社会開発協力部報告書

REPUBLIC OF KENYA

AUGUST 1984

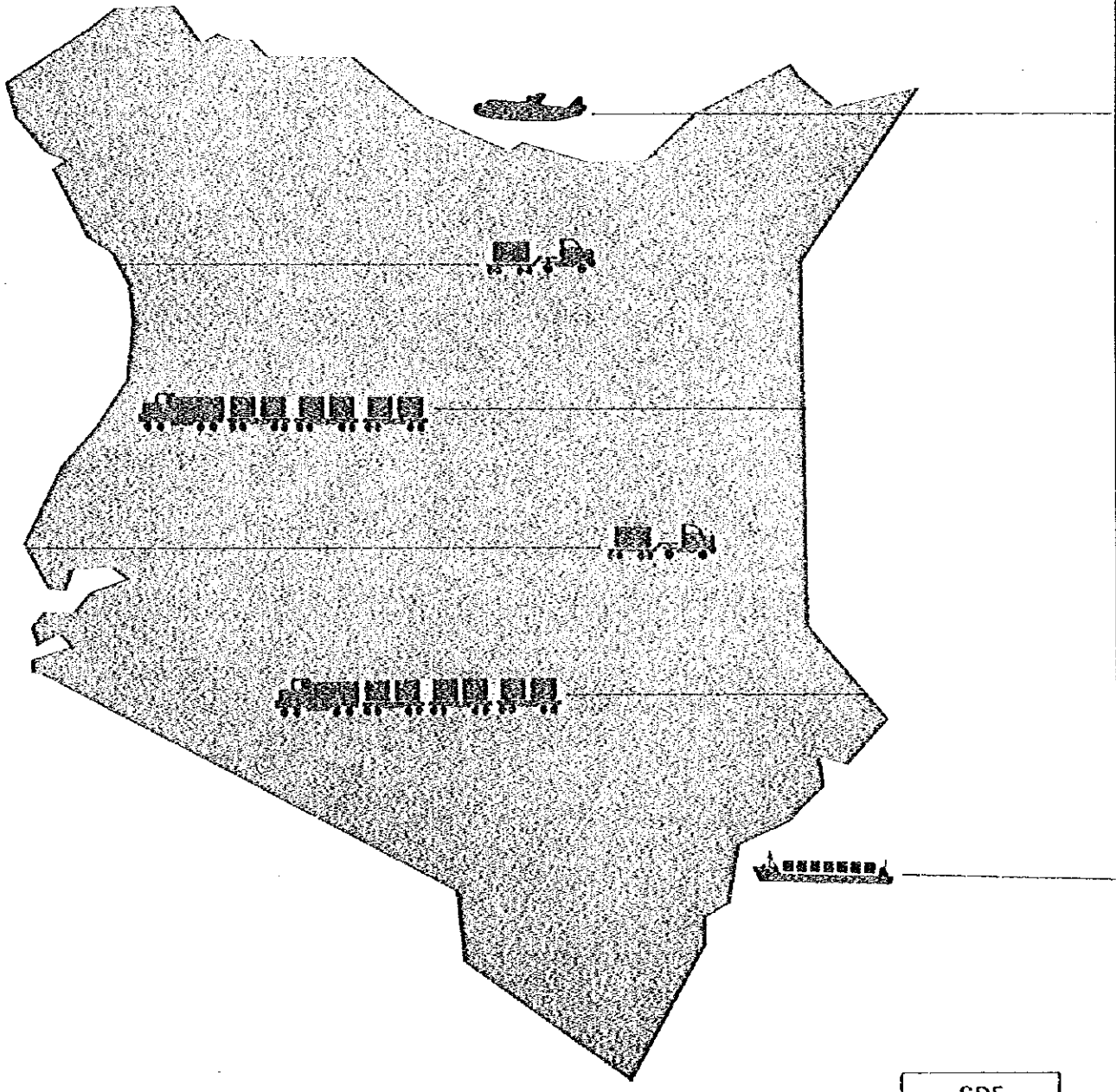
NATIONAL TRANSPORT PLAN

THE STUDY ON NATIONAL TRANSPORT
PLAN IN THE REPUBLIC OF KENYA

FINAL REPORT

VOL. II TRANSPORT MODE

CURRENT PROBLEM AND DEVELOPMENT PLAN



JAPAN INTERNATIONAL
COOPERATION AGENCY

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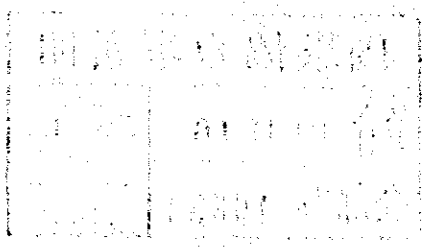


JAPAN INTERNATIONAL
COOPERATION AGENCY

PREFACE

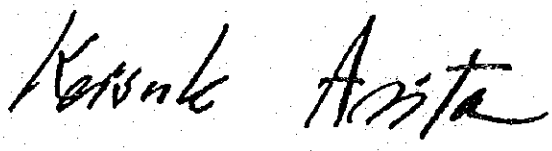
In response to the the request of the Government of the Republic of Kenya, the Government of Japan decided to conduct a study on the National Transport Plan in Kenya and entrusted the study to the Japan International Cooperation Agency (JICA). The JICA sent to Kenya a survey team headed by Mr. Shigetake Ikeda (Mitsubishi Research Institute Inc.) from January 1983 to June 1983 under the guidance of the Advisory Committee chaired by Professor Yoshiji Matsumoto, University of Tokyo.

The team held discussion with the officials concerned of the Government of Kenya on their national transport plan and conducted a survey in Kenya. Subsequently, further studies were made in Japan and the present report has been prepared.

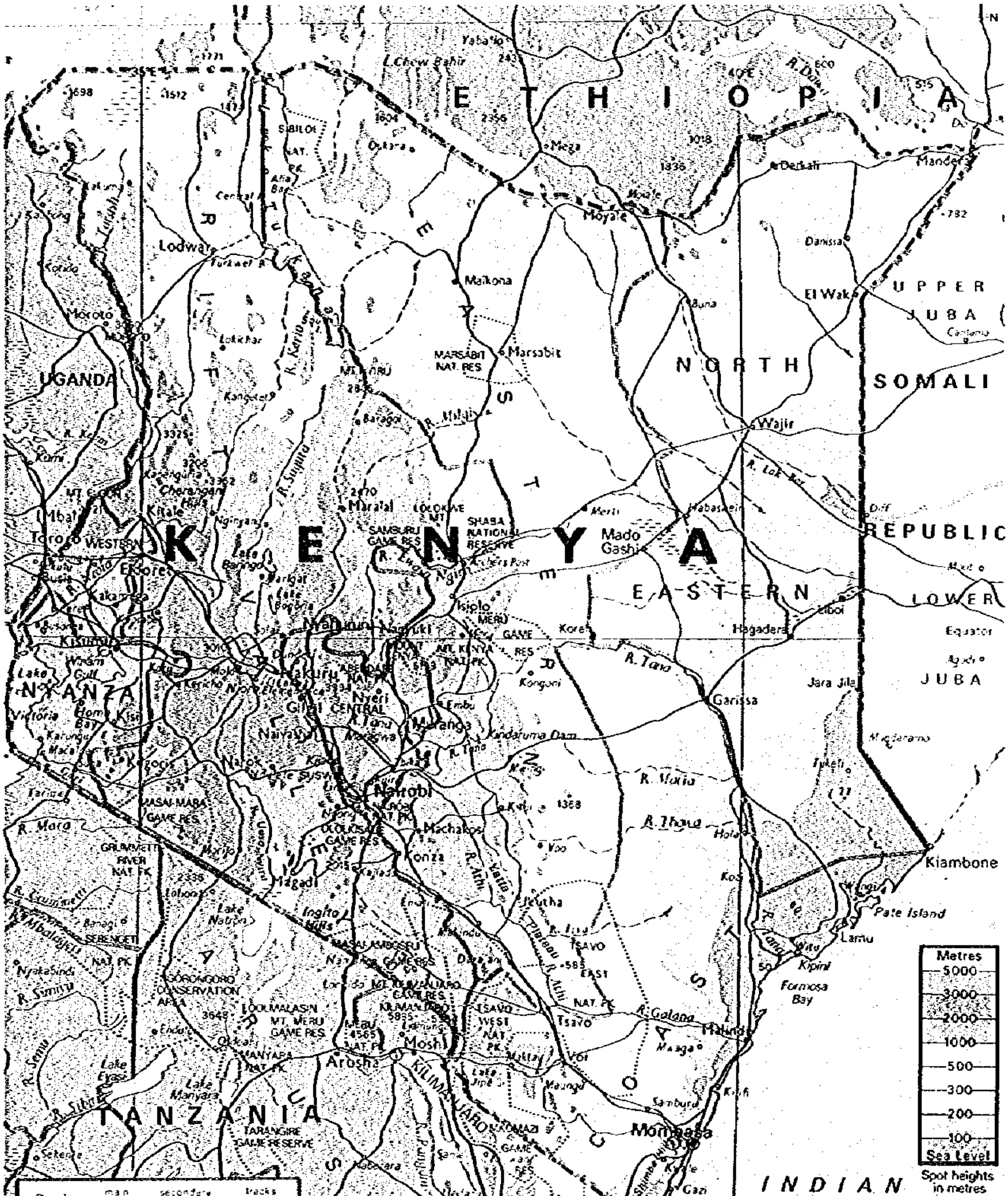
I hope that this report will serve for the development of the transport sector in Kenya and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to all the officials concerned of the Government of Kenya for their close cooperation extended to the team.

August 1984



Keisuke Arita
President
Japan International Cooperation Agency



E T H I O P I A
K E N Y A
UGANDA
TANZANIA
UPPER JUBA
SOMALI REPUBLIC
LOWER JUBA
NORTH
EASTERN
COAST
INDIAN OCEAN
Lodwar
Moroto
Maikona
Marsabit
MARSABIT NAT. RES.
Moyale
Mega
El Wak
Mandera
Wajir
Mado Gashi
Garissa
Hagadera
Jara Jila
Kiambone
Pate Island
Lamu
Kipini
Formosa Bay
Malindi
Mombasa
Gazi
Tanga
TANGA
Korogwe
Lushoto
Usumbara Mts
Moshi
Arusha
Voi
Tsavo
TSAVO EAST NAT. PK.
TSAVO WEST NAT. PK.
R. Galana
R. Tana
R. Athi
Nairobi
Machakos
Konza
Magadi
Naivasha
Nakuru
Nyeri
CENTRAL
Nanyuki
Nyahururu
Isiolo
Maralal
Embu
Murang'a
Narok
Kisumu
NYANZA
Kericho
Kisii
Homa Bay
Kakamega
Eldoret
Kitale
WESTERN
Tororo
Mbale
Kumi
MT. ELGON
Lake Baringo
Lake Natron
Lake Manyara
Lake Eyasi
SERENGETI NAT. PK.
MASAI MARA GAME RES.
NGORONGORO CONSERVATION AREA
TARANGIRE GAME RESERVE
Metres
5000
3000
2000
1000
500
300
200
100
Sea Level
Spot heights in metres
Roads main secondary tracks
National Parks etc Railways
0 100 200 km
0 50 100 miles

EXCHANGE RATE

US$1.00 = Ksh12.63 = Yen 240

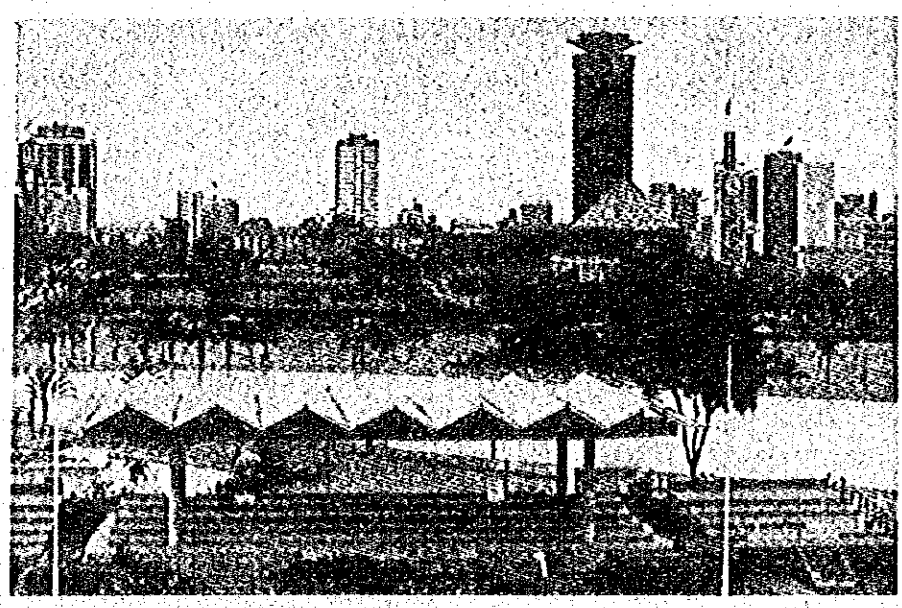
K£1.00 = Ksh20

ABBREVIATIONS

MOTC	–	Ministry of Transport and Communications
KQ	–	Kenya Airways Limited
KR	–	Kenya Railways Corporation
KPA	–	Kenya Ports Authority
KPC	–	Kenya Pipeline Company

CONTENTS

PART I. INTRODUCTION



1. Introduction

1.1 Objective

The objective of the study was to formulate a comprehensive plan for a National Transport System in Kenya integrating the various modes of transport into an optimum transport system. The plan was prepared in two phases: the first phase covers the period 1984–1988, coinciding with Kenya's fifth Five Year Plan, and the second phase covers the period 1989 to 1993 and from 1994 onwards.

The study has made recommendations on improvement of existing transport services and facilities and on formulation of a coordinated development and investment program for the transport sector of the Republic of Kenya.

1.2 Outline of the study

(1) Area under Study

The entire area of Kenya was the object of this study. Transnational means of transport such as maritime transport, air transport, and inland transport, all of which may cross international boundaries, were analysed giving due consideration to the present and future status of OD traffic in counterpart countries.

(2) Subjects under study

The study investigated railways, roads, road transport, ports, maritime transport, inland water-borne transport, air, civil aviation, and pipeline transport.

The study focused mainly on the inter-city traffic of the aforementioned transport modes.

(3) Plan and Planned Time Horizons

A comprehensive plan for a national transport system has been prepared which is consistent with Kenya's economic and regional development plans. In formulating the plan, the study team has considered the efficient use of the existing transport infrastructure. The transport development plan has been formulated in two phases.

1) Short-Term Transport Development Plan (FY 1984–1988)

Candidate projects proposed for incorporation into the Fifth Five Year Plan have been ranked and promising projects will herein be presented as a short term transport development plan. These are presented with a development time schedule and a corresponding investment plan.

2) Long-Term Transport Development Plan (FY 1989–2000)

A transport development plan for the period 1989–1993 and for 1994–2000 will herein be presented as a long-term national development plan.

2. Organisation of the Report

The contents of the final report specified in the scope of work are summarised in the following three reports:

1) Summary of Final Report.

2) Final Report, Vol. I Comprehensive Plan.

3) Final Report, Vol. II Transport Mode.

Volumes I and II of the final report are composed of the following parts respectively.

(1) Vol. I Comprehensive Plan: Economy, Transport Demand, and Investment

Part I Introduction

Part II Current Condition of Transport System and Its Issues

Part III Current Socio-Economic Condition and a Future Framework

Part IV Strategies for Transport Development

Part VI Short and Long-Term Transport Plan

(2) Vol. II Transport Mode: Current Problems and Development Plan

Part I Introduction

Part II Railway

Part III Road/Road Transport

Part IV Port

Part V Maritime Transport

Part VI Inland Waterway Transport

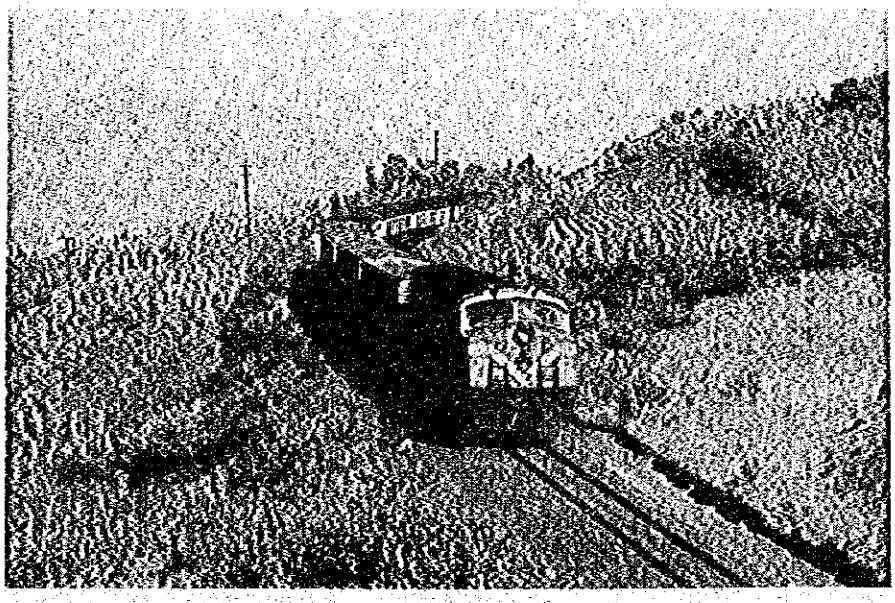
Part VII Civil Aviation

Part VIII National Airline

Part IX Pipeline

This Report corresponds to Final Report, Volume II.

PART II. RAILWAYS



1. Current Condition and Problems

1.1 Current Condition of Railway System

(1) Network

Until 1977, the East African Railways (the EAR) linked the Kenya Railways (the KR) and the Uganda Railways, with a corridor of the KR and the Tanzania Railways in a neighbouring country which is now no longer linked. For the past six years, however, each company has been separately operating its own system and assuming its own liability.

The network does not form a loop but is in a tree shape stretching from the seacoast inland. Figure 1-1 shows the networks in these three countries and Table 1-1 shows the track mileage of the main, principal, and branch lines.

(2) Rolling Stock

Number of rolling stock held is shown in Table 1-2. Technical data on the main diesel locomotives are given in Table 1-3.

