From Maputo and Beira, most Far East and South America bound containers are presently transshipped in Durban at an extra cost of 300-400 US$/TEU). In this case also, the volume of future traffic will determine the choice between direct calls (at equal tariff) and transshipment. South Asia, Middle East and Mediterranean tariffs will stay approximately equal for Durban, Maputo and Beira, and the Nacala tariff will continue to be substantially higher than either Dar es Salaam or Beira because of the low overall traffic volume. If more efficient transshipment service is provided, either to Dar or to Beira, a price difference of approximately 300-400 US$/TEU (that is, 30 US$/ton) can be expected.

5.20 Overseas freight tariffs for bulk shipments do not show significant differences between Dar es Salaam, Nacala, Beira, Maputo or Durban, because no important economies of scale exist and shipping distances to the main markets are not significantly different. Lobito, on the other hand, offers a real advantage for all cargo with destinations in Northwest Europe or America, of around 4 to 6 US$/ton. This will continue to be the case in the future.

Port Impacts

5.22 Corridor traffic changes will have impacts on corridor ports as well as rail and road transport services. The range of possible traffic in each corridor port is expected to vary in a

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24/ There are exceptions made by the Mozambique government in the present situation for juice transport in the Beira corridor.

relatively small range with approximately 500,000 tons switching between corridors, depending on the scenario. This will only have a significant impact on ports with low present throughput (Lobito and Nacala) which have more than sufficient capacity to handle these new flows.[25]

Table 21: Port Traffic Impacts

Port	Capacity	1987-88 Throughput (mil. port tons)	Potential Variation[a] Corridor Traffic (mil. port tons)
Maputo and Matola	12.3	2.2	1.1-1.3
Beira	6.8	2.8	0.8-0.9
Nacala	1.5	0.3	0.0-0.2
Dar-es-Salaam	6.3	3.9	0.7-1.1
Lobito	2.7	0.5	0.0-0.3[b]
Durban (RSA)	30.0+	24.0+	0.7-1.2
Port Elizabeth/ Capetown	n.a.	n.a.	0.3
Matadi (Zaire)	n.a	n.a.	0.0-0.3

[a] Only transit flows, not including the imports and exports of coastal countries
[b] Excluding new mineral exports from Zaire induced by the opening of the CFB.

Source: Volume 2, Chapter 2 and Annex G.

The Insurance Cost of Redundancy in Corridor Infrastructure

5.23 As noted in Chapter 2, the physical existence of ten corridors serving the SADCC states creates a situation with some duplication of capacity and services, whose costs can be considered similar to an insurance payment for the provision of transit services in uncertain circumstances. The size of this cost is critical to the analysis of the insurance function. This must be assessed in terms of total extra cost per ton of international traffic or per dollar of import/export value. The elements of this cost can be identified; they are extra infrastructure ownership costs, costs of subsidies for maintaining the corridor infrastructure, and the cost of inefficiencies in corridors which are deprived of management attention due to spreading of responsibility over more than one corridor.

5.24 Extra Infrastructure Ownership Costs. The investment in two of the ten corridors can be considered somewhat redundant from an overall regional perspective. Based on traffic forecasts the Nacala and the Benguela Railways would have the most difficulty reaching financial viability (although both would also serve some domestic functions which are not examined here). The extra cost of rehabilitating the Nacala line was of course, justified on the basis of providing a crucial import/export access for Malawi while the Sena line was closed (a genuine insurance concept). When

[25] See Volume 2, Chapter 2 for more detail.

all CFM lines are open, this will reduce the demand for this corridor. The Benguela corridor will compete for Zairois and northern Zambian traffic, as it did in the past, and, if past practices are followed, it may be a more reliable route than other corridors. The estimated asset value of the railway infrastructure in the two corridors is US$755 million which generates an equivalent annual ownership cost of US$77 million.[26/]

5.25 Extra Operation Costs. Because the users of the corridors will support most of the cost and they are willing to pay for their shipments, the only extra costs involved are the subsidies assumed by the governments to support operating cost above those covered by revenues. This will amount to approximately US$20 million per year (US$10 million per corridor).

5.26 Corridor Inefficiencies. This cost is difficult to assess, especially in the case of civil unrest in certain SADCC countries. Therefore, no attempt is made here to assess its magnitude, but it is noted that it is a real cost to the users of corridors which are not run as efficiently as they would be with greater management attention. Present investment in the Beira Corridor is an example of the benefits of investors focusing on a reduced number of corridors.

5.27 Total Insurance Costs per Ton-km. Total costs per ton-km were computed from the sum of the costs estimated above (US$97 million/year), divided by the present total ton-km of international border-crossing rail traffic (19 billion). This calculation results in a total of 0.005 $US per system ton-km, which represents approximately 8 percent of the transport cost for SADCC border-crossing traffic, and only 0.55 percent of the value of these commodities.[27/] This may be a reasonable price to pay for an insurance program in the case of corridor closings in the future.

26/ Taking the equivalent annual payment at 10 percent interest for an average 40 year life.

27/ Based on the value of copper (US$2500 per ton) and 7 million tons of border-crossing traffic.

VI. CONCLUSIONS

6.01 The preceding chapters have examined SADCC transport operations in the ten principal transport corridors and concluded that there are certain key factors which are both interfering with the effective operation of SADCC corridors and causing the principal long distance transport operators, the railways, to face a major crisis in financial viability. This situation has arisen despite major corridor development efforts by SATCC in conjunction with national governments and significant investments by the international donor community.

6.02 Although the regional rail system has more than sufficient rail line capacity as noted in Chapter 2, there are still bottlenecks in the present system which lead to longer and more uncertain travel times. In addition the lack of shipper information in the SADCC corridors has compounded the uncertainty problems and further handicapped these transport corridors with respect to the RSA routes. Measures to counteract these problems, such as the formation of the Beira Corridor Authority, have not yet had a significant impact on the corridor system, due in part to external factors that control traffic flows and affect corridor choice by shippers.

6.03 Even with additional corridors open, the situation will not improve substantially for SADCC countries' shippers until (i) corridor management and operating problems are addressed, (ii) the Dar-es-Salaam and other rail-port interface problems are overcome,and (iii) the UNDP/UNCTAD shipper information system is working. It appears particularly important for regional rail systems to reduce their delays and uncertainty factors and improve their operating procedures to better meet shippers' needs.

Corridor Financial Viability

6.04 The main issue in corridor financial viability is the question of railway viability. The present situation shows two of the eight active corridor railways (Zambia and TAZARA) in a position to recover their fixed costs and rolling stock depreciation, but none of the SADCC railways is in a position to recover full costs. As a group, the railways lost US$265 million in 1988/89 operations which amounts to more than 1 percent of the combined SADCC 1988 GDP.[28/] Their return on total gross renewable assets (RORA) was a negative 2 percent, compared with an estimated 10 percent cost of capital.

6.05 The situation for border-crossing traffic alone is somewhat better as shown in Table 22. Overall return on assets is zero rather than negative and system average return on rolling stock is 9 percent rather than 5 percent. Zambia, TAZARA, Zimbabwe and Botswana all have a positive return on rolling stock and the first two have a positive return on total assets for this traffic. With all corridors open, TAZARA will be in worse financial health and CFM and NRZ will be in better health. With improved productivity and all corridors open, all SADCC railways can improve their financial health over the present situation (see Table 22). The financial health of the system as a whole would be improved with cost-based tariffs and an overall RORA of 10 percent could be achieved. However, two railways (Benguela and CFM-N) would not achieve an adequate RORA. TAZARA, Malawi, Zimbabwe, and Botswana railway would benefit with higher tariffs while Zambia, CFM-C and CFM-S would reduce present tariffs and suffer a net drop in financial performance.

28/ Regional GNP is estimated at US$19 billion.

Tariff decreases in these cases are not recommended except possibly in the case of Zambia.[29] If cost-based tariffs are adopted generally in the region Botswana, Malawi and Swaziland Railways would increase their traffic and thereby improve their viability.

Table 22: Return on Assets by Corridor Railways
(border-crossing traffic only)

Railway	Present RORA[a]		Potential RORA[b]	
	R. S.	Total	Short Term	Medium Term
Zambia	33	18	29	34
TAZARA	6	1	3	4
Malawi	n.a.	n.a.	(3)	(3)
CFM-N	n.a.	n.a.	0	1
CFM-C	11	1	8	10
CFM-S	4	(7)	6	8
Zimbabwe	3	(1)	5	7
Botswana	12	0	1	1
SADCC Average	9	2	5	7

RORA = Return on renewable assets.

[a] Present corridors open.
[b] All corridors open and improved productivity, but no tariff increase.

Source: Annex I.

6.06 All SADCC railways need to reduce operating costs, increase traffic, and/or raise tariffs to attain financially viable status. In fact, the best strategy for most railways is to do a combination of the three. However, it is crucial to achieve productivity increases before raising tariffs to cost-recovery levels, in order to avoid a vicious circle of higher costs and traffic losses.

6.07 Rail financial performance with traffic forecasts in the short term future under three scenarios were analyzed in Annex I, showing that three of the regional railways (Zambia, CFM-Centro, and CFM-Sul) could achieve total cost recovery[30] at present tariffs but improved productivity with all corridors open (see Annex I, Scenario 2). Four more railways (TAZARA, CFM-Norte, NRZ, and Botswana) would cover cash costs, while the other three railways would at least recover long run marginal costs without raising tariffs.

29/ Zambia's tariffs for border-crossing traffic are much higher than the other railways, and should be examined to determine if they are driving too much traffic off onto road transport.

30/ Full cost recovery includes full rolling stock maintenance costs.

6.08 The traffic analysis also concluded that (i) the use of cost-based tariffs will not change the traffic pattern significantly, and (ii) the railways would not lose a significant amount of traffic to road transport under either tariff type if productivity gains are achieved.

Railway Productivity and Regional Actions

6.09 Despite their basic position of strength as long-distance haulers, SADCC corridor railways are faced with the following situation:

(a) partial or total closure of some railways for security reasons, with consequent lack of service reliability and high costs;

(b) lowered productivity of rolling stock and labor, resulting in higher operating costs and more capacity limitations on freight and passenger traffic;

(c) lower level of service to shippers than in the past, resulting in a shift of freight from rail to road;

(d) low to negative returns on assets.

This represents a very vulnerable situation for the railways, combined with a financial crisis in some cases, which requires urgent actions.

6.10 A key indicator of the major problems underlying the relatively high operating costs experienced by SADCC railways is the present low locomotive and wagon productivity in several key corridors. The reasons behind this are complex, starting, of course, with the security constraints on five corridor railways (CFM-N, CFM-C, CFM-S, Malawi Railways and CFB). They involve a complex set of shipper and institutional behavior (see Chapter 2), including inefficient corridor operating rules and policies, inadequate maintenance expenditures and workshop performance, unnecessarily time-consuming border formalities and border-crossing train and yard maneuvers, inefficient terminal and port interface coordination and management control, all of which reduce the ability of railways to efficiently handle long distance corridor traffic.

6.11 As a result, the present availability and utilization of the SADCC railways' locomotives and rolling stock is relatively low as shown in Chapter 4. In particular, locomotive availabilities range from 47-70 percent which is substantially below the normal level of 75 to 80 percent which has been attained in other developing countries with efficient repair and maintenance operations, and also by NRZ in the past with newer locomotives. Also, locomotive utilization in terms of the number of km per available locomotive day is only 35-75 percent of achievable levels. Wagon availability and utilization show similar potential for improvement.

6.12 Several types of actions that could improve the situation have been identified by the study team and the participants in the Maputo workshop of December 1989 (see Annex J). These actions include the following most critical steps:

(a) Operational Improvements including greater use of unit trains and through blocking, use of specialized wagons, accelerated implementation of wagon tracking and shipper information systems, scrapping policy improvement, and border-crossing simplification;

(b) Workshop Improvements including improved procedures and preventive maintenance, and possible joint workshops for major repairs and central spare parts depots by manufacturers;

(c) Active System Management Practices including personnel training, improved incentives, implementation of costing systems, monitoring of rolling stock utilization, more strategic and corporate planning and top management training, and more human resources development;

(d) Terminal Operations Improvements including improved coordination procedures between rail and ports; and

(e) Strengthening of the SATCC planning unit to prepare a regional transport policy focusing on financial strategy, and render technical assistance in this area to member railways.

These steps along with the recommendations of the Brazzaville workshop on developing effective railway corporate management, and increased maintenance expenditures are needed to achieve significant productivity increases.

Financial Impact of Productivity Improvements

6.13 The impact of these actions is described in Chapters 4 and 5, including increased locomotive and rolling stock productivity and availability, decreased service time in the corridor and faster turn-around times for rolling stock. The net result with short-term improvements is expected to be 25 to 43 percent lower marginal operating costs per ton-km and 35 to 50 percent lower ownership costs of rolling stock, since fewer locomotives and wagons wili be required for the same freight tonnage.[31/] There are two types of impacts of improved productivity on railway financial performance: reduction in operating costs and increased return on assets.

6.14 The operating cost impacts of specific types of improvements in railway operations and management are summarized in Table 23. This shows that annual cost savings of US$85 million are possible in the SADCC railway system, for international traffic alone. The most significant action is to increase productivity of locomotives and rolling stock, which has the potential to reduce total operating costs by 22 percent. Other actions to increase average wagon loads and decrease the number of locomotives per train (e.g with loco banking) also show significant cost savings potential. The remaining two thirds of the present regional losses of US$ 265 million must be made up by tariff increases to reach financial sustainability.

31/ See Annex D. Medium- to long-term improvements are even larger.

Table 23: Potential Cost Savings from Railway Productivity Improvements
(Border-Crossing Traffic Only)
(US$ mil)

	Operating Costs			Other Cost Savings		Total
	Present	Short-Term[a/]	Cost Savings	Train Load[b/]	Long-Term[c/]	Cost Savings
Zambia	34.9	29.0	5.9	1.8	1.8	9.5
TAZARA	53.1	40.1	7.0	5.8	2.0	14.8
CFM-Centro	8.6	7.4	1.2	0.9	0.4	2.5
CFM-Sul	12.0	10.7	1.3	0.2	0.2	1.7
NR Zimbabwe	99.9	72.2	27.7	8.8	1.8	38.3
Botswana	18.0	15.9	2.1	1.9	0.3	3.3
Swaziland	21.1	17.2	3.9	3.0	1.5	8.4
Total	247.6	192.5	55.1	22.4	8.0	85.5

Note: Results differ slightly from Annex I, Scenario 1 which uses forecast traffic rather than present traffic. See Annex I Scenario 2 for results with all corridors open.

a/ Improvements to loco and wagon productivity alone.
b/ Twenty percent increase in average wagon loading, greater gross training tons per train and maximum use of banking locos.
c/ Further productivity increase for locos and wagons.

Source: Annex I, Scenario 0 with improvements.

6.15 Complementary actions not included in the locomotive and rolling stock productivity analysis shown above would also have a positive impact. A more active scrapping policy will decrease yard and workshop congestion while generating foreign exchange income. When intermediate classification stops are eliminated and more through blocking and unit trains are introduced or expanded, there will be a reduction in delay times and uncertainty and shippers will develop more confidence in the SADCC corridor transport system. The usefulness of many corridors for shippers and freight forwarders will also increase if they can identify the location of their shipments through a freight tracking system. Wagon tracking as part of the UNDP/UNCTAD system has already demonstrated benefits for rail operators.[32/]

Impact of Productivity Improvements on Return on Assets

6.16 The impact on two measures of return on assets was calculated below:

32/ In Malawi tank wagon turn around time has decreased from 5 to 2.5 days as a result of its initial application.

(a) return on gross fixed assets in rolling stock (locomotives and wagons), where the operating costs exclude the fixed operating costs, interest and the depreciation of the permanent way;

(b) return on total renewable assets (rolling stock plus the renewable portion of permanent way, plant and equipment) where operating costs include depreciation of renewable assets only and excludes interest.

Table 24: Return on Assets With and Without Productivity Improvements
(border-crossing traffic only - with present tariffs)

Railway	Return on Rolling Stock			Return on Renewable Assets		
	Present	Improved		Present	Improved	
		Short	Long		Short	Long
ZR	15	42	97	11	24	35
TAZARA	12	29	53	2	4	7
CFM-C	(2)	13	68	(4)	6	5
CFM-S	(2)	29	30	(5)	8	(9)
NRZ	4	10	23	1	4	7
BR	20	2	56	(2)	0	4
SADCC Average	9	22	45	4	9	10

Note: Negative figures are shown in brackets

Source: Annex D, Part II.

6.17 Under present conditions for border-crossing traffic operations the average return on rolling stock (excluding other assets) is 9 percent and return on total gross renewable assets (priced at replacement value) is 4 percent. However, with productivity improvements in the short and long term described above, significant impacts can be achieved on ROA for both rolling stock and renewable assets. Even at present traffic levels and tariffs, the average return on renewable assets could reach 9 percent for presently operating railways with short term improved productivity. This return on assets is almost equal to the cost of capital, which is estimated at 10 percent. Higher returns approximating 10 percent on total renewable assets with all corridors open for each railway (except Zambia) will require tariff increases as well as productivity improvements in the short term (see Table 25).

Table 25: Tariff Increases Needed if Short-Term Productivity Goals are Achieved (Border-Crossing Traffic Only)

Railway	Present Tariffs UScents/tkm	Scenario 1[a] UScents/tkm	Scenario 1[a] %Over	Scenario 2[b] UScents/tkm	Scenario 2[b] % Over	Scenario 3[c] UScents/tkm	Scenario 3[c] %Over
CF Benguela	1.9[d]	n.a.	n.a.	3.4	79	5.0	187
Zambia	6.5	3.3	-	3.0	-	3.4	-
TAZARA	2.1	2.3	10	2.2	5	2.4	14
Malawi	3.0[d]	n.a.	n.a.	5.5	65	6.4	113
CFM-N	4.0	n.a.	n.a.	5.1	28	6.0	150
CFM-C	4.1	5.8	42	4.9	20	5.7	139
CFM-S	8.5/3.6[e]	12.5	47	3.5	-	4.1	14
NRZ	2.5	3.1	24	3.1	24	3.2	28
Botswana	3.1	4.3	39	3.9	26	4.5	44
Swaziland	3.5	6.3	80	4.8	37	6.5	86
Average	3.0	3.7[f]	23	3.6[f]	20	3.8[f]	27

Note: Tariff increases are calculated as the total operating cost without interest plus 10 percent of renewable assets divided by the forecast traffic in ton-km.

a/ Scenario 1 is the present corridor open and traffic assigned according to present tariff structure.
b/ Scenario 2 is for all corridors open and traffic forecast for present tariff structure.
c/ Scenario 3 is for all corridors open and traffic forecast for cost-recovering tariffs.
d/ Benguela and Malawi have not updated their present long-distance tariffs due to lack of traffic.
e/ 8.5 for Swaziland traffic and 3.6 for Limpopo line.
f/ With Zambian tariff unchanged.

Source: Annex I.

6.18 The differences between the railways in return on assets are relatively large, and so are the returns for increased productivity. The railway with the highest productivity at present (Botswana) is expected to benefit the least from a productivity increase. On the other hand, CFM would benefit enormously even in the present security situation.

6.19 The size of the SADCC railway assets involved (US$6.9 billion), is equivalent to a large multinational investment company such as Lonrho, and these should be treated with the same care as a multinational company would give to ensure the best return. Since these railway assets also represent a significant proportion of total SADCC government assets, they should receive closer attention by SADCC financial managers than they have in the past.

Conditions for Viable Corridors

6.20 In summary, the principal condition for creating financially viable corridors is to allow each of the corridor railways to perform to the maximum extent possible as a business, with the objective of achieving at least a 10 percent return on renewable assets, priced at replacement value. This will require the following actions:

(a) providing autonomy to the railways' managements to operate as commercial entities, with clearly defined and annually measured accountability in the managing of each type of asset;

(b) allowing the railways to raise tariffs to cost-recovery levels (an average of 33 percent to cover long-run marginal costs and fixed costs, plus 10 percent return on renewable assets, with improved productivity);

(c) improving rail operational efficiency, management and human resources through the actions listed in the strategic action matrix (Figure IV), (short-term goals of 22 percent reduction in operating cost per ton-km or in the case of CFM and Malawi Railway, 2-2.7 UScents per ton-km long-run marginal operating costs);

(d) creating an effective shipper and wagon information system; and

(e) improving the port-rail interface in each SADCC port.

Only in this way will the SADCC corridors become more efficient and more financially viable.

6.21 It is absolutely essential for SADCC corridor railways to focus first on improving productivity and level of service before raising tariffs to the level associated with cost recovery. Great care must be taken by the railways to avoid a vicious circle condition where tariffs are increased without an increase in level of service. This would only drive traffic off the railway while financing inefficient operations. Each year would worsen the situation as greater and greater tariff increases are needed to compensate for lower traffic volumes.

6.22 Specific objectives recommended for each corridor railway are given in Table 26 below. The tariff strategy of each railroad should be oriented to a short-term future combination of traffic levels, productivity increases and 10 percent return on renewable assets (see Table 26, column 8). Tariff increases should be phased in following productivity increases to achieve maximum railway financial viability in order to avoid loss of traffic to road transport.

6.23 Specific priority actions recommended for each group of decision-makers in the region are summarized in Figure IV below. These actions are oriented to regional transportation coordinating authorities, government transport policy makers, and railway managers. It is essential for the future viability of the SADCC transport corridors that these actions be carried out as soon as possible. They will address all the important but hidden causes of the present financial crisis and provide significant potential savings to those governments and railway managers that take the initiative. There are no short cuts to the tasks involved, but the effort will reward the railway companies, the shippers and the national economies of the SADCC region.

Table 26: Recommended Railway Objectives
(Border-Crossing Traffic Only)

Railway	Locomotive Management				Wagon Management			Freight Traffic[b] (mil/tkm)	Tariff Increases for Border-Crossing Traffic with Improved Productivity
	Availability		Utilization[a]		Availability (percent)	Utilization[a]			
	Short-Med Term (%)	Med-Long Term (%)	Short-Med Term (km)	Med-Long Term (km)		Short-Med Term (km)	Med-Long Term (km)		
Benguela	75	85	430	600	90	200	250	250	79
Zambia	75	85	400	500	90	80	100	1,800	0
TAZARA	75	85	430	630	90	200	250	1,700	5
Malawi	75	85	300	400	90	80	100	250	65
CFM-N	75	85	400	500	90	90	120	100	28
CFM-C	75	85	350	470	90	80	100	450	20
CFM-S	75	85	450	600	90	100	130	500	0
Zimbabwe	75	85	500	550	90	90	100	5,700	24
Botswana	75	85	430	470	90	200	250	1,000	26
Swaziland	75	85	350	470	90	80	100	250	37

[a] Km per available day minimum.

[b] Short term with all corridors open and cost-based tariffs (Scenario 3).

[c] To achieve 10% return on renewable assets or an operating ratio of 80 with improved productivity and assets priced at replacement costs (based on Scenario 2).

ACTION MATRIX

A. ACTIONS UNDER REGIONAL COOPERATION

AREA	PRODUCTIVITY ELEMENT	ACTION ELEMENTS
REGIONAL COOPERATION (RC)	INFORMATION SHARING (RC1)	i. FINALIZE AND IMPLEMENT A REGIONAL SHIPPER INFORMATION SYSTEM ii. DEVELOP AND IMPLEMENT RELATED RAILWAY WAGON TRACKING SYSTEMS iii. DEVELOP SYSTEMS FOR SHARING RAILWAY SPARE PARTS INVENTORY INFORMATION iv. DEVELOP PROCEDURES FOR RAIL-PORT TRAFFIC INFORMATION EXCHANGE
	FACILITIES SHARING (RC2)	i. DEVELOP COMMON FACILITIES FOR MAINTENANCE AND MANUFACTURE ii. DEVELOP COMMON TRAINING INSTITUTIONS FOR SPECIALIZED TRAINING iii. DEVELOP STAFF-SHARING ARRANGEMENTS BETWEEN RAILWAYS (SADCC AND OTHER)
	STANDARDIZATION (RC3)	i. DEVELOP COMMON STANDARDS FOR TRACK, MOTIVE POWER, ROLLING STOCK AND MAINTENANCE EQUIPMENT ii. SIMPLIFY AND STANDARDIZE PROCEDURES FOR BORDER-CROSSING TRAFFIC
	ORGANIZATION (RC4)	i. ESTABLISH A SATCC TECHNICAL ASSISTANCE UNIT FOR RAILWAY MANAGEMENT, FINANCIAL STRATEGY AND REGIONAL COORDINATION AND DEVELOP SATCC TECHNICAL CAPABILITY TO SUPPORT THE UNIT ii. CREATE CORRIDOR OPERATING AUTHORITIES OR THROUGH TRAIN FACILITATION UNITS BETWEEN COUNTRIES iii. CREATE CORRIDOR PORT-RAIL COORDINATION UNITS OR COMMITTEES
	STUDIES (RC5)	i. STUDY PRESENT RESTRICTIONS ON RAILWAY MANAGEMENT AUTONOMY AND TARIFF SETTING ii. REPORT ON SUCCESSFUL RAIL OPERATIONS TECHNIQUES TO IMPROVE REGIONAL RAILWAY PRODUCTIVITY iii. STUDY REQUIREMENTS FOR REDUCING DUPLICATE RAIL YARDS AND BORDER-CROSSING PROCEDURES FOR THROUGH TRAINS iv. STUDY CORRIDOR ROAD TRANSPORT POLICY TO FACILITATE TRAFFIC

ACTION MATRIX (continued)

B. ACTIONS UNDER GOVERNMENT CONTROL

AREA	PRODUCTIVITY ELEMENT	ACTION ELEMENTS
GOVERNMENT POLICY AND ASSISTANCE (GP)	GOVERNMENT POLICY (GP1)	i. BASE TARIFF POLICY ON FULL RECOVERY OF COSTS AND ADEQUATE RETURN ON INVESTMENT FOR AN OPTIMIZED SYSTEM ii. GIVE ADEQUATE MANAGEMENT AUTONOMY TO THE RAILWAY MANAGEMENT, ALLOWING THE OPERATIONS TO BE RUN ON COMMERICAL LINES WITH CLEARLY DEFINED ACCOUNTABILITIES FOR THE MANAGERS MEASURED ANNUALLY iii. CREATE AN INTEGRATED AND CLEAR TRANSPORT POLICY iv. RATIONALIZE COST STRUCTURES TO AVOID HIDDEN SUBSIDIES TO ANY TRANSPORT SUBSECTOR AND THUS PROMOTE INTERMODAL COMPETITION v. PERMIT RELEASE OF SURPLUS RAILWAY STAFF vi. PERMIT RAILWAYS TO INTRODUCE PERFORMANCE-RELATED PAYMENT SYSTEMS
	GOVERNMENT ASSISTANCE (GP2)	i. ENSURE TIMELY RELEASE OF NECESSARY FOREIGN EXCHANGE FOR MAINTENANCE AND EQUIPMENT PURCHASE TO BOTH RAIL AND ROAD TRANSPORT SECTOR ii. APPOINT RAILWAY BOARDS WITH PROFESSIONALS AND ENSURE ACCOUNTABILITY
	GOVERNMENT LEGAL AGREEMENTS (GP3)	i. DEVELOP BILATERAL THROUGH TRAIN OPERATION AGREEMENTS ii. ADOPT BILATERAL TRAIN BORDER-CROSSING FACILITATION AGREEMENTS iii. CREATE LEGISLATION TO SUPPORT ABOVE NATIONAL POLICY CHANGES, WHERE NECESSARY iv. ADOPT LEGISLATION NEEDED FOR DRY PORT IMPLEMENTATION, WHERE FEASIBLE

ACTION MATRIX (continued)

C. ACTIONS UNDER RAILWAY CONTROL

AREA	PRODUCTIVITY ELEMENT	ACTION ELEMENTS
TARIFF RESTRUCTURING (TR)	TARIFF SETTING (TR1)	i. SET TARIFFS TO ENSURE FULL RECOVERY OF COSTS AND ADEQUATE RETURN ON INVESTMENT FOR AN OPTIMIZED OPERATING SYSTEM ii. FIX SHUNTING CHARGES TO PROVIDE INCENTIVES FOR ACCEPTANCE OF BLOCKS OF WAGONS iii. DEVELOP A BASIS FOR ADJUSTMENT OF TARIFFS TO ACCOUNT FOR INFLATION AND CURRENCY DEPRECIATION
COST REDUCTION (CR)	BUDGET CONTROL (CR1)	i. EXERCISE STRICTER BUDGETARY CONTROL TO DECREASE BOTH FIXED AND VARIABLE COSTS ii. REDUCE COSTS ON STAFF, SPACE, EQUIPMENT AND MATERIALS COMMENSURATE WITH PRODUCTIVITY IMPROVEMENTS TO REALIZE SAVINGS POTENTIAL
	INVESTMENT ANALYSIS (CR2)	i. USE ECONOMIC AND FINANCIAL ANALYSIS AS THE BASIS FOR INVESTMENT DECISIONS ON BOTH CAPACITY-SUSTAINING AND CAPACITY-BUILDING PROJECTS
HUMAN RESOURCE MANAGEMENT (HRM)	PERFORMANCE-RELATED PAYMENT SYSTEMS (HRM1)	i. STUDY IMPROVEMENTS IN PERSONNEL PERFORMANCE SYSTEM DESIGN ii. RELATE A PART OF LABOR PAYMENTS TO INDIVIDUAL, GROUP OR SYSTEMS PERFORMANCE iii. COMMENCE IMPLEMENTATION OF IMPROVED SYSTEMS IN CRITICAL AREAS SUCH AS LOCO MAINTENANCE AND OPERATIONS iv. SET PERFORMANCE NORMS USING BEST PAST PERFORMANCE OR BEST REGIONAL PERFORMANCE v. ANALYZE EQUIPMENT CAPACITY AND OTHER RAILWAYS EXPERIENCE AND WORK MEASUREMENT TECHNIQUES
	STAFF RATIONALIZATION (HRM2)	i. IDENTIFY AREAS OF MANPOWER SHORTAGES AND SURPLUSES BASED ON PERFORMANCE NORMS AND TRAFFIC FORECASTS ii. IMPLEMENT PLANNED REDUCTION OF STAFF IN SURPLUS AREAS iii. RECRUIT AND TRAIN STAFF IN AREAS OF SHORTAGE
	SKILL UPGRADING (HRM3)	i. REVIEW AND REFINE EXISTING TRAINING PROGRAMS ii. DEVELOP NEW TRAINING PROGRAMS TO MEET NEEDS iii. CREATE SPECIALIZED TRAINING PROGRAMS IN COSTING, WORK STUDY, TARIFF STRUCTURING, TRANSPORT PLANNING, MAINTENANCE MANAGEMENT, MATERIALS MANAGEMENT AND BUSINESS DEVELOPMENT

ACTION MATRIX (continued)

C. ACTIONS UNDER RAILWAY CONTROL (continued)

AREA	PRODUCTIVITY ELEMENT	ACTION ELEMENTS
SYSTEMS DESIGN AND STANDARDS (SD)	SYSTEM DESIGN (SD1)	i. IMPROVE TRAIN OPERATING SYSTEMS BASED UPON COMMODITY ORIGIN-DESTINATION PATTERNS AND PROGRESSIVELY INCREASE THE SHARE OF UNIT, BLOCK, THROUGH AND SPECIALIZED TRAINS ii. IMPROVE YARD OPERATING SYSTEMS USING WELL-DEFINED OPTIMIZING CRITERIA iii. IMPROVE OPERATING SYSTEM INFORMATION SYSTEMS iv. IMPROVE MANAGEMENT INFORMATION SYSTEMS v. DEVELOP AND IMPLEMENT MATERIALS MANAGEMENT SYSTEMS vi. DEVELOP AND IMPLEMENT STRATEGIC PLANNING SYSTEMS vii. IMPLEMENT STANDARD COSTING SYSTEMS
	STANDARDIZATION (SD2)	i. IMPLEMENT AXLE LOAD DESIGN FOR 18.6 TONNES AND CORRESPONDING STANDARDS FOR TRACK, LOCOMOTIVES AND ROLLING STOCK ii. USE WELDED RAILS FOR TRACK REPLACEMENT iii. IMPLEMENT STANDARDIZED PASSING LOOP LENGTH iv. PURCHASE SPECIAL PURPOSE WAGONS WHERE ECONOMICALLY AND FINANCIALLY FEASIBLE, FOR OIL, MINERALS, CATTLE, ETC. (USING PRIVATE CAPITAL WHERE POSSIBLE)
OPERATIONS MANAGEMENT (OM)	LOCOMOTIVE AVAILABILITY (OM1)	i. PLAN REHABILITATION OR REBUILDING OF SET ASIDE LOCOMOTIVES ii. PLAN LIQUIDATION OF MAINTENANCE ARREARS iii. LINK ALL REHABS AND OVERHAULS TO IMPROVED PERFORMANCE TARGETS iv. REVAMP SPARE PARTS MANAGEMENT SYSTEMS v. IMPROVE MAINTENANCE PROCESSES THROUGH MAINTENANCE AUDITS vi. CLOSELY MONITOR TIME SPENT ON MAINTENANCE vii. INTRODUCE QUALITY ASSURANCE SYSTEMS, INCLUDING INVESTMENT ON EQUIPMENT WITH A VIEW TO IMPROVED RELIABILITY
	LOCOMOTIVE UTILIZATION (OM2)	i. IMPROVE TRAIN PLANS WITH PROGRESSIVELY INCREASING SHARE OF BLOCK, THROUGH, AND UNIT TRAINS ii. INCREASE YARD FLEXIBILITY BY REMOVAL OF SCRAP WAGONS FROM YARDS iii. SET AND ENFORCE REGULATIONS FOR WAGON LOADING AND UNLOADING TIMES iv. CREATE FUELING AND CREW CHANGE FACILITIES IN THE YARDS v. RATIONALIZE TRAIN EXAMINATION PATTERNS vi. ENSURE HIGH LEVEL OF LOCO RELIABILITY THROUGH STRICT ADHERENCE TO MAINTENANCE PLANS vii. USE OPTIMIZING CRITERIA FOR YARD SHUNTING OPERATIONS, SUCH AS LAST IN-FIRST OUT, PRIORITY FOR EXPENSIVE, SPECIAL-PURPOSE AND LONG DISTANCE WAGONS

ACTION MATRIX (continued)

C. ACTIONS UNDER RAILWAY CONTROL (continued)

AREA	PRODUCTIVITY ELEMENT	ACTION ELEMENTS
	PAYLOAD PER TRAIN (OM3)	i. PREPARE COMMODITY RELATED AND WAGON TYPE RELATED PAYLOAD CHARTS ii. SET TARIFFS TO ENCOURAGE OPTIMAL WAGON LOADING iii. PROVIDE WAGON WEIGHING FACILITIES WHERE NEEDED iv. CARRY OUT REGULAR SPOT CHECKS ON WAGON LOADING v. ASSIGN MOST APPROPRIATE WAGONS FOR DIFFERENT COMMODITIES
	TRAILING LOAD PER TRAIN (OM4)	i. REASSESS LOCOMOTIVE HAULING CAPACITY ii. REASSESS LOOP LENGTH CONSTRAINTS ON TRAIN LENGTH AND PLAN INCREASE IN LENGTH OF CONSTRAINING LOOPS iii. REASSESS TRAILING LOAD LIMITATIONS DUE TO STEEP GRADIENTS AND CONSIDER USE OF BANKING LOCOS iv. REASSESS PROCEDURES FOR FINALIZING TRAILING LOADS IN YARDS

SADCC Transport Corridors

Study of Financial Strategy

Network Data

(Annex A)

Part I. Physical Description of the Network

Part II. Rail and Port Capacity Calculations

Part III. Network Description for Modelling

Part IV. Tariff and Travel Time

Part V. Road Use Cost and Road Use Charges

Annex A

Part I

Physical Description of the Network

PHYSICAL DESCRIPTION OF THE NETWORK

Following is a brief description of the SADCC transport network by country.

The Angolan Transportation System

Ports. Angola has three major ocean ports: Lobito, Luanda, and Mocamedes. Of these, only Lobito is considered within this regional analysis because it is connected by road and rail to Zaire and Zambia.

Lobito can handle general cargo (1.2M tonnes), dry bulk (0.5M tonnes) and liquid bulk (1.0M tonnes). Current demand on the port, however, is far below capacity as a result of very limited traffic from the Benguela Railway.

Railway. The 1,340 km Benguela Railway which connects to Zaire and Zambia has the theoretical capacity of handling 7M tonnes/year. However, actual capacities are lower due to poor track conditions, limited rolling stock, and the debilitating impact of insurgent raids on the line. The line has been open to transit traffic for only a few weeks since 1975.

Road. The road system in Angola is not developed to serve regional traffic. There are proposed roads to connect with Zambia, which are presently only tracks and are not likely to be developed in the foreseeable future.

The Botswana Transport System

Ports. Botswana is landlocked and has no seaports. However, it is a member of the South African Customs Union which facilities its use of Republic of South Africa (RSA) transport system and ports. It is serviced primarily by Johannesburg City Deep, Durban, East London, and Cape Town, 450 km, 1,285 km, and 1,540 km, respectively, from Gaborone.

Botswana also has access to the Mozambique port of Maputo through the South African rail system but has traditionally seldom utilized it.

Rail. The north-south Botswana Railroad is a branch of the trunk rail link between Zambia and Zaire and the RSA ports. In addition to local Botswana traffic, it handles transit traffic for Zaire, Zambia, and Zimbabwe. Management of this railway has been recently taken from NRZ.

A rail link across the Kalahari Desert, connecting Botswana with the Namibian rail network, has been proposed for potential future large-scale coal shipment. However, this link does not appear to be under serious consideration at the present time.

Ferry. The Kazungula Ferry is a significant connection with Zambia to the north, on a road route which bypasses Zimbabwe.

Road. There are road links to and from Zimbabwe and Zambia which carry import/export traffic and South African traffic for these two countries as well as Malawi. A trans-Kalahari road link is also under consideration.

The Malawi Transport Network

Ports. Malawi is landlocked. The transport is dependent on Mozambican, Tanzanian, and South African ports.

Rail. The railways in Malawi have been well established since colonial times, and connect to two Mozambique ports (Beira and Nacala). The railway is relatively efficient but handicapped at present due to the loss of access to Beira (see description below for Mozambique). A short rail extension from Mchinji to Chipata has been proposed, but it lacks financing.

Road. Two major international roadways connect with Zambia via Chipata and with Zimbabwe (Harare) via Tete in Mozambique. A new alignment for the road to Harare has been recently constructed to the Mozambique border. Also the north-south corridor through Malawi has been improved to handle traffic with Tanzania and export traffic via Dar-es-Salaam. This connection with the Tanzam Highway and the TAZARA Railroad at Mbeya has only recently been opened for international trade.

The Mozambique Transport System

Ports. Mozambique plays a major role as a regional transit center with three ports which belong to the regional system. These are Maputo (including Matola), Beira, and Nacala. These ports serve Malawi, Zimbabwe, Swaziland, and part of South Africa.

The best of these ports technically is Nacala which has a natural deep water harbor. Recently the port has received substantial international investment capital for container traffic to Malawi to compensate for lack of access from Malawi to Beira.

The port of Beira has served as a regional port for half a century. It is situated at the mouth of a river which has an 8.5M channel, limiting ship size to 30,000 tons. The port infrastructure and rail links are under major reconstruction. The port also serves as a major oil and sugar terminal.

Maputo is the capital of the nation as well as a port. It has served regionally as the terminus of three rail lines (from Zimbabwe, Swaziland, and RSA), and the Matola side of the port has supported bulk iron ore shipments. The port is now functioning well below capacity as much of the inland access is cut off by insurgent activities.

Rail. The three Mozambique railway systems are CFM-Sul, CFM-Centro, and CFM-Norte. Maputo is the base of CFM-Sul, which consists of three branch lines, the 74 km Goba line to Swaziland, the 88 km Rassano Garcia line to South Africa and the 534 km Limpopo line to Chicualacuala on the Zimbabwe border.

The CFM-Centro is composed of the 319 km Beira-Dondo to the Machipanda section, which connects with the NRZ system and the 335 km long stretch, Dondo-Sena-Vila Nova de Fonteira, connecting with the Malawi railways. A track upgrading and repair work project is underway on the Beira-Machipanda line, which is to be completed by mid 1992. Similarly another project on track upgrading between Dona-Vila Nova is expected to be completed by the beginning of 1993. At Dona Ana, the Moatize line of 354 km branches off, providing a connection between the Moatize coal mines (not presently in operation) and Beira.

The CFM-Norte is composed of a 615 km line between Nacala and Entre Lagos on the Malawi border, and a spur to east of Lake Malawi.

These three systems are physically isolate from one another, although connections are possible through Malawi and Zimbabwe.

Road. Although the Mozambique road network is extensive, it is not considered here, because it is still not fully developed for international traffic. Consequently, Mozambique policy requires that transit traffic to and from neighboring countries by railborne.

The Swaziland Transport Network

Although Swaziland is landlocked, the country is well-connected to the regional transport system by road and rail. Its non-South African exports are shipped mainly via the port of Maputo.

Road. The main road is the road from Mbabane to the industrial center of Matsapha, which then leads on to Maputo and branches south to enter South Africa.

The road from the Mozambique border toward Matsapha has been improved to a 2-lane paved standard road. Rehabilitation of the continuation of this road from Namaacha and Maputo was completed in 1986.

Rail. The railway from Kadake to Siweni links into Mozambique. The Swazi rail system is also linked to the South African system via the so-called Southern Link between Phuzomoya and Lavumisa. Construction of the Northern rail link, connecting the existing system at Mpaka with the South African system via Border Gate and Komatipoort, was completed in 1986. As part of the Northern link the Mpaka-Phuzomoya section of the existing system was also upgraded.

The Tanzania Transport Network

The major components of the Tanzanian transport network that interest the Southern African Regional are the port of Dar-es-Salaam, the Tanzam Highway and the TAZARA Railroad.

Port. The four international ports are Tanga, Dar-es-Salaam, Zanzibar and Mtwara, of which only Dar-es-Salaam is of regional importance. Dar-es-Salaam port serves traffic originating/terminating in Zambia, Malawi, Burundi, Rwanda, eastern Zaire, and Uganda. The port is presently experiencing major constraints due to management difficulties.

There is an ongoing port rehabilitation project and a container terminal was completed in 1989. A project to further modernize the port is under implementation.

Road. The 925 km Tanzam Highway extends between Dar-es-Salaam and Tunduma on the border with Zambia. This road which is paved throughout carries in addition to local traffic, a substantial amount of transit traffic to and from Zambia. Parts of the Tanzam Highway are in need of rehabilitation and there is an ongoing project to carry this out on major sections.

Rail. The only railway line belonging to the SADCC regional system is the TAZARA, which over a distance of 975 km, links Tunduma with Dar-es-Salaam. This railroad serves Zambia and, to some extent, Zaire. The line capacity of the TAZARA has been calculated at 9 million tonnes. The present capacity is, however, much lower (on the order of 0.7 million tonnes in each direction). This is, inter alia, because of less than full productive use of locomotives and wagons. Present SATCC programs are in progress to improve management and acquire locomotives which will increase capacity to 2 million from 1990 onward.

The Zambian Transport Network

Zambia is a freight exporter of the landlocked countries of Southern Africa and has the most potential transport corridors to the ocean. The major arteries used for transporting goods into and out of Zambia are the following:

Rail. Zambia Railway, which comprises approximately 2,000 km of rail line, has a main line which runs from Livingstone in the South to Sakania on the border with Zaire. In the south this railway connects with the NRZ providing access to Beira and Maputo in Mozambique and all South African ports.

In the north, it connects with SNCZ to Zaire, through which it links up with the Benguela Railway through Angola to the port of Lobito. The current Zambia Railway capacity is 13M tonnes.

The Zambia Railway provides the TAZARA with its only access to most of Zambia's principal traffic centers. Botswana, Zimbabwe, Mozambique, and RSA can be reached by rail from Zambia. The TAZARA joins the Zambia Railway at Kapiri Mposhi to give access to Dar-es-Salaam in Tanzania.

Road. The Tanzam Highway, which runs parallel to TAZARA, also provides access to the sea. It is paved throughout but is in need of rehabilitation currently being carried out under an ongoing project.

The Great Eastern Road form Lusaka to Katete and Chipata. At Katete it connects with a new road into Mozambique to Moatize, where it meets with the railway line to Beira. From Chipata, the road continues to Mchinji on the Malawi border where it connects with the Malawi Railway line, eventually reaching Nacala and Beira.

The road from Lusaka to Harare is the main road link with Zimbabwe. This road can also be used to reach the NRZ railhead at Zawi (northwest of Harare), thereby obtaining rail access to the ports at Beira, Maputo, and RSA.

The Great Southern Road to Livingstone provides access to South Africa via either Botswana or Zimbabwe. Zambia is also linked to Botswana via the ferry at Kazungula. A future link to Angola has been proposed via Kaoma and Chavuma, but this is not expected to be constructed in the near future.

Zimbabwe's Transport Network

Zimbabwe is also a landlocked country; it has the best developed transportation system of the SADCC countries.

Rail. The National Railroad of Zimbabwe (NRZ) forms an interconnecting system with railroads of five surrounding countries. Once the best run railroad outside of South Africa, it has undergone several changes of staff and there are now clear signs of reduced efficiency.

The NRZ includes the following corridors:

(a) The rail line from Somabula via Harare to Mutare connecting with CFM-Centro to Beira,

(b) The railway from Somabula via Harare to Chicualacuala connecting with CFM-Sul to Maputo,

(c) The railway from Somabula via Harare to Beitbridge connecting with SATS and South African ports,

(d) The railway via from Somabula via Harare to Botswana connecting with SATS and South African ports, and

(e) The railway from Bulawayo to Victoria Falls linking with Zambia, Zaire, and Tanzania.

Because of insurgency problems which has all but closed the Limpopo line between Chicualacuala and Maputo, overseas traffic via Maputo has also been routed by rail via Komatipoort in RSA and Beitbridge to or from Zimbabwe.

Road. Zimbabwe also has an extensive road system which is used to serve regional transport demand. The road to Beitbridge, and Messina, and then normally by rail to South African ports is well used by truckers, who may then take transit cargo on to Zambia or Malawi.

Connections to Zaire

There are primarily two provinces in Zaire of relevance to the SADCC regional transport network, Kivu and Shaba. Kivu, in the eastern part of the country, utilizes three routes to the sea, one via Uganda and Kenya to Mombasa port, another via Kalemie on Lake Tanganyika and Kigoma to Dar-es-Salaam, and a third domestic route called Voie Nationale. The Voie Nationale is a rail-riverboat-rail combination to the Zaire port of Matadi near the estuary of the Zaire River.

Shaba, the southernmost province, has available a number of routes including the Voie Nationale, Benguela Railway (CFB) to Lobito, the Zambia Railway (ZR) and Zimbabwe's NRZ connecting to most ports in Southern African, the ZR and TAZARA Railway route to Dar-es-Salaam, and Zaire's own railway to Kameli on Lake Tanganyika, and then Tanzania Railway (TRC) from Kigoma to Dar-es-Salaam.

Annex A

Part II

Rail and Port Capacity Calculations

Table A.1: MAJOR SADCC CORRIDOR RAILWAY LINE CAPACITY

Railway Line	Length (km)	Max. axle load (t)	Max speed kmh	Train length (wagons)	Capacity (mil tons)
TAZARA (Dar es Salaam-Kapiri Mposhi)	1,860	20	70	37	9
CFM-N (Nacala-Nayuci)	625	16-20	80-100	40	9
CFM-C Sena line (Villa Nova de F. - Beira)	440	16	60	28	6
CFM-C Beira line (Biera-Machipanda)	319	18-20	60-80	28	9
CFM-S Limpopo line (Chicualacuala-Maputo)	534	20 *	60-80 *	35	>6 **
CFM-S Goba line (Maputo-Mpaka)	75	18-20	50-70	50	6
Zambia Railways (Ndola-Victoria Falls)	810	15-17	60-80 ***	32	13
Botswana Railway (Mafeking-Ramokgwebana)	650	18.6	90	26	8
Harare-Bulawayo	475	18.6	60-90	47	18
Bulawayo-Beitbridge	556	18.6	60-90	47	18
Komatiport-Mpata	93	20	80	60	13
Beneguela line (Lobito-Dilolo)	1,303	20	60-80	33	7

* after rehabilitation
** could be increased to 10 m. tons by reactivating passing loops
*** upto 120 kmh for passenger trains

Source: IBRD, SADCC Transport Corridors, Study of Financial Strategy, Working paper 2, August 28, 1989

Table A.2: MAJOR SADCC CORRIDOR PORT CAPACITY

	SADCC				RSA		
	Maputo &	Matola	Beira	Nacala	Dar	Lobito	Durban
Quaylength (m)							
General cargo &	2690 a)	-	1120 b)	530	1470	920	8000
Containers (# gantry's)	250 b)	-	250 c)	200 d)	550	-	1580
Bulk sugar	180	-	-	-	-	-	180
Bulk ores/coal	180	210	160	-	-	180	1400
Pol. # berth	-	2	1	1	1	1	na.e)
Coastal	"	-	-	-	350 f)	150	-
Max shipsize	30.000/ 50.000	60.000 50.000 g)	20.000/	30.000	30.000/ 50.000	20.000 m)	60.000
Max throughput capacity (10 MT)							
Gen. Cargo & MP	3.6		1.6	0.7	2.1	1.2 h)	13.0
Containers	0.7		1.0	0.3	1.2	-	9.0
Bulk	2.0	2.0/7.0i)	1.2	-		0.5	8.0
Pol (m^3)	-	4.0	3.0	0.5	3.0	1.0	n.a.
Actual throughput 1987/1988 (10^6 portton)							
Gen. Cargo & MP	1.5	-	0.9	0.2	1.3	0.4	11.4
Containers	0.1	-	0.1j)	0.0	0.7	0.0	7.1
Bulk	0.6	0.3	0.0	-	0.0	0.0	5.5
Pol	-	0.2	0.9	0.1	1.9	0.1	n.a.
Scenario 1 traffic forecast (1000 MT) (excl. POL)	2700	350	1750	350	2150	750	
Occupancy (%)	45	-	65	35	65	55	
Average prod. T/day (90)							
Breakbulk Gen. Cargo	440		480	450	450	510h)	
Bags	640		840	-	900	740h)	ca. 1000
# Ships/year (87/88) (incl. coastal sh.)	710		390	150	950	280	2400k)

..... continued in next page

a) Incl. one berth with heavy lift capacity for metals.
b) 660 m new quay under construction, available from '91 onwards.
c) Remaining length of new quay (see b) counted on MP quay.
d) Remain. length of quay (without gantry access) counted as MP quay.
e) Oil berth in Durban outside port area.
f) Under rehabilitation now (lighterwarf and Belgian warf).
g) 50,000 T after completion of channel dredging (91) and new container berth and POL berth (91 and 92 resp.).
h) Assuming 3 shifts/day (at present: 1 shift/day).
i) 7.0 mln T/y only after complete renewal of the terminal.
j) At temporary container terminal without gantry cranes.
k) Excl. bulk and coastal shipping.
m) Port basin allows for larger vessels.

Source: IBRD, SADCC Transport Corridors, Study of Financial Strategy, Issue Paper 5, (Port and Shipping).

Annex A

Part III

Network Description for Modelling

Table A.5 : **PRELIMINARY RAIL NETWORK DEFINITION**

Link	Node	Node	Km
101	1 Matadi/Ilebo	2 Lubumbashi	1,578
102	2 Lubumbashi	4 Dilolo/Luau	759
103	2 Lubumbashi	3 Sakania	255
104	4 Dilolo/Luau	5 Lobito	1,303
105	3 Sakania	6 Ndola	25
106	6 Ndola	7 Kapiri/Mposhi	145
107	7 Kapiri/Mposhi	8 Lusaka	185
108	8 Lusaka	27 Victoria Falls	480
109	7 Kapiri/Mposhi	10 Mbeya	1,015
110	10 Mbeya	11 Dar-es-Salaam	845
111	9 Chipata	14 Lilongwe	135
112	14 Lilongwe	15 Blantyre	344
113 a	14 Lilongwe	16 Nayuci	389
113 b	15 Blantyre	16 Nayuci	189
114	15 Blantyre	17 Villa Nova de F	209
115	18 Lichinga	19 Nacala	1,160
116	16 Nayuci	19 Nacala	625
117	17 Villa Nova de F	21 Beira	255
118	20 Tete	21 Beira	450
119	21 Beira	22 Machipanda	319
120	22 Machipanda	23 Mutare	10
121	23 Mutare	24 Harare	273
122	24 Harare	25 Gweru	335
123	26 Bulawayo	30 Plumtree/Ramokgweban	118
124	26 Bulawayo	27 Victoria Falls	458
125	28 Beit Bridge/Messina	29 Rutenga	160
126	25 Gweru	26 Bulawayo	151
127	25 Gweru	29 Rutenga	245
128	29 Rutenga	31 Chicualacuala	155
129	31 Chicualacuala	32 Maputo	534
130	32 Maputo	33 Ressano Garcia	80
131	32 Maputo	34 Goba	75
132	35 Mbabane/Matsapa	46 Lavumisa	144
133	34 Goba	35 Mbabane/Matsapa	141
134	33 Ressano Garcia	35 Mbabane/Matsapa	223
135	30 Plumtree/Ramokgweba	36 Francistown	70
136	36 Francistown	37 Gaborone	435
137	37 Gaborone	38 Mafeking/Ramatlabama	145
138	28 Beit Bridge/Messina	33 Ressano Garcia	710
139	33 Ressano Garcia	39 Johannesburg	495
140	38 Mafeking/Ramatlabam	39 Johannesburg	312
141	39 Johannesburg	41 East London	1,055
142	39 Johannesburg	40 Durban	720
143	46 Lavumisa	40 Durban	410
144	28 Beit Bridge/Messina	39 Johannesburg	605
145	39 Johannesburg	42 Cape Town	1,545
146	38 Mafeking/Ramatlabam	42 Cape Town	1,406

Source : NEI, Traffic Allocation and Financial Analysis, October 1989.

Table A.6: **LIST OF NODES IN THE ALLOCATION MODEL**

Place	Number
Matadi/Ilebo	1
Lubumbashi	2
Sakania	3
Dilolo/Luau	4
Lobito	5
Ndola	6
Kapiri/Mposhi	7
Lusaka	8
Chipata	9
Mbeya	10
Dar-es-Salaam	11
Mzuzu	12
Mchinji	13
Lilongwe	14
Blantyre	15
Nayuci	16
Villa Nova de F	17
Lichinga	18
Nacala	19
Tete	20
Beira	21
Machipanda	22
Mutare	23
Harare	24
Bulawayo	25
Victoria Falls	26
Beit Bridge/Messina	27
Rutenga	28
Plumtree/Ramokgweban	29
Chicualacuala	30
Maputo	31
Ressano Garcia	32
Goba	33
Mbabane/Matsapa	34
Francistown	35
Plumtree/Ramokgweban	36
Gaborone	37
Mafeking/Ramatlabama	38
Johannesburg	39
Durban	40
East London	41
Cape Town	42
NWC/USA	43
EA/MED/ME/SA	44
FE/AUS	45
Lavumisa	46

Source: NEI, Traffic Allocation and Financial Analysis, Oct. 1989

Table A.7: RAIL LINKS IN THE ALLOCATION MODEL

From:	To:	Distance by rail (km)
Matadi/Ilebo	Lubumbashi	1,578
Lubumbashi	Dilolo/Luau	759
Lubumbashi	Sakania	255
Dilolo/Luau	Lobito	1,303
Sakania	Ndola	25
Ndola	Kapiri/Mposhi	145
Kapiri/Mposhi	Lusaka	185
Lusaka	Victoria Falls	480
Kapiri/Mposhi	Mbeya	1,015
Mbeya	Dar-es-Salaam	845
Chipata	Lilongwe	135
Lilongwe	Blantyre	344
Lilongwe	Nayuci	389
Blantyre	Nayuci	189
Blantyre	Villa Nova de F	209
Lichinga	Nacala	1,160
Nayuci	Nacala	625
Villa Nova de F	Beira	255
Tete	Beira	450
Beira	Machipanda	319
Machipanda	Mutare	10
Mutare	Harare	273
Harare	Gweru	335
Bulawayo	Plumtree/Ramokgweban	118
Bulawayo	Victoria Falls	458
Beit Bridge/Messina	Rutenga	160
Gweru	Bulawayo	151
Gweru	Rutenga	245
Rutenga	Chicualacuala	155
Chicualacuala	Maputo	534
Maputo	Ressano Garcia	80
Maputo	Goba	75
Mbabane/Matsapa	Lavumisa	144
Goba	Mbabane/Matsapa	141
Ressano Garcia	Mbabane/Matsapa	223
Plumtree/Ramokgweban	Francistown	70
Francistown	Gaborone	435
Gaborone	Mafeking/Ramatlabama	145
Beit Bridge/Messina	Ressano Garcia	710
Ressano Garcia	Johannesburg	495
Mafeking/Ramatlabama	Johannesburg	312
Johannesburg	East London	1,055
Johannesburg	Durban	720
Lavumisa	Durban	410
Beit Bridge/Messina	Johannesburg	605
Johannesburg	Cape Town	1,545
Mafeking/Ramatlabama	Cape Town	1,406

Source: NEI, Traffic Allocation and Financial Analysis, Oct. 1989.

Table A.8: ROADLINKS IN THE ALLOCATION MODEL

From:	To:	Distance by road (kms)
Lubumbashi	Ndola	240
Lubumbashi	Kapiri/Mposhi	335
Ndola	Kapiri/Mposhi	120
Kapiri/Mposhi	Lusaka	205
Kapiri/Mposhi	Mbeya	925
Lusaka	Chipata/Mchinji	615
Mbeya	Dar-es-Salaam	925
Mbeya	Mzuzu	375
Mzuzu	Lilongwe	500
Chipata/Mchinji	Lilongwe	130
Lilongwe	Blantyre	300
Blantyre	Tete	225
Tete	Harare	355
Lusaka	Harare	490
Lusaka	Francistown	1015
Lusaka	Bulawayo	920
Harare	Gweru	340
Gweru	Bulawayo	170
Harare	Beitbridge	575
Bulawayo	Beitbridge	310
Harare	Mutare	285
Mutare	Beira	320
Bulawayo	Francistown	220
Francistown	Gaborone	435
Gaborone	Cape Town	470
Gaborone	Johannesburg	470
Beitbridge	Johannesburg	560
Beitbridge	Durban	1150
Beitbridge	Komatipoort	650
Johannesburg	Durban	605
Johannesburg	Port Elisabeth	1110
Johannesburg	Mbabane/Matspha	500
Komatipoort	Maputo	90
Mbabane/Matsapha	Maputo	180
Mbabane/Matsapha	Durban	525

Source: NEI, Traffic Allocation and Financial Analysis, Oct. 1989.

Annex A

Part IV

Tariff and Travel Time

Table A.9: **SELECTED TRUCK RATES FOR VERY HEAVY GOODS VEHICLES (VHGV)**

From	To	Kms.	Commodity	Packing	Cost $/ton-km	$/ton	via
Harare	Beira	605	Froz.Juice	Cont.	0.12	73	
Joburg	Ndola	1959	Gen.Cargo		0.07	137	Beitbridge
Dar	Ndola	2005	Gen.Cargo	Cont.	0.08	162	
Joburg	Lusaka	2021	Gen.Cargo		0.06	126	Kazungula
Harare	Durban	2027	Tobacco	Cont.	0.07	142	
Kitwe	Dar	2050	Metals	Bulk	0.08	164	
Joburg	Lubumbashi	2175	Gen.Cargo		0.08	167	Beitbridge
Joburg	Lilongwe	2183	Gen.Cargo		0.09	194	Beitbridge
Joburg	Ndola	2342	Gen.Cargo		0.06	134	Kazungula
Joburg	Lubumbashi	2558	Gen.Cargo		0.06	157	Kazungula
Joburg	Lilongwe	2702	Gen.Cargo		0.06	151	Kazungula
Ndola	Durban	3090	Metals	Bulk	0.07	201	
Kitwe	Durban	3126	Gen.Cargo	Cont.	0.07	203	
Harare	Dar	3513	Gen.Cargo	Cont.	0.07	235	
				Avg	0.07		

Source: IBRD, SADCC Transport Corridors, Study of Financial StrategY, Working Paper 2, August 1989.