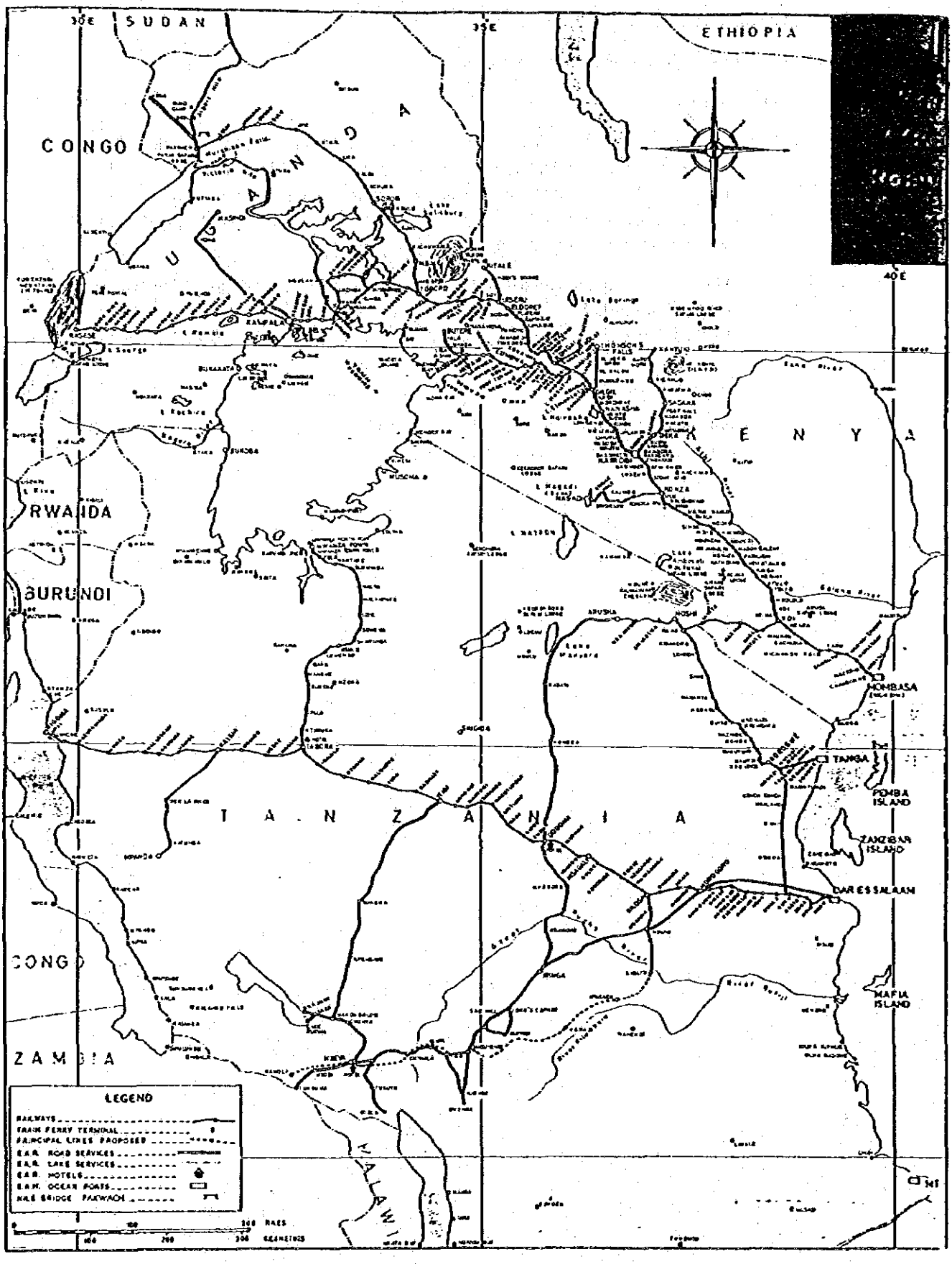

SUDAN
ETHIOPIA
CONGO
U G A N D A
K E N Y A
RWANDA
BURUNDI
T A N Z A N I A
CONGO
ZAMBIA
MALAWI
MOMBASA
TANGA
PEMBA ISLAND
ZANZIBAR ISLAND
DAR ES SALAAM
MAFIA ISLAND
LEGEND
RAILWAYS
FERRY TERMINAL
PRINCIPAL LINES PROPOSED
E.A.R. ROAD SERVICES
E.A.R. LAKE SERVICES
E.A.R. HOTELS
E.A.R. OCEAN PORTS
KILE BRIDGE PAKWACH
MILES
KILOMETRES

Table 1-1 Railways – Mileage of Track

Lines open for Traffic at 31st December, 1980 (All Metre Gauge)

	Route Km. of Running Lines*	Km. of Sidings Reduced to Single Track	Total Km. of Single Track including Sidings
	1980	1980	1980
Main Lines			
Mombasa to Malaba	1,085·44	—	1,085·44
	1,085·44	—	1,085·44
Principal Lines			
Nakuru West to Kisumu	234·96	—	234·96
Voi to Taveta	129·96	—	129·96
	364·92		364·92
Minor Branch Lines			
Nanyuki Branch	232·64	—	232·64
Nyahururu Branch	76·69	—	76·69
Solai Branch	42·49	—	42·49
Kitale Branch	65·20	—	65·20
Yala—Butere Branch	69·98	—	69·98
	487·00	—	487·00
Lines Worked but not owned†			
Kibini Hill Siding	19·31	—	19·31
Magadi Branch	144·85	—	144·85
Miwani Sugar Company Siding	—	2·20	2·20
Private Sidings	—	546·61	546·61
TOTAL	2,101·52	548·81	2,650·33

* All single track except for 5·67 Km. of double track between Nakuru West and Nakuru junction.
† Excludes track owned by Harbours Corporation.

Table 1-2 Locomotive and Rolling Stock Statistics 1980

NUMBERS IN SERVICE

Locomotives — Type	Stock at 31-12-79	Number Withdrawn	Number into Service	Stock at 31-12-80	Tractive Effort (kgs.)
Steam—Garratt	35	—	—	35	1,233,258
Tender	48	—	—	48	593,514
Tank	13	—	—	13	171,843
Diesel—Electric	89	—	—	89	2,487,750
Hydraulic	132	—	6	138	1,909,570
Mechanical	12	—	—	12	61,661
TOTAL	329	—	6	335	6,457,596

Carriages	Stock at 31-12-79	Number For Scrapping	Withdrawn For Conversion	Number in Service Newly Converted		Stock at 31-12-80	Number of Seats or Berths		Kenya Fleet
A. Passenger									
First Class	26	—	—	—	—	26	627	418	
Second Class	41	—	—	—	—	41	1,422	1,389	
Third Class	110	—	—	9	—	119	10,022	—	28*
Composite	4	—	—	—	—	4	242	28	
B. Restaurant									
Restaurant Cars	7	—	—	—	—	7	125	—	
Buffet Car	11	—	—	—	—	11	157	—	
C. Departmental									
Inspection	88	—	—	—	5	93	—	—	
Caboose	104	—	—	—	—	104	—	—	
D. Brake/Luggage Vans	147	—	—	—	—	147	—	—	
TOTAL	538	—	—	9	5	552	12,595	1,835	28*

NOTE.—In upper class stock, the lower berths can seat 3.

Wagons								Carrying capacity tonnes	
Covered goods	3,609	5	—	257	—	3,861	107,320	660*
Oil Tank (Black)									
Oil Tank (White)	853	1	6	—	—	846	28,797	
Refrigerated cooled	32	—	—	—	—	32	860	
Live stock	360	1	5	—	—	354	3,779	
Open High Sided	879	7	—	7	—	879	27,681	100*
Open Low Sided	1,324	10	—	—	—	1,314	34,564	440*
Departmental	13	—	—	—	—	13	167	
Special user	343	—	—	110	6	459	18,776	110*
TOTAL	7,413	24	11	374	6	7,758	221,944	1,310*

	No. of Wagons	No. of Units
Bogie	5,720	11,440
Four Wheels	2,038	2,038
TOTAL	7,758	13,478

* Indicates the Kenya Railways Fleet.

Table 1-3 TECHNICAL INFORMATION ON DIESEL LOCOMOTIVES

CLASS	AXLE ARRGT	TRNAS MISSION	RATED POWER HP	MAX AXLE LOAD TONNES (TONS)	ADHESIVE WEIGHT TONNES (TONS)	TOTAL WT IN WORKING ORDER TONNES (TONS)	TRACTIVE EFFORT			MAX SPEED KM/H (Mph)	WHEEL DIAMETER MM (in)	LENGTH MM (ft in)	NUMBER BUILT	YEAR FIRST BUILT	BUILDERS		
							MAX STARTING KG (Lb)	CONTINUOUS AT KG (Lb)	CONTINUOUS AT KM/h (Mph)						MECHANICAL PARTS	ENGINE AND TYPE	TRANSMISSION
93	Co-Co	ELECTRIC	2610 AT 1050 RPM	16.7 (16.4)	101.8 (100.2)	101.8 (100.2)	35000 (77162)	25700 (52249)	22 (13.6)	72 (45)	953 (3'-1 1/2")	18320 (60'-1 1/4")	[26]	1978	G.E. (USA)	G.E.Co, 7 PDL 12	G.E.
92	Co-Co	ELECTRIC	2550 AT 1050 RPM	15.7 (15.4)	96.5 (94)	118 (116)	35000 (77162)	19773 (43591)	26.5 (16.4)	72 (45)	953 (3'-1 1/2")	13015 (59'-1 1/4")	15 [14]	1971	(CANADA) M.L.W. INDUSTRIES	ALCO-251F	G.E. (CANADA)
87	Co-Co	ELECTRIC	1660 AT 850 RPM	13.5 (13.3)	82.3 (81)	104.7 (103)	23300 (51600)	20185 (44500)	18.9 (11.7)	72 (45)	953 (3'-3 1/2")	16948 (55'-7 1/4")	10 14 20 [32]	1960 1964 1967/8	(UK) ENGLISH ELECTRIC	E.E.12CSVT	E.E.
72	Bo-Bo	ELECTRIC	1240 AT 850 RPM	12.475 (12.28)	49.8 (49)	73 (71.80)	18150 (40000)	14650 (32300)	17.2 (10.7)	72 (4.5)	953 (3'-1 1/2")	13341 (43'-91/4")	10 [1]	1972	(UK) G.E.C.	E.E. 8CSVT	G.E.C.
70	Bo-Bo	ELECTRIC	1240 AT 850 RPM	12.25 (12.06)	49.8 (49)	71 (70)	18150 (4000)	14606 (32200)	16.9 (10.5)	72 (45)	953 (3'-1 1/2")	13341 (43'9 1/4")	[10]	1967	(UK) ENGLISH ELECTRIC	E.E. 8 CSVT	E.E.
62 *	B-B	HYDRAULIC	740 AT 1500 RPM	9.5 (9.35)	38	38	12500 (27750)	9900 (21800)	12.3 (7.6)	72 (45)	953 (3'-1 1/2")	11404 (37'-5")	[56]	1977	(THYSSEN HENSCHEL KASSEL/ RHEINSTAHL AG. W. GERMANY)	MTU 493T2 (10) MTU 396TC (46)	VOITH L520 r U2
47	D	HYDRAULIC	525 AT 1800 RPM	13.5 (13.29)	53	53	15907 (350969)	10700 (23590)	8 (5)	28 (17.5)	1003 (3'-3 1/2")	8290 (27'-2 3/8")	[35]	1977	(UK) HUNSLET AND BRE-METRO	ROLLS-RYCE DV6 TCE - 4 STROKE	VOITH L 2r 3ZU
46	D	HYDRAULIC	2x345 AT 2200 RPM	12.5 (12.3)	49	49	14900 (32900)	13044 (28750)	7.3 (4.6)	32 (20)	1003 3'-3 1/2")	11005 (36'-1 1/4")	[22]	1967	(UK) ANDREW BARCLAY	2X CUMMINS TURBO-CHARGED NT, 380	BRITISH TWIN DISC CF 11500
45 X	D	HYDRAULIC	855	13.25	53	53	15880 (35000)	-	-	35 (22)	1356 (3'- 9")	10643 (34'-11")	[10]	1957	(UK) N.B.L.	M.A.N. WBV 22/30A	N.B.L. VOITH
44 X	D	HYDRAULIC	510	13.25	53	53	15102 (33300)	-	-	HIGH 56(35) LOW 32(20)	1003 (3'-1 1/2")	10055 (33'-0 1/4")	[3]	1956	(UK) N.B.L.	DAVEY PAXMAN 12 RPH XL ser. 2	N.B.L. VOITH
43 X	D	HYDRAULIC	300	10.75	43	43	9075 20000)	-	-	HIGH 56(35) LOW 32(20)	1003 (3'-3 1/2")	9734 (31'-11 3/4")	14 [7]	1955	(UK) N.B.L.	DAVEY PAXMAN 8 RPHL ser.6	N.S.L. VOITH
35	C	HYDRAULIC	302 AT 1500 RPM	13.10	36.56	36.56	11099 (24460)	9070 (20000)	6.1 (3.8)	27 (17)	1003 (3'-3 1/2")	9023 (29'-7 1/4")	15 [5]	1972	(UK) ANDREW BARCLAY	PAXMAN BRPHL	VOITH L 320 V
33 X	C	MECHANICAL	194	9.33	28	28	7071 15800)	-	-	42 (26)	1003 (3'-3 1/2")	8071 (26'-5 3/4")	[6]	1950	DREWRY CAR CO. VULCAN FOUNDRY (UK)	NORRIS HONTY & GARDNER LTG GARDNER 8L 3	TYPE 23 VULCAN SINCLAIR HYO C CAJ WILSON-OPEWIT GEAR BOX
32 X	C	MECHANICAL	80	6.33	19	19	3109 (6850)	-	-	24 (15)	711 (2'4")	7150 (23'-5 1/2")	[6]	1950	(UK) JOHN FOWLER	JLM MCLAREN LTD MCLAREN KKJ	FOWLER
79 (EXPLOREK) *	Co-Co	ELECTRIC	1100	12	72	72	19050 (42000)	10890 (24000)	19.3 (12)	88 (55)	927 (3'-0 1/2")	14173 (46'-6")	[1]	1958	(UK) A.E.I.	LISTER B/STONE ESS 12 T.	A.E.I.

X STABLED
* AT RAILWAY TRAINING SCHOOL

[ ] K.R. OWNED/RASED

(3) Staffing

Staff assignments are shown in Tables 1-4 and 1-5 by systems and job classifications.

1.2 Present Conditions of Railway Transport

(1) Passengers and Freight Traffic

Traffic data, in terms of both volume and revenue, by classifications of passengers, goods, parcels, luggage and livestock, are shown in Table 1-6.

A further breakdown by passengers and goods, in terms of both tonnage and revenue, by railways, roads, and inland waterways is shown in Table 1-7.

The data recorded for the 1977–1980 period regarding passengers versus passenger/kms and tonnes versus tonne/kms are drawn in Figs. 1-2 and 1-3, respectively.

With regard to freight traffic, the general trend and net tonnage of principal commodities for the period 1977 to 1980 are shown in Fig. 1-4 and Table 1-8, respectively.

Table 1-4 Staff Employed in Each Department

Managing Director	17	—	—	—	17	11
Personnel	321	2	2	—	325	304
Management Services	125	2	—	—	127	128
Civil Engineering	8,680	13	11	1	8,705	8,248
Mechanical and Electrical Engineering	5,267	6	35	—	5,308	5,384
Traffic	5,838	—	2	—	5,840	5,774
Accounts	301	—	1	—	302	306
Supplies	658	—	—	—	658	639
Railway Training School	251	1	—	—	252	226
TOTAL	21,458	24	51	1	21,534	21,020

Table 1-5 Staff Statistics: Manpower Employed as at 31st December 1980

	Africans	Europeans	Asians	Others	Total 1980	Total 1979
Senior Officers	165	13	3	—	181	185
Clerical, Station Staff and Controllers	2,701	2	7	—	2,710	2,634
Surveyors, Draughtsmen and Tracers	81	1	5	—	87	81
Inspectors, Instructors, Supervisors and Overseers	521	1	3	1	526	523
Foremen, Chargehands, Artizans and Trade Testing Officers	3,162	5	21	—	3,188	3,181
Drivers: Locomotive, Motor, Crane and Shunters	551	1	10	—	562	553
Travelling Ticket Examiners and Guards	280	—	—	—	280	291
Health inspectors/Assistants, Welfare and Housing Staff and St. John Ambulance	35	—	1	—	36	31
Firemen	174	—	—	—	174	187
Cooks, Stewards and Matrons	88	—	—	—	88	92
Marine Deck Officers: Marine Officers, Tugmasters, Mates and Boatswain	29	—	—	—	29	27
Marine Engine Room Staff: Engineers, ERA's and Serangs	39	—	—	—	39	36
Dressers, Midwife	6	—	—	—	6	13
Trainees	252	—	—	—	252	232
Secretaries and Telephonists	261	—	1	—	262	253
Programmers, Analysts, Machinists, Org. and Methods, Work Study, Photographers and Museum Curator	70	1	—	—	71	76
Commissionaires	2	—	—	—	2	2
Semi Skilled: Artizans, Record Assts. and Watchmen	1,917	—	—	—	1,917	1,894
Unskilled: Labourers, Porters and Sailors	4,127	—	—	—	4,127	4,118
Permanent Way Labour	5,386	—	—	—	5,386	5,287
Others and Casual	1,611	—	—	—	1,611	1,324
TOTAL	21,458	24	51	1	21,534	21,020

NB – Total includes all staff on leave pending retirement and still on payroll at 31st December 1980.

Table 1-6 Recorded data by classification of goods, passengers, parcels, luggage and livestock

RAILWAYS, INLAND WATERWAYS AND ROADS

		1979	1980
Goods Traffic—All Services			
Tonnes Originating—			
Public		3,932,000	4,464,000
Departmental		256,000	215,000
		4,189,000	4,679,000
Tonne-Kilometres—			
Public		1,997,685,000	2,280,932,000
Departmental		69,605,000	55,104,000
		2,067,290,000	2,336,036,000
TOTAL REVENUE FROM PUBLIC GOODS TRAFFIC	Sh.	493,321,000	553,569,000
Revenue per tonne—Public Traffic	Sh.	125·44	124·00
Revenue per tonne—Kilometre Public Traffic	Cts.	24·69	24·27
Average Cost per tonne-Kilometre—Public Traffic	Cts.	25·60	25·91
Average Haul—			
Public	Kilometres	508	511
Departmental	Kilometres	272	257
Passenger Traffic—All Services			
Journeys Originating—			
First		65,900	73,600
Second		156,700	148,300
Third		1,833,000	2,346,500
		2,055,600	2,568,400
Revenue—			
First	Sh.	8,502,000	9,959,000
Second	Sh.	6,973,000	7,501,000
Third	Sh.	29,747,000	39,712,000
		45,222,000	57,172,000
Parcels, Luggage and Mails—All Services			
Tonnes Originating		25,000	21,000
Revenue	Sh.	8,088,000	7,556,000
Livestock—All Services			
No. of Heads		162,000	170,000
Revenue	Sh.	10,399,000	11,048,000

Table 1-7 Recorded Data by Railway, Roads, and Inland Waterways

Traffic by Services			
Tonnes carried (including Departmental)—			
Rail		4,013,000	4,502,000
Waterways		26,000	12,000
Road		150,000	165,000
Tonne-Kilometres (including Departmental)—			
Rail		2,063,185,000	2,331,727,000
Waterways		1,083,000	529,000
Road		3,023,000	3,780,000
Revenue from Public Goods Traffic—			
Rail	Sh.	488,695,000	548,952,000
Waterways		558,000	151,000
Road		4,069,000	4,867,000
Passengers carried—			
Rail		1,915,000	2,401,000
Waterways		139,600	168,000
Revenue from Passenger Traffic—			
Rail (including platform and season tickets)	Sh.	43,796,000	55,290,000
Waterways	Sh.	1,426,000	1,881,000