Table A.10: RAIL TARIFFS IN SADCC FOR SELECTED COMMODITIES (US$)

Commodity	E/I	From	To	ctry.	Kms.	$/tkm	$/tonne
Agr Products (cont)	Imp	Dar	Ndola	Zam	2005	0.003	5
Asbestos, break bulk	Exp	Zvishavane	Maputo	Zim	1071	0.039	42
Asbestos, break bulk	Exp	Zvishavane	Durban	Zim	1683	0.035	59
Cement	Exp	Ndola	Dar	Zam	2005	0.022	44
Cement	Exp	Ndola	Dar	Zam	2005	0.023	45
Coal, B/Bulk	Exp	Thomson Jct.	Maputo	Zim	1621	0.022	36
Coal, B/Bulk	Exp	Thomson Jct.	Durban	Zim	2219	0.020	45
Cobalt	Exp	Ndola	Dar	Zam	2005	0.024	48
Cobalt	Exp	Ndola	Maputo	Zam	2528	0.033	84
Cobalt	Exp	Ndola	Durban	Zam	3126	0.030	94
Cobalt	Exp	Ndola	Dar	Zam	2005	0.026	51
Coke, B/Bulk	Imp	Durban	Gweru	Zim	1766	0.029	52
Coke, B/Bulk	Imp	Maputo	Gweru	Zim	1168	0.033	38
Copper	Exp	Ndola	Dar	Zam	2005	0.026	52
Copper, containerized	Exp	Ndola	Maputo	Zam	2528	NA	NA
Copper, containerized	Exp	Ndola	Durban	Zam	3126	0.070	219
Copper concentrate	Exp	Lubumbashi	Dar	Zai	2230	0.054	120
Copper concentrate	Exp	Ndola	Dar	Zim	2005	0.026	51
Copper concentrate	Exp	Ndola	Maputo	Zam	2528	0.033	84
Copper concentrate	Exp	Ndola	Durban	Zam	3126	0.030	95
Copper ingots	Exp	Ndola	Maputo	Zam	2528	0.055	139
Copper ingots	Exp	Ndola	Durban	Zam	3126	0.050	155
Cotton Lint, S/Bulk	Exp	Kadoma	Maputo	Zim	1310	0.041	53
Cocttn Linc, B/Bulk	Exp	Kadoma	Durban	Zim	1908	0.037	70
Cotton Lint, Cont.	Exp	Kadoma	Maputo	Zim	1310	0.035	45
Cotton Linc, Cont.	Exp	Kadoma	Durban	Zim	1908	0.032	60
Diesel Fuel, Tank Cars	Imp	Durban	Lusaka	Zam	2776	0.035	97
Diesel Fuel, Tank Cars	Imp	Maputo	Lusaka	Zam	2178	0.040	87
Explosives	Imp	Durban	Ndola	Zai	3126	0.075	236
Explosives	Imp	Maputo	Ndola	Zai	2528	0.075	190
Ferro Chrome, break bulk	Exp	Kwekwe	Maputo	Zim	1233	0.027	34
Ferro Chrome, break bulk	Exp	Kwekwe	Durban	Zim	1831	0.027	49
Fertilizer, B/Bulk	Imp	Dar	Ndola	Zam	2005	0.023	45
Fertilizer, B/Bulk	Imp	Durban	Lusaka	Zam	2776	0.030	82
Fertilizer, B/Buik	Imp	Maputo	Lusaka	Zam	2178	0.033	71
Fertilizer, B/Bulk	Imp	Durban	Harare	Zim	2068	0.020	42
Fertilizer, B/Bulk	Imp	Maputo	Harare	Zim	1470	0.021	31
Iron/Steel, Crude, B/Bulk	Exp	Redcliff	Maputo	Zim	1234	0.036	44
Iron/Steel, Crude, B/Bulk	Exp	Redcliff	Durban	Zim	1832	0.034	63
Lead	Exp	Ndola	Dar	Zam	2005	0.021	43
Lead	Exp	Ndola	Dar	Zam	2005	0.022	44
Machinery	Imp	Durban	Ndola	Zai	3126	0.065	203
Machinery	Imp	Maputo	Ndola	Zai	2528	0.064	163
Machinery, Cont	Imp	Durban	Harare	Zim	2068	0.040	82
Machinery, Cont	Imp	Durban	Bulawayo	Zim	1882	0.042	80
Machinery, Cont	Imp	Maputo	Bulawayo	Zim	1284	0.049	63
Machinery, Cont	Imp	Maputo	Harare	Zim	1470	0.044	65
Machinery, Cont	Exp	Ndola	Dar	Zam	2005	0.046	93
Maize, bagged	Imp	Durban	Lusaka	Zam	2776	0.030	82
Maize, bagged	Exp	Lion's Den	Durban	Zim	2219	0.020	44
Maize, bagged	Exp	Lion's Den	Maputo	Zim	1621	0.021	33
Maize, bagged	Imp	Maputo	Lusaka	Zam	2178	0.033	71
Maize, bulk	Imp	Durban	Lusaka	Zam	2776	0.030	84
Maize, bulk	Imp	Maputo	Lusaka	Zam	2178	0.033	73

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Table A.10: RAIL TARIFFS IN SADCC FOR SELECTED COMMODITIES (US$)

Commodity	E/I	From	To	ctry.	Kms.	$/tkm	$/tonne
Malt	Imp	Maputo	Lusaka	Zam	2178	0.037	81
Non-agr products (cont)	Imp	Dar	Ndola	Zam	2005	0.002	5
Petrol, Tank Car	Imp	Durban	Lusaka	Zam	2776	0.050	139
Petrol, Tank Car	Imp	Maputo	Lusaka	Zam	2178	0.058	126
Salt	Imp	Durban	Lusaka	Zam	2776	0.030	82
Salt	Imp	Maputo	Lusaka	Zam	2178	0.033	71
Steel, Unworked	Imp	Durban	Lusaka	Zam	2776	0.038	105
Steel, Unworked	Imp	Maputo	Lusaka	Zam	2178	0.039	86
Scock Feeds	Imp	Durban	Lusaka	Zam	2776	0.031	86
Stock Feeds	Imp	Maputo	Lusaka	Zam	2178	0.034	74
Sugar, Raw, Bulk	Imp	Durban	Lusaka	Zam	2776	0.035	96
Sugar, Raw, Bulk	Imp	Maputo	Lusaka	Zam	2178	0.038	82
Sugar, Raw, B/Bulk	Exp	Chiredri	Durban	Zim	1603	0.027	44
Sugar, Raw, B/Bulk	Exp	Chiredri	Maputo	Zim	981	0.032	31
Sugar, Raw, B/Bulk	Exp	Triangle	Durban	Zim	1579	0.027	43
Sugar, Raw, B/Bulk	Exp	Triangle	Maputo	Zim	981	0.031	31
Sugar, Refined, B/Bulk	Imp	Durban	Lusaka	Zam	2776	0.040	110
Sugar, Refined, B/Bulk	Imp	Maputo	Lusaka	Zam	2178	0.043	93
Sulpher	Imp	Durban	Ndola	Zai	3126	0.027	83
Sulpher	Imp	Maputo	Ndola	Zai	2528	0.027	69
Tea, break bulk	Exp	Mutare	Maputo	Zim	1743	0.042	73
Tea, break bulk	Exp	Mutare	Durban	Zim	2341	0.043	100
Tea, Cont	Exp	Mucare	Durban	Zim	2341	0.041	95
Tea, Cont	Exp	Mutare	Maputo	Zim	1743	0.042	73
Timber	Imp	Durban	Ndola	Zai	3126	0.027	84
Timber	Imp	Maputo	Ndola	Zai	2528	0.027	69
Tobacco, break bulk	Exp	Harare	Maputo	Zim	1467	0.045	67
Tobacco, break bulk	Exp	Harare	Durban	Zim	2068	0.041	86
Tobacco, container	Exp	Harare	Durban	Zim	2068	0.049	102
Tobacco, container	Exp	Harare	Maputo	Zim	1467	0.053	77
Veg Oil	Imp	Dar	Ndola	Zam	2005	0.019	38
Veg Oil	Exp	Ndola	Dar	Zam	2005	0.024	48
Wheat	Imp	Dar	Ndola	Zam	2005	0.023	45
Wheat	Imp	Durban	Lusaka	Zam	2776	0.026	73
Wheat	Exp	Lusaka	Dar	Zam	2045	0.022	84
Wheat	Imp	Maputo	Lusaka	Zam	2178	0.029	62
Wheat, Bags	Imp	Durban	Harare	Zim	2068	0.021	43
Wheat, Bags	Imp	Maputo	Harare	Zim	1467	0.022	32
Zinc	Exp	Ndola	Dar	Zam	2005	0.022	44
Zinc Ingots	Exp	Kabwe	Maputo	Zam	2332	0.028	66
Zinc Ingots	Exp	Kabwe	Durban	Zam	2930	0.027	79
Zinc Ingots	Exp	Lubumbashi	Durban	Zai	3372	0.039	131
Zinc Ingots	Exp	Lubumbashi	Maputo	Zai	3674	0.032	117
Zinc Ingots	Exp	Lubumbashi	E.London	Zai	3427	0.041	141
Zinc Ingots	Exp	Ndola	Dar	Zam	2005	0.021	43

Source: IBRD, SADCC Transport Corridors, Study of Financial Strategy, Working Paper 2, August 1989.

Note: The route to Durban is via Beit Bridge
The route to Maputo is via Komatipoort
Average container stuffing is 14.4 tons/TEU
1 US $ = 2.10 Zim$; 1US $ = 9.357 Kwachas (June 1989)

Table A.11: RAIL TRANSIT TIMES (DAYS)

From	To	rail-km	average	estimated
Harare	Beira	605	6	6
Harare	Maputo	1600	17	17
Ndola	Dar es Salaam	2005	29	21
Lusaka	Dar es Salaam	2045	29	22
Kitwe	Dar es Salaam	2050	29	22
Harare	Durban	2027	17	21
Lusaka	Durban	2839	28	30
Ndola	Durban	3090	28	33
Kitwe	Durban	3126	28	33

Source: IBRD, SADCC Transport Corridors, Study of Financial StrategY, Working Paper 2, August 1989.

Table A.12: STATION TO STATION TRANSIT TIMES FOR SATS RAIL
(excluding loading and unloading time)

Between Small Centers

Kms	Days	Kms/day
150	2.50	60
260	5.65	46
327	4.58	71
400	2.47	162
500	4.44	113
875	8.89	98
880	13.36	66
990	14.31	69
1047	11.8	89
1400	11.9	118

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Between Large Centers

Kms	Days	Kms/Day
395	2.05	193
500	2.97	168
730	2.55	286
1095	2.86	383
1538	3.53	436

		293

Source: IBRD, SADCC Transport Corridors, Study of Financial Strategy, Working Paper 2, August 1989.

Table A.13: ROAD TRAVEL AND TRANSIT TIMES

Country	Link	Length (km)	Travel Time (hrs)	Transit Time (hrs)
Botswana	Francistown-Kazungula	480	8	23
Botswana	Francistown-Plumtree	95	2	5
Botswana	Francistown-Ramatlabama	485	8	23
Malawi	Blantyre-Chipoka	210	3	7
Malawi	Blantyre-Lilongwe	350	6	19
Malawi	Chilumba-Kaporo	100	2	5
Malawi	Chipoka-Chilumba (lake)	405	NA	NA
Malawi	Lilongwe-Chilumba	634	8	28
Malawi	Mchinji-Lilongwe	130	2	6
Malawi	Mwanza-Blantyre	65	2	4
Mozam.	Komatipoort-Maputo	92	2	4
Mozam.	Beira-Mutare	320	8	19
Mozam.	Maputo-Naamacha	60	2	4
Mozam.	Nyamapanda-Mwanza	275	8	18
RSA	Beitbridge-Durban	1150	20	61
RSA	Ramatlabama-Capetown	1345	23	72
RSA	Ramatlabama-Komatipoort	746	13	40
Swaziland	Manzini-Naamacha	90	2	5
Tanzania	Kaporo-Mbeya	140	3	6
Tanzania	Mbeya-Dar es Salaam	815	15	42
Tanzania	Tunduma-Mbeya	115	2	5
Zambia	Chirundu-Lusaka	140	4	6
Zambia	Kazungula-V Falls	75	2	4
Zambia	K-Mposhi-Tunduma	810	15	42
Zambia	K.Mposhi-Zaire Border	270	5	12
Zambia	Lusaka-K.Mposhi	205	3	7
Zambia	Lusaka-Mchinji	615	12	37
Zambia	V Falls-Lusaka	460	9	23
Zimbabwe	Bulawayo-Beitbridge	310	5	15
Zimbabwe	Bulawayo-Harare	510	7	28
Zimbabwe	Bulawayo-V.Falls	460	9	23
Zimbabwe	Harare-Beitbridge	520	9	28
Zimbabwe	Harare-Chirundu	350	6	19
Zimbabwe	Harare-Machipanda	285	5	18
Zimbabwe	Harare-Nyamapanda	240	5	10
Zimbabwe	Plumtree-Bulawayo	125	2	5

Source: IBRD, SADCC Transport Corridors, Study of Financial Strategy, Working Paper 2, August 1989.

Table A.14: VARIABILITY OF RAIL TRANSIT TIMES IN SADCC

	min time	exp time	max time	sigma obsvd.	sigma estimated.
Harare-Beira	4	6	20	3.5	3.6
Harare-Durban	6	8	20	3.1	4.9
Lusaka-Durban	13	17	28	3.1	10.3
Kitwe-Dar	10	25	90	17.4	15.2
Kitwe-Dar	8	28	72	13.4	17.0
Kitwe-Dar	8	40	72	13.1	24.3

Source: IBRD, SADCC Transport Corridors, Study of Financial Strategy, Working Paper 2, August 1989.

Table A.15: VARIABILITY OF RAIL TRANSIT TIMES (SATS)
(line haul only)

Route	Average time (days)	Standard Deviation (days)
Johannesburg - Kimberly	3.0	1.8
Johannesburg - Durban	2.6	1.7
Johannesburg - Cape Town	3.5	1.7
Johannesburg - Port Elizabeth	2.9	1.7
Johannesburg - Bloemfontein	2.1	1.2

Source: IBRD, SADCC Transport Corridors, Study of Financial Strategy, Working Paper 2, August 1989.

Annex A

Part V

Road User Cost and Road User Charges

ROAD USER COSTS AND CHARGES

1. The most complete study of this subject was carried out in 1986 for SATCC by the Institute of Transport Economics of Norway in the Study on Road User Charges in International Transport in the SADCC Region. The data and conclusions of that study are summarized herein.

2. There is substantial variability between countries when compared to the costs the transporters impose on the national budgets. Specifically the typical heavy vehicle operator pays charges in his home country above the road maintenance costs, both variable and fixed, occasioned by the operation of the vehicle. Outside his home country, he pays much less than the costs incurred, a situation that applies to much of the Region's transit traffic. Road maintenance expenditures per standard axle kilometer do not differ much from country to country. However, this does not mean that monies spent on surface maintenance are sufficient to offset damage done to roads. The Zambia study, for example, estimated that expenditure may have to be doubled to maintain serviceability of roads at present condition levels over the long run.

3. Capital cost charges are not fully recovered by user fees except in Tanzania. The study assigns heavy vehicles the total cost of pavement strengthening and spreads other capital charges over all vehicles at the same rate. Capital costs per (Equivalent Standard Axle) ESA-km or per vehicle/km vary considerably between countries, both because of different size and quality of road networks and differing but manually slow capacity utilization.

4. The costs per vehicle/km for a six-axle vehicle averaging 60,000 kms/yr. are given in the table below:

Road Costs per Vehicle km for a a Typical Heavy Vehicle in International Transport. US cent.

	Zambia	Zimbabwe	Botswana	Tanzania
Variable costs of road maintenance	3.91	5.091	4.78	3.98
Contributions to fixed maintenance costs	0.55	0.33	0.24	0.50
Capital costs:				
Increased pavement strength	12.00	24.00	7.38	8.88
Totals	16.46	29.42	12.40	13.36

1 Based on an expenditure level 50 % above the actual level in 1984/85. This would restore expenditure in real terms to 1980/81/82 levels as recommended in the National Transport Study, SWECO. The NTS study definitions of fixed and variable maintenance costs have been used.

2 These costs do not include administrative overheads for operating national highway organization and so understate full costs.

5. Road user charges are divided into fixed and variable components. Fixed costs comprise import duties and special excises included in the vehicle price and all types of periodical charges. Variable charges consist of import duties and excises on consumables like fuel, tyres, and spares and road tolls.

6. Road user charges should only include special charges linked to vehicle procurement or operation. Taxes which are more or less common to all goods should be regarded as part of the general taxation system and not as a specific road user charge. The distinction between general taxes and special charges may in practice be somewhat arbitrary. In the figures used in this analysis the following items are regarded as "general taxes," ones that are levied on almost all types of goods at about the same rate. Therefore they are not included in "road user charges."

Malawi:	Import levy (5%)
	Surtax on imports (30%)
Zambia:	General sales tax (ca 20%)
Zimbabwe:	Surtax on imports (20%)
	Sales tax (15-20%)

For Zambia and Zimbabwe there is an excise on petrol and diesel which also covers sales tax/surtax. An estimated surtax/sales tax is deducted and only the rest is considered as road user charges in our calculations.

7. Differences in tax systems make it difficult to compare the level of road user charges from country to country. The relatively low charges in Zambia and Zimbabwe shown in the table below must be seen as a consequence of a tax system where the major part of taxes included in prices on vehicles, fuel etc. has the character of general taxes. In other countries practically all charges on vehicles, fuel, etc. are "road user charges."

Charges per km for Vehicles of about 30 tons' Carrying Capacity (US cent per km)

	Fixed charges	Variable charges	Total
Angola	..	..	..
Botswana	3.58	8.20	11.78
Lesotho	3.49	8.20	11.69
Malawi	5.14	14.24	19.38
Mozambique	0.06	0.93	0.99
Swaziland	3.37	8.20	11.57
Tanzania	5.60	18.08	23.68
Zambia	2.18	0.77	2.95
Zimbabwe	1.77	2.66	4.42

8. For the four countries for which road cost estimates are available one can make the following comparison:

(US cent per km)

	Zambia	Zimbabwe	Botswana	Tanzania
Total road user charges/km	2.95	4.42	11.78	23.68
Fixed & Variable mainten/km expenses	4.46	5.42	5.02	4.48
Total Road Expenses	**16.47**	**29.36**	**12.38**	**13.36**
User charge/ maint. expense	0.66	0.82	2.35	5.29
User charge/ total expense	0.18	0.15	0.95	1.77

9. While the road operators' responsibility for paying all maintenance costs is seldom questioned, a policy of recovering all capital costs is disputable. Government is normally required to provide a certain minimum capacity road network as a public service. As with many other public investments, the capacity cannot be constructed in stages in a manner which will avoid an excess of capacity for some period after an investment is made. Therefore only increased pavement strengthening costs have been attributed as a cost to be recovered by user fees on heavy vehicles. In the most extreme case, adding twenty-five cents to user charges in Zimbabwe to cover full road expenses would add about 10% to financial vehicle operating costs. For Zambia the increment would be only 14 cents per vehicle km.

10. Given the variations in road maintenance practices and resulting cost calculations shown above, it appears that the use of a regional average cost is most appropriate for transit traffic analysis. This regional average cost was calculated by ITE as follows for a typical heavy vehicle in international transport:

	US cent
Variable maintenance cost:	4.45
Fixed maintenance costs:	0.40
Increased pavement strength:	11.40
Total	16.25

SADCC Transport Corridors

Study of Financial Strategy

Existing Traffic Data for Rail, Road, and Ports

(Annex B)

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Table B.1: **BASE TRAFFIC IN DIFFERENT CORRIDORS ('000 TONS)**

Corridor	Year	Domestic	International	Transit	TOTAL
Zambia & Zaire to Dar-es-Salaam					
TAZARA Railway	1988/89	12		1,090	1,102
Road			100		100
Malawi & Zambia to Nacala					
CFM-N	1988	48.5	-	6	55
Malawi & Zambia to Beira					
Rail					
Road					
Zimbabwe & Zambia to Beira					
CFM-C	1988	92.8	-	396	489
Road from Zambia to Bulawayo or Harare then rail					
Zimbabwe to Maputo					
CFM-S	1988	812	-	1,306	2,117
Rail from Bulawayo & Harare via Beit Bridge & Koomatiport					
Zimbabwe/Malawi to So. African Ports					
NRZ	1989	11,731	725	958	13,414
Zambia & Zaire to So. African Ports					
Rail via Botswana	1988/89		1,177	531	1,708
Road			350		350
Zambia & Zaire to Lobito					
Beneguela Railway					
Road					
Malawi to Harare					
Rail					302 *

Sources:

a) For ZR: Zambia Program for Transport Sector Investment, 1990-1993, Technical Working Papers (draft), Feb. 1990.
b) For BR: Transport Statistics 1988, Transport Statistics Unit, Ministry of Works and Communication, Gaborone, Feb. 1990.
c) For MR: Economic Report 1989, Office of the President & Cabinet.
* This number is provisional.
d) For CFMs: Statistical Tables from Mr. Jorge Rebelo, AFTIN.
e) For TZR: SATCC, Survey on Merchandised Preventive Track Maintenance,, March, 1990.

Table B.2: MAJOR SADCC CORRIDOR PORT FLOWS in 1987/88

	SADCC						RSA
	Maputo &	Matola	Beira	Nacala	Dar	Lobito	Durban
Actual throughput 1987/1988 (10^6 port ton)							
Gen. Cargo & MP	1.5	-	0.9	0.2	1.3	0.4	11.4
Containers	0.1	-	0.1	0.0	0.7	0.0	7.1
Bulk	0.6	0.3	0.0	-	0.0	0.0	5.5
Pol	-	0.2	0.9	0.1	1.9	0.1	n.a.
# Ships/year (87/88) (incl. coastal sh.)	710		390	150	950	280	2,400

Source: IBRD, SADCC Transport Corridor, Study of Financial Strategy, Working Paper #2, August, 1989

SADCC Transport Corridors

Study of Financial Strategy

Back-up Data for Financial Analyses

(Annex C)

Part I. Profit and Loss Statement for Different SADCC Railways

Part II. Depreciation Calculated on Replacement Value

Part III. Calculated Unit Costs for Different SADCC Railways

Annex C

Part I

Profit and Loss Statements for SADCC Railways

Table C.1: PROFIT AND LOSS STATEMENT ZAMBIA RAILWAYS (1988/89)

(million)

	Dom. Currency	US $
REVENUES		
Domestic freight	216.8	25.1
International freight	338.7	39.2
Passenger	44.4	5.1
Other	26.0	3.0
1. Total Revenues	625.9	72.5
OPERATING COSTS		
Crew	33.1	3.8
Fuel	51.1	5.9
Hire/interchange	85.6	9.9
Maintenance rolling stock	24.7	2.9
Maint. permanent way (variable part)	6.5	0.8
Terminal	7.5	0.9
Other operating costs/overhead (var. part)	65.2	7.6
2. Total Variable Operating Cost	273.7	31.7
Maint. Permanent way (fixed part)	18.9	2.2
Other operating costs/overhead (fixed part)	229.6	26.6
3. Total Fixed Operating Costs	248.5	28.8
4. Interest**	89.3	10.3
5. Depreciation rolling stock	70.7	8.2
6. Depreciation permanent way*	27.5	3.2
7. Depreciation plant/bld/equipment*	23.1	2.7
8. Total Operating Costs (2+3+4+5+6+7)	732.8	84.9
Net Operating Income (1-8)	(106.9)	(12.4)
Gross Fixed Assets		
9. Rolling stock	1,786.0	207.0
10. Permanent way*	526.0	61.0
11. Other assets*	1,196.0	138.6
12. Total renewable fixed assets (9+10+11)	3,508.0	406.5
Financial Ratios		
return on gross fixed assets:		
- rolling stock (1-2-5)/(9)	15.8	
- total renewable fixed assets (1+4-8)/(12)	(1)	
Working ratio (2+3+4)/(1)	98	
LRMC recovery (2+4+5)/(1)	69	
TOC (excl. depr. track) recovery (8-6)/(1)	113	
Operating Ratio (8)/(1)	117	

Exchange rate: 1 US$ = 8.63 ZK * renewable portion only
** calculated at 10% of half of rolling stock assets.
Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, and Table C9.

Table C.2: PROFIT & LOSS STATEMENT TANZANIA-ZAMBIA (TAZARA) RAILWAYS (1988/89)
(million)

	Dom. Currency	US $
REVENUES		
Freight	3,777	31.5
Passenger	343	2.9
Other	76	0.6
interchange, hire charges	142	1.2
interest on bank deposits	111	0.9
1. Total Revenues	4,449	37.1
OPERATING COSTS		
Crew	191	1.6
Fuel	594	5.0
Hire/interchange	0	0.0
Maintenance rolling stock	472	3.9
Maint. permanent way (variable part)	120	1.0
Terminal	80	0.7
Other operating costs/overhead (var. part)	99	0.8
2. Total Variable Operating Cost	1,556	13.0
Maint. Permanent way (fixed part)	280	2.3
Other operating costs/overhead (fixed part)	889	7.4
3. Total Fixed Operating Costs	1,169	9.7
4. Interest**	1,285	10.7
5. Depreciation rolling stock	547	4.6
6. Depreciation permanent way*	434	3.6
7. Depreciation plant/bld/equipment*	372	3.1
8. Total Operating Costs (2+3+4+5+6+7)	5,363	44.7
Net Operating Income (1-8)	(914)	(7.6)
Gross Fixed Assets		
9. Rolling stock	25,702	214.2
10. Permanent way*	17,370	144.8
11. Other assets*	8,263	68.9
12. Total renewable fixed assets (9+10+11)	51,335	427.8
Financial Ratios		
return on gross fixed assets:		
- rolling stock (1-2-5)/(9)	9.1	
- total renewable fixed assets (1+4-8)/(12)	1	
Working ratio (2+3+4)/(1)	90	
LRMC recovery (2+4+5)/(1)	76	
TOC (excl. depr. track) recovery (8-6)/(1)	111	
Operating Ratio (8)/(1)	121	

Exchange rate: 1 US$ = 120 TSH * renewable portion only
** calculated at 10% of half of rolling stock assets.
Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, and Table C10.

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Table C.3: PROFIT AND LOSS STATEMENT MALAWI RAILWAYS (1988/89)

(million)

	Dom. Currency	US $
REVENUES		
Domestic freight	11.5	4.3
Passenger and parcel	4.5	1.7
Other	2.0	0.7
1. Total Revenues	18.0	6.7
OPERATING COSTS		
Crew	0.3	0.1
Fuel	4.6	1.7
Hire/interchange	0.0	0.0
Maintenance rolling stock	3.8	1.4
Maint. permanent way (variable part)	0.5	0.2
Terminal	1.7	0.6
Other operating costs/overhead (var. part)	0.8	0.3
2. Total Variable Operating Cost	11.7	4.3
Maint. Permanent way (fixed part)	1.2	0.4
Other operating costs/overhead (fixed part)	6.8	2.5
3. Total Fixed Operating Costs	8.0	2.9
4. Interest**	9.2	3.4
5. Depreciation rolling stock	6.6	2.5
6. Depreciation permanent way*	6.2	2.3
7. Depreciation plant/bld/equipment*	0.3	0.1
8. Total Operating Costs (2+3+4+5+6+7)	42.0	15.5
Net Operating Income (1-8)	(24.0)	(8.8)
Gross Fixed Assets		
9. Rolling stock	183.2	68.6
10. Permanent way*	192.0	71.9
11. Other assets*	17.4	6.5
12. Total renewable fixed assets (9+10+11)	392.6	147.0
Financial Ratios		
return on gross fixed assets:		
- rolling stock (1-2-5)/(9)	(0)	
- total renewable fixed assets (1+4-8)/(12)	(4)	
Working ratio (2+3+4)/(1)	161	
LRMC recovery (2+4+5)/(1)	153	
TOC (excl. depr. track) recovery (8-6)/(1)	199	
Operating Ratio (8)/(1)	233	

Exchange rate: 1 US$ = 2.67 MK * renewable portion only.
** calculated as 10% of half of rolling stock assets.
Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, and Table C11.

Table C.4: PROFIT AND LOSS STATEMENT CFM-N (1988)

(million)

	Dom. Currency	US $
REVENUES		
Domestic freight		
International freight		
Passenger		
Other		
1. Total Revenues	321	0.6
OPERATING COSTS		
Crew	n.a.	n.a.
Fuel	n.a.	n.a.
Hire/interchange	n.a.	n.a.
Maintenance rolling stock	n.a.	n.a.
Maint. permanent way (variable part)	n.a.	n.a.
Other operating costs/overhead (var. part)	n.a.	n.a.
2. Total Variable Operating Cost	0	4.2
Maint. Permanent way (fixed part)	n.a.	n.a.
Other operating costs/overhead (fixed part)	n.a.	n.a.
3. Total Fixed Operating Costs (estimate)	589	1.1
4. Interest**	2,095	3.9
5. Depreciation rolling stock	1,717	3.2
6. Depreciation permanent way*	820	1.5
7. Depreciation plant/bld/equipment*	304	0.6
8. Total Operating Costs (2+3+4+5+6+7)	5,525	14.5
Net Operating Income (1-8)	(5,204)	(13.9)
Gross Fixed Assets		
9. Rolling stock	41,891	78.3
10. Permanent way*	32,809	61.3
11. Other assets*	8,217	15.4
12. Total Renewable fixed assets (9+10+11)	82,917	155.0
Financial Ratios		
return on gross assets:		
- rolling stock (1-2-5)/(9)	(3)	
- total renewable fixed assets (1+4-8)/(12)	(4)	
Working ratio (2+3+4)/(1)	836	
LRMC recovery (2+4+5)/(1)	1188	
TOC (excl. depr. track) recovery (8-6)/(1)	1466	
Operating Ratio (8)/(1)	1721	

Exchange rate: 1 US$ = 535 MT * renewable portion only.
** calculated as 10% of half of rolling stock assets.
Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, and Table C12.

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Table C.5: PROFIT AND LOSS STATEMENT CFM-C (1988)

(million)

	Dom. Currency	US $
REVENUES		
Domestic freight		
International freight		
Passenger		
Other		
1. Total Revenues	3,804	7.1
OPERATING COSTS		
Crew	1,116	2.1
Fuel	669	1.3
Hire/interchange	1,119	2.1
Maintenance rolling stock	643	1.2
Maint. permanent way (variable part)	112	0.2
Other operating costs/overhead (var. part)	131	0.2
2. Total Variable Operating Cost	3,790	7.1
Maint. Permanent way (fixed part)	260	0.5
Other operating costs/overhead (fixed part)	418	0.8
3. Total Fixed Operating Costs	678	1.3
4. Interest**	4,390	8.2
5. Depreciation rolling stock	3,078	5.8
6. Depreciation permanent way*	809	1.5
7. Depreciation plant/bld/equipment*	482	0.9
8. Total Operating Costs (2+3+4+5+6+7)	13,227	24.8
Net Operating Income (1-8)	(9,423)	(17.7)
Gross Fixed Assets		
9. Rolling stock	87,794	164.1
10. Permanent way*	32,341	60.5
11. Other assets*	13,014	24.3
12. Total Renewable fixed assets (9+10+11)	133,149	248.9
Financial Ratios		
return on gross assets:		
- rolling stock (1-2-5)/(9)	(3)	
- total renewable fixed assets (1+4-8)/(12)	(4)	
Working ratio (2+3+4)/(1)	233	
LRMC recovery (2+4+5)/(1)	296	
TOC (excl. depr. track) recovery (8-6)/(1)	326	
Operating Ratio (8)/(1)	348	

Exchange rate: 1 US$ = 535 MT * renewable portion only.
** calculated as 10% of half of rolling stock assets.
Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, and Table C12.

Table C.6: PROFIT AND LOSS STATEMENT CFM-S (1988)

(million)

	Dom. Currency	US $
REVENUES		
Domestic freight		
International freight		
Passenger		
Other		
1. Total Revenues	6,312	11.8
OPERATING COSTS		
Crew	1,549	2.9
Fuel	1,074	2.0
Hire/interchange	1,642	3.1
Maintenance rolling stock	660	1.2
Maint. permanent way (variable part)	122	0.2
Other operating costs/overhead (var. part)	190	0.4
2. Total Variable Operating Cost	5,237	9.8
Maint. Permanent way (fixed part)	284	0.5
Other operating costs/overhead (fixed part)	953	1.8
3. Total Fixed Operating Costs	1,237	2.3
4. Interest**	5,987	11.2
5. Depreciation rolling stock	4,414	8.3
6. Depreciation permanent way*	706	1.3
7. Depreciation plant/bld/equipment*	1,542	2.9
8. Total Operating Costs (2+3+4+5+6+7)	19,123	35.8
Net Operating Income (1-8)	(12,811)	(24.0)
Gross Fixed Assets		
9. Rolling stock	119,733	223.8
10. Permanent way*	28,235	52.8
11. Other assets*	41,634	77.8
12. Total Renewable fixed assets (9+10+11)	189,602	354.4
Financial Ratios		
return on gross assets:		
- rolling stock (1-2-5)/(9)	(3)	
- total renewable fixed assets (1+4-8)/(12)	(4)	
Working ratio (2+3+4)/(1)	197	
LRMC recovery (2+4+5)/(1)	248	
TOC (excl. depr. track) recovery (8-6)/(1)	292	
Operating Ratio (8)/(1)	303	

Exchange rate: 1 US$ = 535 MT * renewable portion only.
** calculated as 10% of half of rolling stock assets.
Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, and Table C12.

Table C.7: PROFIT & LOSS STATEMENT NATIONAL RAILWAYS OF ZIMBABWE (NZR) (1988/89)
(million)

	Dom. Currency	US $
REVENUES		
Freight	227	108.1
Passenger	24	11.4
Other	16	7.6
1. Total Revenues	267	127.1
OPERATING COSTS		
Crew	21	10.0
Fuel	28	13.3
Hire/interchange	19	9.0
Maintenance rolling stock	62	29.5
Maint. permanent way (variable part)	3	1.4
Terminal	54	25.7
Other operating costs/overhead (var. part)	12	5.7
2. Total Variable Operating Cost	199	94.6
Maint. Permanent way (fixed part)	18	8.6
Other operating costs/overhead (fixed part)	112	53.3
3. Total Fixed Operating Costs	130	61.9
4. Interest**	133	63.3
5. Depreciation rolling stock	96	45.7
6. Depreciation permanent way*	23	11.0
7. Depreciation plant/bld/equipment*	62	29.5
8. Total Operating Costs (2+3+4+5+6+7)	643	306.0
Net Operating Income (1-8)	(376)	(178.9)
Gross Fixed Assets		
9. Rolling stock	2,651	1262.4
10. Permanent way*	454	216.2
11. Other assets*	1,208	575.2
12. Total fixed assets (9+10+11)	4,313	2,053.8
Financial Ratios		
return on gross fixed assets:		
- rolling stock (1-2-5)/(9)	(1)	
- total gross fixed assets (1+4-8)/(12)	(6)	
Working ratio (2+3+4)/(1)	173	
LRMC recovery (2+4+5)/(1)	160	
TOC (excl. depr. track) recovery (8-6)/(1)	232	
Operating Ratio (8)/(1)	241	

Exchange rate: 1 US$ = 2.1 Z$ * renewable portion only.
** calculated as 10% of half of the rolling stock assets.
Source: NEI; SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, and Table C13.

Table C.8: PROFIT AND LOSS STATEMENT BOTSWANA RAILWAYS (1988/89)

(million)

	Dom. Currency	US $
REVENUES		
Freight	42.4	21.2
Passenger	6.6	3.3
Other	3.9	2.0
1. Total Revenues	52.9	26.5
OPERATING COSTS		
Crew	3.3	1.6
Fuel	6.1	3.0
Hire/interchange	9.3	4.7
Maintenance rolling stock	3.7	1.9
Maint. permanent way (variable part)	1.4	0.7
Terminal	8.5	4.3
Other operating costs/overhead (var. part)	2.1	1.0
2. Total Variable Operating Cost	34.4	17.2
Maint. Permanent way (fixed part)	8.1	4.0
Other operating costs/overhead (fixed part)	9.3	4.7
3. Total Fixed Operating Costs	17.4	8.7
4. Interest**	6.5	3.3
5. Depreciation rolling stock	6.4	3.2
6. Depreciation permanent way*	2.8	1.4
7. Depreciation plant/bld/equipment*	1.8	0.9
8. Total Operating Costs (2+3+4+5+6+7)	69.3	34.7
Net Operating Income (1-8)	(16.4)	(8.2)
Gross Fixed Assets		
9. Rolling stock	130	64.8
10. Permanent way*	111	55.6
11. Other assets*	25	12.3
12. Total fixed assets (9+10+11)	266	132.7
Financial Ratios		
return on gross fixed assets:		
- rolling stock (1-2-5)/(9)	9	
- total gross fixed assets (1+4-8)/(12)	(4)	
Working ratio (2+3+4)/(1)	110	
LRMC recovery (2+4+5)/(1)	89	
TOC (excl. depr. track) recovery (8-6)/(1)	126	
Operating Ratio (8)/(1)	131	

Exchange rate: 1 US$ = 2 Pula * renewable portion only.
** calculated as 10% of half of rolling stock assets.
Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, and Table C14.

Annex C

Part II

SADCC Railways

Depreciation Calculated on Replacement Value

Table C.9: DEPRECIATION CALCULATED ON REPLACEMENT VALUE (88/89), ZAMBIA RAILWAYS

ROLLING STOCK	number	unit costs ('000 US$)	total costs (min US$)	total costs (mln ZK)	deprec. period (years)	annual depreciation (mln ZK)
Mainline locomotives	59	1,800	106.2	917	20	45.9
Shunting locomotives	12	1,200	14.4	124	20	6.2
Wagons	2,878	30	86.3	745	40	18.6
Total (all renewable)				1,786		70.7

PERMANENT WAY	km	unit costs/km ('000 US$)	total costs (min US$)	total costs (mln ZK)	deprec. period (years)	annual depreciation (mln ZK)
Mainline	847.8	300	254.3	2,195	40	54.9
Branch line	256.0	200	51.2	442	40	11.1
Sidings	187.1	200	37.4	323	20	16.2
Yards/terminals	321.2	200	64.2	554	20	27.7
Total				3,514		109.9
Total Renewable (est. 25%)				526		27.5

OTHER ASSETS	m2	unit costs/m2 (ZK)	total costs (mln ZK)	deprec. period (years)	annual depreciation (mln ZK)
Civil works					
bridges (etc) (m)	1,180	261,500	309	80	3.9
offices	36,000	3,000	108	50	2.2
stations	32,500	3,000	98	50	2.0
terminals (units)	4	5,000,000	20	50	0.4
running sheds	9,560	3,000	29	50	0.6
train crew lodges	2,920	2,500	7	50	0.1
workshops	41,080	3,000	123	50	2.5
stores/fuel points (unit)	5	2,500,000	13	50	0.3
houses	386,000	2,500	965	50	19.3
subtotal			1,672		31.3
Vehicles					
subtotal			7	5	1.4
Total other assets			1,679		32.7
Total Renewable (est. excl. 50% housing)			1,196		23.1

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, with adjusted unit prices.

Table C.10: DEPRECIATION CALCULATED ON REPLACEMENT VALUES 1989, TAZARA

ROLLING STOCK	number (acc. #)	historic value (mln TSH)	replac. value (mln TSH)	deprec. periods years	deprec. per year (mln TSH)
Line Locomotives (6017-19)					
DFH2	33	116.1	7,128	15	475.2
DFH2 rep	25	146.6	5,400	10	540.0
DE	13	487.4	2,808	20	140.4
Total	71	750.1	15,336		1,155.6
Shunting Locomotives					
DFH1	13	27.2	1,872	15	124.8
DFH1 rep	1	3.4	144	10	14.4
Total	14	30.6	2,016		139.2
Goods Wagon: (6021-22)					
Covered	465	94.5	1,676	30	55.9
High side open	364	76.1	1,349	30	45.0
Tank	111	21.3	377	30	12.6
Flat	156	26.3	466	30	15.5
Drop side open	699	125.9	2,231	30	74.4
Well	2	0.7	12	30	0.4
Brake vans	74	10.3	183	30	6.1
Refrigeration	21	22.1	391	20	19.6
Livestock	28	4.7	84	20	4.2
Ballast	67	16.2	286	20	14.3
Total	1,987	398.1	7,055		248.0
Rescue trains	13	14.2	184	25	7.4
Passenger coaches (6020)	111	85.3	1,109	25	44.3
Total Rolling Stock	2,196	1,278.3	25,700		1,594.5

PERMANENT WAY	km	replac. value (mln TSH)	deprec. periods years	deprec. per year (mln TSH)
Mainline	1860	66,960	40	1,674.0
Other	70	2,520	40	63.0
Total	1930	69,480		1,737.0
Total Renewable (est. 25%)		17,370		434.3

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, with adjusted unit prices.

Table C.10A: DEPRECIATION CALCULATED ON REPLACEMENT VALUES 1989, TAZARA (CONT.)

OTHER ASSETS	acct. #	historic value (mln TSH)	replac. value (mln TSH)	deprec. periods years	deprec. per year (mln TSH)
Buildings	(6001)	248.4	3,074	40	76.9
Buildings	(6002)	147.4	1,916	50	38.3
Buildings	(6003)	134.2	1,745	25	69.8
Motor vehicles	(6055)	74.8	92	10	9.2
Motor vehicles	(6056)	116.7	166	5	33.2
Tel/sign Eq.	(6030)	116.8	1,419	15	94.6
Water supply	(6040)	23.7	278	20	13.9
Plants/machinery	(6045)	43.2	552	20	27.6
Plants/machinery	(6046)	17.9	233	15	15.5
Plants/machinery	(6047)	7.0	92	10	9.2
Tools & instrum.	(6065)	12.3	111	10	11.1
Furniture & equip.	(6070)	93.9	123	8	15.4
Total		1,036.3	9,801		414.7
Total Renewable (est. excl. 23% buildings)			8,263		372.3

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, with adjusted unit prices.

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Table C.11: DEPRECIATION CALCULATED ON REPLACEMENT VALUE MALAWI RAILWAYS (88/89)

ROLLING STOCK	number	unit costs ('000 US$)	total costs (min US$)	total costs (mln MK)	deprec. period (years)	annual deprec. (mln MK)
Mainline locomotives						
AEI (1200 HP)	6	1,100	6.6	17.6	30	0.6
Bombardier (1500 HP)	19	1,500	28.5	76.1	30	2.5
Shunting locomotives	16	750	12.0	32.0	30	1.1
Wagons	718	30	21.5	57.5	40	1.4
Total (all renewable)				183.2		5.6

PERMANENT WAY	km	unit costs/km (MK)	cost/ km (MK)	deprec. period (years)	deprec./ km (MK)	total track (km)	total costs (mln MK)
Concrete sleepers/40 kg rail							
Sleepers	1,430	93	132,990	40	3,325		
Rails	1	109,000	109,000	40	2,725		
Labor & other costs	1	10,000	10,000	40	250		
Total			251,990		6,300	444	111.9
Steel sleepers/30 kg rail							
Sleepers	1,430	90	128,700	25	5,148		
Rails	1	82,000	82,000	40	2,050		
Labor	1	10,000	10,000	31	324		
Total			220,700		7,522	187	41.3
Wooden sleepers/30 kg rail							
Sleepers	1,430	33	47,190	10	4,719		
Rails	1	82,000	82,000	40	2,050		
Labor	1	10,000	10,000	29	344		
Total			139,190		7,113	279	38.8
Total Renewable					20,935	910	192.0
Earthworks, ROW, drainage, structures, etc.					62,805		576.0
Total network					83,740		768.0
Other Assets (total)							21.7
Other Assets (renewable - est.)							17.4

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, with adjusted unit prices.

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Table C.11A: DEPRECIATION CALCULATED ON REPLACEMENT VALUES
NATIONAL RAILWAY OF ZIMBABWE - 1988-89 (CONT.)

	year (avg)	number owned	number opera-tional	Replac. value (mln Z$)	depr. period (years)	total depr. (mln Z$)
Goods wagons:						
High sided iron	1955	7,238	7,231	463.2	40	11.6
Drop sided iron	1959	2,749	2,736	169.1	40	4.2
Covered	1963	425	423	31.5	40	0.8
Container	1981	456	456	28.0	40	0.7
Livestock	1948	637	458	46.9	40	1.2
Tankcars	1975	697	694	52.1	40	1.3
Refrigerators	1965	397	370	42.9	40	1.1
Explosives	1954	41	41	3.5	40	0.1
Guards vans	1965	253	248	39.0	40	1.0
Other	1955	491	..	32.5	40	0.8
total		13,384	12,657	908.7		22.8
Steam travel. cranes	1956	7	7	28,000.0	40	700.0
Passenger coaches:						
Upper class econ.	1957	147	145	100.2	40	2.5
Economy class coaches	1968	227	220	139.2	40	3.5
Dining cars, etc.	1964	304	285	220.0	40	5.5
total		678	650	459.4		11.5
Grand total		14,069	13,314	29.4		734.3

	kms	replac. value/km (1000 Z$)	total repl. val. (mln Z$)	deprec. period (years)	annual deprec. (mln Z$)
Permanent Way					
Main line	1,917	301	577.0	50	11.5
Branch lines	891	298	265.5	50	5.3
Yards	84	298	25.0	50	0.5
Service sidings	132	300	39.6	50	0.8
Private sidings	309	415	128.2	50	2.6
Crossing loops	216	301	65.0	50	1.3
Bridges	202	559	113.0	120	0.9
total	3,751	2,472	1,213.3	53.0	22.9

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990.

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Table C.11B: DEPRECIATION CALCULATED ON REPLACEMENT VALUES
NATIONAL RAILWAY OF ZIMBABWE - 1988-89 (CONT.)

	units	repl. value/unit (1000 Z$)	replac. value (mln Z$)	deprec. period (years)	annual deprec. (1000 Z$)
Other Assets					
Civil branch:					
Houses	3393	0.1	204.0	70	2.9
Other buildings	..	..	168.1	70	2.4
Plan, machinery, eq.			60.9	70	0.9
total			433.0		6.2
Mechanical branch	various		103.0	10	10.3
Electrical branch	various		152.8	14	10.9
Signals branch	various		163.9	15	10.9
Traffic branch	26096		15.8	7	2.3
General Management			8.5	5	1.7
Grand total			1,310.0	27.0	48.5

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990.

Table C.12: DEPRECIATION CALCULATED ON REPLACEMENT VALUE (88/89), CFM RAILWAYS

ROLLING STOCK		number	unit costs ('000 US$)	total costs (mln US$)	total costs (mln MT)	deprec. period (years)	annual depreciation (mln MT)
Mainline locomotives							
CFM-N	diesel	15	1,800	27.0	14,445	20	722
	steam	5	1,500	7.5	4,013	20	201
CFM-C*	diesel	30	1,800	54.0	28,890	20	1,445
	steam	8	1,500	12.0	6,420	20	321
CFM-S	diesel	47	1,800	84.6	45,261	20	2,263
	steam	0	1,500	0.0	0	20	0
Shunting locomotives							
CFM-N	diesel	13	1,200	15.6	8,346	20	417
CFM-C	diesel	0	1,200	0.0	0	20	0
CFM-S	diesel	18	1,200	21.6	11,556	20	578
Wagons							
CFM-N		941	30	28.2	15,087	40	377
CFM-C		3,269	30	98.1	52,484	40	1,312
CFM-S		3,920	30	117.6	62,916	40	1,573
Total							
CFM-N					41,891		1,717
CFM-C					87,794		3,078
CFM-S					119,733		4,414

* most of these are out of service due to extensive damage.

PERMANENT WAY	km	unit costs/km ('000 US$)	total costs (mln US$)	total costs (mln MT)	deprec. period (years)	annual depreciation (mln MT)
CFM-N						
Mainline	615	300	184.5	98,708	40	2,468
Branch lines, etc.	304	200	60.8	32,528	40	813
Total	919			131,236		3,281
Total Renewable (est. 25%)				32,809		820
CFM-C						
Mainline	650	300	195.0	104,325	40	2,608
Branch lines, etc.	234	200	46.8	25,038	40	626
Total	884			129,363		3,234
Total Renewable (est. 25%)				32,341		809
CFM-S						
Mainline	701	300	210.3	112,511	40	2,813
Branch lines, etc.	4	200	0.8	428	40	11
Total	705			112,939		2,824
Total Renewable (est. 25%)				28,235		706

exchange rate: 1 US$= 535 MT

Source: World Bank, SADCC Transport Corridors, Study on Financial Strategies, April 1990, with estimated quantities and adjusted unit prices.

Table C.13: DEPRECIATION CALCULATED ON REPLACEMENT VALUE
NATIONAL RAILWAY OF ZIMBABWE - 1988-89

	number owned	number operational	year	HP	Replac. value* (1000 Z$)	depr. period (years)	total depr. (1000 Z$)
Steam locomotives:							
14th	19	18	1948	n/a	45,360	20	2,268
15th	46	45	1966	n/a	141,750	20	7,088
16th	15	15	1966	n/a	47,250	20	2,363
20th	19	19	1958	n/a	59,850	20	2,993
total	99	97			294,210	20	14,712
Diesel shunting locomotives:							
DH2A	8	8	1975		20,160	20	1,008
DE9	20	20	1972		50,400	20	2,520
DE9A	44	28	1975		70,560	20	3,528
total	72	56			141,120	20	7,056
Diesel mainline locomotives:							
DE2	17	16	1958	1275	60,480	20	3,024
DE3	15	15	1963	1380	56,700	20	2,835
DE4	14	14	1963	1327	52,920	20	2,646
DE5	34	11	1973	1690	41,580	20	2,079
DE6	9	9	1966	1559	34,020	20	1,701
DE7	32	7	1971	785	26,460	20	1,323
DE8	14	0	1973	1730	0	20	0
DE8A	18	13	1973	1730	49,140	20	2,457
DE8B	19	19	1976	1730	71,820	20	3,591
DE10A	61	61	1982	1678	230,580	20	11,529
total	233	165			623,700	20	31,185
SATS hired	20	20	?	1559	na	na	na
Electric locomotives:							
EL1	30	30.0	1982	2400	120,000	30.0	4,000
GRAND TOTAL:							
Shunting							
- steam	19	18			45,360	20	2,268
- diesel	72	56			141,120	20	7,056
- total	91	74			262,200	20	13,110
Mainline							
- steam	80	79			248,850	20	12,443
- diesel	233	165			623,700	20	31,185
- electric	30	30			120,000	30	4,000
- total	343	274			992,550	23	47,628
Owned	434	348			1,254,750	21	60,738
Hired	20	20			na	na	na

* based on US$1.2 mil. for shunting locos, US$1.5 mil. for mainline steam locos and US$1.8 mil. for mainline diesel locos.

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, Supplementary Report, April 1990, with adjusted prices.

Table C.14: DEPRECIATION CALCULATED ON REPLACEMENT VALUE BOTSWANA RAILWAYS (1988/89)

ROLLING STOCK	number	Unit rep. value ('000 US$)	Total Cost (mln US$)	deprec. period (years)	Total deprc. (mln US$)
Mainline locomotives					
BD-1	12	1,296	15.6	20	0.8
BD-2	20	2,160	43.2	20	2.2
Total	32	3,456	58.8	20	3.0
Goods Wagons:					
High sided	10	28	0.3	40	0.0
Drop sided	50	28	1.4	40	0.0
Covered	25	39	1.0	40	0.0
Flat	10	10	0.1	40	0.0
Livestock	134	10	1.3	40	0.0
Tankcars	30	35	1.1	40	0.0
Hoppers	20	38	0.8	40	0.0
Total	279	188	6.0	40	0.2
Steam travel cranes	n.a.	n.a.	n.a.	40	n.a.
Passenger coaches	n.a.	n.a.	n.a.	40	n.a.
Grand total			64.8		3.2

PERMANENT WAY	km	Replacemt. costs/km ('000 US$)	Total Rep. cost (mln US$)	deprec. period (years)	deprc. ('000 US$)
Main line single	641	300	192.3	40	4.8
Branch line single	72	200	14.4	40	0.4
Sidings	3	200	0.6	40	0.0
Yards and terminals	52	200	10.4	40	0.3
Total track	768		217.7	40	5.5
Bridges and culvert			1.6	80	0.0
Other infrastructure			3.0	40	0.1
Total permanent way			222.3	41	5.6
Total renewable (est. 25%)			55.6		1.4

	Repl. value ('000 US$)	deprec. period (years)	deprc. (mln US$)
Other Assets			
Building	6,946	35	0.2
Furn., Office equip.	308	5	0.1
Plant & Machinery	3,087	10	0.3
Road vehicles	1,546	5	0.3
Signal & telecom Equip.	3,442	20	0.2
Total	15,327		1.1
Total renewable (est. 80%)	12,262		0.9

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, (supplementary report), April 1990, with adjusted replacement costs.

Table C15: COMPARISON OF ROLLING STOCK UNIT REPLACEMENT VALUES
(mln US$)

Railway	ZR	TZR	MR	NRZ	CFM	BR
Locomotive Type 1	Line	DE	Line	DE10A	DE	BD-2
HP	n.a.	Line	1500	1678	Line	Line
Replacement Cost	2.0	1.2	1.5	1.9	1.7	2.2
Standard Cost*	1.8	1.8	1.8	1.8	1.8	1.8
Locomotive Type 2		DFH-2	Line	DE8B		BD-1
HP		Line	1200	1730		Line
Replacement Cost		0.3	1.1	1.9		1.3
Standard Cost		1.8	1.2	1.8		1.8
Locomotive Type 3	Shunt	DFH-1	Shunt	DE9A	DH	
HP	n.a.	shunt	n.a.	shunt	1250	
Replacement Cost	1.0	0.4	0.8	1.6	1.2	
Standard Cost	1.2	1.2	0.9	1.2	1.2	
Average Goods Wagon						
Av. Replacement Cost	0.060	0.041	0.051	0.032		0.022
Standard Cost**	0.030	0.030	0.030	0.030		0.030

* standard cost for a GE or GM 2000HP diesel electric locomotive, delivered to the region. All line locomotives are in the same cost range if international competitive bidding is used and standard locomotive specifications are used.

** wagons manufactured in Zimbabwe are the standard. Some specialized wagons are more expensive.

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies Supplementary Report, April 1990.

Annex C

Part III

Calculated Unit Costs For Different SADCC Railways

Table C16: COMPARISON OF ROLLING STOCK MAINTENANCE EXPENDITURES (000 US$)

Railway	ZR	TZR	MR	NRZ	CFM-S	BR
Loco Maintenance Standard Cost						
line	87	87	87	87	87	87
shunt	41	41	41	41	41	41
Labor adj. factor*	1.00	0.36	n.a.	0.72	1.00	0.80
Adjusted Standard Cost**						
line	87	65	n.a.	77	87	80
shunt	41	31	n.a.	36	41	38
Actual Expenditure	n.a.	44	n.a.	44	n.a.	48
Wagon Maintenance						
standard cost	1.2	1.2	1.2	1.2	1.2	1.2
adj. stand. cost**	1.2	0.9	n.a.	1.1	1.2	1.1
Actual Expenditure	n.a.	0.4	n.a.	0.7	n.a.	1.2
Ratio of Adj. Standard Cost to Actual Maintenance Expenditures (all roll. stock)	0.35	0.64	n.a.	0.83	0.14	0.66

* based on the ratio of actual to standard crew costs.
** adjusted by taking 40% of standard cost and multiplying by the labor adjustment factor

Note: The labor adjustment factor includes excess staff staff in the case of CFM which are maintained for full scale operations. The ratio of standard to actual maintenance expenditure is similarly biased by excess labor, wagons and locomotives for the present reduced operations.

Source: NEI, SADCC Transport Corridors, Study of Financial Strategy, (supplemental report), April 1990, and analysis.

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Table C17: COMPARISON OF PERMANENT WAY UNIT REPLACEMENT COSTS
(000 US$)

Railway	ZR	TZR**	MR*	NRZ	CFM**	BR	Average
Line Type 1	Main	Main	Conc. sl.	Main	Main	Main	Main
cost/km	170	440	94	158	56	133	250
standard cost	300	300	75	300	300	300	300
Line Type 2	Branch		steel sl.	Branch		Branch	Branch
cost/km	130		83	157		133	150
standard cost	200		50	200		200	190
Line Type 3	Sidings		wood sl.	Priv. sid.		Sidings	Sidings
cost/km	130		52	198		133	150
standard cost	200		50	200		200	190

* rail and sleeper replacement only.
** derived from total depreciation.

Note: Standard costs are based on concrete sleepers and 40 kg rail.

Source: NEI, SADCC Transport Corridors, Study of Financial Strategy, (supplemental report), April 1990.

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Standard Costs for Corridor Rail Transport

(Annex D)

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Table D.1: NORMALIZED VARIABLE COST ANALYSIS BY MAJOR CORRIDOR (in US$)
FOR PRESENT CORRIDOR OPERATIONS

A. Train Costs (excl. wagons)	CORRIDOR BETWEEN... ...AND	LOBITO Lubumbashi Benguela	TAZARA K Mposhi Dar Salaam	NACALA Nkaya Nakala	SENA Villa Nova Beira	BEIRA Harare Beira	R GARCIA Gweru Maputo	LIMPOPO Gweru Maputo	GOBA Matasphe Maputo	BOTSWANA Mpopoma Durban	NRZ-ZR Lubumbashi Harare	NRZ-SATS Gweru Durban
	COUNTRIES	Zaire Angola	Zambia Tanzania	Malawi Mozambique	Mozambique	Zimbabwe Mozambique	Zimbabwe S Africa Mozambique	Zimbabwe Mozambique	Swaziland Mozambique	Zimbabwe Botswana S Africa	Zaire Zambia Zimbabwe	Zimbabwe S Africa
Data Item (See Notes)												
1 KILOMETRES (by country)		1870	1880	716	320	273	425	438	141	212	100	425
						319	666	534	75	642	931	1341
							77			1166	727	
		---	---	---	---	---	---	---	---	---	---	---
		1870	1880	716	320	592	1168	967	216	2020	1758	1766
		---	---	---	---	---	---	---	---	---	---	---
2 SEGMENTS		8	6	3	1	3	5	4	1	7	7	7
3 # LOCOS PER TRAIN		2	2	2	1	2	2	1	2	1	1	1
4 LOCO KM PER DAY		190	180	150	150	150	150	150	150	245	190	200
5 LOCO DAYS PER TRIP		19.7	23.3	9.5	2.1	7.9	15.6	6.4	2.9	8.2	9.3	8.8
6 GROSS TRAILING TONNES		2000	2000	2000	1250	1740	2000	1600	2000	2400	1600	2400
7 GTKm / TRAIN TRIP		3,553,000	3,534,000	1,359,500	380,000	978,576	2,219,200	1,469,840	410,400	4,606,800	2,672,160	4,026,480
8 ROUTE FACTOR		1.4	1.3	1.2	1.1	1.4	1.1	1.2	1.2	1.0	1.0	1.1
TRAIN COSTS PER 1000 GTKm:												
SHORT TERM -												
9 Perm Way Mtce	$0.251 /1000 GTKm	$0.351	$0.328	$0.301	$0.276	$0.351	$0.276	$0.301	$0.301	$0.251	$0.251	$0.276
10 Train Crew	$67.84 /shift	0.158	0.116	0.150	0.179	0.208	0.158	0.186	0.165	0.103	0.178	0.118
11 Loco Fuel	$1.180 /engine km	1.685	1.546	1.427	1.047	1.914	1.308	0.892	1.427	0.496	0.748	0.545
12 Loco Mtce	$298.34 /engine day	1.642	1.950	2.080	1.664	2.390	2.080	1.300	2.080	0.531	1.026	0.650
13 TOTAL SHORT TERM TRAIN COSTS PER 1000 GROSS TONNE KILOMETRES		$3.811	$3.987	$3.958	$3.165	$4.864	$3.817	$2.878	$3.973	$1.380	$2.198	$1.589
LONG TERM -												
14 Loco Dep'n	$268.93 /engine day	$1.490	$1.769	$1.897	$1.510	$2.169	$1.887	$1.180	$1.887	$0.481	$0.931	$0.590
15 Loco Int.	$471.76 /engine day	2.614	3.104	3.311	2.648	3.806	3.311	2.069	3.311	0.845	1.634	1.035
16 TOTAL LONG TERM TRAIN COSTS PER 1000 GROSS TONNE KILOMETRES		$7.915	$8.810	$9.156	$7.323	$10.838	$9.015	$5.928	$9.171	$2.706	$4.763	$3.213

Source: SADCC Transport Corridors, Study of Financial Strategy, Working Paper 2, August 1989, with adjusted productivity data.