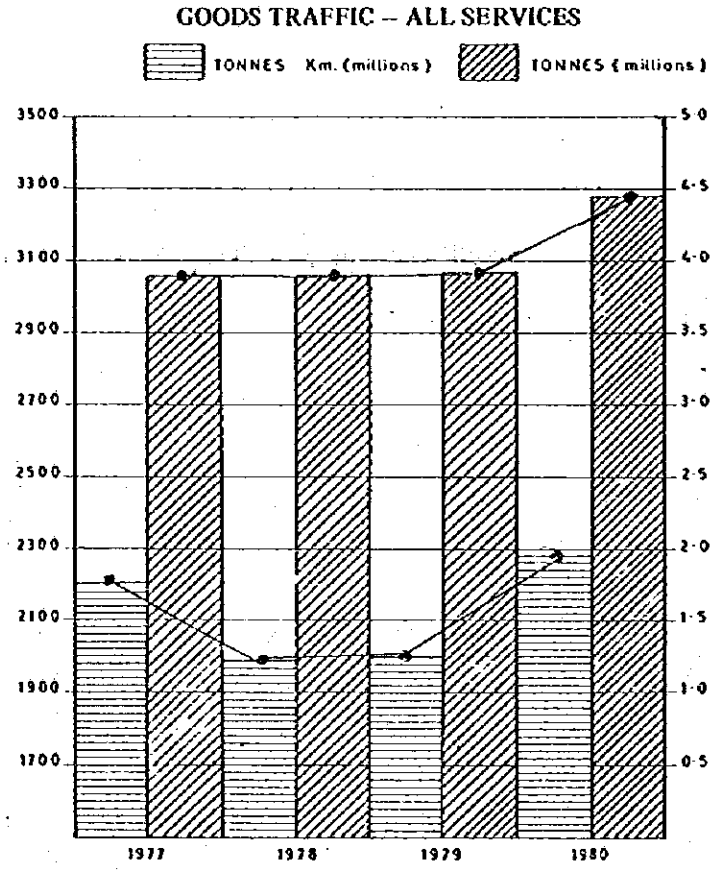


Fig. 1-2 Goods Traffic

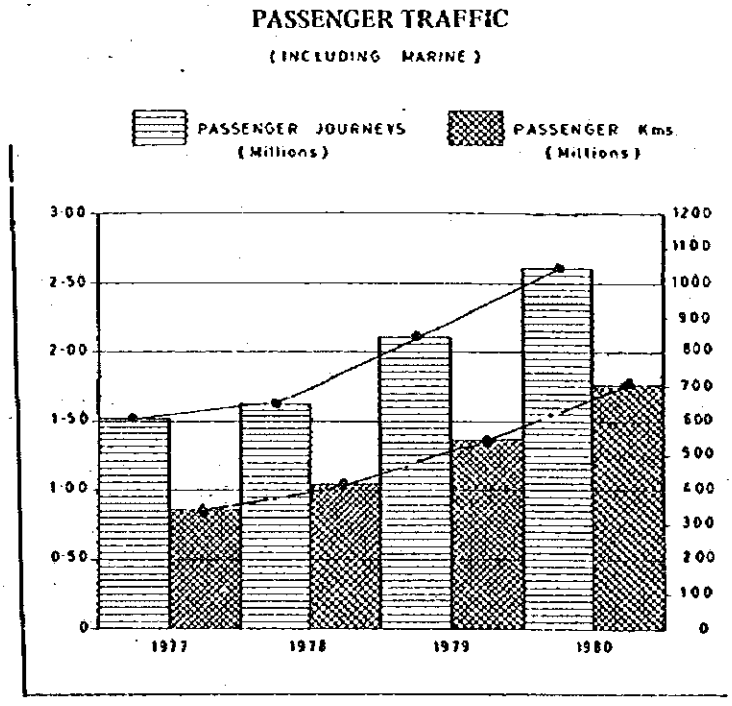


Fig. 1-3 Passenger Traffic

Fig. 1-4 Principal Commodities of Kenya Railways Tonnes '000'

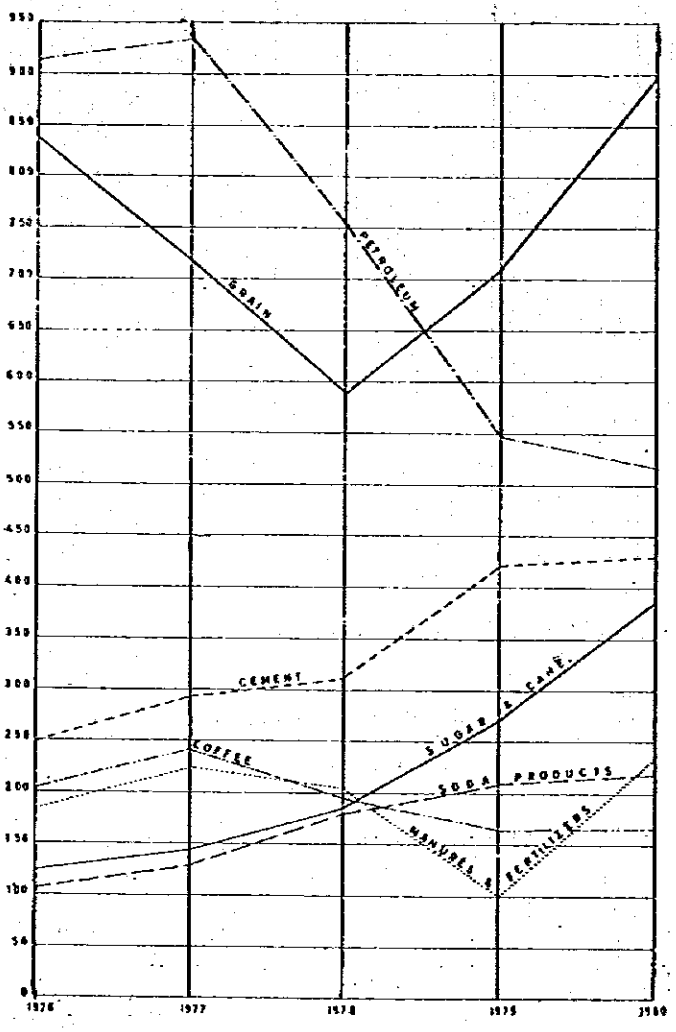


Table 1-8 Principal Commodities Carried (Kenya Railways)

Commodity	1979 Tonnes	1980 Tonnes	Increase or Decrease Tonnes
Bitumen	20,000	24,000	+4,000
Cake Cattle	10,000	27,000	+17,000
Canned Fruit and Fruit Pulp	40,000	36,000	−4,000
Cement	422,000	429,000	+7,000
Chemicals	34,000	39,000	+5,000
Coffee	165,000	168,000	+3,000
Cotton	7,000	5,000	−2,000
Dairy Produce	20,000	24,000	+4,000
Empties, Hollow	14,000	17,000	+3,000
Firewood	11,000	11,000	—
Flourspar	86,000	89,000	+3,000
Grains	711,000	928,000	+217,000
Gunny, Jute etc.	13,000	18,000	+5,000
Hardware etc.	6,000	9,000	+3,000
Hides and Skins	7,000	4,000	−3,000
Iron and Steel	99,000	135,000	+36,000
Lime and Limestone	219,000	161,000	−58,000
Machinery Agriculture	8,000	12,000	+4,000
Manures and Fertilizers	99,000	235,000	+136,000
Meat Products	2,000	2,000	—
Molasses	62,000	65,000	+3,000
Motor Vehicles	4,000	6,000	+2,000
Oils (Other than vegetables)	548,000	518,000	−30,000
Oils (Vegetables)	54,000	59,000	+5,000
Oil Seeds	13,000	19,000	+6,000
Packing Materials	10,000	11,000	+1,000
Paper	60,000	82,000	+22,000
Pipes and Fittings	3,000	3,000	—
Pyrethrum	7,000	7,000	—
Salt and Rock Salt	80,000	78,000	−2,000
Scrap Metal	12,000	11,000	−1,000
Sisal and Sisal Waste	20,000	28,000	+8,000
Soda Products	209,000	220,000	+11,000
Stone	4,000	19,000	+15,000
Sugar and Sugar Cane	271,000	387,000	+116,000
Tea	32,000	23,000	−9,000
Textiles	21,000	5,000	−16,000
Timber	73,000	75,000	+2,000
Tin, Tinplate and Tin ore	19,000	18,000	−1,000
Tractors and Tractor Parts	3,000	2,000	−1,000
Wattle Bark and Extract	12,000	9,000	−3,000
Wire (Other than Electrical)	22,000	9,000	−13,000

(2) OD Table for Passengers, Goods, and Livestock

The OD Tables and traffic density for passengers, goods, and livestock are respectively shown in Table 1-9 (for 12 inter-zones), Table 1-10 (for 26 inter-zones), and Table 1-11 (for 26 inter-zones).

(3) Operation and Maintenance

Operating kilometres of trains and engines for passengers and freight, together with kilometres travelled by coach and freight vehicles, road vehicles, and waterway traffic, are itemized in Table 1-12.

Locomotive availability and failures are shown in Table 1-13 separated by the main line and shunting. Maintenance data for both track and rolling stock are given in Table 1-14.

Table 1-9 Passenger OD Table and Traffic Density

PASSENGER FIGURES 1982 (TWELVE SELECTED BUST STATIONS) ALL CLASSES

	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)		
(1)	0	9922	357	119599	1611	980	977	2036	28571	1761	1376	500	167690	(1)
(2)	9052	0	2046	17891	249	81	65	79	873	86	51	21	30494	(2)
(3)	1432	3976	0	1943	30	33	0	12	408	14	25	15	7888	(3)
(4)	130674	18034	1582	0	15763	3720	2812	9864	180657	20303	8069	887	392315	(4)
(5)	1171	179	0	29703	0	2331	1241	3769	33240	8073	943	0	80650	(5)
(6)	1093	65	10	7586	3243	0	810	4401	0	0	0	0	17208	(6)
(7)	1112	78	0	5111	1562	930	0	1359	0	0	0	0	10252	(7)
(8)	1943	102	0	12510	3909	4276	3179	0	0	0	0	0	25919	(8)
(9)	19547	680	72	190056	26361	0	0	0	0	5276	0	0	242012	(9)
(10)	2006	105	3	25888	6568	0	0	0	7657	0	0	0	42225	(10)
(11)	1076	0	3	8572	833	0	0	0	27898	0	0	0	38382	(11)
(12)	543	12	0	2344	121	0	0	0	14341	0	0	0	17361	(12)
(D'ﾃﾅ)	169649	33151	4073	421203	60370	12361	9084	21520	293645	35513	10404	1423	1072396	(D'ﾃﾅ)

PASSENGER FIGURES 1982 (TWELVE SELECTED BUSY STATIONS) ALL CLASSES (NETWORK)

	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)		
(1)	0	167690	0	0	0	0	0	0	0	0	0	0	167690	(1)
(2)	169649	0	4073	179287	0	0	0	0	0	0	0	0	353009	(2)
(3)	0	7888	0	0	0	0	0	0	0	0	0	0	7888	(3)
(4)	0	180038	0	0	281879	0	0	0	0	0	0	0	461967	(4)
(5)	0	0	0	311568	0	28010	0	0	285813	0	0	0	625391	(5)
(6)	0	0	0	0	38424	0	26066	0	0	0	0	0	64490	(6)
(7)	0	0	0	0	0	31633	0	21520	0	0	0	0	53153	(7)
(8)	0	0	0	0	0	0	25919	0	0	0	0	0	25919	(8)
(9)	0	0	0	0	284808	0	0	0	0	35513	11827	0	332148	(9)
(10)	0	0	0	0	0	0	0	0	42225	0	0	0	42225	(10)
(11)	0	0	0	0	0	0	0	0	55743	0	0	1423	57166	(11)
(12)	0	0	0	0	0	0	0	0	0	0	17361	0	17361	(12)
	169649	355666	4073	490855	605111	59643	51985	21520	383781	35513	29188	1423		

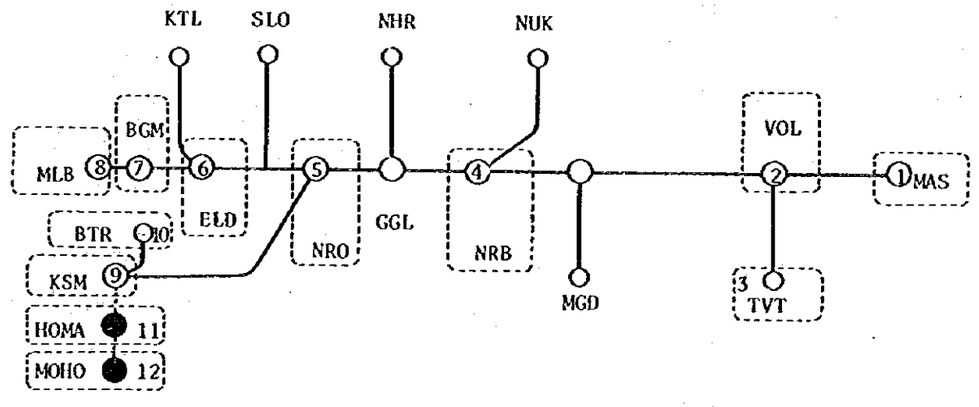


Table 1-10 Goods OD Table and Traffic Density

KENYA RAILWAYS - INTER TOP 50 STATIONS LIVESTOCK (HEADS)

	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151	161	171	181	191	201	211	221	231	241	251	261	
11	0	0	353	194	151	124	4039	76317	64724	29260	5903	709	9753	852	2863	43373	2643	23099	8397	11393	61817	12556	80915	1721	981	1535	438614
21	0	9930	3806	7	161	12847	36061	210255	134921	82550	6088	481	31161	1922	1898	24916	4948	44913	10920	64991	36865	14188	42497	317	46	15	834338
31	2394	100	0	52	5	0	0	1634	320	573	0	0	0	22	0	1	33	0	1	100	1	0	2	15	2	1	1	5222
41	2589	41	229	0	0	0	6	0	1275	343	0	0	0	4	0	0	6	0	0	1	0	0	2	26	1	0	10	4427
51	19	2	0	4	0	0	87708	0	0	1	0	0	0	0	13	0	0	0	0	0	0	0	1	0	0	0	0	87748
61	18959	134785	0	1	1	0	906	8387	2864	4050	132	834	1122	0	277	2933	109	745	616	7434	0	589	1039	43	5	9	186040
71	212	2959	1	0	11	0	0	36042	32952	67266	8806	1155	5347	1040	2137	10959	520	9544	4815	4128	480	5996	9394	1480	525	3	203131
81	23976	18096	327	50	0	230	3197	0	56	55060	27113	3450	1800	6923	561	68361	198	74253	955	4932	8292	4876	64333	61	66	286	344790
91	93102	44934	693	124	188	94	93	0	1	13981	1225	825	104	15	333	19633	3	711	484	599	261	366	21106	180	76	88	204045
101	25794	44905	215	4	1	0	188	3461	45294	6922	2269	534	1271	533	503	2120	767	3558	1922	2949	559	3290	1951	192	182	114	166443
111	1515	4058	52	1	1	0	11	286	32424	4119	0	1319	13	0	1	3006	0	6	6	10	2	29	115	6	4	6	47041
121	121	512	2	0	0	0	0	0	3216	25	9636	0	28	0	1	3	0	11	59	5	1	0	7	3	0	2	14220
131	4589	584	156	14	0	38	0	132	5007	564	214	19	6	1	28	2199	1	536	120	295	55	168	8745	63	20	25	21409
141	446	165	6	5	1	0	239	0	623	874	193	0	64	0	112	118	0	358	69	216	7	10	610	50	1	78	4043
151	3994	1894	1	3	0	0	0	5550	9295	846	50	630	166	0	0	1310	585	296	45	7	0	173	1491	37	2	2	26877
161	27123	9272	221	103	0	0	657	30321	48299	21251	1594	546	6190	961	551	0	291	9130	5903	2294	12	5358	17469	1229	1	110	197483
171	24862	5796	0	0	78	0	23	1146	2202	938	55	1	410	0	1	3426	169	146	49	36	1	0	155	6	5	2	83467
181	22025	5933	406	130	1	594	19	20250	50155	6553	141	54	4963	1	15	24185	40	0	4884	1399	15	5	9509	6	1	2	131059
191	5219	11782	72	0	0	0	272	21022	27559	9139	644	928	865	2	615	19554	150	10316	0	1	29	344	194	2	1	1	308102
201	18874	39432	0	0	0	0	2706	61542	73247	25355	1348	2721	1348	0	1420	9480	56	873	29	32	17688	19	0	0	0	0	240017
211	95769	3977	0	0	0	0	0	0	3824	11	0	1	43	1	0	304	9	464	1	28	0	1	1	0	0	0	102857
221	55428	14659	215	0	3	0	2253	24177	50635	14335	3212	1193	2766	519	2872	12885	2629	1905	298	20	21	4360	46936	318	123	34	199215
231	5319	3540	121	22	0	0	494	14594	17220	23468	825	1287	1495	0	1020	10195	0	16	28	0	0	733	300	1400	6453	0	89603
241	191	33	0	0	0	1	0	1	724	57	0	0	111	1	12	240	0	0	0	0	0	284	1265	0	0	0	2989
251	295	0	0	0	0	0	0	0	3158	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4259
261	2800	0	200	0	0	0	0	0	515	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3516
	460876	361134	7373	724	699	13928	138872	520687	572272	365792	49029	16352	65581	12431	14326	309207	12918	173919	39862	103601	125305	53690	508570	7173	4291	2341	3756751

KENYA RAILWAYS - INTER TOP 50 STATIONS LIVESTOCK (HEADS) (NETWORK)

	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151	161	171	181	191	201	211	221	231	241	251	261	
(11)	0	438614	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	438614
(21)	460876	9930	1263222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1734028
(31)	0	812080	0	714	1262806	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2075600
(41)	0	0	4427	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4427
(51)	0	0	810102	0	0	13928	1359240	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2193270
(61)	0	0	0	0	186040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	186040
(71)	0	0	0	0	657575	0	0	1440468	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2098043
(81)	0	0	0	0	0	0	664544	0	1411377	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2075721
(91)	0	0	0	0	0	0	0	811150	1	401861	0	16352	963493	0	0	0	0	0	0	0	0	0	0	0	0	0	2192857
(101)	0	0	0	0	0	0	0	0	180124	6972	69429	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	256525
(111)	0	0	0	0	0	0	0	0	0	47041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47041
(121)	0	0	0	0	0	0	0	0	14220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14220
(131)	0	0	0	0	0	0	0	0	960562	0	0	0	6	923157	0	0	0	0	0	0	0	0	0	0	0	0	1889725
(141)	0	0	0	0	0	0	0	0	0	0	0	0	970398	0	14326	914750	0	0	0	0	0	0	0	0	0	0	1899474
(151)	0	0	0	0	0	0	0	0	0	0	0	0	0	26877	0	0	0	0	0	0	0	0	0	0	0	0	26877
(161)	0	0	0	0	0	0	0	0	0	0	0	0	0	932036	0	0	425828	0	0	0	0	317325	0	0	0	0	1695189
(171)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	655323	369	413566	0	0	0	0	0	0	0	0	1069058
(181)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	566512	0	39862	215578	0	0	0	0	0	0	821952
(191)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108102	0	0	0	0	0	0	0	0	108102
(201)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	345146	0	12	125505	0	0	0	0	0	470663
(211)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	102857	0	0	0	0	0	0	102857
(221)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	236838	0	0	0	0	0	4360	316358	0	0	0	557956
(231)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90748	300	17307	0	0	108855
(241)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10764	0	10632	0	21396
(251)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7775	0	2341	10116
(261)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3516	0	3516
	460876	1260624	2077751	714	2106421	13928	2033784	2251618	2566084	455874	69429	16352	1955693	1907868	14326	1106911	992509	866814	39862	318467	125505	412451	527622	25518	14148	2341	

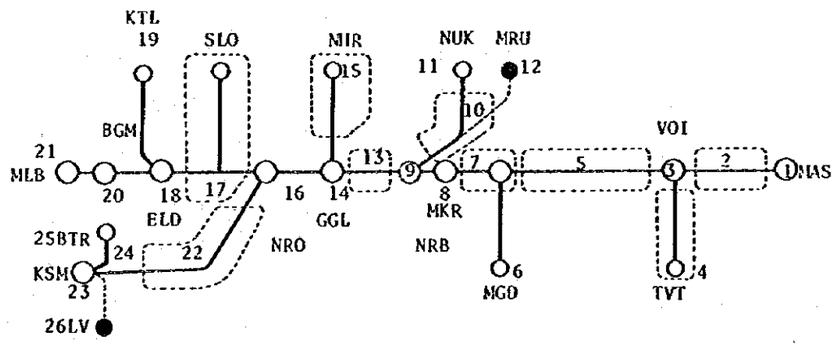


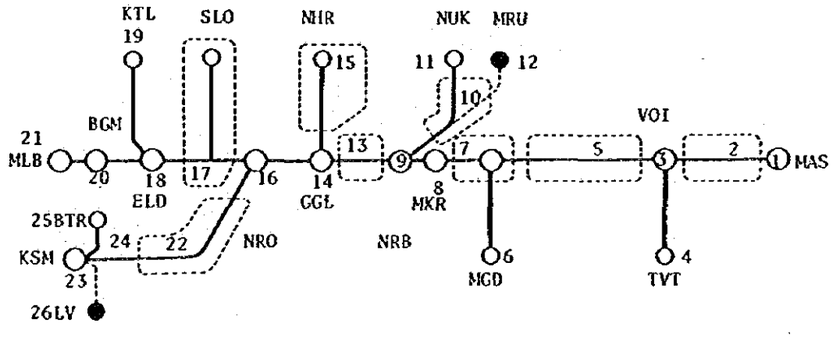
Table 1-11 Livestock Head OD Table and Traffic Density