Table D.2: NORMALIZED VARIABLE COST ANALYSIS BY MAJOR CORRIDOR (in US$)
FOR PRESENT CORRIDOR OPERATIONS

B. Wagon Costs	CORRIDOR BETWEEN... ...AND	LOBITO Lubumbashi Benguela	TAZARA K Mpochi Dar Salaam	NACALA Nkaya Villa Nakala	SENA Nova Beira	BEIRA Harare Beira	R GARCIA Gweru Maputo	LIMPOPO Gweru Maputo	GOBA Matsapha Maputo	BOTSWANA Mpopoma Durban	NRZ-ZR Lubumbashi Harare	NRZ-SATS Gweru Durban
	COUNTRIES	Zaire Angola	Zambia Tanzania	Malawi Mozambique	Mozambique	Zimbabwe Mozambique S Africa	Zimbabwe S Africa	Zimbabwe Mozambique Mozambique	Swaziland Mozambique	Zimbabwe Botswana	Zaire Zambia Zimbabwe	Zimbabwe S Africa Zimbabwe
Data Item (See Notes)												
1 KILOMETRES (by country)		1870	1980	715	320	212	425	425	438	278	100	100
						642	1341	666	534	319	931	931
						1166		77			727	727
		----	----	----	----	----	----	----	----	----	----	----
		1870	1980	715	320	2020	1766	1168	967	592	1758	1758
		----	----	----	----	----	----	----	----	----	----	----
2 SEGMENTS		6	6	3	1	7	7	5	4	3	7	5
6 GROSS TRAILING TONNES		2000	2000	2000	1250	2400	2400	2000	1600	1740	1600	2000
7 GTKm / TRAIN TRIP		3,553,000	3,534,000	1,358,500	380,000	4,805,600	4,028,480	2,219,200	1,469,840	978,576	2,672,160	2,219,200
17 WAGON KM PER DAY		80	84	25	25	25	25	25	25	81	40	45
16 DAYS PER TRIP PER WAGON		23.4	22.1	28.6	12.8	80.6	70.6	46.7	38.7	7.3	44.0	39.1
WAGON COSTS PER 1000 Km:												
SHORT TERM -												
19 Wagon Mtce	$3.379 /wagon day	$42.24	$40.23	$135.16	$135.16	$135.16	$135.16	$135.16	$135.16	$41.72	$84.48	$75.09
TOTAL SHORT TERM WAGON COSTS PER 1000 KILOMETRES ..		$42.24	$40.23	$135.16	$135.16	$135.16	$135.16	$135.16	$135.16	$41.72	$84.48	$75.09
LONG TERM -												
20 Wagon Dep'n	$3.28 /wagon day	$40.77	$38.83	$130.46	$130.46	$130.46	$130.46	$130.46	$130.46	$40.27	$81.54	$72.49
21 Wagon Interest	$16.80 /wagon day	209.99	199.99	671.97	671.97	671.97	671.97	671.97	671.97	207.40	419.98	373.32
22 TOTAL LONG TERM WAGON COSTS PER 1000 KILOMETRES ..		$293.00	$279.04	$937.59	$937.59	$937.59	$937.59	$937.59	$937.59	$289.38	$585.99	$520.88

Source: SADCC Transport Corridor, Study of Financial Strategy, Working Paper 2, August 1989, with adjusted productivity data.

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Table D.3: NORMALIZED VARIABLE COST ANALYSIS BY MAJOR CORRIDOR (in US$)
WITH SHORT TERM IMPROVEMENTS IN PRODUCTIVITY

A. Train Costs (excl. wagons)	CORRIDOR BETWEEN... ...AND	LOBITO Lubumbashi Benguela	TAZARA K Mpochi Dar Salaam	NACALA Nkaya Villa Nova Nakala	SENA Beira	BEIRA Harare Beira	R GARCIA Gweru Maputo	LIMPOPO Gweru Maputo	GOBA Matasphe Maputo	BOTSWANA Mpopoma Durban	NRZ-ZR Lubumbashi Harare	NRZ-SATS Gweru Durban
	COUNTRIES	Zaire Angola	Zambia Tanzania	Malawi Mozambique	Mozambique	Zimbabwe Mozambique	Zimbabwe S Africa Mozambique	Zimbabwe Mozambique	Swaziland Mozambique	Zimbabwe Botswana S Africa	Zaire Zambia Zimbabwe	Zimbabwe S Africa
Data Item (See Notes)												
1 KILOMETRES (by country)		1870	1860	715	320	273	425	438	141	212	100	425
						319	666	534	75	642	981	1341
							77			1166	727	
		1870	1860	715	320	592	1168	967	216	2020	1758	1766
2 SEGMENTS		9	9	3	1	3	5	4	1	7	7	7
3 # LOCOS PER TRAIN		2	2	2	1	2	2	1	2	1	1	1
4 LOCO KM PER DAY		300	320	300	260	260	330	330	330	320	300	375
5 LOCO DAYS PER TRIP		12.5	11.6	4.9	1.2	4.6	7.1	2.9	1.8	6.3	5.9	4.7
6 GROSS TRAILING TONNES		2000	2000	2000	1250	1740	2000	1600	2000	2400	1600	2400
7 GTKm / TRAIN TRIP		3,553,000	3,534,000	1,358,500	380,000	978,576	2,219,200	1,469,840	410,400	4,606,600	2,672,160	4,026,480
8 ROUTE FACTOR		1.4	1.3	1.2	1.1	1.4	1.1	1.2	1.2	1.0	1.0	1.1
TRAIN COSTS PER 1000 GTKm:												
SHORT TERM -												
9 Perm Way Mtce	$0.251 /1000 GTKm	$0.351	$0.328	$0.301	$0.276	$0.351	$0.276	$0.301	$0.301	$0.251	$0.251	$0.276
10 Train Crew	$67.84 /shift	0.153	0.115	0.150	0.179	0.208	0.153	0.185	0.185	0.103	0.178	0.118
11 Loco Fuel	$1.130 /engine km	1.665	1.548	1.427	1.047	1.914	1.308	0.892	1.427	0.496	0.748	0.545
12 Loco Mtce	$298.34 /engine day	1.040	0.975	1.040	0.960	1.379	0.845	0.591	0.945	0.406	0.650	0.347
13 TOTAL SHORT TERM TRAIN COSTS PER 1000 GROSS TONNE KILOMETRES		$3.209	$2.963	$2.918	$2.461	$3.853	$2.683	$1.969	$2.839	$1.256	$1.822	$1.286
LONG TERM -												
14 Loco Dep'n	$268.93 /engine day	$0.944	$0.885	$0.944	$0.871	$1.251	$0.858	$0.536	$0.858	$0.369	$0.590	$0.815
15 Loco Int.	$471.76 /engine day	1.655	1.552	1.655	1.528	2.196	1.505	0.941	1.505	0.647	1.035	0.552
16 TOTAL LONG TERM TRAIN COSTS PER 1000 GROSS TONNE KILOMETRES		$5.908	$5.399	$5.517	$4.860	$7.299	$5.045	$3.445	$5.202	$2.271	$3.446	$2.152

Source: SADCC Transport Corridors, Study of Financial Strategy, Working Paper 2, August 1989, with adjusted productivity data.

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Table D.4: NORMALIZED VARIABLE COST ANALYSIS BY MAJOR CORRIDOR (in US$)
WITH SHORT TERM IMPROVEMENTS IN PRODUCTIVITY

B. Wagon Costs	CORRIDOR	LOBITO	TAZARA	NACALA	SENA	BEIRA	R GARCIA	LIMPOPO	GOBA	BOTSWANA	NRZ-ZR	NRZ-SATS
	BETWEEN...	Lubumbashi	K Mpochi	Nkaya	Villa Nova	Harare	Gweru	Gweru	Matapha	Mpopoma	Lubumbashi	Gweru
	...AND	Benguela	Dar Salaam	Nakala	Beira	Beira	Maputo	Maputo	Maputo	Durban	Harare	Durban
	COUNTRIES	Zaire Angola	Zambia Tanzania	Malawi Mozambique	Mozambique	Zimbabwe Mozambique S Africa	Zimbabwe S Africa	Zimbabwe Mozambique Mozambique	Swaziland Mozambique	Zimbabwe Botswana	Zaire Zambia Zimbabwe	Zimbabwe S Africa Zimbabwe
Data Item (See Notes)												
1 KILOMETRES (by country)		1870	1960	715	320	212	425	425	433	273	100	100
						642	1341	666	534	319	931	931
						1166		77			727	727
		----	----	----	----	----	----	----	----	----	----	----
		1870	1960	715	320	2020	1766	1168	967	592	1758	1758
		----	----	----	----	----	----	----	----	----	----	----
2 SEGMENTS		8	8	3	1	7	7	5	4	3	7	5
6 GROSS TRAILING TONNES		2000	2000	2000	1250	2400	2400	2000	1600	1740	1600	2000
7 GTKm / TRAIN TRIP		3,553,000	3,534,000	1,358,500	380,000	4,605,600	4,026,480	2,219,200	1,469,840	978,576	2,672,160	2,219,200
17 WAGON KM PER DAY		180	180	75	72	72	75	75	75	180	72	80
19 DAYS PER TRIP PER WAGON		10.4	10.3	9.5	4.4	28.1	23.5	15.6	12.9	3.3	24.4	22.0
WAGON COSTS PER 1000 Km:												
SHORT TERM -												
19 Wagon Mtce	$3.379 /wagon day	$18.77	$18.77	$45.05	$46.93	$46.93	$45.05	$45.05	$45.05	$18.77	$46.93	$42.24
TOTAL SHORT TERM WAGON COSTS PER 1000 KILOMETRES ..		$18.77	$18.77	$45.05	$46.93	$46.93	$45.05	$45.05	$45.05	$18.77	$46.93	$42.24
LONG TERM -												
20 Wagon Dep'n	$3.28 /wagon day	$18.12	$18.12	$43.49	$45.30	$45.30	$43.49	$43.49	$43.49	$18.12	$45.30	$40.77
21 Wagon Interest	$16.00 /wagon day	$3.33	$3.33	$228.99	$233.32	$233.32	$228.99	$228.99	$228.99	$3.33	$233.32	$209.99
22 TOTAL LONG TERM WAGON COSTS PER 1000 KILOMETRES ..		$130.22	$130.22	$312.53	$325.55	$325.55	$312.53	$312.53	$312.53	$130.22	$325.55	$293.00

Source: SADCC Transport Corridor, Study of Financial Strategy, Working Paper 2, August 1989, with adjusted productivity data.

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Table D.5: NORMALIZED VARIABLE COST ANALYSIS BY MAJOR CORRIDOR (in US$)
WITH LONG TERM IMPROVEMENTS IN PRODUCTIVITY AND TRAIN LOADING

A. Train Costs (excl. wagons)												
CORRIDOR BETWEEN...		LOBITO Lubumbashi	TAZARA K Mpochi	NACALA Nkaya	SENA Villa Nova	BEIRA Harare	R GARCIA Gweru	LIMPOPO Gweru	GOBA Matsapha	BOTSWANA Mpopoma	NRZ-ZR Lubumbashi	NRZ-SATS Gweru
...AND		Benguela	Dar Salaam	Nakala	Beira	Beira	Maputo	Maputo	Maputo	Durban	Harare	Durban
COUNTRIES		Zaire Angola	Zambia Tanzania	Malawi Mozambique	Mozambique	Zimbabwe Mozambique	Zimbabwe S Africa Mozambique	Zimbabwe Mozambique	Swaziland Mozambique	Zimbabwe Botswana S Africa	Zaire Zambia Zimbabwe	Zimbabwe S Africa
Data Item (See Notes)												
1 KILOMETRES (by country)		1870	1860	715	320	273	425	433	141	212	100	425
						319	666	534	75	642	931	1341
							77			1166	727	
		---	---	---	---	---	---	---	---	---	---	---
		1870	1860	715	320	592	1168	967	216	2020	1758	1766
		---	---	---	---	---	---	---	---	---	---	---
2 SEGMENTS		8	6	3	1	3	5	4	1	7	7	7
3 # LOCOS PER TRAIN		1.2	1.2	1.2	1.5	1.5	1.2	1.2	1.2	1.0	1.2	1.0
4 LOCO KM PER DAY		470	535	450	400	400	400	510	400	400	425	487
5 LOCO DAYS PER TRIP		4.8	4.2	1.9	1.2	2.2	3.5	2.3	0.6	5.1	5.0	3.8
6 GROSS TRAILING TONNES		2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400
7 GTKm / TRAIN TRIP		4,268,600	4,240,800	1,630,200	729,600	1,349,760	2,663,040	2,204,760	492,480	4,606,800	4,008,240	4,026,480
8 ROUTE FACTOR		1.4	1.3	1.2	1.1	1.4	1.1	1.2	1.2	1.0	1.0	1.1
TRAIN COSTS PER 1000 GTKm:												
SHORT TERM -												
9 Perm Way Mtce	$0.251 /1000 GTKm	$0.351	$0.326	$0.301	$0.276	$0.351	$0.278	$0.301	$0.301	$0.251	$0.251	$0.276
10 Train Crew	$67.84 /shift	0.127	0.096	0.125	0.093	0.151	0.127	0.123	0.139	0.103	0.118	0.118
11 Loco Fuel	$1.180 /engine km	0.833	0.773	0.714	0.818	1.041	0.654	0.714	0.714	0.496	0.595	0.545
12 Loco Mtce	$296.34 /engine day	0.332	0.292	0.347	0.487	0.487	0.390	0.308	0.390	0.325	0.367	0.278
13 TOTAL SHORT TERM TRAIN COSTS PER 1000 GROSS TONNE KILOMETRES		$1.643	$1.487	$1.488	$1.674	$2.030	$1.448	$1.444	$1.543	$1.175	$1.331	$1.218
LONG TERM -												
14 Loco Dep'n	$268.98 /engine day	$0.301	$0.265	$0.315	$0.442	$0.442	$0.354	$0.278	$0.354	$0.295	$0.333	$0.253
15 Loco Int.	$471.76 /engine day	0.528	0.464	0.552	0.776	0.776	0.621	0.487	0.621	0.517	0.584	0.443
16 TOTAL LONG TERM TRAIN COSTS PER 1000 GROSS TONNE KILOMETRES		$2.473	$2.216	$2.353	$2.892	$3.249	$2.422	$2.208	$2.517	$1.987	$2.248	$1.918

Source: SADCC Transport Corridors, Study of Financial Strategy, Working Paper 2, August 1989, with adjusted productivity data.

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Table D.6: NORMALIZED VARIABLE COST ANALYSIS BY MAJOR CORRIDOR (in US$)
WITH LONG TERM IMPROVEMENTS IN PRODUCTIVITY AND TRAIN LOADING

B. Wagon Costs	CORRIDOR BETWEEN... ...AND	LOBITO Lubumbashi Benguela	TAZARA K Mposhi Dar Salaam	NACALA Nkaya Nakala	SENA Villa Nova Beira	BEIRA Harare Beira	R GARCIA Gweru Maputo	LIMPOPO Gweru Maputo	GOBA Matasphe Maputo	BOTSWANA Mpopoma Durban	NRZ-ZR Lubumbashi Harare	NRZ-SATS Gweru Durban
	COUNTRIES	Zaire Angola	Zambia Tanzania	Malawi Mozambique	Mozambique	Zimbabwe Mozambique S Africa	Zimbabwe S Africa	Zimbabwe Mozambique Mozambique	Swaziland Mozambique	Zimbabwe Botswana	Zaire Zambia Zimbabwe	Zimbabwe S Africa Zimbabwe
Data Item (See Notes)												
1 KILOMETRES (by country)		1870	1960	715	320	212	425	425	433	273	100	100
						642	1341	666	534	319	931	931
						1166		77			727	727
		----	----	----	----	----	----	----	----	----	----	----
		1970	1960	715	320	2020	1766	1168	967	592	1758	1758
		----	----	----	----	----	----	----	----	----	----	----
2 SEGMENTS		8	6	3	1	7	7	5	4	3	7	5
8 GROSS TRAILING TONNES		2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400
7 GTKm / TRAIN TRIP		4,268,600	4,240,800	1,630,200	729,600	4,805,600	4,028,480	2,663,040	2,204,760	1,349,760	4,008,240	2,663,040
17 WAGON KM PER DAY		225	225	100	90	90	100	117	100	225	90	90
18 DAYS PER TRIP PER WAGON		8.3	8.3	7.2	3.6	22.4	17.7	10.0	9.7	2.6	19.5	19.5
WAGON COSTS PER 1000 Km:												
SHORT TERM -												
19 Wagon Mtce	$3.379 /wagon day	$15.02	$15.02	$33.79	$37.54	$37.54	$33.79	$29.88	$33.79	$15.02	$37.54	$37.54
TOTAL SHORT TERM WAGON COSTS PER 1000 KILOMETRES ..		$15.02	$15.02	$33.79	$37.54	$37.54	$33.79	$29.88	$33.79	$15.02	$37.54	$37.54
LONG TERM -												
20 Wagon Dep'n	$3.26 /wagon day	$14.50	$14.50	$32.62	$36.24	$36.24	$32.62	$27.88	$32.62	$14.50	$36.24	$36.24
21 Wagon Interest	$16.80 /wagon day	74.66	74.66	167.99	186.66	186.66	167.99	143.58	167.99	74.66	186.66	186.66
22 TOTAL LONG TERM WAGON COSTS PER 1000 KILOMETRES ..		$104.18	$104.18	$234.40	$260.44	$260.44	$234.40	$200.34	$234.40	$104.18	$260.44	$260.44

Source: SADCC Transport Corridor, Study of Financial Strategy, Working Paper 2, August 1989, with adjusted productivity data.

NOTES FOR ANNEX D TABLES

1. Kilometres shown separately by country.

2. Segments are crew shift and fueling locations and are usually linked to classification yards. Normally The more segments the more delays in the corridor. This delay can be reduced for through trains with rapid crew change and refueling.

3. Based on a balance between tonnage capacity of locomotives on the line (using a standard 2000 HP loco), and the restrictions on lengths resulting from the capacity of passing loops.

4. Based on present or improved operating conditions for through trains.

5. Calculated from (1) times (3) divided by (4).

6. Based on combination of capacity of locomotives (3 above) and length capacity.

7. GTKm per train includes allowance for a 95% load factor.

8. Factors to differentiate between physical characteristics of different lines; applied to costs of permanent way maintenance and fuel.

9. Estimated at US$0.251, by NEI in Working Paper 3.

10. Based on NRZ train crew costs.

11. Based on NRZ fuel costs.

12. Estimated at US$ 88,902 per loco per year with 300 operating days.

13. Sum of (9), (10), (11), (12) above.

14. Based on standard 2000 HP locomotive at a cost of US$1.8 million divided by a 25 year life, times the number of loco days (5 above) divided by GTKM (7).

15. Unit cost of interest (cost of capital = 10%) per loco day times loco days (5 above) divided by GTKM.

16. Sum of (13), (14) and (15) above.

17. Based on present or improved operating conditions.

18. Number of kilometers per trip (1 above) divided by wagon kilometers per day (17 above).

NOTES FOR ANNEX D TABLES (Cont.)

19. Estimated at US$ 1,115 per wagon per year, divided by 330 annual wagon operating days.

20. Based on an average unit cost of US$30,000 per wagon divided by 40 years of life times the number of days per trip (18 above) divided by the km per trip (1).

21. Unit cost of interest (cost of capital = 10%) per wagon day times the number of wagon days (18 above), divided by the km per trip (1).

22. Sum of (19), (20) and (21) above.

SADCC Transport Corridors

Study of Financial Strategy

Standard Truck Costs For Corridor Shipping

(Annex E)

Table E.1: STANDARD TRUCK COSTS PER TON-KM FOR CORRIDOR SHIPPING

	Financial			
	short haul		long haul	
	US$c	%	US$c	%
Crew	0.4	3%	0.3	3%
Fuel & Lubricants	1.1	9%	0.9	10%
Maintenance	1.8	15%	1.5	17%
Tires	2.6	21%	2.0	23%
Overhead & Insurance	2.0	16%	1.4	16%
Interest	1.5	12%	0.9	10%
Depreciation	2.3	19%	1.4	16%
Profit Margin	0.5	4%	0.4	5%
Road Maintenance	0.0	0%	0.0	0%
Total Cost	12.2	100%	8.8	100%
Load factor (%)		60		80
Interest rate (%)		22		22
Taxes on vehicles (%)		35		35
Truck/kms year		70,000		90,000
Max. load truck (tons)		30		30

Source: SADCC Transport Corridors Workshop, Policy Issues in Financial Strategy, Working Paper 3, Maputo December 1989.

SADCC Transport Corridors

Study of Financial Strategy

Breakeven Analysis for SADCC Railways

(Annex F)

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Table F.1: Breakeven Analysis for SADCC Railways
(present corridors open)

	ZR	TAZARA	MR	CFM-C	CFM-S	NRZ	BR	Aver.
A. Total Traffic								
Freight Oper. cost* (US cents/ntkm)	4.6	3.0	20.1	15.2	24.8	5.1	4.2	4.6
LRMC**(US cents/ntkm)	2.2	1.2	3.8	3.8	3.8	2.6	1.9	2.7
Fixed cost (US$ mil) for freight***	38.8	27.3	11.9	16.5	30.0	143.6	13.1	
Share of freight gtkm	97%	98%	95%	88%	99%	90%	95%	
Freight Revenues (US cents/ntkm)	4.1	2.5	9.2	5.7	7.3	2.0	3.0	2.5
Present Traffic (mil ntkm)	1,776	1,460	73	145	143	5,287	771	n.a.
Breakeven 1 (mil tkm)	2,042	2,098	221	869	858	n.a.	1,189	
B. Border-crossing Traffic after short term improvements (Scenario 1)								
Freight Oper. cost (US cents/ntkm)	3.1	2.0	n.a.	5.2	12.1	2.6	3.1	2.9
LRMC**(US cents/ntkm)	1.7	1.1	n.a.	2.7	3.8	1.6	1.2	1.6
Fixed cost (US$ mil) for border-crossing freight	11.9	18.2	n.a.	6.0	7.1	27.7	4.9	
Share of gtkm	53%	93%	0%	59%	67%	57%	52%	
Freight Revenues 1) (US cents/ntkm)	6.5	2.1	n.a.	4.1	8.5	2.5	3.1	3.1
Forecast Traffic (mil ntkm)	864	2,009	0	240	85	2,632	252	n.a.
Breakeven 2 (mil tkm)	249	1,734	n.a.	429	150	2,941	251	

* Total operating costs allocated by share of gtkm for freight.

** LRMC = Long Run Marginal Cost = variable cost + locomotive and rolling stock depreciation. This is modified in the cases of Malawi Railways and the CFM lines to take into account specific studies of fixed and variable costs by Hamburg Port Consultants for CFM-C which were extrapolated to CFM-S and Malawi (resulting in a variable cost of US cents 3.8/tkm).

*** Fixed operating cost plus depreciation of permanent way and plant plus interest, allocated on the basis of the share of gtkm for freight.

1) Revenues in the case of CFM and Botswana were estimated from Scenario 1 data.

Breakeven = PresentPresent Traffic X (Fixed cost/Revenue - LRMC)

Source: Annex C for total costs and Annex I for Scenario 1 data.

Table F.2: Breakeven Analysis for SADCC Railways (Scenarios 2 and 3)
(all corridors open)

	CFB	ZR	TAZARA	MR	CFM-N	CFM-C	CFM-S	NRZ	BR	SWR
A. Scenario 2 - Border-crossing traffic only										
Freight Oper. cost* (US cents/ntkm)	3.1	2.6	2.0	5.0	4.7	4.3	3.1	2.6	3.5	5.4
LRMC**(US cents/ntkm)	0.8	1.3	0.9	1.6	1.3	2.0	1.3	1.6	1.6	2.5
Fixed cost (US$ mil) for freight***	8.9	11.9	15.3	5.7	3.0	6.9	8.8	26.6	4.9	7.3
Share of gtkm	94%	55%	90%	79%	75%	63%	92%	54%	52%	95%
Freight Revenues (US cents/ntkm)	1.9	6.5	1.9	3.0	4.0	5.2	3.6	2.5	3.1	3.5
Present Traffic (mil ntkm)	375	910	1423	166	87	291	502	2491	258	254
Breakeven 1 (mil tkm)	790	227	1,529	398	109	213	385	2,872	333	717
B. Scenario 3 - Border-crossing traffic only										
Freight Oper. cost (US cents/ntkm)	4.8	2.9	2.1	6.0	5.5	5.1	3.7	2.6	4.1	6.5
LRMC**(US cents/ntkm)	1.0	1.7	1.0	2.6	1.6	2.7	2.0	1.6	2.2	3.6
Fixed cost (US$ mil) for border-crossing freight	7.8	12.9	15.9	5.5	2.7	6.9	9.0	27.4	5.0	7.1
Share of gtkm	91%	58%	91%	79%	70%	64%	93%	57%	53%	95%
Freight Revenues 1) (US cents/ntkm)	3.5	3.3	2.3	7.1	6.1	6.4	4.1	3.2	5.0	7.9
Present Traffic (mil ntkm)	208	1029	1543	161	69	293	524	2622	262	243
Breakeven 2 (mil tkm)	313	802	1,259	122	60	186	426	1,690	177	164

* Total operating costs allocated by share of gtkm for freight.
** LRMC = Long Run Marginal Cost = variable cost + locomotive and rolling stock depreciation. This is modified in the cases of Malawi Railways and the CFM lines to take into account specific studies of fixed and variable costs by Hamburg Port Consultants for CFM-C which were extrapolated to CFM-S and Malawi (resulting in a variable cost of US cents 3.8/tkm).
*** Fixed operating cost plus depreciation of permanent way and plant plus interest, allocated on the basis of the share of gtkm for freight.

Breakeven = Present Traffic X (Fixed cost/Revenue - LRMC)

Source: Annex I.

SADCC Transport Corridors

Study of Financial Strategy

Traffic Forecasts

(Annex G)

Part I. Traffic Forecast Details by Scenario

Part II. Intraregional Trade

Part III. Local Traffic

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Annex G

Part I

Traffic Forecast Details by Scenario

Table G.1: BREAKDOWN OF OVERSEAS FREIGHT - 1990 - BY COUNTRY AND CORRIDOR - SCENARIO 1
IMPORTS (in '000 m. tons)

Rail\Road From:	Matadi	Lobito	Dar	Nacala	Beira	Maputo	Durban	Port E.	Cape T.	Ndola	Dar	Harare	Beira	Maputo	Durban	Cape T.	Total
Zaire	2.0	0.0	49.7			12.1	23.1			120.0	3.1		0.0				210
Zambia		0.0	258.7			140.7	0.0				12.6		0.0				412
Malawi			63.0	0.0	0.0		92.2			34.8	15.8	54.8			13.3		274
Zimbabwe					168.9	72.7	116.5						0.0	0.0	9.9		368
Swaziland						23.1	27.0							0.0	9.9		60
Botswana							30.5		16.4				0.0		5.7	1.4	54
																	0
Total	2.0	0.0	371.4	0.0	168.9	248.6	289.3	0.0	16.4	154.8	31.5	54.8	0.0	0.0	38.8	1.4	1378

EXPORTS (in '000 m. tons)

Rail\Road to:	Matadi	Lobito	Dar	Nacala	Beira	Maputo	Durban	Port E.	Cape T.	Dar	Beira	Maputo	Durban	Cape T.	Total
Zaire	252.6	0.0	210.9		0.0	0.0	21.1	60.6		33.8					579
Zambia		0.0	431.4		97.9	9.9	0.0	0.0		22.8			0.0		562
Malawi			70.4	0.0	46.0		90.3			8.5			12.7		228
Zimbabwe					452.0	318.8	227.0	169.9					11.4		1179
Swaziland						472.2	377.6						85.1		935
Botswana						18.0	15.9	20.0	13.5				1.7	0.9	70
Total	252.6	0.0	712.7	0.0	595.9	818.9	731.9	250.5	13.5	65.1	0.0	0.0	110.9	0.9	3553

Source: SADCC Transport Corridor Workshop, Policy Issues in Financial Strategy, Working Paper 3, Maputo, Dec. 1989.

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Table G.2: BREAKDOWN OF OVERSEAS FREIGHT - 1990 - BY COUNTRY AND CORRIDOR - SCENARIO 2

IMPORTS (in '000 m. tons)

	Rail\Road From:									Road from:							
	Matadi	Lobito	Dar	Nacala	Beira	Maputo	Durban	Port E.	Cape T.	Ndola	Dar	Harare	Beira	Maputo	Durban	Cape T.	Total
Zaire	0.8	31.0	32.1			13.2	7.3			120.0	1.0		4.6				210
Zambia		48.9	154.2			109.0	54.7				4.6		40.6				412
Malawi			4.9	76.9	169.4		2.9				0.8	11.0	7.8		0.3		274
Zimbabwe					168.7	109.8	54.5						80.4		4.5		368
Swaziland						27.6	17.5							8.5	6.4		60
Botswana							29.7		16.2				1.7		5.0	1.4	54
																	0
Total	0.8	79.9	191.2	76.9	338.1	259.6	166.6	0.0	16.2	120.0	6.4	11.0	85.1	8.5	16.2	1.4	1378

EXPORTS (in '000 m. tons)

	Rail\Road to:									Road to:					
	Matadi	Lobito	Dar	Nacala	Beira	Maputo	Durban	Port E.	Cape T.	Dar	Beira	Maputo	Durban	Cape T.	Total
Zaire	0.8	159.5	206.8		25.4	68.3	3.9	37.2		20.8	56.3				579
Zambia		50.2	328.3		14.7	86.7	2.9	37.2		11.0	29.8		1.3		562
Malawi			2.0	62.1	155.9		3.2			0.1	4.3		0.3		228
Zimbabwe					336.6	451.9	180.2	154.5			46.8	0.0	9.0		1179
Swaziland						411.6	310.9	5.2				137.7	69.7		935
Botswana						18.6	11.5	18.2	17.9		1.2		1.7	0.9	70
Total	0.8	209.7	537.1	62.1	532.6	1037.1	512.6	252.3	17.9	31.9	138.4	137.7	82.0	0.9	3553

Source: SADCC Transport Corridor Workshop, Policy Issues in Financial Strategy, Working Paper 3, Maputo, Dec. 1989.

Table G.3: BREAKDOWN OF OVERSEAS FREIGHT - 1990 - BY COUNTRY AND CORRIDOR - SCENARIO 3
IMPORTS (in '000 m. tons)

	Rail\Road From:									Road from:							
	Matadi	Lobito	Dar	Nacala	Beira	Maputo	Durban	Port E.	Cape T.	Ndola	Dar	Harare	Beira	Maputo	Durban	Cape T.	Total
Zaire	0.8	15.3	33.0			22.4	13.5			120.0	0.8		4.1				210
Zambia		30.5	138.9			133.5	76.0				3.0		30.2				412
Malawi			7.1	58.7	171.4		3.9				1.3	19.6	11.7		0.3		274
Zimbabwe					165.2	105.8	58.3						34.3		4.4		368
Swaziland						25.3	15.7							11.0	8.0		60
Botswana							29.6		16.2				2.0		4.9	1.2	54
																	0
Total	0.8	45.8	179.0	58.7	336.6	287.0	197.0	0.0	16.2	120.0	5.1	19.6	82.3	11.0	17.6	1.2	1378

EXPORTS (in '000 m. tons)

	Rail\Road to:									Road to:					
	Matadi	Lobito	Dar	Nacala	Beira	Maputo	Durban	Port E.	Cape T.	Dar	Beira	Maputo	Durban	Cape T.	Total
Zaire	0.7	89.7	271.1		33.8	79.2	6.8	41.6		14.2	41.8				579
Zambia		26.0	346.2		16.2	103.0	3.7	40.4		6.4	19.0		1.1		562
Malawi			2.7	52.6	162.2		3.9			0.2	5.9		0.4		228
Zimbabwe					328.4	443.1	188.7	158.4			52.2	0.0	8.2		1179
Swaziland						396.0	292.0	4.8				163.1	79.1		935
Botswana						18.5	11.6	18.3	18.1		1.2		1.6	0.8	70
Total	0.7	115.7	620.0	52.6	540.6	1039.8	506.7	263.5	18.1	20.8	120.1	163.1	90.4	0.8	3553

Source: SADCC Transport Corridor Workshop, Policy Issues in Financial Strategy, Working Paper 3, Maputo, Dec. 1989.

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Annex G

Part II

Intraregional Trade Forecasts

Table G.4: INTRAREGIONAL TRADE 1990 (in '000 metric tons)

From:	To: Zaire	Zambia	Tanzania	Malawi	Mozambique C.	Zimbabwe	Mozambique SUL.	Swaziland	Botswana	South Africa	Total
Zaire	0	16	0	2	0	6	0	0	0	1	25
Zambia	52	0	72	38	0	58	2	0	5	0	222
Tanzania	0	6	0	4	0	0	0	0	0	0	10
Malawi	27	7	1	0	26	14	0	0	3	8	86
Mozambique C.	0	0	0	16	0	2	0	0	0	0	18
Zimbabwe	204	200	29	68	117	0	32	20	214	347	1231
Mozambique SUL	0	0	0	0	0	2	0	0	0	0	2
Swaziland	0	6	0	0	0	15	2	0	0	342	365
Botswana	1	5	0	2	0	30	1	0	0	57	96
South Africa	108	128	0	127	0	829	0	490	630	0	2312
TOTAL	392	368	102	252	143	956	37	510	852	755	4367

Source: SADCC Transport Corridor Workshop, Policy Issues in Financial Strategy, Working Paper 8, Maputo Dec. 1989.

Annex G

Part III

Local Traffic Forecasts

Table G.5: **LOCAL RAIL FREIGHT TRAFFIC FORECAST**

	1990 tonnage (000)	2000 tonnage (000)	1990 ntkm (mln)	2000 ntkm (mln)	1990 gtkm (mln)	2000 gtkm (mln)
CFB	50	200	22	86	45	181
BR	470		234		491	
MR	421		92		193	
CFM-C	660	978	161	210	338	440
CFM-N	144	206	28	40	59	83
CFM-S	795	1,352	45	82	94	171
SWR	10		1		2	
TAZARA	269	730	119	304	251	639
ZR	3,332	3,824	742	868	1,558	1,823
NRZ	10,300					

Source: SADCC Transport Corridor Workshop, Policy Issues in Financial Strategy, Working Paper 3, Maputo Dec. 1989.

SADCC Transport Corridors

Study of Financial Strategy

Calculation of Corridor Assets

(Annex H)

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Table H.1: CURRENT ASSETS OF ZAMBIA RAILWAYS FOR 1988/89

	Numbers	Unit Costs (1000 US$)	Total costs (US$ mil)
Mainline Locomotives	59	1,800	106.2
Shunting Locomotives	12	1,200	14.4
Wagons	2,878	30	86.3
Total			206.9

	km	Unit costs/km (1000 US$)	Total costs (US$ mil)
Permanent Way			
Mainline	847.8	300	254.3
Branch line	256.0	200	51.2
Sidings	187.1	200	37.4
Yards/terminals	321.2	200	64.2
Total	1,612.1		407.1

Other Assets	m2	unit costs/m2 (US$)	total costs (mln US$)
Civil works			
Bridges (etc) (m)	1,180	30,300	35.8
Offices	36,000	350	12.6
Stations	32,500	350	11.4
Terminals (units)	4	580,000	2.3
Running sheds	9,560	350	3.3
Train crew lodges	2,920	290	0.8
Workshops	41,080	35	1.4
Stores/fuel points (unit)	5	290,000	1.5
Houses	386,000	290	111.8
Total			180.9
Vehicles			0.8
Total other assets			181.7
GRAND TOTAL OF ASSETS			795.7

1 US $ = 8.63 ZK

Source:

a) NEI, SADCC Transport Corridors, Study on Financial Strategies, Supplementary report, April 1990

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Table H.2: CURRENT ASSETS OF TAZARA RAILWAYS FOR 1988/89

TAZARA Railways		Numbers	Unit Costs (1000 US$)	Total costs (US$ mil)
Mainline Locomotives				
	DFH2	33	1,800	59.4
	DFH2 rep	25	1,800	45.0
	DE	13	1,800	23.4
Shunting Locomotives				
	DFH1	13	1,200	15.6
	DFH1 rep	1	1,200	1.2
Wagons				
	Covered	465	22	10.2
	High side open	364	23	8.4
	Tank	111	21	2.3
	Flat	156	18	2.8
	Drop side open	699	20	14.0
	Well	2	38	0.1
	Brake vans	74	15	1.1
	Refrigeration	21	114	2.4
	Livestock	28	18	0.5
	Ballast	67	26	1.7
	Total			188.1
		km	Unit Costs (1000 US$)	Total costs (US$ mil)
Permanent Way				
	Main Line	1860	300	558.0
	Sidings*	50	200	10.0
	Yards*	20	200	4.0
	Total			572.0
Other Assets				
	Buildings			56.1
	Motor vehicles			2.1
	Tel/sign Eq.			11.8
	Water supply			2.3
	Plants/machinery			7.3
	Tools & instrum.			0.9
	Furniture & equip.			1.0
Total				81.5
	GRAND TOTAL OF ASSETS			841.6

1 US $ = 120 TSH
* estimate

Source: NEI, SADCC Transport Corridors, Study in Financial Strategies, (supplementary report), April 1990.

Table H.3: CURRENT ASSETS OF MALAWI RAILWAYS FOR 1988/89

	Numbers	Unit Costs (1000 US$)	Total costs (US$ mil)
Mainline Locomotives			
AEI (1200HP)	6	1,100	6.6
Bombardier (1500HP)	19	1,500	28.5
Shunting Locomotives	16	750	12.0
Wagons	718	30	21.5
Total			68.6
Permanent Way	**km.**	**Unit Costs (1000 US$)**	**Total costs (US$ mil)**
Concrete sleepers/40 kg rail	444	300	133.2
Steel sleepers/30 kg rail	187	250	46.8
Wooden sleepers/30 kg rail	279	200	55.8
Total	910		235.8
Other Assets *			4.0
GRAND TOTAL OF ASSETS			308.4

1 US $ = 2.67 MK

* estimates

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, Supplementary report, April 1990

Table H.4: CURRENT ASSETS OF NATIONAL RAILWAYS OF ZIMBABWE FOR 1988/89

NATIONAL RAILWAY OF ZIMBABWE		Numbers	Unit Costs (1000 US$)	Total costs (US$ mil)
Mainline Locomotives				
	Steam	97	1,800	174.6
	Diesel	165	1,800	297.0
	Electric	30	1,800	54.0
Shunting				
	Steam	19	1,200	22.8
	Diesel	72	1,200	86.4
Wagons				
	High sided iron	7,238	30	217.1
	Drop sided iron	2,749	29	79.7
	Covered	425	35	14.9
	Container	456	29	13.2
	Livestock	637	35	22.3
	Tank cars	697	36	25.1
	Refrigerators	397	51	20.2
	Explosives	41	41	1.7
	Guards van	253	73	18.5
	Others	491	31	15.2
	Total			1,062.7
		km	Unit cost/km (1000 US$)	Total costs (US$ mil)
Permanent Way				
	Main line	1,917	300	575.1
	Branch lines	891	200	178.2
	Yards	84	200	16.8
	Service sidings	132	200	26.4
	Private sidings	309	200	61.8
	Crossing loops	216	200	43.2
	Total			901.5
Other Assets				
	Civil branch			206.2
	Mechanical branch			49.0
	Electrical branch			72.8
	Signals branch			78.0
	Traffic branch			7.5
	Gen. management			4.1
	Total			417.6
	GRAND TOTAL OF ASSETS			2,381.8

1 US $ = 2.1 Z$

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, Supplementary report, April 1990

Table H.5: CURRENT ASSETS OF BOTSWANA RAILWAYS FOR 1988/89

BOTSWANA Railways		Numbers	Unit Costs (1000 US$)	Total costs (US$ mil)
Mainline Locomotives				
	BD-1	12	1,296	15.6
	BD-2	20	2,160	43.2
Wagons				
	High sided	10	26	0.3
	Drop sided	50	27	1.4
	Covered	25	37	0.9
	Flat	10	10	0.1
	Livestock	134	10	1.3
	Tank cars	30	33	1.0
	Hoppers	20	36	0.7
	Total			64.5
		km	Unit cost/km (1000 US$)	Total costs (US$ mil)
Permanent Way				
	Main line single	641	300	192.3
	Branch line single	72	200	14.4
	Sidings	3	200	0.6
	Yards & terminals	52	200	10.4
	Total	768		282.2
Other Assets				
	Buildings			27.8
	Furniture, Off. Equ.			1.2
	Plant & Machinery			12.3
	Road vehicles			6.2
	Signal telecom. eq.			13.8
	Total			61.3
	GRAND TOTAL OF ASSETS			408.0

1 US $ = 2 Pula

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, Supplementary report, April 1990

Table H.6: CURRENT ASSETS CFM-N RAILWAYS FOR 1988/89

	Numbers	Unit Costs (1000 US$)	Total costs (US$ mil)
Mainline Locomotives			
Diesel	15	1,800	27.0
Steam	5	1,500	7.5
Shunting Locomotives	13	1,200	15.6
Wagons	941	30	28.2
Total			78.3

	km.	Unit Costs/km (1000 US$)	Total costs (US$ mil)
Permanent Way			
Network	615	300	184.5
Branch lines	304	200	60.8
Total	919		245.3
Other Assets *			141.0
GRAND TOTAL OF ASSETS			464.6

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, Supplementary report, April 1990

Table H.7: CURRENT ASSETS OF CFM-C RAILWAYS FOR 1988/89

	Numbers	Unit Costs (1000 US$)	Total costs (US$ mil)
Mainline Locomotives			
Diesel	30	1,800	54.0
Steam	8	1,500	12.0
Wagons	3,269	30	98.1
Total			164.1

	km.	Unit Costs/km (1000 US$)	Total costs (US$ mil)
Permanent Way			
Network	650	300	195.0
Branch lines	234	200	46.8
Total	884		241.8
Other Assets *			222.0
GRAND TOTAL OF ASSETS			627.9

* estimates

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, Supplementary report, April 1990

Table H.8: CURRENT ASSETS OF CFM-S RAILWAYS FOR 1988/89

CFM-S	Numbers	Unit Costs (1000 US$)	Total costs (US$ mil)
Mainline Locomotives			
Diesel	47	1,800	84.6
Shunting Locomotives	18	1,200	21.6
Wagons	3,920	30	117.6
Total			223.8

	km.	Unit Costs/km (1000 US$)	Total costs (US$ mil)
Permanent Way			
Network	701	300	210.3
Branch lines	4	200	0.8
Total	705		211.1
Other Assets *			291.0
GRAND TOTAL OF ASSETS			725.9

* estimates

Source: NEI, SADCC Transport Corridors, Study on Financial Strategies, Supplementary report, April 1990

Table H.9: SADCC LONG DISTANCE TRUCK FLEET ASSETS

Country	Size of truck fleet 10 tons or> (km)	Unit Cost (US $)	Total cost (mln US$)
Angola	500	60,000	30
Botswana	650	60,000	39
Lesotho	400	60,000	24
Malawi	450	60,000	27
Mozambique	200	60,000	12
Swaziland	400	60,000	24
Tanzania	700	60,000	42
Zambia	1,700	60,000	102
Zimbabwe	1,650	60,000	99
Total	6,650		399

Source: SADCC Transport Corridors, Study of Financial Strategies, Working paper #2, August 1989.

Table H.10 : ROAD CORRIDOR ASSETS

Corridor	Length (km)	Unit Cost per km (US $)	Total Value (mln US $)
Zambia & Zaire to Dar-es-Salaam	2210	300,000	6,630
Zambia & Zaire to So. African Ports Road via Harare & Beit Bridge to Durban	2,230	300,000	6,690
Malawi & Zambia to Nacala & Beira Road from Zambia to Mchinje	745	300,000	2,235
Zimbabwe & Zambia to Beira Road from Zambia to Bulawayo	920	300,000	2,760
Swaziland to Maputo	180	300,000	540
Malawi to Harare	580	300,000	1,740
Total	6,865		20,595

Source: Road lengths from NEI Supplementary Report and calculations

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SADCC Transport Corridors

Study of Financial Strategy

Financial Analysis of Scenarios

(Annex I)

Part I.	Financial Results for Present Situation and Potential Short-Term Improvements (Border-Crossing Traffic Only)
Part II.	Train Operating Characteristics Assumptions (Border-Crossing Traffic Only)

Annex I

Part I

Financial Results for Present Situation
and Potential Short-Term Improvements
(Border-Crossing Traffic Only)

Scenario 0

-150'

ANNEX 1 FINANCIAL ANALYSIS

FINANCIAL ANALYSIS OF SCENARIO 0 - PRESENT SITUATION

TABLE I.1 VARIABLE OPERATING COSTS (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
STANDARD UNIT COSTS											
maintenance											
. line locomotives (US$/loc)	86,902	86,902	86,902	86,902	86,902	86,902	86,902	86,902	86,902	86,902	
. shunt. locomotives (US$/loc)	40,965	40,965	40,965	40,965	40,965	40,965	40,965	40,965	40,965	40,965	
. wagons (US$/wagon)	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	
. permanent way, var (US$/mln gtkm)	251	251	251	251	251	251	251	251	251	251	
permanent way factor	1.4	1.0	1.3	1.2	1.2	1.3	1.0	1.1	0.7	1.2	
adj. perm. way var (US$/mln gtkm)	351	251	326	301	301	326	251	276	176	301	
PRODUCTION											
bordercr.tr. (mln gtkm) ;	0	2,297	3,913	0	0	302	6,556	238	1,070	575	14,950
bordercr.tr. (1,000 ton);	0	1,708	1,080	0	0	396	3,456	1,306	1,598	1,610	11,154
line locomotives (no);	0	21	67	0	0	6	75	3	10	16	198
shunting locomotives (no);	0	12	8	0	0	5	23	10	2	9	69
wagons (no);	0	4,084	3,317	0	0	702	10,223	643	1,027	1,663	21,659
haul distance (km)	0	641	1811	237	0	286	1068	69	313	178	670
loco kms per calendar day	190	190	160	90	150	150	200	150	245	150	
wagon kms per calendar day	25	40	84	25	25	25	45	25	81	25	
VARIABLE OPERATING COSTS (mln US$)											
crew	0.0	1.6	1.8	0.0	0.0	0.4	4.0	0.2	0.6	0.9	9.5
fuel	0.0	3.0	4.4	0.0	0.0	0.3	7.4	0.3	0.8	0.6	16.9
maintenance											
. line locomotives	0.0	0.8	3.3	0.0	0.0	0.1	5.6	0.0	0.6	1.2	11.6
. wagons	0.0	1.6	1.8	0.0	0.0	0.2	8.4	0.1	0.7	1.3	14.0
. permanent way, var.	0.0	0.6	1.0	0.0	0.0	0.1	1.6	0.1	0.3	0.1	3.8
terminal	0.0	0.3	0.7	0.0	0.0	0.6	9.1	1.2	2.4	2.1	16.4
other op.costs & overhead, var.	0.0	1.2	1.9	0.0	0.0	0.1	5.4	0.1	0.6	0.9	10.2
labor cost adjustment factor	0.75	1.00	0.36	0.75	1.00	1.00	0.72	1.00	0.80	0.75	
maintenance ratio actual/standard	0.75	0.35	0.64	0.20	0.16	0.19	0.83	0.14	0.66	0.80	

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TABLE I.2 DEPRECIATION COSTS (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
PERMANENT WAY											
network (km)	1,303	1,894	1,860	770	625	780	2,845	705	921	292	11,995
inv./km (US$) 1)	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	
perm.way factor	1.4	1.0	1.3	1.2	1.2	1.3	1.0	1.1	0.7	1.2	
total inv. (US$) 2)	493	511	653	249	203	274	768	209	174	95	3,629
depr.period (yr)	40	40	40	40	40	40	40	40	40	40	
total depr. (US$)	12.3	12.8	16.3	6.2	5.1	6.8	19.2	5.2	4.4	2.4	90.7
bordercr.tr. (mln gtkm)	0	2,297	3,913	0	0	302	6,556	238	1,070	575	14,950
loc. pass. (mln gtkm) 3)	0	120	80	5	0	92		3	86	0	386
loc. fr. tr (mnl gtkm)	45	1,558	251	92	59	338		94	490	1,269	4,194
total traffic (mln gtkm) 4)	45	3,976	4,243	97	59	732	11,104	334	1,645	1,843	24,078
depreciation bordercr.tr. (mln US$)	0.0	7.4	15.0	0.0	0.0	2.8	11.3	3.7	2.8	0.7	43.9
depr. (renewable - 25%)	0.0	1.8	3.8	0.0	0.0	0.7	2.8	0.9	0.7	0.2	10.9
LINE LOCOMOTIVES											
locomotives (no)	0	21	67	0	0	6	75	3	10	16	198
investment/loc (mln US$)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	
depreciation period (yr)	25	25	25	25	25	25	25	25	25	25	
depreciation (mln US$)	0.0	1.5	4.8	0.0	0.0	0.4	5.4	0.2	0.7	1.2	14.3
WAGONS											
wagons (no)	0	4,084	3,317	0	0	702	10,223	643	1,027	1,663	21,659
investment/wagon (mln US$)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
depreciation period (yr)	40	40	40	40	40	40	40	40	40	40	
depreciation (mln US$)	0.0	3.1	2.5	0.0	0.0	0.5	7.7	0.5	0.8	1.2	16.2
PLANT/BLDS/EQ.											
depreciation (US$/ton) 5)	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	
bordercr.traffic (1,000 ton)	0	1,708	1,080	0	0	396	3,456	1,306	1,598	1,610	11,154
depreciation (mln US$)	0.0	0.7	0.5	0.0	0.0	0.2	1.5	0.5	0.7	0.7	4.7
depr. (renewable - 75%)	0.0	0.5	0.3	0.0	0.0	0.1	1.1	0.4	0.5	0.5	3.4
TOTAL DEPRECIATION (mln US$)	0.0	12.7	22.8	0.0	0.0	4.0	25.9	5.0	5.0	3.8	79.1
TOTAL RENEWABLE ASSET DEPR. (mln US$)	0.0	6.9	11.4	0.0	0.0	1.8	17.0	2.0	2.7	3.1	44.8

TABLE I.3 GROSS FIXED ASSETS (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
line locomotives	0.0	37.8	120.6	0.0	0.0	10.8	135.0	5.4	18.0	28.8	356.4
wagons	0.0	122.5	99.5	0.0	0.0	21.1	306.7	19.3	30.8	49.9	649.8
subtotal	0.0	160.3	220.1	0.0	0.0	31.9	441.7	24.7	48.8	78.7	1,006.2
permanent way	0.0	295.5	602.0	0.0	0.0	113.1	453.5	148.9	113.2	29.5	1,755.7
plant/buildings/equipment	0.0	11.4	7.2	0.0	0.0	2.7	23.2	8.8	10.7	10.8	74.7
subtotal	0.0	307.0	609.2	0.0	0.0	115.7	478.7	157.6	123.9	40.3	1,830.4
total assets	0.0	467.3	829.3	0.0	0.0	147.6	918.4	182.3	172.7	119.0	2,836.6
total renewable assets(3)	0.0	242.8	376.0	0.0	0.0	62.1	572.4	68.5	85.1	94.2	1,501.1

(3) 100% of locomotives and rolling stock, 25% of permanent way and 75% of plant, buildings and equipment.

TABLE I.4 FIXED OPERATING COSTS (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
PERMANENT WAY											
network (km)	1,303	1,894	1,860	770	625	780	2,845	705	921	292	11,995
fixed costs (US$/km)	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362	23,620
perm.way factor	1.4	1.0	1.3	1.2	1.2	1.3	1.0	1.1	0.7	1.2	
tot. fixed costs (mln US$)	4.3	4.5	5.7	2.2	1.8	2.4	6.7	1.8	1.5	0.8	31.7
share bordercrossing tr.	0.00	0.58	0.92	0.00	0.00	0.41	0.59	0.71	0.65	0.31	
fixed cost borderc.tr. (mln US$)	0.0	2.6	5.3	0.0	0.0	1.0	4.0	1.3	1.0	0.3	15.4
OVERHEAD AND ADMINISTRATION											
fixed costs/ton	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	25.4
borderc.tr. (1,000 ton)	0	1,708	1,080	0	0	396	3,456	1,306	1,598	1,610	11,154
fixed overh/adm. (mln US$)	0.0	4.3	2.7	0.0	0.0	1.0	8.8	3.3	4.1	4.1	28.3

TABLE I.5 INCOME STATEMENT BORDERCROSSING TRAFFIC SCENARIO 0 (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
REVENUES											
total revenues	0.0	67.2	38.2	0.0	0.0	6.1	68.1	3.6	13.4	8.9	203.5
OPERATING COSTS											
crew	0.0	1.6	1.8	0.0	0.0	0.4	4.0	0.2	0.6	0.9	9.5
fuel	0.0	3.0	4.4	0.0	0.0	0.3	7.4	0.3	0.8	0.6	16.9
maintenance											
. line locomotives	0.0	0.8	3.3	0.0	0.0	0.1	5.6	0.0	0.6	1.2	11.6
. wagons	0.0	1.6	1.8	0.0	0.0	0.2	8.4	0.1	0.7	1.3	14.0
. permanent way (var)	0.0	0.6	1.0	0.0	0.0	0.1	1.6	0.1	0.3	0.1	3.8
. permanent way (fixed)	0.0	2.6	5.3	0.0	0.0	1.0	4.0	1.3	1.0	0.3	15.4
terminal	0.0	0.3	0.7	0.0	0.0	0.6	9.1	1.2	2.4	2.1	16.4
other op.costs/overhead (var)	0.0	1.2	1.9	0.0	0.0	0.1	5.4	0.1	0.6	0.9	10.8
other op.costs/overhead (fix)	0.0	4.3	2.7	0.0	0.0	1.0	8.8	3.3	4.1	4.1	28.3
interest	0.0	12.1	18.8	0.0	0.0	3.1	28.6	3.4	4.3	4.7	75.1
depreciation											
. line locomotives	0.0	1.5	4.8	0.0	0.0	0.4	5.4	0.2	0.7	1.2	14.3
. wagons	0.0	3.1	2.5	0.0	0.0	0.5	7.7	0.5	0.8	1.2	16.2
. permanent way (renewable)	0.0	1.8	3.8	0.0	0.0	0.7	2.8	0.9	0.7	0.2	11.0
. plant/bld/eq (renewable)	0.0	0.5	0.3	0.0	0.0	0.1	1.1	0.4	0.5	0.5	3.5
total operating costs	0.0	34.9	53.1	0.0	0.0	8.6	99.9	12.0	18.0	19.3	245.8
OPERATING INCOME	0.0	32.3	(16.8)	0.0	0.0	(2.5)	(31.9)	(8.3)	(4.6)	(10.5)	(42.3)
GROSS FIXED ASSETS											
. rolling stock	0.0	160.3	220.1	0.0	0.0	31.9	441.7	24.7	48.8	78.7	1,006.2
. permanent way/others	0.0	307.0	609.2	0.0	0.0	115.7	476.7	157.6	123.9	40.3	1,830.4
. total assets	0.0	467.3	829.3	0.0	0.0	147.6	918.4	182.3	172.7	119.0	2,836.6
. total renewable assets	0.0	242.8	376.0	0.0	0.0	62.1	572.4	68.5	85.1	94.2	1,501.1
FINANCIAL RATIOS											
return on gross fixed assets;											
- rolling stock	n.a.	33	6	n.a.	n.a.	11	3	4	12	(1)	9
- total renewable assets	n.a.	18	1	n.a.	n.a.	1	(1)	(7)	(0)	(6)	2
working ratio	n.a.	42	115	n.a.	n.a.	111	122	274	115	183	99
LRMC recovery	n.a.	38	113	n.a.	n.a.	94	122	166	88	161	92
TC (excl.depr.track) recovery	n.a.	49	136	n.a.	n.a.	129	143	304	129	216	115
operating ratio	n.a.	52	147	n.a.	n.a.	140	147	329	135	218	121

Scenario 1

FINANCIAL ANALYSIS OF SCENARIO 1 - FORECAST TRAFFIC WITH IMPROVED SHORT TERM PRODUCTIVITY, PRESENT CORRIDORS OPEN AND PRESENT TARIFFS

TABLE I.6 VARIABLE OPERATING COSTS (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
STANDARD UNIT COSTS											
maintenance											
. line locomotives (US$/loc)	86,902	86,902	86,902	86,902	86,902	86,902	86,902	86,902	86,902	86,902	
. shunt. locomotives (US$/loc)	40,965	40,965	40,965	40,965	40,965	40,965	40,965	40,965	40,965	40,965	
. wagons (US$/wagon)	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	
. permanent way, var (US$/mln gtkm)	251	251	251	251	251	251	251	251	251	251	
permanent way factor	1.4	1.0	1.3	1.2	1.2	1.3	1.0	1.1	0.7	1.2	
adj. perm. way, var (US$/mln gtkm)	351	251	326	301	301	326	251	276	176	301	
PRODUCTION											
bordercr.tr. (mln gtkm) ;	0	1,910	4,218	140	0	614	6,342	200	612	624	14,660
bordercr.tr. (1,000 ton);	0	1,400	1,180	550	0	780	3,270	1,100	940	1,640	10,860
line locomotives (no);	0	11	36	1	0	7	39	1	4	9	108
shunting locomotives (no);	0	10	9	4	0	6	22	8	7	10	76
wagons (no);	0	1,887	1,669	104	0	495	5,562	181	265	602	10,765
haul distance (km)	0	650	1787	237	0	286	1091	69	304	190	
loco kms per calendar day	300	300	320	225	300	260	375	330	320	300	
wagon kms per calendar day	180	72	180	72	75	72	80	75	180	75	
VARIABLE OPERATING COSTS (mln US$)											
crew	0.0	0.8	1.0	0.1	0.0	0.3	2.1	0.0	0.2	0.5	5.0
fuel	0.0	2.5	4.7	0.2	0.0	0.7	7.1	0.2	0.5	0.7	16.6
maintenance											
. line locomotives	0.0	1.3	3.1	0.1	0.0	0.8	4.0	0.1	0.4	0.9	10.8
. wagons	0.0	2.8	1.5	0.1	0.0	0.6	6.1	0.2	0.3	0.7	11.9
. permanent way, var.	0.0	0.5	1.1	0.1	0.0	0.2	1.6	0.1	0.2	0.2	3.8
terminal	0.0	0.2	0.8	0.4	0.0	1.0	8.7	1.0	1.8	2.1	15.9
other op.costs & overhead, var.	0.0	1.1	1.8	0.1	0.0	0.2	4.4	0.1	0.4	0.8	8.9
labor cost adjustment factor	0.75	1.00	0.36	0.75	1.00	1.00	0.72	1.00	0.80	0.75	
maintenance ratio actual/standard	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	