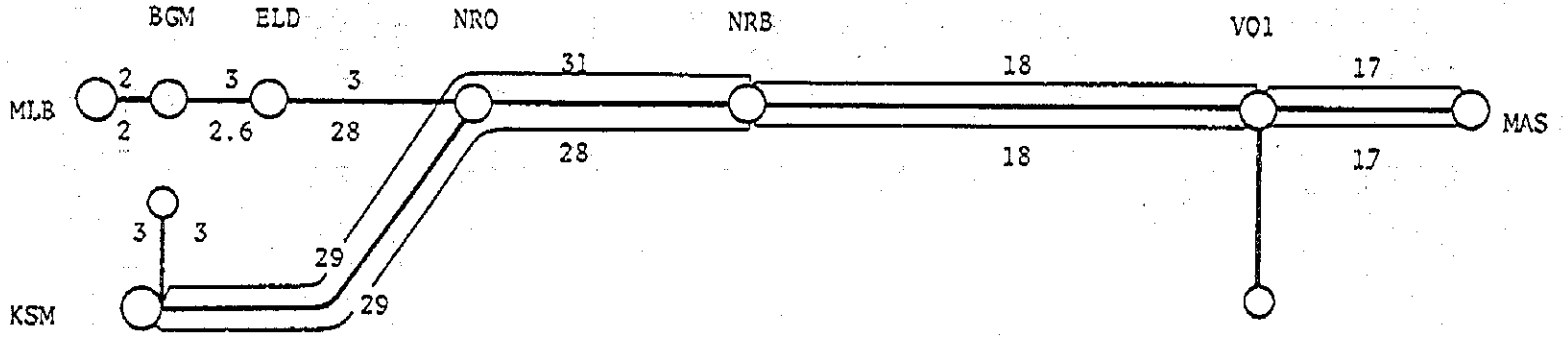
Kenya Railways -- inter top 50 stations livestock (heads)

	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151	161	171	181	191	201	211	221	231	241	251	261	
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	153
51	172	1118	0	0	0	0	321	0	0	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1738
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	3617	6	0	0	0	0	0	0	0	60	0	64	265	0	0	0	0	0	0	0	0	0	0	0	0	3956
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	0	0	0	0	0	0	615	0	0	24	0	0	1437	0	0	0	0	0	0	0	0	0	0	0	0	0	2095
111	0	744	105	0	142	0	12144	0	0	789	0	0	777	0	0	0	0	0	0	0	0	0	0	0	0	0	14706
121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
131	12	0	0	0	0	0	121	0	0	60	0	0	12	0	0	12	0	0	10	0	0	0	0	0	0	0	229
141	0	349	0	0	0	0	430	0	0	0	0	0	236	0	0	0	0	0	0	0	0	0	0	0	0	0	1015
151	0	651	0	0	160	0	1129	0	0	416	0	0	408	0	0	0	0	0	120	0	0	90	0	0	0	0	3378
161	136	100	0	0	0	0	603	0	0	0	0	0	511	0	0	0	0	0	0	0	0	0	0	0	0	0	1800
171	0	0	0	0	0	0	1158	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	1174
181	0	0	0	0	0	0	8563	0	0	30	0	0	2704	0	0	0	0	0	0	0	0	0	0	0	0	0	11297
191	56	0	0	0	0	0	2728	0	0	627	0	0	4028	24	0	36	0	0	0	0	0	0	0	0	0	0	7497
201	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	100
211	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	18
221	571	0	0	0	0	0	5227	0	0	652	0	0	1627	989	8	196	0	0	0	0	0	0	0	0	0	0	9065
231	0	0	0	0	0	0	65	0	0	0	0	0	475	0	0	0	0	0	0	0	0	0	0	0	0	0	520
241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
261	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	947	7536	7824	24	6812	0	36441	36300	40519	16902	60	0	32843	34543	8	23702	19042	7745	232	18	0	624	0	0	0	0	58769

Kenya Railways -- inter top 50 stations livestock (heads) (Network)

	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151	161	171	181	191	201	211	221	231	241	251	261	
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	947	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	971
31	0	7536	0	24	153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7713
41	0	0	153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	153
51	0	0	7647	0	0	0	601	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8248
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	6659	0	0	460	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7119
81	0	0	0	0	0	0	35840	0	460	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36300
91	0	0	0	0	0	0	0	35840	0	2172	2	0	2501	0	0	0	0	0	0	0	0	0	0	0	0	0	40519
101	0	0	0	0	0	0	0	0	15989	24	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16073
111	0	0	0	0	0	0	0	0	0	14706	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14706
121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
131	0	0	0	0	0	0	0	0	24070	0	0	0	12	229	0	0	0	0	0	0	0	0	0	0	0	0	24311
141	0	0	0	0	0	0	0	0	0	0	0	0	34404	0	8	28	0	0	0	0	0	0	0	0	0	0	34440
151	0	0	0	0	0	0	0	0	0	0	0	0	0	3578	0	0	0	0	0	0	0	0	0	0	0	0	3578
161	0	0	0	0	0	0	0	0	0	0	0	0	0	30836	0	0	130	0	0	0	0	94	0	0	0	0	31060
171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20058	0	130	0	0	0	0	0	0	0	0	0	20216
181	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18912	0	130	0	0	0	0	0	0	0	0	19042
191	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7497	0	0	0	0	0	0	0	0	0	7497
201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	118	0	0	0	0	0	0	0	0	0	118
211	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18
221	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9588	0	0	0	0	0	0	0	0	0	0	9586
231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	520	0	0	0	0	520
241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
261	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	947	7536	7824	24	6812	0	36441	36300	40519	16902	60	0	36923	34543	8	23702	19042	7745	232	18	0	624	0	0	0	0	





Passengers by Railway in 1982: 10^4 persons

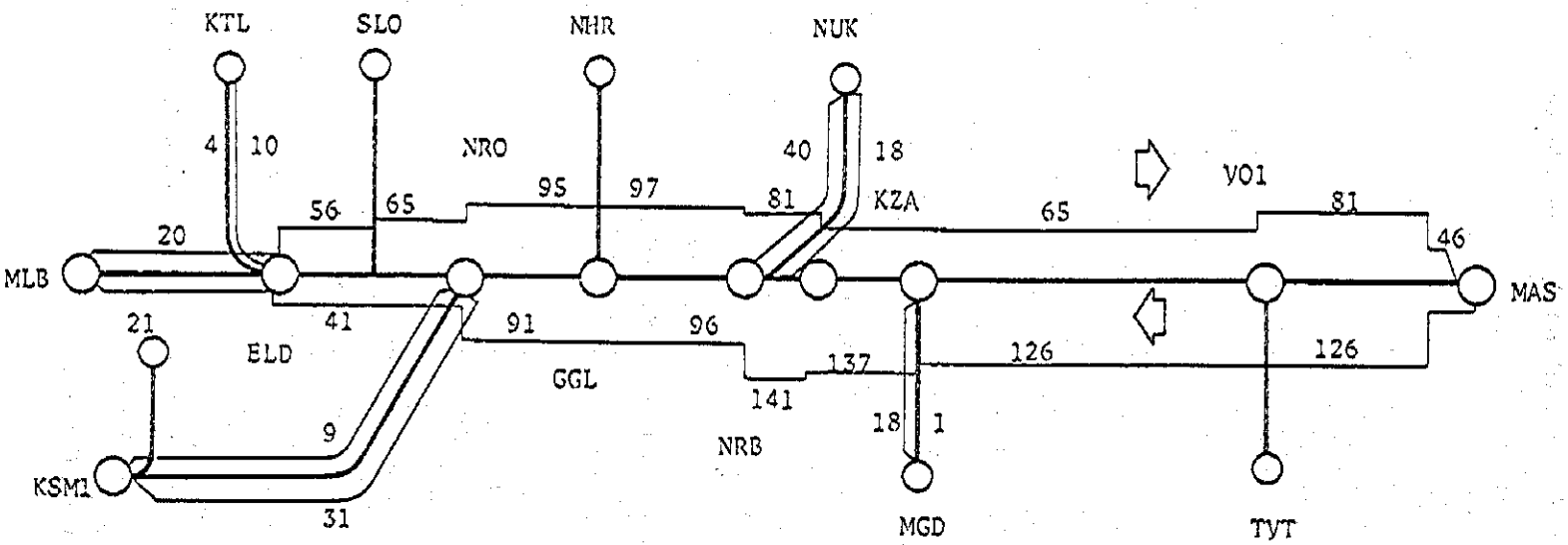


Fig. 1-6 Freight by Railway in 1982: 10^4 tonnage

Table 1-12 Commercial and Operating Statistics

		1979	1980
Train and Engine Kilometres			
Public Trains—			
Passenger		1,219,000	1,056,000
Goods		5,641,000	5,703,000
Departmental Trains		469,000	502,000
Assisting Engines		666,000	797,000
Light Engines		12,000	2,000
Shunting Engines		2,515,000	2,745,000
Locomotive User			
Steam—			
Average number of locomotives on hand		76·85	46·93
Average number available for traffic		58·31	32·57
Kilometres per locomotive available		15,572	11,006
Hours per day in use of locomotives available for traffic		7·87	5·44
Diesel—			
Average number of locomotives on hand		204·79	213·18
Average number available for traffic		132·61	147·92
Kilometres per locomotive available		75,553	73,237
Hours per day in use of locomotive available for traffic		16·42	15·17
Rolling Stock User—Goods Vehicles			
Average number of units on hand		10,809	11,922
Tonnage capacity		211,830	221,944
Average number available for traffic		9,685	10,038
Unit Kilometres—			
Loaded		195,759,000	206,389,000
Empty		58,337,000	62,671,000
Loaded Wagon Units forwarded		271,000	288,000
Average load per loaded unit (tonnes)		13·96	14·89
Rolling Stock User—Coaching Vehicles			
Average number of units on hand—			
Passenger carrying		334	358
Other coaching		374	393
Average number available for traffic—			
Passenger carrying		278	302
Other coaching		281	294
Unit Kilometres—			
Passenger—Loaded		31,036,000	33,372,523
Empty		41,000	18,530
Other coaching—Loaded		16,012,000	18,103,000
Empty		267,000	235,000
Waterways			
Kilometres operated		—	—
Road Vehicles			
Carrying capacity of goods vehicles and trailers owned	Tonnes	690	620
Public Kilometres run—			
Passenger		—	—
Goods (including trailers)		186,200	440,800

Table 1-13 Locomotive Availability and Failures

Availability	Steam				Diesel			
	Main Line		Shunting		Main Line		Shunting	
	1979	1980	1979	1980	1979	1980	1979	1980
Excluding Workshops shunting and Port Work	78·70%	78·01%	74·65%	69·13%	65·79%	68·35%	49·91%	60·44%
Including Workshops shunting and Port Work	78·70%	78·01%	75·63%	69·13%	65·79%	68·35%	62·57%	71·59%
Average engine kilometres per day ..	144·05	140·74	32·59	26·20	234·46	220·91	146·51	157·86
Average number of locomotives per day available for traffic	4·84	1·10	53·47	31·47	91·30	99·11	41·31	48·81
Failures								
Total number of failures	36	6	93	44	894	980	231	298
Average kilometres per failure	7,070	9,453	6,838	6,858	8,735	8,177	9,563	9,463

Lack of motive power for 60 minutes or over is classified a "Failure".

LOCOMOTIVE AND ROLLING STOCK GENERAL REPAIRS

	No. of Units		Cost in Ksh. per Unit	
	1979	1980	1979 (Corrected)	1980
Diesel Locomotives	53	34	312,257	454,103
Coaching Stock	228	255	32,280	36,288
Wagons	1,292	1,428	6,375	6,852

Note:—General overhauls include casual repairs on the basis of three casual repairs equalling one scheduled general repair.

Table 1-14 Track – Renewals and Maintenance

Year	Kilometerage Completely Renewed	Kilometerage Re-Railed	Kilometerage Re-Sleepered	Unit* Kilometerage	Cost per Ordinary Repairs	Average Number of Men per Km.
					Sh.	
1980	35·5 km.	7·6 km.	9·7 km.	2,671	31,858	2·2

*"Unit Kilometerage" includes Route Kilometerage plus sidings on the basis of 4.8 km of siding being equivalent to one Route Kilometerage. Men employed include Permanent Way Inspectors, Passed Gangers, Gangers, Headmen, Keymen, Gangmen, Trolleymen and Artisans employed on normal track maintenance.

1.3 Present Railway Transport Capacity

Railway transport capacity is generally comprised of three factors: network, vehicle and staff capacities.

(1) Network Capacity

The network capacity consists of both the link capacity of track and the node capacity of terminals and yards. Since the KR's network is a tree configuration, the stream line is converged along the truck line, thus generating the largest traffic flow.

1) Link

Generally, single track rail volume can be roughly calculated as follows:

$$N = \frac{1{,}440 \times F}{t + S(1-2p)}$$

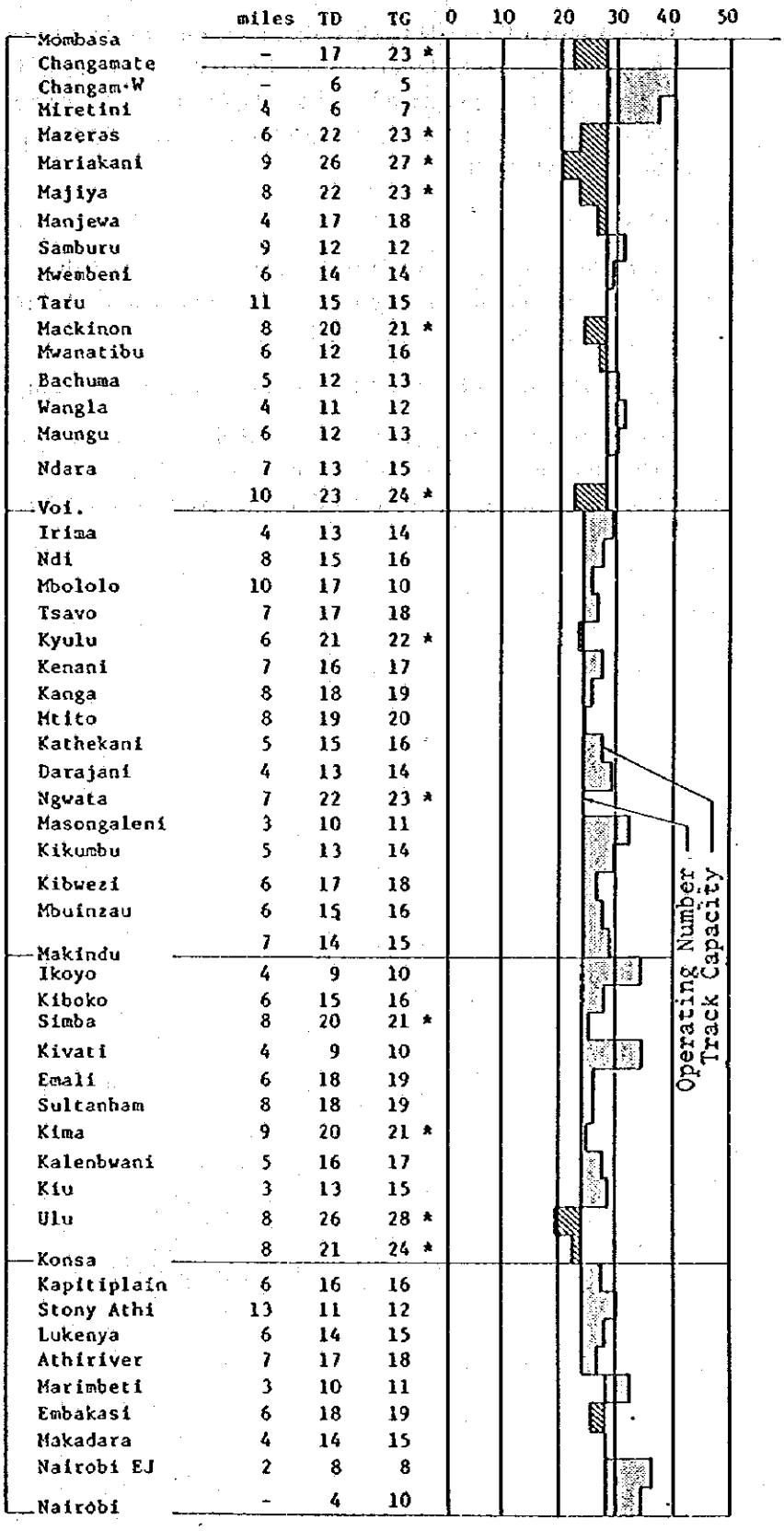
N = track capacity between stations (number of trains/day)
F = percentage of available train operating time, excluding maintenance hours
S = average time required to change trains in a station
t = time required for transit between stations
p = rate of travel in one direction (twice this figure equals the total)

Shown in Fig. 1-7 is KR's most important section between Nairobi and Mombasa, calculated with their operating timetable. Here, p = 0.1 and s = 20 minutes.

The result shows that under present operating conditions the traffic capacity of locomotive power, the gradients, and train blocking systems are fully employed.

According to the diagram, the actual capacity surpasses the calculated capacity in 12 sections.

Fig. 1-7 LIne Capacity and Number of Operating Trains



TD: Driving time between stations by passenger 87 Class Locomotives (660 tonne)
TG: Driving time between stations by goods 87 Class Locomotives (1220 tonne)

Therefore, in the future when traffic demand increases, it will be necessary to find ways to reduce categories t and s to meet the demand.

The capacity of a single track without a gradient is said to be about 100 trains per day. With the existence of a gradient, this capacity is usually reduced. In the case of KR a capacity of 50–60 trains per day is believed possible if appropriate improvements are executed, paying attention to the gradient.

2) Node

As defined above, the node includes the station and the yard. For the station, one improvement point would be provision of a relief track at every station because of the single track.

The installation of KR relief tracks has already been accomplished.

One issue concerning yards may be their capacity. The current yard condition for the principal linehaul with rough estimates of volume of origin and handling number per day is shown in Table 1-15.