TABLE I.7 DEPRECIATION COSTS (mln US$)

	CFB	ZR	TZR	WR	CFW-N	CFW-C	NRZ	CFW-S	BR	SWR	total
PERMANENT WAY											
network (km)	1,303	1,894	1,860	770	625	780	2,845	705	921	292	11,995
inv./km (US$) 1)	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	
perm.way factor	1.4	1.0	1.3	1.2	1.2	1.3	1.0	1.1	0.7	1.2	
total inv. (US$) 2)	493	511	653	249	203	274	768	209	174	95	3,629
depr.period (yr)	40	40	40	40	40	40	40	40	40	40	
total depr. (US$)	12.3	12.8	16.3	6.2	5.1	6.8	19.2	5.2	4.4	2.4	90.7
bordercr.tr. (mln gtkm)	0	1,910	4,218	140	0	614	6,342	200	612	624	14,660
loc. pass. (mln gtkm) 3)	0	120	80	5	0	92		3	86	0	386
loc. fr. tr (mnl gtkm)	45	1,558	251	92	59	338		94	490	1,269	4,195
total traffic (mln gtkm) 4)	45	3,589	4,549	236	59	1,043	11,104	297	1,188	1,893	24,003
depreciation bordercr.tr. (mln US$)	0.0	6.8	15.1	3.7	0.0	4.0	11.0	3.5	2.2	0.8	47.2
depr. (renewable only)	0.0	1.7	3.8	0.9	0.0	1.0	2.7	0.9	0.6	0.2	11.8
LINE LOCOMOTIVES											
locomotives (no)	0	11	36	1	0	7	39	1	4	9	108
investment/loc (mln US$)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	
depreciation period (yr)	25	25	25	25	25	25	25	25	25	25	
depreciation (mln US$)	0.0	0.8	2.6	0.1	0.0	0.5	2.8	0.1	0.3	0.6	7.8
WAGONS											
wagons (no)	0	1,887	1,669	104	0	495	5,562	181	265	602	10,765
investment/wagon (mln US$)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
depreciation period (yr)	40	40	40	40	40	40	40	40	40	40	
depreciation (mln US$)	0.0	1.4	1.3	0.1	0.0	0.4	4.2	0.1	0.2	0.5	8.1
PLANT/BLDS/EQ.											
depreciation (US$/ton) 5)	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	
bordercr.traffic (1,000 ton)	0	1,400	1,180	550	0	780	3,270	1,100	940	1,640	10,860
depreciation (mln US$)	0.0	0.6	0.5	0.2	0.0	0.3	1.4	0.5	0.4	0.7	4.6
depr. (renewable only)	0.0	0.4	0.4	0.2	0.0	0.2	1.0	0.3	0.3	0.5	3.3
TOTAL DEPRECIATION (mln US$)	0.0	9.6	19.5	4.1	0.0	5.2	19.3	4.2	3.1	2.6	67.6
TOTAL RENEWABLE ASSET DEPR. (mln US$)	0.0	4.3	8.0	1.3	0.0	2.1	10.7	1.4	1.4	1.8	30.9

TABLE I.8 GROSS FIXED ASSETS (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
line locomotives	0.0	19.8	64.8	1.8	0.0	12.6	70.2	1.8	7.2	16.2	194.4
wagons	0.0	56.6	50.1	3.1	0.0	14.9	166.9	5.4	8.0	18.1	323.0
subtotal	0.0	76.4	114.9	4.9	0.0	27.5	237.1	7.2	15.2	34.3	517.4
permanent way	0.0	272.2	605.4	147.4	0.0	161.0	438.7	141.3	89.7	31.2	1,886.9
plant/buildings/equipment	0.0	9.4	7.9	3.7	0.0	5.2	21.9	7.4	6.3	11.0	72.8
subtotal	0.0	281.6	613.3	151.0	0.0	166.3	460.6	148.7	96.0	42.2	1,959.7
total assets	0.0	358.0	728.2	156.0	0.0	193.7	697.7	155.9	111.2	76.4	2,477.0
total renewable assets (3)	0.0	151.5	272.1	44.5	0.0	71.6	363.2	48.1	42.3	50.3	1,043.6

(3) 100% of locomotives and rolling stock, 25% of permanent way and 75% of plant, buildings and equipment.

TABLE I.9 FIXED OPERATING COSTS (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
PERMANENT WAY											
network (km)	1,303	1,894	1,860	770	625	780	2,845	705	921	292	11,995
fixed costs (US$/km)	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362	23,620
perm.way factor	1.4	1.0	1.3	1.2	1.2	1.3	1.0	1.1	0.7	1.2	
tot. fixed costs (mln US$)	4.3	4.5	5.7	2.2	1.8	2.4	6.7	1.8	1.5	0.8	31.7
share bordercrossing tr.	0.00	0.53	0.93	0.59	0.00	0.59	0.57	0.67	0.52	0.33	
fixed cost borderc.tr. (mln US$)	0.0	2.4	5.3	1.3	0.0	1.4	3.8	1.2	0.8	0.3	16.5
OVERHEAD AND ADMINISTRATION											
fixed costs/ton	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	25.4
bordercr.tr. (1,000 ton)	0	1,400	1,180	550	0	780	3,270	1,100	940	1,640	10,860
fixed overh/adm. (mln US$)	0.0	3.6	3.0	1.4	0.0	2.0	8.3	2.8	2.4	4.2	27.6

TABLE I.10 INCOME STATEMENT BORDER-CROSSING TRAFFIC SCENARIO 1 (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
REVENUES											
overseas import	0.0	9.7	16.7	0.5	0.0	2.9	11.2	2.0	0.4	0.5	44.0
overseas export	0.0	25.5	21.1	0.2	0.0	6.6	22.4	5.2	1.6	4.9	87.5
intraregional	0.0	24.6	2.5	0.5	0.0	0.3	30.5	0.2	5.8	4.1	68.5
total revenues	0.0	59.8	40.4	1.3	0.0	9.3	64.1	7.3	7.8	9.5	200.0
OPERATING COSTS											
crew	0.0	0.8	1.0	0.1	0.0	0.3	2.1	0.0	0.2	0.5	5.0
fuel	0.0	2.5	4.7	0.2	0.0	0.7	7.1	0.2	0.5	0.7	16.6
maintenance											
. line locomotives	0.0	1.3	3.1	0.1	0.0	0.8	4.0	0.1	0.4	0.9	10.8
. wagons	0.0	2.3	1.5	0.1	0.0	0.6	6.1	0.2	0.3	0.7	11.9
. permanent way (var)	0.0	0.5	1.1	0.1	0.0	0.2	1.6	0.1	0.2	0.2	3.8
. permanent way (fixed)	0.0	2.4	5.3	1.3	0.0	1.4	3.8	1.2	0.8	0.3	16.5
terminal	0.0	3.7	3.5	1.5	0.0	2.3	8.7	3.3	2.5	4.3	29.8
other op.costs/overhead (var)	0.0	1.7	2.2	0.3	0.0	0.7	4.4	0.6	0.6	1.1	11.7
other op.costs/overhead (fix)	0.0	3.6	3.0	1.4	0.0	2.0	8.3	2.8	2.4	4.2	27.6
interest	0.0	3.8	5.7	0.2	0.0	1.4	11.9	0.4	0.8	1.7	25.9
depreciation											
. line locomotives	0.0	0.8	2.6	0.1	0.0	0.5	2.8	0.1	0.3	0.6	7.8
. wagons	0.0	1.4	1.3	0.1	0.0	0.4	4.2	0.1	0.2	0.5	8.1
. permanent way (renewable)	0.0	1.7	3.8	0.9	0.0	1.0	2.7	0.9	0.6	0.2	11.8
. plant/bld/eq (renewable)	0.0	0.4	0.4	0.2	0.0	0.2	1.0	0.3	0.3	0.5	3.3
total operating costs	0.0	26.8	39.3	6.6	0.0	12.5	68.7	10.3	10.0	16.3	190.5
OPERATING INCOME	0.0	33.0	1.1	(5.3)	0.0	(2.7)	(4.6)	(3.0)	(2.2)	(6.8)	9.5
GROSS FIXED ASSETS											
. rolling stock	0.0	76.4	114.9	4.9	0.0	27.5	237.1	7.2	15.2	34.3	517.4
. permanent way/others	0.0	281.6	613.3	151.0	0.0	166.3	460.6	148.7	96.0	42.2	1,959.7
. total	0.0	358.0	728.2	156.0	0.0	193.7	697.7	155.9	111.2	76.4	2,477.0
. total renewable assets	0.0	151.5	272.1	44.5	0.0	71.6	363.2	48.1	42.3	50.3	1,043.6
FINANCIAL RATIOS											
return on gross fixed assets;											
- rolling stock	n.a.	59	17	(27)	n.a.	12	10	36	17	0	18
- total renewable assets	n.a.	24	3	(11)	n.a.	(2)	2	(5)	(4)	(10)	3
working ratio	n.a.	38	77	427	n.a.	106	91	121	111	153	80
LRMC recovery	n.a.	31	66	224	n.a.	80	82	69	76	118	66
TC (excl.depr.track) recovery	n.a.	42	88	455	n.a.	117	103	128	121	170	89
operating ratio	n.a.	45	97	527	n.a.	127	107	140	129	172	95

Scenario 2

FINANCIAL ANALYSIS OF SCENARIO 2 - FORECAST TRAFFIC WITH IMPROVED SHORT TERM PRODUCTIVITY, ALL CORRIDORS OPEN AND PRESENT TARIFFS

TABLE I.11 VARIABLE OPERATING COSTS (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
STANDARD UNIT COSTS											
maintenance											
. line locomotives (US$/loc)	86,902	86,902	86,902	86,902	86,902	86,902	86,902	86,902	86,902	86,902	
. shunt. locomotives (US$/loc)	40,965	40,965	40,965	40,965	40,965	40,965	40,965	40,965	40,965	40,965	
. wagons (US$/wagon)	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	
. permanent way, var (US$/mln gtkm)	251	251	251	251	251	251	251	251	251	251	
permanent way factor	1.4	1.0	1.3	1.2	1.2	1.3	1.0	1.1	0.7	1.2	
adj. perm. way, var (US$/mln gtkm	351	251	326	301	301	326	251	276	176	301	
PRODUCTION											
bordercr.tr. (mln gtkm) ;	784	2,011	2,989	365	174	744	6,003	1,174	627	584	15,455
bordercr.tr. (1,000 ton);	290	1,350	830	690	140	900	3,210	1,330	940	1,510	11,190
line locomotives (no);	7	11	26	4	2	9	37	6	4	8	114
shunting locomotives (no);	2	10	6	5	1	7	21	10	7	9	78
wagons (no);	314	1,986	1,183	273	141	599	5,265	1,060	271	563	11,655
haul distance (km)	1353	709	1801	237	622	286	1052	69	312	193	
loco kms per calendar day	300	300	320	225	300	260	375	330	320	300	
wagon kms per calendar day	180	72	180	72	75	72	80	75	180	75	
VARIABLE OPERATING COSTS (mln US$)											
crew	0.4	0.8	0.7	0.2	0.1	0.4	2.0	0.3	0.2	0.4	5.5
fuel	0.0	2.6	3.4	0.4	0.2	0.8	6.8	1.3	0.5	0.7	16.6
maintenance											
. line locomotives	0.7	1.3	2.2	0.4	0.2	1.0	3.8	0.7	0.4	0.8	11.7
. wagons	0.4	2.5	1.1	0.3	0.2	0.7	5.8	1.3	0.3	0.6	13.2
. permanent way, var.	0.2	0.5	0.8	0.1	0.0	0.2	1.5	0.3	0.2	0.1	3.9
terminal	0.2	0.2	0.5	0.5	0.1	1.1	8.4	1.2	1.8	1.9	16.0
other op.costs/overhead, var.	0.3	1.2	1.3	0.3	0.0	0.2	4.2	0.2	0.4	0.7	8.8
labor cost adjustment factor	0.75	1.00	0.36	0.75	1.00	1.00	0.72	1.00	0.80	0.75	
maintenance ratio actual to standar	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	

TABLE I.12 DEPRECIATION COSTS (mln US$)

	CFB	ZR	TZR	WR	CFW-N	CFW-C	NRZ	CFW-S	BR	SWR	total
PERMANENT WAY											
network (km)	1,303	1,894	1,860	770	625	780	2,845	705	921	292	11,995
inv./km (US$) 1)	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	
perm.way factor	1.4	1.0	1.3	1.2	1.2	1.3	1.0	1.1	0.7	1.2	
total inv. (US$) 2)	493	511	653	249	203	274	768	209	174	95	3,629
depr.period (yr)	40	40	40	40	40	40	40	40	40	40	
total depr. (US$)	12.3	12.8	16.3	6.2	5.1	6.8	19.2	5.2	4.4	2.4	90.7
bordercr.tr. (mln gtkm)	784	2,011	2,989	365	174	744	6,003	1,174	627	584	15,455
loc. pass. (mln gtkm) 3)	0	120	80	5	0	92		3	86	0	386
loc. fr. tr (mnl gtkm)	45	1,558	251	92	59	338		94	490	1,269	4,195
total traffic (mln gtkm) 4)	830	3,689	3,320	462	233	1,173	11,104	1,271	1,203	1,853	25,137
depreciation bordercr.tr. (mln US$)	11.6	7.0	14.7	4.9	3.8	4.3	10.4	4.8	2.3	0.7	64.6
depr. (renewable only)	2.9	1.7	3.7	1.2	0.9	1.1	2.6	1.2	0.6	0.2	16.1
LINE LOCOMOTIVES											
locomotives (no)	7	11	26	4	2	9	37	6	4	8	114
investment/loc (mln US$)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	
depreciation period (yr)	25	25	25	25	25	25	25	25	25	25	
depreciation (mln US$)	0.5	0.8	1.9	0.3	0.1	0.6	2.7	0.4	0.3	0.6	8.2
WAGONS											
wagons (no)	314	1,986	1,183	273	141	599	5,265	1,060	271	563	11,655
investment/wagon (mln US$)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
depreciation period (yr)	40	40	40	40	40	40	40	40	40	40	
depreciation (mln US$)	0.2	1.5	0.9	0.2	0.1	0.4	3.9	0.8	0.2	0.4	8.7
PLANT/BLDS/EQ.											
depreciation (US$/ton) 5)	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	
bordercr.traffic (1,000 ton)	290	1,350	830	690	140	900	3,210	1,330	940	1,510	11,190
depreciation (mln US$)	0.1	0.6	0.3	0.3	0.1	0.4	1.3	0.6	0.4	0.6	4.7
depr. (renewable only)	0.1	0.4	0.3	0.2	0.0	0.3	1.0	0.4	0.3	0.5	3.5
TOTAL DEPRECIATION (mln US$)	12.5	9.8	17.8	5.7	4.1	5.8	18.3	6.6	3.2	2.4	86.2
TOTAL RENEWABLE ASSET DEPR. (mln US$)	3.7	4.4	6.8	1.9	1.1	2.5	10.2	2.8	1.4	1.7	36.5

TABLE I.13 GROSS FIXED ASSETS (mln US$)

	CFB	ZR	TZR	WR	CFW-N	CFW-C	NRZ	CFW-S	BR	SWR	total
line locomotives	12.6	19.8	46.8	7.2	3.6	16.2	66.6	10.8	7.2	14.4	205.2
wagons	9.4	59.6	35.5	8.2	4.2	18.0	158.0	31.8	8.1	16.9	349.7
subtotal	22.0	79.4	82.3	15.4	7.8	34.2	224.6	42.6	15.3	31.3	554.9
permanent way	465.7	278.7	587.8	197.2	151.6	173.5	415.3	193.5	90.8	29.8	2,583.9
plant/buildings/equipment	1.9	9.0	5.6	4.6	0.9	6.0	21.5	8.9	6.3	10.1	75.0
subtotal	467.6	287.8	593.4	201.8	152.5	179.6	436.8	202.4	97.1	39.9	2,658.9
total	489.7	367.2	675.7	217.2	160.4	213.7	661.3	245.0	112.4	71.2	3,213.7
total renewable assets (3)	139.9	155.8	233.4	68.1	46.4	82.1	344.5	97.7	42.7	46.3	1,256.9

(3) 100% of locomotives and rolling stock, 25% of permanent way and 75% of plant, buildings and equipment.

TABLE I.14 FIXED OPERATING COSTS (mln US$)

	CFB	ZR	TZR	WR	CFW-N	CFW-C	NRZ	CFW-S	BR	SWR	total
PERMANENT WAY											
network (km)	1,303	1,894	1,860	770	625	780	2,845	705	921	292	11,995
fixed costs (US$/km)	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362	23,620
perm.way factor	1.4	1.0	1.3	1.2	1.2	1.3	1.0	1.1	0.7	1.2	
tot. fixed costs (mln US$)	4.3	4.5	5.7	2.2	1.8	2.4	6.7	1.8	1.5	0.8	31.7
share bordercrossing tr.	0.95	0.55	0.90	0.79	0.75	0.63	0.54	0.92	0.52	0.32	
fixed cost borderc.tr. (mln US$)	4.1	2.4	5.1	1.7	1.3	1.5	3.6	1.7	0.8	0.3	22.6
OVERHEAD AND ADMINISTRATION											
fixed costs/ton	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	25.4
bordercr.tr. (1,000 ton)	290	1,350	830	690	140	900	3,210	1,330	940	1,510	11,190
fixed overh/adm. (mln US$)	0.7	3.4	2.1	1.8	0.4	2.3	8.2	3.4	2.4	3.8	28.4

TABLE I.15 INCOME STATEMENT BORDER-CROSSING TRAFFIC SCENARIO 2 (mln US$)

	CFB	ZR	TZR	MR	CFW-N	CFW-C	NRZ	CFW-S	BR	SWR	total
REVENUES											
overseas import	2.7	9.0	9.5	2.4	2.2	5.6	9.7	4.9	0.4	0.5	46.8
overseas export	4.5	26.5	15.8	2.0	1.3	9.0	21.7	12.6	1.7	4.2	99.3
intraregional	0.0	23.2	2.5	0.6	0.0	0.5	30.9	0.5	5.8	4.3	68.3
total revenues	7.2	58.7	27.7	5.0	3.5	15.1	62.3	18.0	7.9	8.9	214.4
OPERATING COSTS											
crew	0.4	0.8	0.7	0.2	0.1	0.4	2.0	0.3	0.2	0.4	5.5
fuel	0.0	2.6	3.4	0.4	0.2	0.8	6.8	1.3	0.5	0.7	16.6
maintenance											
. line locomotives	0.7	1.3	2.2	0.4	0.2	1.0	3.8	0.7	0.4	0.8	11.7
. wagons	0.4	2.5	1.1	0.3	0.2	0.7	5.8	1.3	0.3	0.6	13.2
. permanent way (var)	0.2	0.5	0.8	0.1	0.0	0.2	1.5	0.3	0.2	0.1	3.9
. permanent way (fixed)	4.1	2.4	5.1	1.7	1.3	1.5	3.6	1.7	0.8	0.3	22.6
terminal	0.2	0.2	0.5	0.5	0.1	1.1	6.4	1.2	1.8	1.9	16.0
other op.costs/overhead (var)	0.3	1.2	1.3	0.3	0.0	0.2	4.2	0.2	0.4	0.7	10.0
other op.costs/overhead (fix)	0.7	3.4	2.1	1.8	0.4	2.3	8.2	3.4	2.4	3.8	28.4
interest	1.1	4.0	4.1	0.8	0.4	1.7	11.2	2.1	0.8	1.6	27.7
depreciation											
. line locomotives	0.5	0.8	1.9	0.3	0.1	0.6	2.7	0.4	0.3	0.6	8.2
. wagons	0.2	1.5	0.9	0.2	0.1	0.4	3.9	0.8	0.2	0.4	8.7
. permanent way	2.9	1.7	3.7	1.2	0.9	1.1	2.6	1.2	0.6	0.2	16.1
. plant/bld/eq	0.1	0.4	0.3	0.2	0.0	0.3	1.0	0.4	0.3	0.5	3.5
total operating costs	11.8	23.3	28.1	8.3	4.1	12.6	65.8	15.4	9.1	12.7	191.1
OPERATING INCOME	(4.6)	35.4	(0.4)	(3.3)	(0.6)	2.5	(3.5)	2.6	(1.1)	(3.8)	23.3
GROSS FIXED ASSETS											
. rolling stock	22.0	79.4	82.3	15.4	7.8	34.2	224.6	42.6	15.3	31.3	554.9
. permanent way/others	467.6	287.8	593.4	201.8	152.5	179.6	436.8	202.4	97.1	39.9	2,658.9
. total	489.7	367.2	675.7	217.2	160.4	213.7	661.3	245.0	112.4	71.2	3,213.7
. total renewable assets	139.9	155.8	233.4	68.1	46.4	82.1	344.5	97.7	42.7	46.3	1,256.9
FINANCIAL RATIOS											
return on gross fixed assets;											
- rolling stock	20	60	18	15	31	28	10	27	24	8	22
- total renewable assets	(3)	25	2	(4)	(0)	5	2	5	(1)	(5)	4
working ratio	112	32	77	129	84	67	89	70	97	123	72
LRMC recovery	56	26	61	69	43	49	81	48	63	88	56
TC (excl.depr.track) recovery	124	37	88	143	91	76	101	79	107	140	82
operating ratio	164	40	101	167	116	83	106	85	114	142	89

Scenario 3

FINANCIAL ANALYSIS OF SCENARIO 3 - FORECAST TRAFFIC WITH IMPROVED SHORT TERM PRODUCTIVITY, ALL CORRIDORS OPEN AND COST-BASED TARIFFS

TABLE I.16 VARIABLE OPERATING COSTS (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
STANDARD UNIT COSTS											
maintenance											
. line locomotives (US$/loc)	86,902	86,902	86,902	86,902	86,902	86,902	86,902	86,902	86,902	86,902	
. shunt. locomotives (US$/loc)	40,965	40,965	40,965	40,965	40,965	40,965	40,965	40,965	40,965	40,965	
. wagons (US$/wagon)	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	
. permanent way, var (US$/mln gtkm)	251	251	251	251	251	251	251	251	251	251	
permanent way factor	1.4	1.0	1.3	1.2	1.2	1.3	1.0	1.1	0.7	1.2	
adj. perm. way, var (US$/mln gtkm	351	251	326	301	301	326	251	276	176	301	
PRODUCTION											
bordercr.tr. (mln gtkm) ;	435	2,273	3,241	355	137	749	6,320	1,225	637	559	15,931
bordercr.tr. (1,000 ton);	160	1,410	900	680	110	910	3,240	1,360	940	1,450	11,160
line locomotives (no);	4	13	28	3	1	9	38	6	5	8	115
shunting locomotives (no);	2	10	7	5	2	7	22	10	7	9	81
wagons (no);	174	2,245	1,282	265	111	603	5,543	1,106	275	539	12,143
haul distance (km)	1360	768	1801	237	624	286	1098	69	316	193	
loco kms per calendar day	300	300	320	225	300	260	375	330	320	300	
wagon kms per calendar day	180	72	180	72	75	72	80	75	180	75	
VARIABLE OPERATING COSTS (mln US$)											
crew	0.2	1.0	0.7	0.2	0.0	0.4	2.0	0.3	0.3	0.4	5.5
fuel	0.0	3.0	3.6	0.4	0.2	0.8	7.1	1.4	0.5	0.6	17.6
maintenance											
. line locomotives	0.4	1.5	2.4	0.3	0.1	1.0	3.9	0.7	0.5	0.8	11.8
. wagons	0.2	2.8	1.2	0.3	0.1	0.7	6.1	1.4	0.3	0.6	13.7
. permanent way, var.	0.1	0.6	0.8	0.1	0.1	0.2	1.6	0.3	0.2	0.1	4.1
terminal	0.1	0.2	0.6	0.5	0.1	1.1	8.6	1.2	1.8	1.9	16.1
other op.costs/overhead, var.	0.2	1.4	1.4	0.3	0.0	0.2	4.4	0.2	0.4	0.7	9.1
labor cost adjustment factor	0.75	1.00	0.36	0.75	1.00	1.00	0.72	1.00	0.80	0.75	
maintenance ratio actual to standar	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	

TABLE I.17 DEPRECIATION COSTS (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
PERMANENT WAY											
network (km)	1,303	1,894	1,860	770	625	780	2,845	705	921	292	11,995
inv./km (US$) 1)	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	
perm.way factor	1.4	1.0	1.3	1.2	1.2	1.3	1.0	1.1	0.7	1.2	
total inv. (US$) 2)	493	511	653	249	203	274	768	209	174	95	3,629
depr.period (yr)	40	40	40	40	40	40	40	40	40	40	
total depr. (US$)	12.3	12.8	16.3	6.2	5.1	6.8	19.2	5.2	4.4	2.4	
bordercr.tr. (mln gtkm)	435	2,273	3,241	355	137	749	6,320	1,225	637	559	15,931
loc. pass. (mln gtkm) 3)	0	120	80	5	0	92		3	86	0	386
loc. fr. tr (mnl gtkm)	45	1,558	251	92	59	338		94	490	1,269	4,195
total traffic (mln gtkm) 4)	480	3,951	3,572	451	196	1,178	11,104	1,321	1,213	1,828	25,296
depreciation bordercr.tr. (mln US$)	11.2	7.4	14.8	4.9	3.5	4.3	10.9	4.9	2.3	0.7	65
depr. (renewable only)	2.8	1.8	3.7	1.2	0.9	1.1	2.7	1.2	0.6	0.2	16.2
LINE LOCOMOTIVES											
locomotives (no)	4	13	28	3	1	9	38	6	5	8	115
investment/loc (mln US$)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	
depreciation period (yr)	25	25	25	25	25	25	25	25	25	25	
depreciation (mln US$)	0.3	0.9	2.0	0.2	0.1	0.6	2.7	0.4	0.4	0.6	8
WAGONS											
wagons (no)	174	2,245	1,282	265	111	603	5,543	1,106	275	539	12,143
investment/wagon (mln US$)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
depreciation period (yr)	40	40	40	40	40	40	40	40	40	40	
depreciation (mln US$)	0.1	1.7	1.0	0.2	0.1	0.5	4.2	0.8	0.2	0.4	9.1
PLANT/BLDS/EQ.											
depreciation (US$/ton) 5)	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	
bordercr.traffic (1,000 ton)	160	1,410	900	680	110	910	3,240	1,360	940	1,450	11,160
depreciation (mln US$)	0.1	0.6	0.4	0.3	0.0	0.4	1.4	0.6	0.4	0.6	4.7
depr. (renewable only)	0.1	0.4	0.3	0.2	0.0	0.3	1.0	0.4	0.3	0.5	3.5
TOTAL DEPRECIATION (mln US$)	11.6	10.6	18.2	5.6	3.8	5.8	19.2	6.7	3.2	2.3	87.0
TOTAL RENEWABLE ASSET DEPR. (mln US$)	3.3	4.8	7.0	1.8	1.1	2.5	10.6	2.9	1.5	1.7	37.1

TABLE I.18 GROSS FIXED ASSETS (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
line locomotives	7.2	23.4	50.4	5.4	1.6	16.2	68.4	10.8	9.0	14.4	207.0
wagons	5.2	67.4	38.5	8.0	3.3	18.1	166.3	33.2	8.3	16.2	364.3
subtotal	12.4	90.8	88.9	13.4	5.1	34.3	234.7	44.0	17.3	30.6	571.3
permanent way	446.2	294.2	592.4	196.0	142.0	174.0	437.2	194.1	91.4	28.9	2,596.4
plant/buildings/equipment	1.1	9.4	6.0	4.6	0.7	6.1	21.7	9.1	6.3	9.7	74.8
subtotal	447.3	303.6	598.4	200.5	142.7	180.1	458.9	203.2	97.7	38.6	2,671.2
total	459.7	394.4	687.3	213.9	147.9	214.3	693.6	247.2	115.0	69.2	3,242.5
total renewable assets (3)	124.8	171.4	241.5	65.8	41.2	82.4	360.3	99.3	44.8	45.1	1,276.6

(3) 100% of locomotives and rolling stock, 25% of permanent way and 75% of plant, buildings and equipment.

TABLE I.19 FIXED OPERATING COSTS (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
PERMANENT WAY											
network (km)	1,303	1,894	1,860	770	625	780	2,845	705	921	292	11,995
fixed costs (US$/km)	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362	2,362	
perm.way factor	1.4	1.0	1.3	1.2	1.2	1.3	1.0	1.1	0.7	1.2	
tot. fixed costs (mln US$)	4.3	4.5	5.7	2.2	1.8	2.4	6.7	1.8	1.5	0.8	31.7
share bordercrossing tr.	0.91	0.58	0.91	0.79	0.70	0.64	0.57	0.93	0.53	0.31	
fixed cost borderc.tr. (mln US$)	3.9	2.6	5.2	1.7	1.2	1.5	3.8	1.7	0.8	0.3	22.7
OVERHEAD AND ADMINISTRATION											
fixed costs/ton	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	
bordercr.tr. (1,000 ton)	160	1,410	900	680	110	910	3,240	1,360	940	1,450	11,160
fixed overh/adm. (mln US$)	0.4	3.6	2.3	1.7	0.3	2.3	8.2	3.5	2.4	3.7	28.3

TABLE I.20 INCOME STATEMENT BORDER-CROSSING TRAFFIC SCENARIO 3 (mln US$)

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR	total
REVENUES											
overseas import	2.8	5.3	10.4	5.4	2.5	6.9	14.5	6.1	0.6	0.9	55.4
overseas export	4.5	15.2	21.4	4.9	1.6	11.2	29.7	14.8	3.0	9.1	115.4
intraregional	0.0	13.0	3.0	1.3	0.0	0.6	40.9	0.6	9.4	9.0	77.8
total revenues	7.3	33.5	34.8	11.5	4.2	18.6	85.1	21.6	13.0	19.1	248.6
OPERATING COSTS											
crew	0.2	1.0	0.7	0.2	0.0	0.4	2.0	0.3	0.3	0.4	5.5
fuel	0.0	3.0	3.6	0.4	0.2	0.8	7.1	1.4	0.5	0.6	17.6
maintenance											
. line locomotives	0.4	1.5	2.4	0.3	0.1	1.0	3.9	0.7	0.5	0.8	11.8
. wagons	0.2	2.8	1.2	0.3	0.1	0.7	6.1	1.4	0.3	0.6	13.7
. permanent way (var)	0.1	0.6	0.8	0.1	0.1	0.2	1.6	0.3	0.2	0.1	4.1
. permanent way (fixed)	3.9	2.6	5.2	1.7	1.2	1.5	3.8	1.7	0.8	0.3	22.7
terminal	0.5	4.0	2.6	2.0	0.4	2.7	9.3	3.9	2.7	4.1	32.1
other op.costs/overhead (var)	0.2	1.9	1.7	0.5	0.1	0.9	4.5	1.2	0.7	1.0	12.7
other op.costs/overhead (fix)	0.4	3.6	2.3	1.7	0.3	2.3	8.2	3.5	2.4	3.7	28.3
interest	0.6	4.5	4.4	0.7	0.3	1.7	11.7	2.2	0.9	1.5	28.6
depreciation											
. line locomotives	0.3	0.9	2.0	0.2	0.1	0.6	2.7	0.4	0.4	0.5	8.3
. wagons	0.1	1.7	1.0	0.2	0.1	0.5	4.2	0.8	0.2	0.4	9.1
. permanent way	2.8	1.8	3.7	1.2	0.9	1.1	2.7	1.2	0.6	0.2	16.2
. plant/bld/eq	0.1	0.4	0.3	0.2	0.0	0.3	1.0	0.4	0.3	0.5	3.5
total operating costs	9.9	30.3	31.9	9.7	3.8	14.8	68.8	19.4	10.7	14.8	214.2
OPERATING INCOME	(2.6)	3.2	2.8	1.9	0.3	3.8	16.2	2.2	2.3	4.3	34.4
GROSS FIXED ASSETS											
. rolling stock	12.4	90.8	88.9	13.4	5.1	34.3	234.7	44.0	17.3	30.6	571.3
. permanent way/others	447.3	303.6	598.4	200.5	142.7	180.1	458.9	203.2	97.7	38.6	2,671.2
. total	459.7	394.4	687.3	213.9	147.9	214.3	693.6	247.2	115.0	69.2	3,242.5
. total renewable assets	124.8	171.4	241.5	65.8	41.2	82.4	360.3	99.3	44.8	45.1	1,276.6
FINANCIAL RATIOS											
return on gross fixed assets;											
- rolling stock	42	18	21	55	58	31	19	25	42	34	23
- total renewable assets	(2)	5	3	4	1	7	8	4	7	13	5
working ratio	90	76	72	68	67	66	68	77	71	69	71
LRMC recovery	37	65	59	42	34	51	62	59	51	53	58
TC (excl.depr.track) recovery	97	85	81	73	71	74	78	84	78	77	80
operating ratio	136	90	92	84	92	80	81	90	83	78	86

Annex I

Part II

Train Operating Characteristics Assumptions
(Border Crossing Traffic Only)

TABLE I.21 THROUGH TRAIN OPERATING CHARACTERISTICS ASSUMED FOR CORRIDOR FINANCIAL ANALYSIS

	CFB	ZR	TZR	MR	CFM-N	CFM-C	NRZ	CFM-S	BR	SWR
A. PRESENT SITUATION										
Gross tons per train	2000	1600	2000	1250	2000	1740	2400	1600	2400	2000
Number of locos per train	2	1	2	1	2	2	2	1	2	3
gtkm/ntkm	2.09	2.21	2.10	2.20	1.99	2.56	2.41	2.34	2.43	2.30
Average wagon capacity (tons)	32.6	31.2	32.7	32.1	31.5	32.9	31.1	33.2	30.2	31.6
Average wagon tare weight	17.7	18.8	18.0	25.7	20.8	25.7	20.7	21.0	19.2	19.4
Load factor	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Average gross tons per wagon	43.8	43.8	44.2	51.4	46.0	52.0	45.6	47.6	43.4	44.7
Empty return factor	0.6	0.6	0.6	0.2	0.2	0.6	0.7	0.7	0.8	0.7
A. MEDIUM TERM IMPROVEMENTS										
Gross tons per train	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400
Number of locos per trains	1.2	1.2	1.2	1.2	1.2	1.5	1	1.2	1	1.2
gtkm/ntkm	1.90	2.00	1.92	2.00	1.83	2.30	2.18	2.12	2.19	2.09
Average wagon capacity (tons)	32.6	31.2	32.7	32.1	31.5	32.9	31.1	33.2	30.2	31.6
Average wagon tare weight	17.7	18.8	18.0	25.7	20.8	25.7	20.7	21.0	19.2	19.4
Load factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Average gross tons per wagon	49.0	48.8	49.4	56.5	51.0	57.3	50.6	52.9	48.2	49.7
Empty return factor	0.6	0.6	0.6	0.2	0.2	0.6	0.7	0.7	0.8	0.7

• assuming that locomotive banking is used where needed.

Note: Average wagon capacity, tare weight and load was calculated from the commodity mix on each corridor as given in Scenario 2, as was the empty return ratio. The gtkm/ntkm ratio was calculated from average wagon loads and empty returns. Present gross tons and locos per train were from field discussions for typical through trains. Improved performance is based on the use of 2000HP locos.

SADCC Transport Corridors

Study of Financial Strategy

Maputo Workshop Report

(Annex J)

This report records the conclusions of the SADCC Transport Corridors Workshop held in Maputo, December 11-14, 1989. It was attended by representatives of the SATCC, SADCC government Ministries of Transport, SADCC Corridor Railways, the World Bank and USAID.

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Southern Africa Development Coordination Conference

SATCC

Southern Africa Transport and Communications Commission

SADCC TRANSPORT CORRIDORS WORKSHOP

ISSUES IN FINANCIAL STRATEGY

REPORT OF THE WORKSHOP PARTICIPANTS

Maputo, Mozambique

December 11-14, 1989

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REPORT OF THE WORKSHOP PARTICIPANTS

1. INTRODUCTION

Following the first day's plenary session, the seminar was split into two Group Workshops: The Operations Group Workshop and the Finance/Planning Workshop.

Both groups initially noted that some of the issues raised by the Consultants had already been raised in earlier studies conducted by SATCC with assistance from other Consultants. In a number of such cases action were already under way.

It was agreed that the goal of the discussion in Workshops would be:

(a) to identify those issues in the report which have never been addressed before, with the aim of making conclusions and recommendations on the actions to be taken: and

(b) to identify those issues already receiving attention, and to determine what further assistance would be required in order to achieve timely implementation.

Both groups also noted that the distribution to participants of the most important working document (Working Paper No.3) was late, which has impeded the work and deliberations at Workshops.

2. ACTIVE SYSTEM MANAGEMENT

2.1 Personnel Training

(a) It was noted that training needs were identified in earlier studies. The needs were for the whole cross-section of staff categorised as follows:

(i) Management Staff
(ii) Local Trainers
(iii) Specialists staff (technical, commercial, planning, etc.
(iv) The general lower level of staff.

(b) So far three courses have already been conducted for the first three categories. The fourth category will be conducted in-house by the local trainers.

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(c) Funding for such courses has already been identified for the next six years.

(d) Currently a proposal to establish a regional management training centre is under consideration.

2.2 Incentives

It was noted that Railways in the region were generally unable to offer competitive incentives in order to keep their trained staff from moving into the private sector. Two main constraints for improvement appear to be common, which are:

(a) Difficult financial positions of the Railways.

(b) Government seals on emoluments paid by parastatals.

Bonding of staff is currently being used as a temporary measure with limited success.

- It is recommended that Railway Administrations should re-examine incentive to promote retention of staff and recommend to their Governments to review pay scales.

2.3 Top Management Training

It was further noted that there was a lack of emphasis given to one particular aspect of the overall management development, namely the Top Management Training.

- It is recommended that periodic short-term seminars, at regular intervals, for the Chief Executives/General Manager be instituted.

3. OPERATIONAL ASPECTS

3.1 Unit Trains and Wagons Bonding

This problem has been identified as a training need. A course in operations management is already being organised to take place sometime next year (1990).

The concept of unit and block trains is universally accepted and is being promoted. However, certain conditions in the region would have to be modified for unit and block trains to be extended.

(a) Differences in the standards of track require the reduction of load at some points i.e. bridges, loops, axle load, and gradient etc.

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It was noted that a number of individual Railway Administrations are currently looking into these problems with the aim of eliminating them.

(b) It is strongly recommended that Railway Administrations should include this concept in their operational plans, as well as in SATCC training programmes.

3.2 Specialised Wagons

(a) It was noted that specialised wagons require sufficiently high volumes of the particular traffic for which the wagon are acquired. Empty running is prevalent in one direction, and for seasonal traffic there is a lot of idle time for the wagon.

(b) Implementation of this requires customer cooperation as special handling facilities are often required.

(c) The proposal is economically desirable and some Railways are already acquiring such wagons.

Other Administrations should make efforts in this direction when acquiring new rolling stock and where traffic levels justify.

3.3 Wagon Tracking and Shipper Information Systems

(a) It was noted that a project is already underway to develop a sub-regional cargo tracking and shipper information system under the auspices of UNCTAD/UNDP. The project has been endorsed by the Railway General Managers of SATCC and is part of the work programme for the next five years.

(b) It is recommended that the system be supported and implemented on a priority basis. Interlinkage with systems currently running in other administrations should be taken into account.

3.4 Regional Standardisation

(a) It was noted that standards on track and rolling stock were already agreed upon. In some cases standardisation has been possible due to donors who offer equipment which does not meet the standards.

(b) It is recommended that Railway Administrations should stand firm on the implementation of the agreed standards and the donors must be made aware of these standards.

(c) Standardisation of wagon spare parts was also agreed upon. An exercise was conducted by SATCC to produce a common catalogue. A report on the exercise will be released soon.

It was noted that standard locomotive specifications have not been agreed upon. It is, therefore, recommended that the Technical Sub-committee of SATCC should discuss this aspect.

3.5 Terminal Operations

It was noted that terminal operations is one of the bottlenecks in the corridor traffic movement.

Issues on terminal operations are included in the SATCC operation management courses, the first of which is in 1990.

Other terminal operation improvements are also heavily involved with institutional constraints. The best method of dealing with them is to identify the problem and arrange for its correction through meeting of the major parties involved. Additional corridor or regional level attention can facilitate these changes in many cases.

3.6 Airbrake Installations

(a) The principle of converting the airbrake systems was accepted by all SATCC Railway Administrations. Procurement of new wagons will have to take into account the possibility of installing the airbrake system.

(b) The standard airbrake system to be used is being discussed.

3.7 Border Crossing Simplification

(a) It was noted that most of the border crossing points in the region have one yeard only where all handover checks are conducted. However, it was recommended that where more yeards than one existed, they should be reduced to one in order to speed up traffic movement.

3.8 Signals and Communication

(a) It was noted that the region has currently different signalling systems. At current traffic levels standardisation on expensive CTC systems would not be justified.

However, another less expensive system called the Electronic token system is currently on trial on Botswana Railways. If successful, ot could provide an alternative in standardisation considerations.

(b) It was noted that where signals existed in some cases the failure rate was very high due to poor maintenance procedures. It was recommended that better maintenance procedures be instituted by the Administrations concerned.

3.9 Scrapping Policy

(a) It was noted that a lot of scrap is indeed lying around in a number of Railway premises.

Management of the various Administrations whould therefore, be urged to streamline the procedures for scrapping obsolete equipment.

3.10 Light and Medium Repairs

Current SATCC projects are addressing the shortcomings with respect to service facilities, high and medium repairs. Efforts should be made to get complete funding as shortfalls still existed.

3.11 Major Repair Workshops

(a) It was noted that a study was conducted under the auspices of the Commonwealth Fund for Technical Cooperation. The study looked at the possibility of manufacturing and maintenance of locos and rolling stock on a regional basis, and the report is under consideration by the Railway Administration.

(b) The establishment of joint workshops for the region could pose some problems because bottlenecks still existed in various aspects of the economies in the region e.g. customs regulations, foreign exchange, ect.

It is recommended that a study be carried out to determine the technical, economic and financial feasibility of this arrangement.

3.12 Spare Parts and Inventory Control

(a) It was noted that there were a lot of inventory control problems in most of the Administrations in the region.

Although foreign exchange shortages were contributory, there was lack of proper inventory management systems.

(b) Installation of proper inventory management systems in the individual Railways is highly recommended to alleviate these problems.

(c) The future possibility of having joint mass orders to take advantage of economies of scale would also be a much welcome development.

4. FINANCE/PLANNING ASPECTS

4.1 Cargo Allocation

(a) The document is based upon certain assumptions and does not take into account the internal cargo movements, specific traffic agreements between member-states and also certain administrative decisions affecting constraints on road traffic. Therefore, the projections of cargo allocations among the various corridors does not essentially portray the correct picture. Nevertheless, the document can form a useful reference for further assessing the transport scenario in the region as a whole or indepth study of an individual corridor or railways with additional data. Therefore, this report should be viewed in this perspective only.

(b) Given this present status of the analysis, it should be clearly understood that this study does not aim at presenting an economic feasibility study and should not be used to appraise the projects and can not be considered bankable as such.

(c) The present study covers only one reference year, i.e. 1990, and as such does not depict the development of the system over the time.

(d) It is recommended to extend the study to include spwecific details with respect to cargo allocations, timeframe of the development as well as (see point 4.3 below) actual cost data for particular rail systems to replace the standard unit costs. Such indepth study should be undertaken in close coordination with SATCC, and include active participation of experts from SADCC member states,

4.2 Rolling Stock Requirements

(a) It was observed that the data on rolling stock fleet needs compilation and updating at regular intervals, as in absence of such vital information, no adequate assessment of further requirement of rolling stock can be made.

(b) While agreeing with the need for a scrapping policy, it was observed that the technical assessment should be made in respect of each locomotive/wagon whilst it could be rehabilitated at reasonable cost.

(c) Taking into account the large impact of capital cost of rolling stock on the total operating cost of the railways, the requirements of rolling stock should be kept as low as possible by increasing the operational efficiency, as it forms the single largest item of cost in the total cost.

(d) It was felt that maintenance of a central spares depot for all member state railways would considerably reduce the down time, increasing the availability of locomotives. Since there are implications of custom duties, foreign exchange, etc., it is felt that SATCC should examine this concept also, while finalising its report on standardisation of spares/maintenance.

(e) Maintenace of Central Inventory by manufacturers of locomotives (GM/GE) should be explored.

4.3 Costs and Possibility to Reduce Costs

(a) The rolling stock replacement cost considered in the study based on cost of U.S. locomotive appear to be higher than the present average cost of the locomotives in the region.

(b) It is felt that it is imperative to have an efficient costing system to produce the correct and relevant costs for control purposes. While one or two railways in the region have developed such systems, others need to follow it up. It is strongly recommended that the experience of the railways who have succeeded in implementing such a system should be used to develop a uniform costing system in the region.

(c) While appreciating the problem of labour-redundancey in many railways, it was felt that it whould be tackled more merely as a cost reduction measure in short-term, but also with a view of achieving an appropriate workforce structure of adequate skilled and trained manpower in long-run.

(d) The single most important way to reduce operating cost is in optimising the utilisation of rolling stock resulting in saving on cost of interest and depreciation.

4.4 Foreign Exchange Component in Costs

(a) It was appreciated that except local workforce, almost all other components of operating costs are in fact foreign exchange costs. But there may be scope to reduce such foreign exchange costs particularly by exploring the possibilities of using the locally produced materials.

4.5 Tariff - Impact and Feability of Increase

(a) In order to ascertain the adjustments to tariff levels, it is essential to have a reliable costing system (reference para 4.3 (b)).

(b) The study attempts to assess the average scope for and the impact of tariff adjustments, but should not be used to recomment X% increase in tariff of a particular railway.

(c) While it is noted that regular increases in tariff are effected by all railways to take care of inflation in the economy and also of the variation in the exchange rate of currencies, it is recommended that they should aim at achieving the cost based tariff in a phased manner, so that total operating costs are recovered.

(d) In many corridors, railways face stiff competition with road sector. The potential of tariff increase is determined by such competition to a great extent, and therefore, need to resort to tariff adjustment should be minimised by reducing the operating costs themselves). Various remedies are tried to overcome the problem, like specific tonnage-tarrif managements which have been entered into by some railways with large customers.

4.6 Cost Recovery Ratios and Financial Targets

(a) The targets for Railway administrations vary from earning profits to providing public services in the region. However, it was noted that most of the railways are now expected to operate as self-sufficient financially viable interprise in long-run. In short-run, however, subsidies in different forms from the Governments are provided to most of the railways.

4.7 Framework and need for strategic Planning

(a) Most of the member countries have developed or are in the process of developing national transport policy covering the aspects of operational and economic objectives for road and rail sectors, investment policies and manpower development. the period covered by such policy or

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to 10 years. Some railways have also prepared corporate plan setting out their objectives and policies.

(b) It is recommended that planning unit of SATCC should be strengthened not only to prepare a regional transport policy, but also to synchronise the policies and plans of each member country with those of the region as a whole SATCC should also render necessary assistance to the railways of member countries to enable them toi prepare their corporate plans.

(c) Special attention need to be paid to projects which reflect the apparent conflicting priorities.

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SATCC TRANSPORT CORRIDOR STRATEGY WORKSHOP

STRATEGIC ACTION MATRIX

Area/Topic	Issue	Action	Responsibility			Period
			Regional	Government	Railway	
Active System Management	1. Management Training Required	a) SATCC training program already in progress	SATCC (on-going program			6 year prog. 89-95
		b) Regional Management Training Center for SATCC Railways	SATCC project			prepar. in 1 year
	2. Performance Incentives Needed	a) Railroads Administration should examine incentives	SATCC item for General Managers		x	immed.
		b) Administrations should recommend to their Govt. payscale review	"		x	immed.
Unit Trains and through Blocking	1. Block trains are inhibited by both management and infrastructures	a) Training of operations managers should include this topic	SATCC			immed. and cont.
		b) Elimination of Infrastructure bottlenecks	SATCC program		x	as soon as possible
		c) Include this type of operations in railway operating plans.	SATCC Regional Operations Planning		x	immed. and ongoing 90-92

SATCC TRANSPORT CORRIDOR STRATEGY WORKSHOP

STRATEGIC ACTION MATRIX

Area/Topic	Issue	Action	Responsibility			Period
			Regional	Government	Railway	
Specialized Wagons	1. Opportunity exists for more use of Specialized Wagons	a) Railway Administrations should consider this in acquiring new rolling stock			x	when feasible
		b) Railway Administrations should encourage customers to purchase specialized wagons where feasible			x	"
Wagon Tracking and Shipper Information System	1. Wagon tracking and Shipper Information is a critical need	a) UNDP/UNCTAD system under development and should be implemented on priority basis	SATCC carried out UNDP/UNCTAD		x	ongoing 88-91
		b) Interlinkage between systems should be implemented	"		x	"
Regional Standardization	1. Track and rolling stock standards are not followed consistently	a) Consider reduce the diversity of the equipment including those financed by donor sources. It is vital to reduce the maintenance problems for a long period in future	SATCC		x	cont.
		b) Donors should be made aware of standards	SATCC		x	cont. and JAN/FEB 1990

SATCC TRANSPORT CORRIDOR STRATEGY WORKSHOP

STRATEGIC ACTION MATRIX

Area/Topic	Issue	Action	Responsibility			Period
			Regional	Government	Railway	
	2. Locomotive interconnection standards do not exist	a) Technical Subcommittee of SATCC should take up this matter	SATCC			Apr 90
Terminal Operations	1. This is a bottleneck for the movement of traffic in the corridors	a) Training of operations staff going on as part of SATCC program	SATCC		x	ongoing
		b) Meeting of the parties involved in the terminal to identify problem and correct it	SATCC -Rail and Port Adm. WG -Shipping and Forwarding WG -Shippers Councils for institutional questions		x	1990
Air Brake Installation	1. Standard Air Brake System needed	a) Technical Subcommittee is considering choice of standard system	SATCC regional project		x	Apr 91
Border Crossing Simplification	1. Delays at border interchanges	a) Where there is more than one yard at border, should be analysed and procedures of change performed at one yard			x	immed.

SATCC TRANSPORT CORRIDOR STRATEGY WORKSHOP

STRATEGIC ACTION MATRIX

Area/Topic	Issue	Action	Responsibility			Period
			Regional	Government	Railway	
Signals and Communications	1. CTC systems too expensive and failure prone	a) Seriously examine less expensive electronic to ken systems such as system being tested in Botswana	SATCC		x	Apr 90 and cont.
		b) Institute better maintenance procedures			x	immed.
		c) Consider new methods of training and retention of skilled staff			x	"
Scrapping Policy	1. Scrap interfering with operations and workshops	a) Railmanagement streamline scrapping procedures			x	"
Repair Workshops	1. There are shortcomings in equipment for high mediums workshops and service facilities	a) Funding should be procured to finance SATCC projects for these facilities	SATCC		x	"
	2. Need for better equipped major maintenance facilities, but this is too expensive for every railway	a) CFTC study currently under consideration regarding manufacturing and maintenance	SATCC item for Gen. Manag. meeting			Apr 90

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SATCC TRANSPORT CORRIDOR STRATEGY WORKSHOP

STRATEGIC ACTION MATRIX

Area/Topic	Issue	Action	Responsibility			Period
			Regional	Government	Railway	
		b) Recommend technical, financial and economic study of feasibility of establishing regional workshops	SATCC item for Gen. Man. meeting			Apr 90 for approval
Spare Parts and Inventory	1. There are inventory control problems in most administrations	a) Recommend installation of inventory management systems	SATCC		x	immed.
	2. Present system for ordering spare parts could possibly be improved with regional stocking	b) Maintenance of Inventory of Loco spares by the manufacturers (GM/GE) in the region should be explored	SATCC			
		c) Failing b, examine the central spares depot in SADCC region to be maintained and issues of Funds Foreign Exchange, Custom Duties to be addressed to.	SATCC			

SATCC TRANSPORT CORRIDOR STRATEGY WORKSHOP

STRATEGIC ACTION MATRIX

		Issue	Action	Responsibility			Period
				Regional	Government	Railway	
T	ation	Shipping Services	1. Negotiate extension of the cellular container service to Beira with SAECS.			x	DEC 90
			2. Negotiate with the East Africa Shipping Conference a tariff for Nacala at Dar-es-Salaam level.			x	DEC 90
		Marketing	A marketing plan should be prepared for the Corridors being reopened at regional level.	SATCC		x	DEC 90
R		Reducing downtime of Rolling Stock and increase in utilisation	1. Inventory of Rolling Stock fleet to be taken and updated regularly	SATCC		x	MAR 90 and regularly
			2. Pooling of locomotives at regional level should be analysed.	SATCC		x	JUN 90

STRATEGIC ACTION MATRIX

Area/Topic	Issue	Action	Responsibility			Period
			Regional	Government	Railway	
Cost Reduction	- Costing system - no uniform costing system exists in the region.	Appropriate costing system to be introduced, where not done. To have a uniform system, experience of the Railways who have successfully implemented the system and the World Bank Malawi Pilot Project expected to be issued shortly should be used.			x	DEC 90
	- Productivity control	Setting up targets for rolling stock availability and utilisation and exerting control over them			x	JUN 90
	- Optimum Utilisation of Manpower	1. Review actual work force structure in order to reduce non profitable labour force				1 year
		2. Consider programs for recycling/reallocating/retiring etc of existing personnel in surplus categories.				
		3. Increase balance of qualified labour force injecting specialized medium and high level personnel.				

SATCC TRANSPORT CORRIDOR STRATEGY WORKSHOP

STRATEGIC ACTION MATRIX

Area/Topic	Issue	Action	Responsibility			Period
			Regional	Government	Railway	
Foreign Exchange	Expenditure is foreign exchange	Possibility to use locally manufactured materials to be explored constantly.			x	Immed.
Financial Performance. Assessment	Financial and Cost Recovery Ratios	Data required for calculating the ratio to be compiled and informed to SATCC on a regular basis.	SATCC		x	JUNE 90 and regularl.
Strategic Planning	Corporate Plan	Railways to formulate their Corporate Plans with assistance of SATCC, wherever required. The plans should be updated regularly.	SATCC		x	DEC 90 and regul.
Tariff	Tariff Formulation	Once the costing system is implemented and specific costs for commodities and traffics are known, aim should be to devise cost based tariffs.				

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SATCC TRANSPORT CORRIDOR STRATEGY WORKSHOP

STRATEGIC ACTION MATRIX

Area/Topic	Issue	Action	Responsibility			Period
			Regional	Government	Railway	
Regional Planning	1. Comprehensive Strategic Plan	1. Organising a comprehensive strategic plan in addition to the study report brought out by World Bank covering all traffics, using actual costs and considering the development over the period. Special attention to be paid to involvement of SATCC and Member States in such plan.	SATCC		x	JUNE 90
		2. Strenghtening of Technical Unit of SATCC.	SATCC			Immed.
	2. Lack of coordination at regional level for rail/road modes of transport	It is a vital ingredient for preparing a regional plan under action 1. As soon as adequate preparations have been made, a detailed regional transport policy should be established.	SATCC			DEC 90

SATCC TRANSPORT CORRIDOR STRATEGY WORKSHOP

STRATEGIC ACTION MATRIX

Area/Topic	Issue	Action	Responsibility			Priority
			Regional	Government	Railway	
Management Development	Top Management Training	Periodic short seminars, at regular intervals, for Chief Executives/GMs of Railway Companies, consisting of two parts: a) General : all management functions b) Specific: -recent developments and changes in the region -changes in patterns of management development (including the mutual exchange of experiences).	SATCC	Railway Authorities		Ongoing program.

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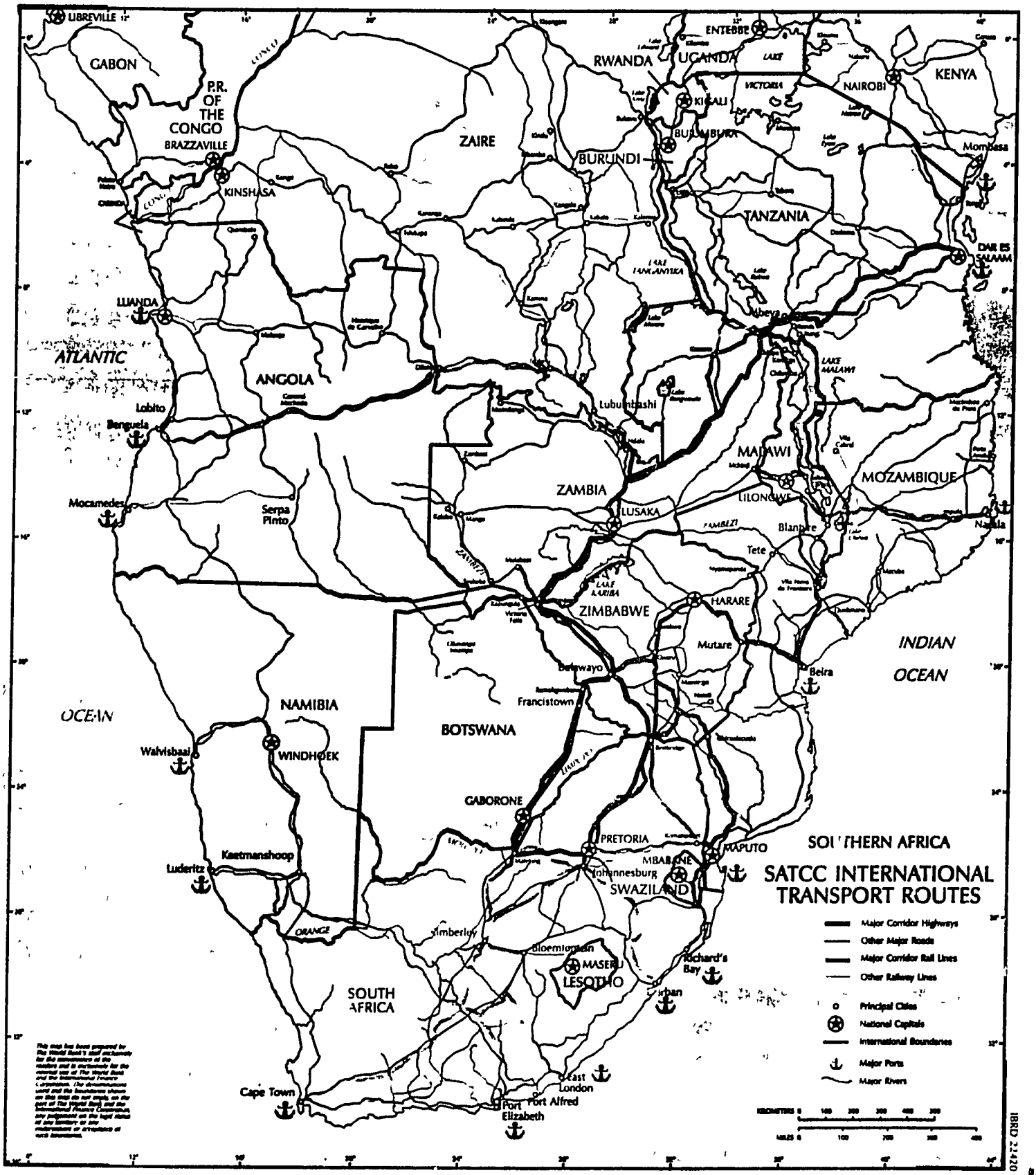

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