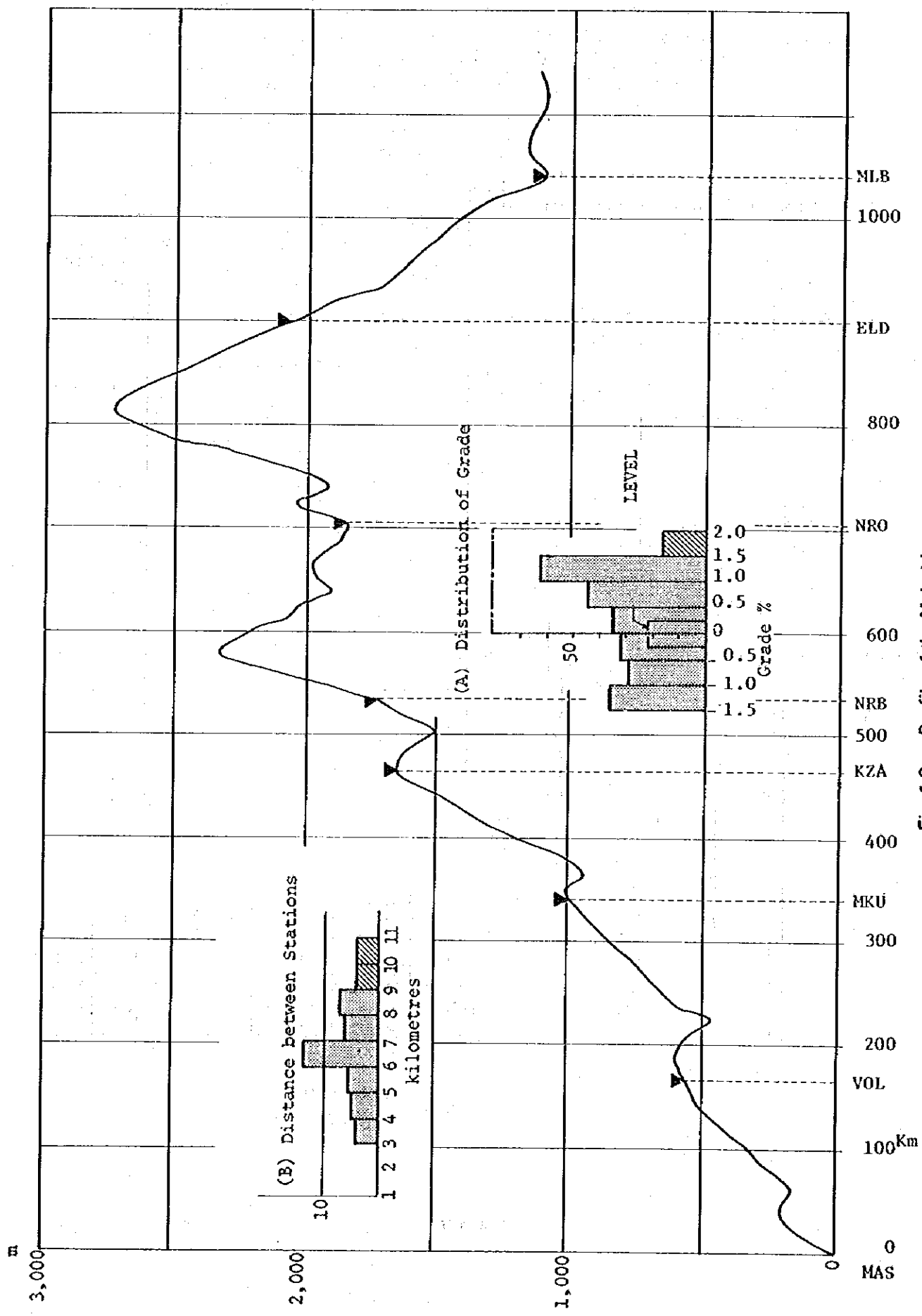


Fig. 1-8 Profile of the Main Line

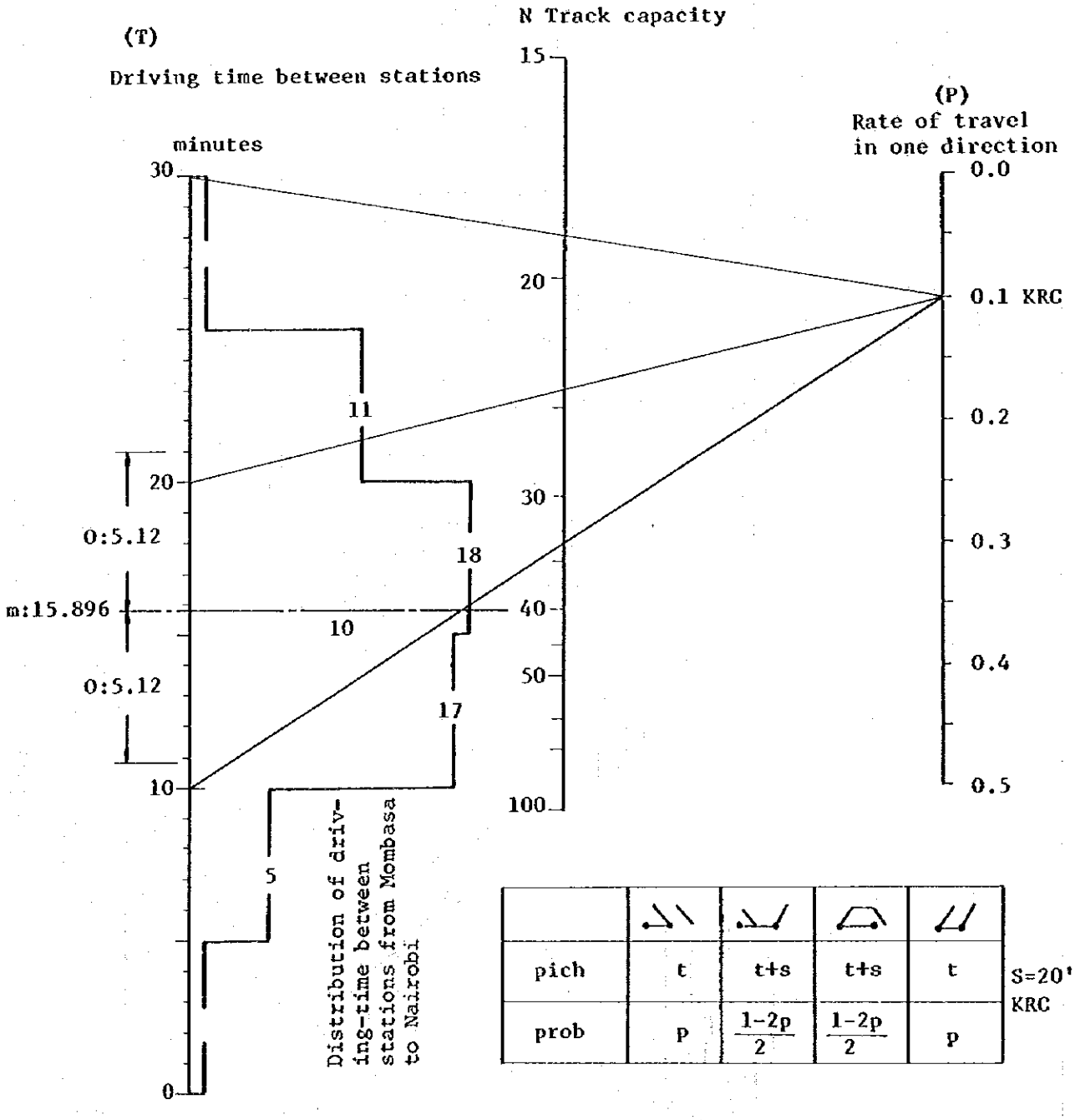

(T)
Driving time between stations
minutes
30
20
0:5.12
m:15.896
0:5.12
10
0
11
18
10
17
5
Distribution of driving-time between stations from Mombasa to Nairobi
N Track capacity
15
20
30
40
50
100
(P)
Rate of travel in one direction
0.0
0.1 KRC
0.2
0.3
0.4
0.5
pich
prob
t
p
t+s
1-2p/2
t+s
1-2p/2
t
p
S=20'
KRC
N = 1440 x 0.6 / T + 20(1-2P)

Fig. 1-9

The network capacity may be divided into links and nodes as shown in Table 1-15. The present status of each network can be compared by a rough calculation of the transport capacity as illustrated.

(2) Rolling Stock Capacity

The traffic capacity of locomotives and rolling stock is shown in Table 1-16. The present status of each price of rolling stock can be compared by a rough calculation of the transport capacity.

(3) Staff Transport Capacity

Traffic capacity by staff is shown in Table 1-17. The present status of each staff member can be compared by a rough calculation of the transport capacity.

Table 1-15 Traffic Capacity by The Network

Item				① Traffic volume	② Original units	③ Efficiency	④ Capacity by Calculation	⑤ Present Traffic Volume			⑥ Comparison
				①	②	③	①×②×③ (Goods)	Goods	Passenger or mix	Σ	⑤/①
				Km	Trains/day *	fan/train	10^4tonnes/year	Trains	Trains	Trains	
Network	Links	Main Lines	Mombasa-Nairobi	540	27	500 x 365	64 % (1-0.2)(1-0.2) 27×365×0.64×0.05=315	21	6	27	100 %
			Nairobi-Nakuru	170	27	"	315	20	8	28	104
			Nakuru-Eldoret	190	27	350 x 365	percentage of empty cars 0.2 27×365×0.64×0.035=221	17	8	25	93
			Eldoret-Malaba	140	27	"	percentage of passenger trains 0.2 221	11	8	19	70
		Principal Lines	Kisum-P.L	Km 235	* 20	250 x 365	40 % (1-0.2)(1-0.5) 20×365×0.4×0.025= 73	10	8	18	90
			Taveta-P.L	130	20	"	percentage of passenger trains 0.5 " 73	4	2	6	30
		Branch Lines	Nanyuki-B.L	Km 230	20	250 x 365	40 % (1-0.2)(1-0.5) " 73	4	6	10	50
			Nyahururu B.L	75	* 15	"	15×365×0.4×0.025= 55	2	0	2	13
			Solai - B.L	42	15	"	percentage of empty cars 0.2 " 55	0	2	2	13
			Kitale-B.L	65	15	"	" 55	6	0	6	40
			Butere-B.L	70	15	"	percentage of passenger trains 0.5 " 55	0	4	4	26
Node	Yards	Yards	Mombasa . yard	Car/day 500	4Tonnes/per car $\frac{1\times10}{365\ 16.5}=1.66$		Cars/day 500	240x1.66x1.25		:498	100
			Changamuwe yard	500	$\frac{1}{(1-0.2)}=1.25$		500	"		:498	100
			Nairobi . yard	850			850	256x1.66x1.25		:531	62
			Nakuru . yard	850			500	156x1.66x1.25		:324	65
			Eldoret . yard	300			300	61x1.66x1.25		:127	42
			Kisum . yard	120			120	31x1.66x1.25		: 64	53

* $\frac{1440\times0.6}{T+20(1-P)}$

Table 1-16 Traffic Capacity by the Locomotive and Rolling Stock

Item		Number and Capacity	① Traffic Volume	② Original Units	③ Availability	④ Capacity by Calculation	⑤ Present Traffic Volume	⑥ Comparison
								⑤ / ④
Locomotives 117	Goods $117 \times \frac{5037}{6129}$: 97	Tractive Engines 97 Shunting Engines (yard) 22 Shunting Engines (other) 67	train Km 5,037,000	Km per train day 220 Shunting Cars per Engine day 250 125	70%	train Km $97\times365\times220\times0.7=5443\ 5\times10^3$ car $22\times250\times0.7=3,885.0$ car $67\times125\times0.7=5,827.5$	5,073,000 $13,451\times\frac{1}{5}=2,690$ $13,451\times\frac{3}{5}=8,071$	93.2 69.2 138.5
	Passenger $117 \times \frac{1056}{6129}$: 20	Tractive Engines 20 Shunting Engines 22	1,056,000	Km per train day 220 Shunting Cars per Engine day Shunting Engine 20	70%	train Km $20\times365\times220\times0.7=1,133\times10^3$ $22\times20\times0.7=308$	1,056,000 $190\times0.8=152$	93.2 49.4
Rolling-stock	Wagons 13,451	cars tonnes 7,758(221,944) Converted Number car 13,451 (=221,944/165.5 ton/car)	tonnes/year 450×10^4 Train Km/year 507.3×10^4	Average net tonnes per Wagon 16.5 tonnes/car Days per wagon journey 13.08 day Km per wagon journey 746 Km Average net train load 567 tonnes	80%	tonnes/year $22.2\times10^4\times365\times0.8/13.08=495.6\times10^4$ train Km/year $495.6\times10^4\times746/567=652.1\times10^4$	tonnes/year 450×10^4 Train Km/year 507.3×10^4	90.8% 77.8%
	Carriages 190	O1st class $627^{seat}\times75\%=470$ O2nd class $1,442\times77\%=1,110$ O3rd class $10,022\times110\%=11,024$ OOther Total 12,604	persons/year 260×10^4 train Km/year 105.6×10^4	Average net person per train 500 person Km per person journey 300 Km	80%	person/year $12,604\times365\times0.7=322\times10^4$ train Km/year $322.0\times10^4\times300/500=193.2\times10^4$	persons/year 260×10^4 Train Km/year 105.6×10^4	80.7% 54.7

Table 1-17 Traffic Capacity by Staff

	Items	① Traffic Volume	② Original Units	③ Efficiency	④ Capacity by Calculation ① × ② × ③		⑤ Present Manpower	⑥ Comparison ⑤ / ④	Note
Head and Branch office			7% to Spot Number	100%	1,415 7% to Spot Number		1,681 (7.8%)	119%	
Spot	Maintenance of Way and Works	Km 2,671	persons/Km 2.5	125%	persons 8,347		8,705	104.3%	
	Maintenance of Car and Works				persons				
	LOC	car 215	persons/car 10.0	125	2,688				
	F.C.	car 13,478	" 0.1	125	1,685	4,787	4,757	99.4	
	P.C.	552	" 0.6	125	414				
	Train Operation				persons				
	Goods	Train Km 5,703,000	person/150 Train Km 1.0	200	260				
	Passenger	Train Km 1,056,000	" 1.0	200	48	606	551	91.0	
	Shunting	car 104	person/car 1.0	250	260				
	Other	car 15	" 1.0	250	37.5				
	Traffic Operation				persons				
	Stations	137	persons/station 7.5	250	2,569		2,701	105.1	
	Yards	104 (LOC)	persons/shunting 15.0	250	3,902		3,139	80.5	
Spot Σ					20,211		21,534	99.6	

(4) General Transport Output

The railway has adequate capacity to handle the required kilometres of 1,056 million for passenger trains and 5,073 million for freight trains.

1.4 Present Status of Organisation and Management

(1) Management

Earnings and operating expenditures may be broken down as shown in Tables 1-18 and 1-19. Breakdowns of the balance sheet, fixed assets, and loan funds are shown in Tables 1-20, 1-21, and 1-22.

Table 1·18 Revenue Account for the Period Ended 31st December, 1980

	1979 Total Sh.	1980 Total Sh.
EARNINGS		
Passenger Traffic	43,796,588	55,290,257
Other Coaching Traffic	7,834,729	7,424,341
Goods Traffic	488,694,715	548,551,735
Livestock (Goods)	10,399,215	11,047,906
Catering Services	10,628,936	12,168,715
Water Transport Services	2,118,981	2,164,334
Road Services	4,068,870	4,866,602
Net Miscellaneous Earnings	17,647,337	26,025,642
TOTAL EARNINGS	585,189,371	667,539,532
EXPENDITURE		
A—Maintenance of Way and Works	117,636,685	136,569,297
B—Maintenance of Locomotives, Rolling Stock and Electrical Installations, etc.	57,289,220	59,948,858
C—Locomotive Running Expenses	135,286,151	178,519,880
D—Traffic Expenses	78,576,412	81,260,573
E—Catering Services	11,547,260	12,735,246
F—Water Transport Services	7,080,650	8,745,256
G—Road Services	1,136,452	1,483,870
H—General Charges	36,503,165	37,718,044
J—Net Miscellaneous Expenditure	66,257,189	80,180,179
TOTAL EXPENDITURE	511,312,184	597,161,203
CONTRIBUTIONS TO PROVISIONS, ETC.		
Depreciation—Wasting Assets	82,189,244	102,189,244
Amortization—Non-Wasting Assets	2,810,755	2,810,756
Obsolescence	1,460,000	1,460,000
Insurance	1,000,000	1,000,000
TOTAL	87,460,000	107,460,000
NET EXPENDITURE—TOTAL	598,771,184	704,621,203
NET OPERATING INCOME—SURPLUS (DEFICIT)	(—) 13,582,813	(—)37,081,671
INTEREST ON CAPITAL		
External Loans	29,123,643	35,293,882
Internal Borrowings	27,620,478	30,561,877
TOTAL	56,744,121	65,855,759
DEFICIT AFTER CHARGING INTEREST	(—)70,326,934	(—)102,937,430
SINKING FUND CONTRIBUTIONS	986,651	1,134,033
DEFICIT FOR PERIOD	(—)71,313,585	(—)104,071,463

Table 1-19 Expenditures

ACCOUNT		1979 Sh.	1980 Sh.
	A. Maintenance of Way and Works		
100–108	Chief Civil Engineer Headquarters and District Staff	22,554,395	24,230,497
110–119	Maintenance of Way	38,490,596	40,796,156
125–126	Maintenance of Bridges and Culverts	888,941	772,345
130–136	Maintenance of Works	12,142,730	14,654,244
140–145	Locomotive Water Supplies	4,207,512	3,269,388
150–157	Miscellaneous Services	24,675,661	35,325,214
160	For floods and Accidents	1,137,476	3,117,301
165	Printing and Stationery	743,458	765,370
170–176	Maintenance and renewals of Signals and Telegraph Systems	5,149,987	5,251,800
180–182	Telephone and Telegraphic Services	6,532,568	6,627,411
190	Minor Works	334,384	177,293
195	Non-Capitalised Major Works	777,977	1,082,278
	TOTAL (A)	117,636,685	136,569,297
	B. Maintenance of Locomotives, Rolling Stock, Electrical Installations etc.		
200–208	Chief Mechanical Engineer's Headquarters and Workshops Staff	12,244,657	11,544,334
210–215	Workshop Maintenance of Locomotives	17,833,843	17,282,126
220–225	Workshop Maintenance of Coaching Stock	7,908,883	9,597,250
230–235	Workshop Maintenance of Goods Stock	9,814,097	11,392,851
240–244	Maintenance of Machinery, Tools and Plant	6,766,958	6,996,313
245	Work done for other Departments	2,953,636	3,346,671
246	Commercial and Private Work Orders	840,695*Cr*	639,319*Cr*
250	Electrical Maintenance	200,799	56,413
255	Printing and Stationery	376,821	342,822
290	Minor Works	39,237	29,397
296	Non-Capitalised Major Works	984	—
	TOTAL (B)	57,289,220	59,948,858
	C. Locomotive Running Expenses		
300–305	Headquarters and District Staff	3,028,112	3,524,460
310–317	Running Repairs	38,526,002	40,838,223
320–326	Running Stores	4,576,708	5,632,663
330–336	Fuel	66,447,048	101,439,848
340–341	Locomotive running sheds	3,095,072	3,847,791
345	Work done for other Departments	238,891	292,293
350–351	Cleaning and care of locomotives	1,432,863	2,387,820
360–362	Maintenance of Machinery, Tools and Plant	1,573,413	1,673,879
370–371	Maintenance of mechanical handling equipment	1,572,189	1,729,443
380–382	Running Staff	13,351,526	13,907,762
384	Electrical Maintenance	2,025,212	2,703,726
385	Printing and Stationery	390,295	488,525
390	Minor Works	28,920	53,127
395	Non-Capitalised Major Works	—	320
	TOTAL (C)	135,286,151	178,519,880
	D. Traffic Expenses		
400–408	Chief Traffic Manager's Headquarters and District Staff	11,896,306	11,948,971
410–423	Station Pier and Shore Working	47,100,035	47,597,573
430	Running Staff	6,118,751	6,185,291
435	Carriage Cleaning	1,064,421	1,084,352
440–444	Station Stores	4,341,182	6,086,231
450	Clothing	812,365	1,409,351
455	Commission	45,613	55,300
460	Printing and Stationery	2,881,851	2,275,588
470	Public Announcements	1,100	—
475	Commercial Advertising	19,465	15,091
480–484	Collection, delivery and local haulage	323,908	329,084
490	Communications	2,300,310	2,336,779
500–505	Supplementary Road Services	39,443	—
510–514	Local Road Haulage	1,631,612	1,936,962
	TOTAL (D)	78,576,412	81,260,573

Table 1-19 Expenditures (cont'd)

—EXPENDITURE

		1979 Sh.	1980 Sh.
	E. Catering Services		
550–558	Superintendence	479,759	447,302
560–567	Hotel	125,033	93,065
570–577	Refreshment rooms, Restaurant Cars etc.	10,942,293	12,194,707
580–586	Inland Waterways	125	172
	TOTAL (E)	11,547,260	12,735,246
	F. Inland Waterways		
600–608	Superintendence	548,164	496,910
610–619	Maintenance and Minor renewals in Workshops	2,954,640	3,997,771
625–631	Running Expenses	3,471,457	3,935,519
635	Maintenance of Channels	17,885	18,000
636	Printing and Stationery	21,443	134,912
637	Uniforms	66,521	160,110
640	Minor Works	340	2,034
	TOTAL (F)	7,080,650	8,745,256
	G. Road Services		
650–655	Superintendence	—	147,072
660–665	Stations and Depots	70,468	73,616
670–677	Running Expenses	652,871	835,805
680–682	Maintenance of Vehicles and Machinery	402,915	427,377
685	Printing and Stationery	198	—
690	Minor Works	—	—
	TOTAL (G)	1,136,452	1,483,870
	H. General Charges		
700–701	Board Expenses	258,579	501,669
705–706	Managing Director	567,056	579,562
710–711	Chief Administrative Secretary	201,021	270,118
715–722	Management Services	6,488,477	6,128,617
730–738	Personnel	5,471,741	6,056,021
740–742	Railway Training School	3,811,652	3,902,711
745–748	Railway Training School Hostels	1,097,433	2,054,722
755–756	Staff Training	875,240	490,827
760–761	Accounts	7,409,751	7,481,020
762	Audit Expenses	833,780	1,032,936
770–772	Supplies	8,226,097	7,866,320
780–790	Public Relations	1,261,338	1,353,521
	TOTAL (H)	36,502,165	37,718,044
	J. Miscellaneous Expenditure		
800–804	Pensions and Gratuities	38,865,110	37,732,986
810–815	Compensation	754,116	1,187,233
820–822	Watch and Ward	14,049,539	13,448,577
825–827	Fire Precautions	−824,014	809,144
830–831	Headquarters Central Despatch Office	203,554	183,457
835–836	Office Cleaning	467,879	599,941
840–843	Staff Housing	5,174,695	5,762,655
850–856	Staff Allowances	2,932,698	411,376
860–873	Miscellaneous	12,901,213	13,931,172
	TOTAL (J)	65,823,428	74,066,501
	Add Other Miscellaneous Expenditure	433,761	6,113,678
	TOTAL MISCELLANEOUS EXPENDITURE	66,257,189	80,180,179
	TOTAL EXPENDITURE	511,312,184	597,161,203

Table 1-20 Balance Sheet as at 31st December, 1980

31st December 1979 Balances			31st December 1980 Balances	
Sh	Sh		Sh.	Sh.
		FIXED ASSETS (Note 1)		
2,826,818,108		Permanent Way, Rolling Stock, locomotives etc.	3,145,479,280	
1,571,967,124		*Less* Accumulated Depreciation	1,676,228,244	
1,254,850,984			1,469,251,036	
296,636,828		*Add* Works in Progress	298,697,089	
	1,551,487,812	**FIXED ASSETS TOTAL** .. .		1,767,948,125
		INVESTMENTS (Note 2)		
1,228,767		Trade Investments	1,228,767	
124,693,991		Other Investments..	135,901,398	
	125,922,758	**INVESTMENTS TOTAL** . .		137,130,165
		CURRENT ASSETS (Note 3)		
242,929,789		Stores Stocks	329,910,877	
11,854,814		*Less* Provision for Obsolescence	12,354,815	
231,074,975		Net Value of Stores Stocks	317,556,062	
104,671,113		Short-term Investments	86,717,093	
(—)3,521,863		Cash and Bank Balances	(—)79,760,502	
214,828,886		Debtors	223,588,510	
547,053,111		**CURRENT ASSETS TOTAL** ..	548,101,163	
		DEDUCT CURRENT LIABILITIES		
166,857,330		Creditors and Accrued Charges	143,516,445	
	380,195,781	**NET CURRENT ASSETS TOTAL**		404,584,718
	2,057,606,351	**TOTAL**		2,309,663,008
471,403,073		**FINANCED FROM LOANS (Note 4)**	451,439,479	
52,196,785		*Less* Invested Sinking Funds (Note 4)	59,402,847	
	419,206,288	**NET PUBLIC DEBT**		392,036,632
	909,244,437	**GOVERNMENT SUBVENTIONS AND EQUITY (Note 9)**		1,122,233,746
		PROVISIONS (Note 5 and 7)		
525,331,059		Staff Pensions	575,895,265	
45,285,857		Widows' and Orphans Pensions	48,032,620	
52,196,785		Loan Redemption Account	59,402,847	
37,697,712		Fixed Assets Obsolescence	38,657,712	
105,579 *Dr.*		Insurance	295,624 *Dr.*	
37,220,541		Gratuities and Provident Fund	41,350,001	
	697,626,375	**PROVISIONS TOTAL** .		763,042,821
		RESERVES (Note 6 and 8)		
149,390,446		General	254,282,466	
(—)117,861,195		*Less* Deficit	(—)221,932,657	
	31,529,251	**RESERVES TOTAL**		32,349,809
	2,057,606,351	.. **TOTAL**		2,309,663,008

Table 1-21 Fixed Assets for the Period Ended 31st December, 1980

	Earthworks Ballast and Fencing	Permanent Way, Buildings and other Improvements	Locomotives and Rolling Stock	Workshop Plant and Machinery	Telecommunications	Water Transport, Road Services and other Assets	Total
	Sh.	*Sh.*	*Sh.*	*Sh.*	*Sh.*	*Sh.*	*Sh.*
ASSETS IN USE							
Fixed Assets—31st December, 1979	173,647,565	1,007,103,143	1,528,078,895	44,740,411	15,917,992	57,330,102	2,826,818,108
Additions during period	11,163,269	71,789,872	233,028,309*	4,347,469	545,037	—	320,873,956
SUB-TOTAL	184,810,834	1,078,893,015	1,761,107,204	49,087,880	16,463,029	57,330,102	3,147,692,064
Disposal during period	—	87,489	2,090,295	35,000	—	—	2,212,784
Fixed Assets as at 31st December, 1980	184,810,834	1,078,805,526	1,759,016,909	49,052,880	16,463,029	57,330,102	3,145,479,280
DEPRECIATION AND AMORTISATION							
Accumulated Provision as at 31st December, 1979	126,923,888	839,624,678	492,334,272	44,471,465	14,449,677	54,163,144	1,571,967,124
Provisions during period:							
Depreciation	—	32,681,413	62,163,200	3,106,208	839,964	3,399,459	102,189,244
Amortisation	2,810,756	—	—	—	—	—	2,810,756
SUB-TOTAL	129,734,644	872,306,091	554,496,472	47,577,673	15,289,641	57,562,603	1,676,967,124
Amount written out on disposals	—	87,489	616,391	35,000	—	—	738,880
Accumulated provision as at 31st December, 1980	129,734,644	872,218,602	553,880,081	47,542,673	15,289,641	57,562,603	1,676,228,244
NET VALUE OF FIXED ASSETS	55,076,190	206,586,924	1,205,136,828	1,510,207	1,173,388	—232,501	1,469,251,036
WORKS IN PROGRESS							
Expenditure as at 31st December, 1979	7,261	184,699,322	69,250,158	14,972,010	4,336,990	23,371,087	296,636,828
Less Capitalization in 1980	11,163,269	71,789,872	233,028,309	4,347,469	545,037	—	320,873,956
Add Expenditure in 1980	12,840,486	91,396,364	214,107,364	680,195	543,917	3,365,891	322,934,217
NET VALUE OF WORK IN PROGRESS AS AT 31st DECEMBER, 1980	1,684,478	204,305,814	50,329,213	11,304,736	4,335,870	26,736,978	298,697,089

* This includes purchases through Government Equity of Sh. 212,989,309 as per Statement No. 4.

Table 1-22 Loans and Sinking Funds at 31st December, 1980

	Liability at Maturity	Sinking Funds Accumulated to 31st Dec. 1980	Liability *Less* Sinking Funds at 31st Dec. 1980
	Sh.	Sh.	Sh.
Fixed Term Loans Raised by Public Subscription			
East African Loan Stocks:			
1954 £STG. 5,000,000 (1973/76) 4%	3,202,079	—	3,202,079
1956 £STG. 3,500,000 (1980/84) 5½%	21,685,392	14,661,073	7,024,319
1957 £STG. 8,500,000 (1977/83) 5½%	53,944,175	34,821,401	19,116,774
1975 £STG. 5,000,000 (1977) 9%	48,000,000	9,118,656	38,881,344
1970 K£1,000,000 (1990) 6¾%	9,600,000	360,770	9,239,230
1971 K£3,400,000 (1986) 6¾%	18,376,320	434,947	17,941,373
TERM LOANS TOTAL	154,807,966	59,402,847	95,405,119

	Liability at 31st December 1979	Redemption or Drawings during Period	Liability at 31st December 1980
	Sh.	Sh.	Sh.
Serial Loans			
FROM INTERNATIONAL AGENCIES:			
International Bank for Reconstruction and Development—			
1965 $US 38,000,000 (1995) 5¼%	92,249,286	(—)4,714,158	87,535,128
1970 $US 42,400,000 (1995) 7%	128,683,920	(—)5,489,441	123,194,479
1970 $ C14,000,000 CIDA	41,967,072	—	41,967,072
INTERNATIONAL LOANS SUB-TOTAL	262,900,278	(—)10,203,599	252,696,679
From Other Governments			
BRITISH GOVERNMENT:			
1961 £STG. 7,500,000 (1986) 6¼% (Exchequer)	18,208,404	(—)2,375,381	15,833,023
1965 £STG. 3,150,000 (1984) ECGD—Sec. 3	7,595,865	(—)1,688,400	5,907,465
1970 £STG. 1,000,000 Interest Free	5,668,482	(—) 385,920	5,282,562
1970 £STG. 1,000,000 Commercial Credit 5½%	1,939,864	(—) 782,893	1,156,971
FEDERAL GOVERNMENT OF WEST GERMANY:			
1962 DM 8,960,000 (1982) 5%	3,521,708	(—)3,521,708	NIL
1971 DM 8,600,000 (1989) 3%	16,760,506	(—)1,005,693	15,754,813
OTHER GOVERNMENT LOANS SUB-TOTAL	53,694,829	(—)9,759,995	43,934,834
SERIAL LOANS TOTAL	316,595,107	(—)9,963,594	296,631,513

	Sh.
Total Public Debt	451,439,479[1]
Less invested Sinking Funds at 31st December, 1980	59,402,847
Net Public Debt	392,036,632

Term Debt maturities for the next five years following 31st December, 1980 are as follows— (in thousands)

	Sh.
1981	51,202
1983	53,944
1984	21,685

Loan repayments have been converted at the rates of £1Stg. to Sh. 16.75 and the drawings at the rate of US Dollar 1 to Sh. 7.32 throughout the year.

(2) Fare Rate and Revenues

The impact of fare rate increases on operating revenue is analysed as follows. There were fare rate increases in October 1978, December 1980, and July 1981. The rate was increased by about 20 percent for both passenger and freight traffic in December 1980 above the October 1978 level. The rate as of July 1981 also shows an increase of 20 percent above December 1980 as shown in Fig. 1-10.

Traffic volume, in terms of passenger kms and tonne kms, varied as a result of the fare rate increases, thus causing variation in the consequent earnings. Since the passenger traffic varied in a different way from the freight traffic, the actual revenues are compared with their expected values in Table 1-23.

Table 1-23 Revenues of Kenya Railways

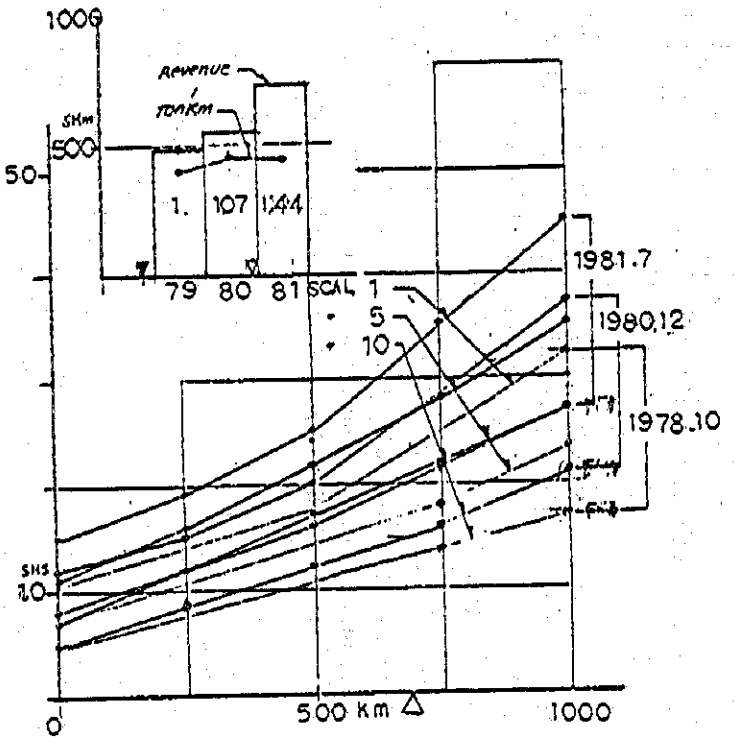
		1979	1980	1981	
Goods	Traffic volume rate (tonnes/km)	1 ($2{,}008.5\times10^6$)	1.138	1.116	(1)
	Seasonally adjusted fare rate	1	1.017*	1.320**	(2)
	Expected revenue rate	1	1.157	1.473	(1)×(2)
	Actual revenue rate (Kshs.)	1 (488.7×10^6) (Kshs.)	1.122	1.480	
Passenger	Traffic volume rate (passenger km)	1 (550×10^6)	1.278	1.414	(1)'
	Seasonally adjusted fare rate	1	1.017*	1.320**	(2)'
	Expected revenue rate	1	1.299	1.860	(1)'×(2)'
	Actual revenue	1 (43.8×10^6)(Kshs)	1.263	1.795	

* $1 \times \frac{11}{12} + 1.2 \times \frac{1}{12} = 1.017$ (12.1980:1.2)

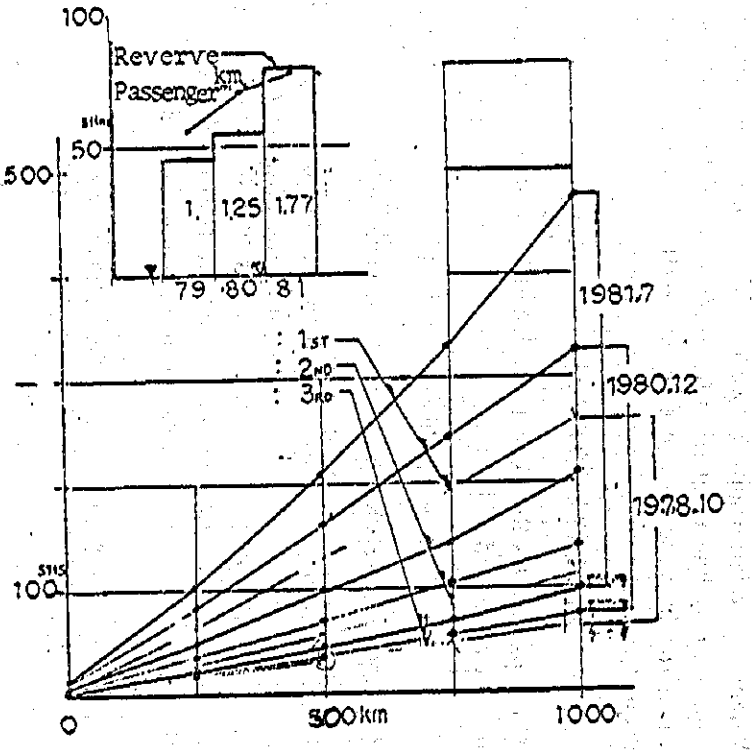
** $1.2 \times \frac{6}{12} + 1.44 \times \frac{6}{12} = 1.320$ (7.1981:1.44)

Fig. 1-10

(1) Freight Fare by distance and class



(2) Passenger Fare by distance and class



When the relationship between fare increases and transport volume is expressed by linear equation by application of the least-square method, and when the increase rate of fare and traffic volume is denoted by p and z, respectively;

$$z = 1.174 - 0.02525P$$

Then, pz denotes the expected value of increase in operating revenues, which may be expressed as F.

$$F = pz = 1.174p - 0.02525p2$$

The value F for each p may be seen in Table 1-24.

It should be noted, however, that this relationship may well be explained by a value of p = 1.3 or so, since such relationships as expressed by the linear equation mean the tangential line of the real curve is the relationship between the fare increase rate p and the traffic volume increase rate z. It is difficult to estimate the relationship beyond that point.

Table 1-24 Fare Impact of Operating Revenues

Fare increase rate (P)	1.01	1.32	1.5	2.0
Operating revenue increase rate (F)	1.16	1.505	1.704	2.247

Since operating revenues include sundry revenues in addition to the earnings from carriages of passengers and goods, they are calculated as shown in Table 1-25, with the partial use of estimated figures because of lack of relevant data for 1981.

Operating expenditures calculated by an original unit of train kilometres show no substantial increase for the years 1979 and 1980, rather they show a declining tendency. Therefore, only the figure of 18 percent as the increase rate for fuel and payroll costs is taken into account.

Table 1-25

	1979	1980	1981*
1. Revenue increase	1 (585.2x10^6)	1.161 (667.5x10^6)	1.505 (=1.48x0.92+1.795x0.08)
2. Expenditure increase (not including interest)	1.023 (598.8x10^6)	1.204 (704.6x10^6)	1.417
3. Capital and interest	0.097	0.099	0.100
4. Profit and loss for term	-0.12	-0.162	-0.012

* Estimated figures.

Here:

Revenues include sundry and other miscellaneous sources of income besides those indicated in the preceding table.

Payroll cost show an increase of 13% and fuel cost increase by 52% as the increase rate of the 1980-1981 period.

1.5 Points for Improvement

It is recommended that the existing railway system be improved following the order of priorities given below:

(1) Stabilisation of management

(2) Resolution of problems related to traffic foundations

(3) Development of transport capacity

(4) Strengthening of transport capacity to prepare for future increased demand

(5) Modernisation of the railway system

Among these points, those from (1) to (3) cover improvements to present operating conditions, while items (4) and (5) aim at future improvements in response to increasing demand. In any case, investment will be needed within the capacity of management finance, although management stability is always closely related with investment in a cause and effect manner.

2. Railway Transport Plan

2.1 Basic Policy of Project

2.1.1 General Description

In working out the plan for the railway development project, it is strongly suggested that it be formulated in three different stages, with due consideration to the present situation and the problems with which Kenya Railways is confronted today, and also in anticipation of future demand. The project should preferably be executed by the establishment of an investment plan under stable management and a proper fare rate system, based on the three stages of (1) fundamental development, (2) expanding transport capacity, and (3) modernisation of the transport system.

(1) Fundamental Development

1) Standardisation

2) Improvement of car coupling devices

3) Improvement of signalling and communication systems

(2) Expanding Transport Capacity

1) Rationalisation of existing systems

2) Plan for expanding capacity

(3) Modernisation of Transport System

1) Containerisation

2) Railway electrification

To implement the programme itemised above, a test run must first be conducted to get a full grasp of the problems. Once this has been done, the plan can start on a steady and solid basis.

Here, the future freight OD traffic of 26 stations and passenger OD traffic of 12 major stations are estimated using the present pattern under the Freighter Method.

Table 2-1-1 shows OD and cross sectional traffic figures for 12 stations. Table 2-1-2 shows the same for general freight traffic. Table 2-1-3 shows data on livestock.

Table 2-1-1 Passengers OD and Cross Sectional Traffic Figures

PASSENGER FIGURES PROJECTED FOR YEAR 2000 (TWELVE SELECTED BUSY STATIONS) ALL CLASSES

	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	ｺﾞｳｹｲ)	
(1)	0	7393	325	308857	2024	1034	912	1538	17068	1132	740	316	341339	(1)
(2)	6268	0	2119	52394	355	97	69	68	593	63	31	15	62072	(2)
(3)	1532	5193	0	8706	66	61	0	16	428	16	24	17	16057	(3)
(4)	318858	53597	5728	0	78097	15596	10404	29696	431340	52111	17270	2236	1014932	(4)
(5)	1152	215	0	122504	0	3952	1862	4587	32030	8369	819	0	175488	(5)
(6)	879	64	12	25743	5364	0	996	4385	0	0	0	0	37443	(6)
(7)	747	64	0	14517	2299	1081	0	1132	0	0	0	0	19840	(7)
(8)	1295	83	0	35247	5364	4929	3242	0	0	0	0	0	50160	(8)
(9)	9713	414	54	401617	27097	0	0	0	0	2768	0	0	441663	(9)
(10)	1164	73	3	63608	7855	0	0	0	4357	0	0	0	77060	(10)
(11)	1145	0	5	38019	1809	0	0	0	29068	0	0	0	70045	(11)
(12)	700	19	0	12546	317	0	0	0	18101	0	0	0	31683	(12)
(ｺﾞｳｹｲ)	343453	67114	8246	1083756	130648	26750	17484	41421	532984	64459	18884	2583	2337757	(ｺﾞｳｹｲ)

PASSENGER FIGURES PROJECTED FOR YEAR 2000 (TWELVE SELECTED BUSY STATIONS) ALL CLASSED (NETWORK)

ｿﾞｰﾝ ｶﾝ ｺｳﾂｳ ﾘｮｳ

	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)		
(1)	0	341339	0	0	0	0	0	0	0	0	0	0	341339	(1)
(2)	343453	0	8246	396640	0	0	0	0	0	0	0	0	748339	(2)
(3)	0	16059	0	0	0	0	0	0	0	0	0	0	16059	(3)
(4)	0	395984	0	0	663433	0	0	0	0	0	0	0	1059417	(4)
(5)	0	0	0	731602	0	69892	0	0	564618	0	0	0	1366112	(5)
(6)	0	0	0	0	91678	0	54533	0	0	0	0	0	146211	(6)
(7)	0	0	0	0	0	65626	0	41422	0	0	0	0	107048	(7)
(8)	0	0	0	0	0	0	50150	0	0	0	0	0	50160	(8)
(9)	0	0	0	0	566158	0	0	0	0	64459	21468	0	652085	(9)
(10)	0	0	0	0	0	0	0	0	77060	0	0	0	77060	(10)
(11)	0	0	0	0	0	0	0	0	101729	0	0	2584	104313	(11)
(12)	0	0	0	0	0	0	0	0	0	0	31683	0	31683	(12)
	343453	753382	8246	1128242	1321269	135518	104693	41422	743407	64459	53151	2584		

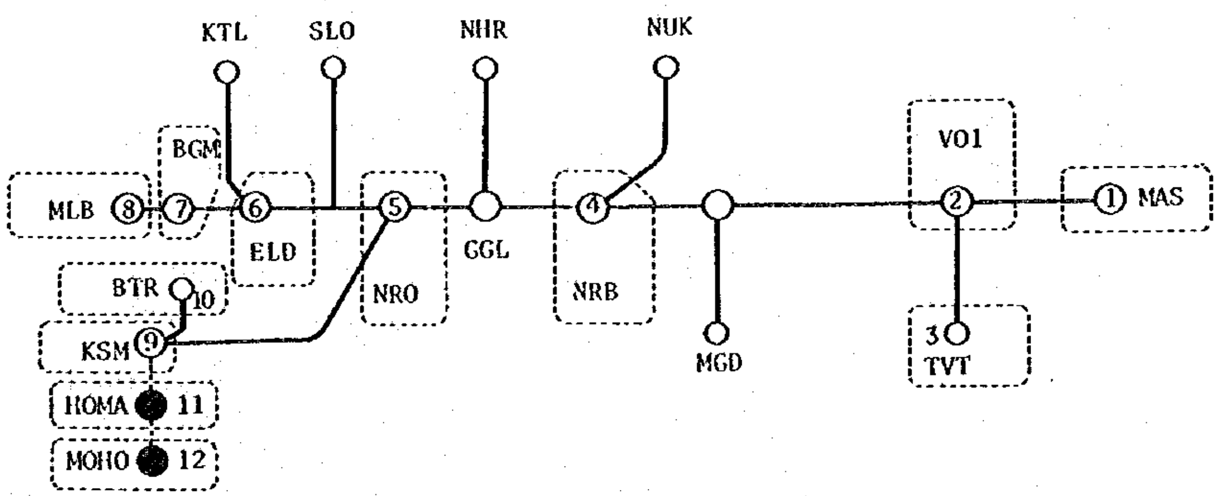


Table 2-1-2 Goods OD and Cross Sectional Traffic Figures

KENYA RAILWAYS - GOODS INTER TOP 50 STATIONS (TONNAGE)

	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151	161	171	181	191	201	211	221	231	241	251	261	ｵﾌｾｯﾄ
(11)	0	0	1436	339	272	257	7632	196999	1721122	55220	9585	1275	12458	1436	6201	82634	5775	41511	16678	21578	137214	21850	127851	3115	1948	2556	907998
(21)	0	16450	6830	12	760	25090	64152	524806	347896	144838	9288	780	63528	3021	3144	134299	10178	75900	19768	119369	93124	26517	65379	540	66	20	1727623
(31)	3862	178	0	92	0	0	0	4289	359	1091	0	0	48	0	2	83	0	2	189	2	0	4	43	2	0	17	10811
(41)	4481	74	259	0	0	0	12	0	3576	683	0	0	9	0	0	0	0	0	2	0	0	0	2	0	0	0	9165
(51)	34	4	0	8	0	0	181578	0	0	2	0	0	0	24	0	0	0	0	0	0	0	1164	1472	89	11	17	181651
(61)	35465	270352	0	2	2	0	1950	23917	8671	8706	255	1709	2787	0	678	5503	278	1227	1315	16859	0	10216	14532	2623	632	5	385133
(71)	341	9099	2	0	19	0	0	68363	63757	329293	14007	2033	11338	1785	4501	20440	1112	13100	8470	9953	892	10216	14532	2623	632	700	420511
(81)	37175	67451	929	150	0	710	6993	0	350	92931	65881	9185	5802	11838	1796	194040	646	193978	2610	15906	23417	12629	151481	164	389	222	907154
(91)	234891	133978	2030	333	520	298	270	0	4	40523	3062	2239	346	38	1099	57521	10	1966	1593	1742	150	1566	51265	500	231	222	536849
(101)	41587	76102	403	7	2	0	349	9016	119377	12229	3622	1023	2705	814	1063	3968	1647	8240	3560	5988	669	2189	5029	270	555	184	295692
(111)	2085	9995	82	1	2	0	17	637	72483	6528	0	2081	18	0	2	4103	0	9	9	16	3	42	146	9	7	8	94983
(121)	288	1068	4	0	0	0	0	0	10473	50	16810	0	44	0	2	8	0	21	28	10	2	0	12	6	0	5	28713
(131)	8774	1292	362	30	0	96	0	426	9728	3296	424	42	16	2	99	5104	3	1218	274	680	127	336	16833	339	93	50	47317
(141)	840	333	9	10	2	0	518	0	1900	1892	369	0	159	0	276	258	0	692	191	869	15	20	743	104	2	147	69487
(151)	6446	3229	2	5	0	0	0	16484	24339	1571	80	1114	554	0	0	2454	838	325	83	13	0	286	3093	66	4	5	59038
(161)	45597	16734	432	184	0	0	1273	106855	151663	41102	2653	1190	13740	797	1215	0	652	16803	12513	5853	33	9556	28278	2035	2	185	437011
(171)	159618	13250	0	0	182	0	55	3961	7597	2249	74	2	1152	0	3	8479	478	341	119	88	2	0	318	14	13	4	197983
(181)	31383	10862	805	236	2	3282	37	55855	83386	12643	250	101	11181	2	34	17803	91	0	9133	2739	30	9	15622	8	2	3	29002C
(191)	7637	18534	123	0	0	0	460	49838	65170	13617	934	688	1673	3	1318	53261	295	16549	0	2	19	535	274	5	2	1	212764
(201)	24926	60339	0	0	0	0	6453	142008	178607	91628	1903	4256	2540	0	2659	19702	107	1363	35	20	29230	23	0	0	0	0	511735
(211)	179650	8167	0	0	0	0	0	0	11651	24	0	2	109	4	0	1565	23	974	2	62	0	2	2	0	0	0	202441
(221)	31496	24221	585	0	8	0	3996	60183	76445	25781	4900	2013	3621	823	3737	25046	5389	5211	924	36	37	7121	69611	880	229	52	369763
(231)	7513	5564	199	33	0	0	804	36230	39440	34154	1151	1592	3627	0	1889	16723	0	25	45	0	0	1136	4086	2182	11039	0	165952
(241)	304	56	0	0	0	2	0	3	1863	68	0	0	128	182	35	443	0	0	0	0	0	478	1926	0	0	0	5248
(251)	351	0	0	0	0	0	0	0	7253	1	0	0	168	0	2	6	0	0	0	0	0	142	1	0	0	0	7904
(261)	4724	0	392	0	0	0	0	0	1407	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	6526
(ｵﾌｾｯﾄ)	917774	719151	14682	1421	1790	27336	276546	1317809	1461020	671639	134853	31761	139803	24474	30493	658210	27499	302995	75470	196524	237615	95857	550593	12810	14803	4180	8029054

KENYA RAILWAYS - GOODS INTER TOP 50 STATIONS (TONNAGE) (NETWORK)

	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151	161	171	181	191	201	211	221	231	241	251	261	
(11)	0	908000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	908000
(21)	917774	16450	2619180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3553404
(31)	0	1620473	0	1422	2621492	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4243387
(41)	0	0	9164	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9164
(51)	0	0	1618914	0	0	27336	2656911	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4502661
(61)	0	0	0	0	385133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	385133
(71)	0	0	0	0	1316175	0	0	3015739	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4331914
(81)	0	0	0	0	0	0	1331937	0	2967152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4299069
(91)	0	0	0	0	0	0	0	1693987	4	783417	0	31765	1980910	0	0	0	0	0	0	0	0	0	0	0	0	0	4470081
(101)	0	0	0	0	0	0	0	0	361597	12929	134855	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	515381
(111)	0	0	0	0	0	0	0	0	0	99983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9998
(121)	0	0	0	0	0	0	0	0	28713	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2871
(131)	0	0	0	0	0	0	0	0	2030812	0	0	0	0	16	1886760	0	0	0	0	0	0	0	0	0	0	0	391738
(141)	0	0	0	0	0	0	0	0	0	0	0	0	0	2048888	0	30495	1852828	0	0	0	0	0	0	0	0	0	393220
(151)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58035	0	0	0	0	0	0	0	0	0	0	0	59035
(161)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2003940	0	0	658405	0	0	0	582991	0	0	0	0	3445336
(171)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1353272	479	832448	0	0	0	0	0	0	0	0	2186192
(181)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1156834	0	75469	404853	0	0	0	0	0	0	16371160
(191)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	212766	0	0	0	0	0	0	0	0	212766
(201)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	684921	0	20	237614	0	0	0	0	0	922555
(211)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	202441	0	0	0	0	0	0	202441
(221)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	460440	0	0	0	0	0	7121	566781	0	0	0	1034342
(231)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	170143	408	31792	0	0	202343
(241)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19972	0	18979	0	38951
(251)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14429	0	4177	18606
(261)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6525	0	6525
	917774	2546923	4247256	1422	4322800	27736	3987948	4709726	5394258	891329	134855	31763	4009814	3949735	30495	3666533	2015718	1730135	75469	607318	237614	760455	587166	46221	25504	4177	

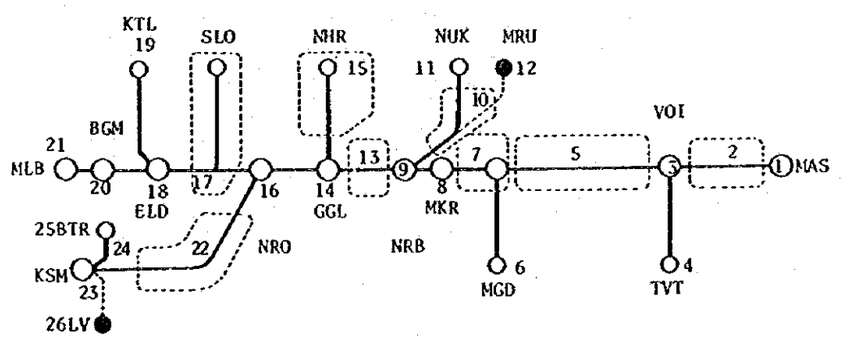


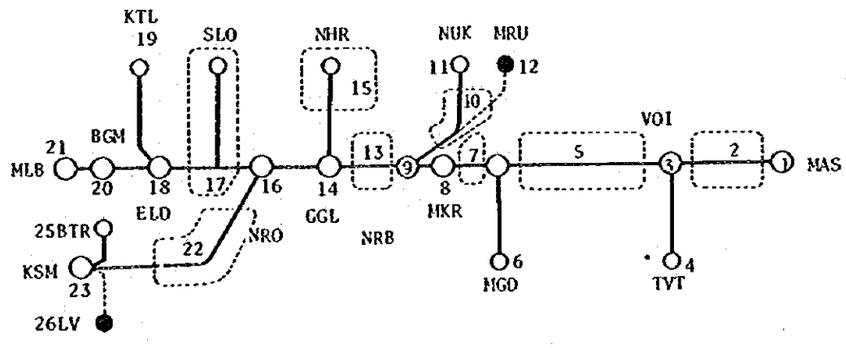
Table 2-1-3 Livestock OD and Cross Section Traffic Figures

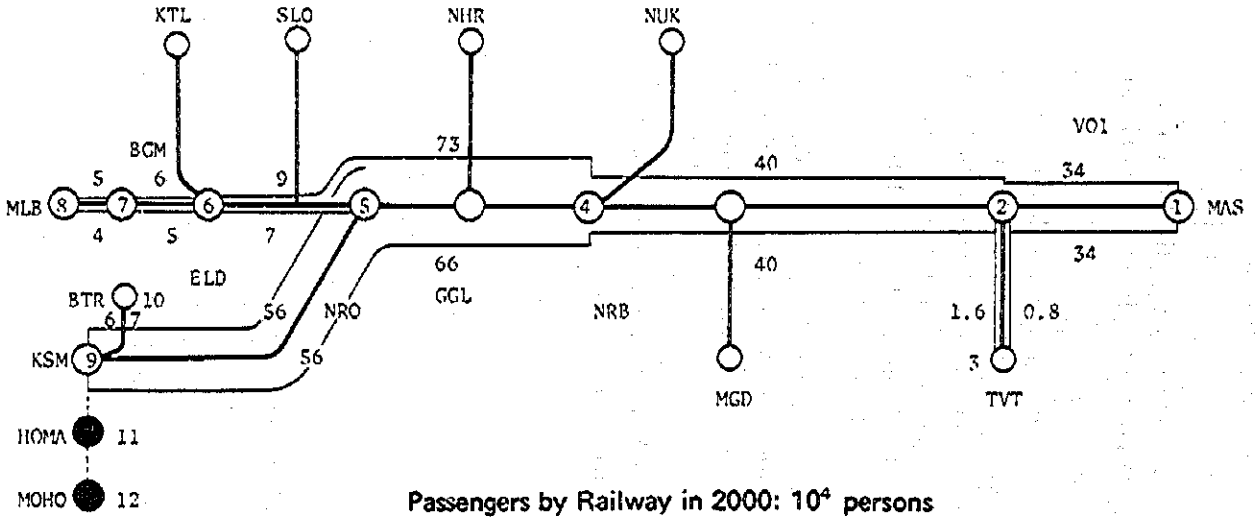
KENYA RAILWAYS - INTER TOP 50 STATIONS LIVESTOCK (HEADS)

	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151	161	171	181	191	201	111	221	231	241	251	261	
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	315
51	387	2233	0	0	0	0	684	0	0	266	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3570
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	7316	13	0	0	0	0	0	0	0	318	0	161	527	0	0	0	0	0	0	0	0	0	0	0	0	8126
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	0	0	0	0	0	0	1152	0	0	88	0	0	3003	0	0	0	0	0	0	0	0	0	0	0	0	0	4189
111	0	1397	210	0	272	0	24321	0	0	1551	0	0	1732	0	0	0	0	0	0	0	0	0	0	0	0	0	29161
121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
131	28	0	0	0	0	0	263	0	0	128	0	0	29	0	0	36	0	0	19	0	0	0	0	0	0	0	503
141	0	717	0	0	0	0	942	0	0	0	0	0	369	0	0	0	0	0	0	0	0	7	0	0	0	0	2229
151	0	1355	0	0	334	0	2457	0	0	1750	0	0	1943	0	0	0	0	0	0	0	0	0	0	0	0	0	7856
161	311	203	0	0	0	0	1391	0	0	0	0	0	1217	0	0	0	0	0	229	0	0	162	0	0	0	0	3513
171	0	0	0	0	0	0	2530	0	0	0	0	0	98	0	0	0	0	0	0	0	0	0	0	0	0	0	2578
181	0	0	0	0	0	0	16360	0	0	63	0	0	6380	0	0	0	0	0	0	0	0	0	0	0	0	0	24803
191	110	0	0	0	0	0	5052	0	0	1140	0	0	8210	52	0	75	0	0	0	0	0	0	0	0	0	0	14640
201	0	0	0	0	0	0	0	0	0	0	0	0	195	0	0	0	0	0	0	0	0	0	0	0	0	0	195
211	0	0	0	0	0	0	0	0	0	0	0	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	35
221	1065	0	0	0	0	0	9224	0	0	783	0	0	3160	2043	17	408	0	0	0	0	0	0	0	0	0	0	16699
231	0	0	0	0	0	0	76	0	0	0	0	0	881	0	0	0	0	0	0	0	0	0	0	0	0	0	957
241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
261	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1900	13222	222	49	606	0	65776	0	0	5725	318	0	27544	2613	17	519	0	0	248	0	0	169	0	0	0	0	119726

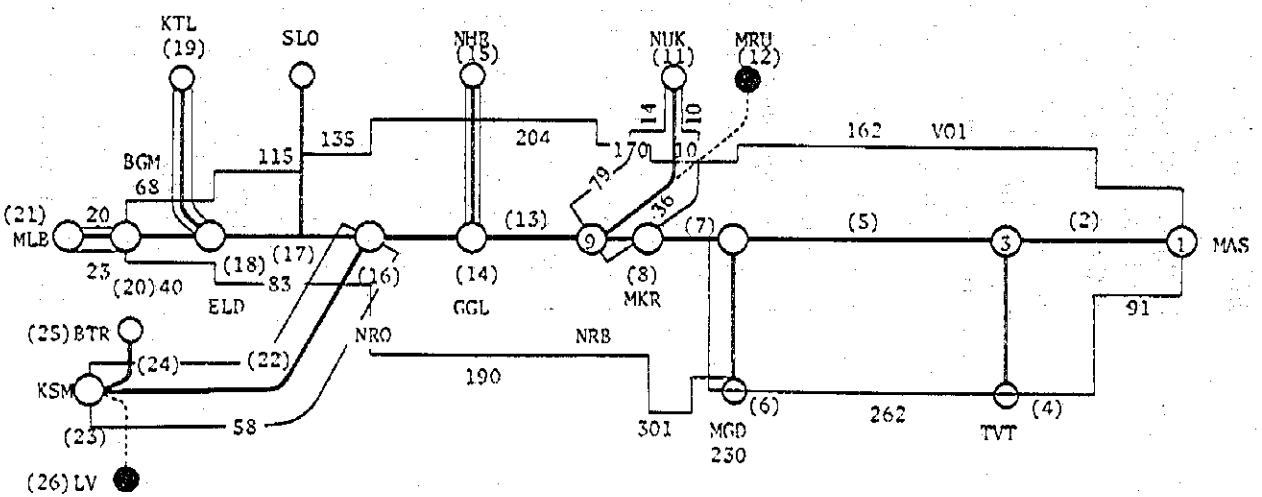
KENYA RAILWAYS - INTER TOP 50 STATIONS LIVESTOCK (HEADS) (NETWORK)

	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151	161	171	181	191	201	211	221	231	241	251	261	
(11)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(21)	1901	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1950
(31)	0	15122	0	49	315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15486
(41)	0	0	315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	315
(51)	0	0	15385	0	0	0	3265	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18650
(61)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(71)	0	0	0	0	13331	0	0	1062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14393
(81)	0	0	0	0	0	0	71780	0	1062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72842
(91)	0	0	0	0	0	0	0	71780	0	5298	0	0	5393	0	0	0	0	0	0	0	0	0	0	0	0	0	81421
(101)	0	0	0	0	0	0	0	0	32067	44	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52229
(111)	0	0	0	0	0	0	0	0	0	29463	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29463
(121)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(131)	0	0	0	0	0	0	0	0	38292	0	0	0	29	572	0	0	0	0	0	0	0	0	0	0	0	0	48893
(141)	0	0	0	0	0	0	0	0	0	0	0	0	10511	0	17	62	0	0	0	0	0	0	0	0	0	0	70590
(151)	0	0	0	0	0	0	0	0	0	0	0	0	0	1856	0	0	0	0	0	0	0	0	0	0	0	0	7856
(161)	0	0	0	0	0	0	0	0	0	0	0	0	0	62546	0	0	248	0	0	0	0	169	0	0	0	0	62963
(171)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42250	0	248	0	0	0	0	0	0	0	0	42693
(181)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59672	0	248	0	0	0	0	0	0	0	59920
(191)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14639	0	0	0	0	0	0	0	0	14639
(201)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	230	0	0	0	0	0	0	0	0	230
(211)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0	0	0	0	0	0	35
(221)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17657	0	0	0	0	0	17657
(231)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	957	0	0	0	0	957
(241)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(251)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(261)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1901	15122	15709	49	13646	0	75045	72842	81421	35755	118	0	75933	70974	17	59569	39920	15137	248	35	0	1126	0	0	0	0	





Passengers by Railway in 2000: 10^4 persons



Freight by Railway in 2000: 10^4 tonnes

2.2 Fundamental Development

2.2.1 Standardisation

Standardisation is now underway for the improvement of track, rolling stock, mechanical, and electrical systems, telecommunications and signalling, office administration, and accounting. However, since almost all rails, ties, bridges, engines, and cars now in use are of various foreign makes, it will be difficult to standardise the system.

In the case of rolling stock, it is no exaggeration to say that the losses resulting from standardisation could actually determine the financial foundation of the management.

Therefore, even though all equipment parts may not be available domestically, its is advisable that all be unified to certain specific standards by design, trial model fabrication, and testing using KR's own expertise; specified parts should then be procured from countries abroad. For rolling stock, the present shortage of spare parts may be resolved and the total transport capacity of improved stock could be increased by 16 percent.

Standardisation can be realized almost entirely by improving employee technical capability and with scrupulous adherence to the technical rules and regulations. This is most critical as it pertains to technical education for engineers.

Attention should first be directed to such technical education and the following items should be included in standardisation provisions:

General matters:

Construction standards
Railway equipment standards
Fare rate and freight regulations

Business affairs:

Business handling procedures
Statistical data and tabulation standards
Transportation rules and regulations
Passenger service regulations
Freight service regulations
Personnel administration
Financial control

Technical affairs:

Structural standards
Individual standards for facilities (such as passenger stations, freight stations, operational facilities and workshops)
Structural design standards
Rolling stock structural standards
Rolling stock design standards
Train operation rules and regulations
Signalling and communication system standards

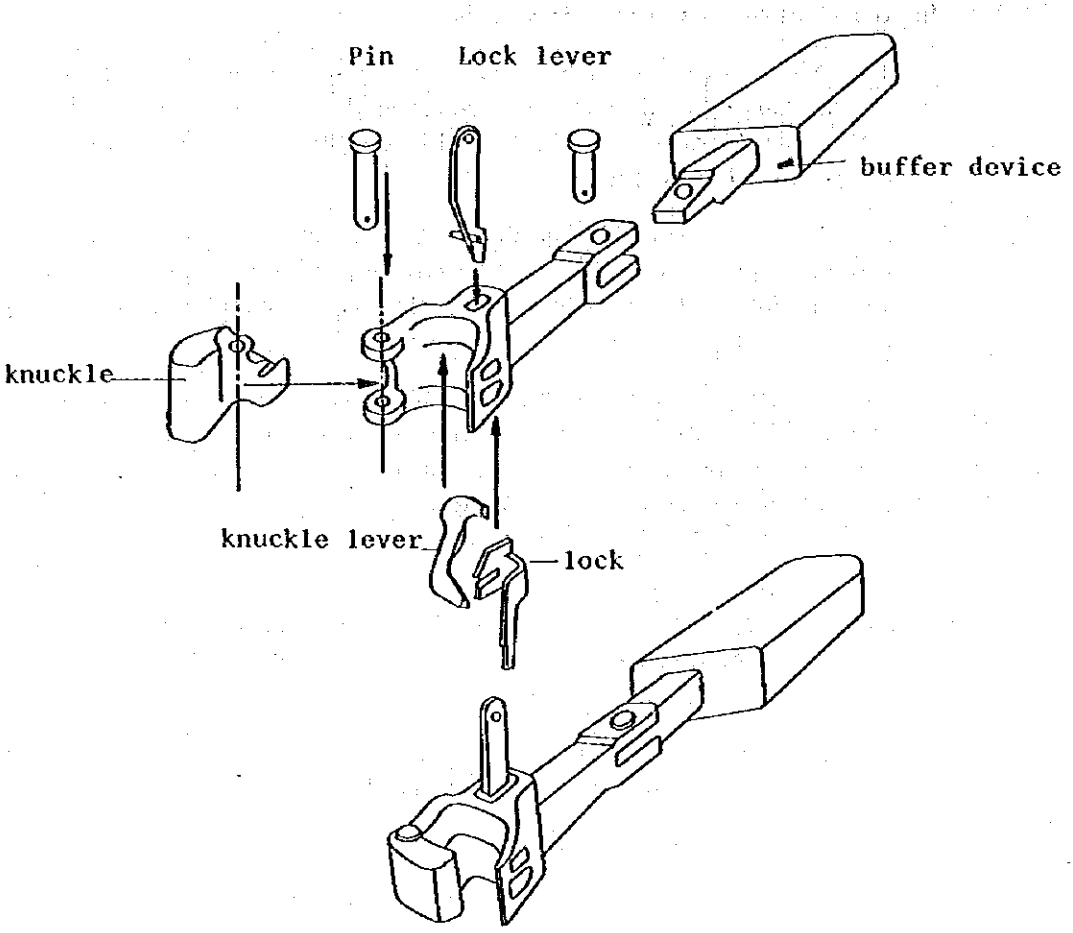
2.2.2 Improvement of the Coupling Device

The existing tree shape KR network means that all cars of a train must head in the same direction and the coupling device now being used is fully serviceable. However, this device will be unsuitable for the network if a loop line is formed in the future.

At present, much time is needed to do the shunting in the yard to couple and uncouple cars; it is also an extremely dangerous procedure for the workers involved. Improvement of this aspect could increase transport capacity by 150 percent.

To solve these shortcomings, all couplers must be replaced by automatic couplers. The effect of this single improvement can be of tremendous value over a wide range of operations, including safety, security, the handling capacity of the yard, and train traction force.

Fig. 2-2-1 Coupling Device



Although this improvement scheme requires a long preparatory period, the replacement of all couplers must be done in one day.The required cost for such a renewal would be much less than its advantages, compared with other improvement items. It is therefore considered appropriate that this scheme be incorporated into the proposed points of implementation under the master plan of this project.

Automatic couplers generally used in Japan are shown in Fig. 2-2-1.

2.2.3 Improvement of Signalling and Fail-Safe Systems in Connection with Strengthening of Track

Operational safety and tariff capacity yield by tracks on the main line network are key problems to be addressed in the fundamental development of the railway system. An average of 70 trains daily (between 58 and 85) can be operated if a single-track section is in good condition.

In KR's existing operating system, however, track capacity is limited to only 30 trains a day because of unbalanced distances between stations and the slow running speeds caused by steep grades. By improving the existing system, the train frequency could be increased to 50 trains a day. This improvement would require some additional track, installation of signalling stations, and improvement of the safety system.

On descending grades, the matter of assuring safety with the increased train speed is of serious concern.

Steep grades and share curves are points of weak maintenance. Replacement of existing steel ties with PCC (precast concrete) ties for easier and less costly track maintenance, and conversion of the signalling system to an improved electric token system are required. This replacement scheme, together with the improvement of the signalling safety system, is incorporated into the fundamental development plan.

2.3 Expanding Transport Capacity

2.3.1 Rationalisation of the Existing System

In a railway system, the rated output is possible only by a well-balanced relationship between the three main capacity factors: facilities, rolling stock, and staff. Facilities include track, stations, and a base depot. Rolling stock includes locomotives, passenger coaches, and freight wagons. Staff includes facility maintenance, workshop, electrical system, operation, and services. If any one of these three weakens, transport capacity is certain to decline proportionately.

The KR's existing network still has reserves for transport capacity greater than the present level, without any change to the system, if the unbalanced track capacity and availability of rolling stock are improved. The increased value possible if these improvements are made is estimated to be 150 percent.

Looking at transport capacity on the single track in particular, some factors still require improvement, such as the irregular intervals between stations, the speed drop due to steep grades and sharp curves, and train control functions. These must be improved before any action is taken to strengthen transport capacity.

The track on the main line particularly requires prompt improvement.

2.3.2 Expanding Transport Capacity

Earlier in this section it was stated that transport capacity of the existing track can be increased by 150 percent. In anticipation of a future demand double that at present, the change of railway track must be considered on a system-wide basis by conversion to double track, automatic signal control, and CTC systems.

It is estimated that the transport capacity can be increased 225% by rationalisation of the existing system.

2.4 Modernisation of the Railway Transport System

As soon as possible after the actions necessary for the fundamental development and expansion of transport capacity, the modernisation of the system to improve quality, as represented by stability, mass transportability and speed, should be undertaken.

Modernisation should include both electrification and containerisation. The investment in electrification will increase KR's efficiency, especially on tracks with long steep grades and sharp curves.

The container freight transport system will require a network with newly constructed container terminals; these may be needed for express delivery of goods by railway and to save transshipping costs.

2.4.1 Container Transport System

It is recognised that the basic principle of transportation applicable to both passenger traffic and freight transport aims at convenience by door-to-door delivery. Railway freight should be assessed a transshipping cost at each junction port or station, in addition to the costs of loading and unloading at stations of departure and arrival. Since transshipping accounts for a large share of the total transportation cost, as well as considerable time, conversion to the pallet system or container system has rapidly progressed in recent years. General commodities imported from abroad, except for one specific item, are carried by container, each unit being standardised to 8x8x20 feet in size and 20 tonnes.

With expansion of cargo handling equipment in Mombasa and Kilindini, an inland container terminal in Nairobi is under construction. An essential point of the transport modernisation scheme thus is to form a suitable network for future container transport. It is most desirable that this plan be carried out on a step-by-step basis. Therefore, the plan should envisage both the composition and the allotment of container units, container cars, terminals, and equipment handling, and should also aim at the optimisation of a train operation system.

The plan encompasses construction of a port side track line and yard as a part of the expansion of Mombasa South Port.

2.4.2 Railway Electrification

The important portions of KR's main line network are located 650 km distant from the coastline at an altitude of 2,700m. Precisely at the time when engines for the locomotives were replaced with internal combustion engines, the supply of oil energy became unstable. Furthermore, the flow of goods headed inland amounts to double that oriented toward the coast.

In this situation, electrification of the main line would most effectively realize future benefits. However, the vast sum necessary for this work requires that the plan be worked out in full consideration of available financial resources and increased demand.

Railway electrification may contribute much towards the reduction of energy costs and still more towards increases in traction force and speed, thus possibly shortening required transport time with resultant increases in track capacity and rotation of cars for assignments.

By electrification both special express and ordinary express trains can be operated at high speed in the passenger traffic system to which the power dispersion system is applicable.

From the energy aspect, there is the advantage that regenerative energy on the descending grade can be stored for a subsequent ascent.

Since vast sums will be required for the execution of this project, the electrification scheme will necessitate financial aid and grants for interest payments by the government as a national project outside the framework of

the independent profit system managed by the KR Authority.

Prior to its full introduction, an electrification system must be test run on a stage-by-stage basis on a partial section until full completion of the scheme can be realised. Careful study must be made to determine whether an alternating current or a direct current system should be adopted for electrification. The most feasible sequence is to first electrify the 150km section between Nairobi and Nakuru and then the section between Mombasa and Nairobi, leaving the rest to subsequent stages.

2.5 Management Plan

2.5.1 Fare Rate, Revenue, and Finance

The relationship between fare rates and finance was covered in section 1-4.

The trend value of traffic volume Z may be shown in relation to a fare increase with the assumed level of 1979 as Base 1.

$$z = (1.174 - 0.02525P)\, 5.852 \times 10^8 \text{ Kshs}$$

Revenue F can be shown by F = PZ,

$$F = (1.174P - 0.02525P^2)\, 5.852 \times 10^8 \text{ Kshs}$$

Thus, the calculated result shows P = 1.3 in approximation.

Transport cost has increased remarkably and its value E may be determined as follows:

$$E = 1.023\,(1 + 0.177)^t\, 5.852 \times 10^8 \quad E = \text{Expenditures}$$

Table 2-5-1

Fare increase rate (P)	* 1.0	1.5	2.0	Remarks
Traffic volume (Z)	1.149	1.136	1.124	* 1979=1 (Revenue) as base year
Revenue (F=PZ)	1.149	1.704	2.470	

Thus t denotes the number of years elapsing from 1979.

Both P and t values are calculated as shown in the following tables for 1, 1.5 and 2.0 and for years 0, 1, 2, 3, 4 and 5, respectively.

Transportation cost rate	0 (1979)	1	2	3	4	5
Cost Value for $1.023(1 + 0.177)^t$	1.023*	1.204	1.42	1.668	1.963	2.311

1.023*: Cost rate at base year of 1979 for revenue

The results of this comparison reveal that the fare rate must be increased by 50 percent every three years if it is to compensate for cost increases.

It is difficult to ensure a return of capital investment at the present level of traffic demand. Fare rate increases may therefore also be necessary to augment the investment return.

2.5.2 Finance and Capital Investment

The KR's financial statement as of the end of 1980 may be outlined as follows:

Table 2-5-2

(1) Unit: Million Kshs

Assets		Liabilities and capital		
Fixed assets	1,470	Borrowed funds (General)	390	1,510
Under construction	300	" (Government)	1,120	
New construction	140	Reserved funds	760	
Floating assets	400	Retained funds	30	
Total	2,310		2,310	

Initial profit and loss

(2) Unit: Million Kshs

Expenditures		Revenues	
Operating expense	590	Passenger	55
Depreciation cost	107	Freight	550
Others (Including 70 mil. for repayment)		Others	62
Interest accrual	66		
Total	770		667
Grand total	-103		

Cost breakdown

(3) Unit: Million Kshs

Total cost	Track maintenance	Rolling stock maintenance	Operation		Transportation	Others
			Others	Fuel		
			179 (30)			
597	137	60	79	100	81	140
% (100)	(23)	(10)	(13)	(16)	(14)	(23)

Passenger: Freight = 0.16 : 0.84
(for train Km)

The cost breakdown shows that investment priorities are given to track maintenance above all else, with fuel as the second priority. This reflects their major effect on railway management.

To examine investment effect, a calculation is made to determine fund efficiency. Fund efficiency compares the annual cost based on the investment with the net profit (to which any discount rate is applied) at an annual average for n years (for the average depreciation period) after the commencement of service of new railway facilities, and after subtracting the depreciation value (or equal installments of the repayment sum of both principal and interest), and finally comparing the profit with the capital investment.

This can be further explained by the following formulae:

$$r = \left[\sum_{t=1}^{n} \frac{(\Delta R_t - \Delta E_t)}{n} - \frac{0.9 \times I}{n} \right] / I \quad \ldots\ldots (1)$$

$$\text{or} \quad r = \left[\sum_{t=1}^{n} \frac{(\Delta R_t - \Delta E_t)}{n} - I \left(\frac{ixe^{in}}{ein-1} \right) \right] / I \quad \ldots\ldots (2)$$

Where,

- ΔR_t: Revenue difference between new and existing facilities
- ΔE_t: Expenditure difference between new and existing facilities
  In Formula (1), interest for I is included in ΔE_t, but in Formula (2) it is not included.
- I: Investment sum
- i: Average interest (0.07)
- n: Average depreciation period

Therefore, the value of I is sought by the optional choice of the value r: (0.1)

$$I = \sum_{t=1}^{n} (\Delta R_t - \Delta E_t)/(nr + 0.9) \quad \ldots\ldots (3)$$

$$I = \sum_{t=1}^{n} (\Delta R_t - \Delta E_t)/n\left(r + \frac{ixe^{in}}{(ein-1)}\right) \quad \ldots\ldots (4)$$

The value I thus obtained is the ceiling sum of investment required in relation to the value r.

Fig. 2-5-1 Depreciation Period and Cost Conversion

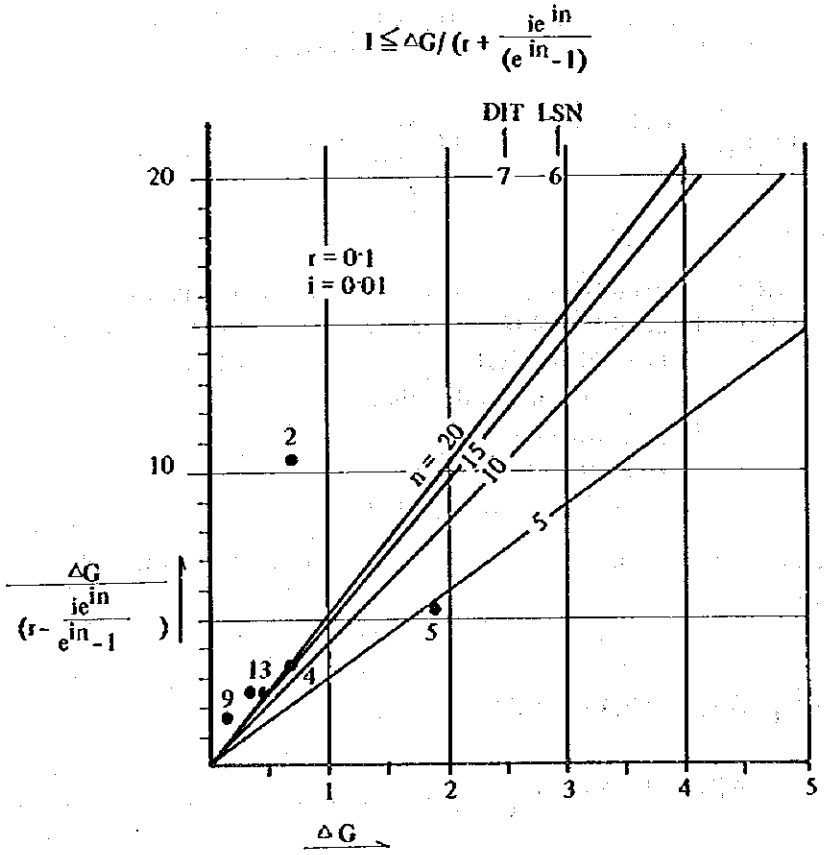


Table 2-5-3 Traffic Demand and Expenditures in Future

			Demand		Traffic		Review			Expenditures							Depreciation and Other	Interest on Capital	Total	Defict for Period
			Goods	Pas-sen-gers	Goods	Pas-sen-gers	Goods	Pas-sen-gers	Σ	Maintenance of way and work	Maintenance of Cars	Operating Expence		Traffic Expences	Other	Σ				
												Fuel	Other							
			ton^{Km} 10^8	pas^{Km} 10^8	10^6 Train^{Km}		10^8kshs			kshs 10^8										
1980	1		22.81	7.0	5.70	1.06	5.87	0.81	6.67	1.37	0.6	1.0	0.79	0.81	1.4	5.97	1.07	0.66	7.7	-1.03
1990	2		34.22	10.5	8.55	1.59	10.16 (8.81)	1.40 (1.22)	11.55 (10.01)	2.06	0.9	1.5	1.19	1.22	2.1	8.96	1.61	0.99	11.55	
2000	3		45.62	14.0	11.40	2.12	13.54 (11.74)	1.87 (1.62)	15.40 (13.34)	2.74	1.2	2.0	1.58	1.62	2.8	11.94	2.14	1.32	15.40	

Table 2-5-4 Investment and Gain for Each Project

	Case	n	Demand		Traffic		Review			Expenditure							① Invertment	② Gain of Investment	③ Limite of Investment	① / ③
			Goods	Pas-sen-ger	Goods	Pas-sen-ger	Goods	Pas-sen-ger	Σ	Maintenance of Way and work	Maintenance of Cars	Operating Expence		Traffic Expences	Other	Σ				
												Fuel	Other							
																				%
Standardisation	1	20								(case 1) 10% -0.137	(case 1) 10% -0.06		(case 1) 10% -0.079	(case 1) 10% -0.081			2.38	0.357	1.851	128.5
Strengthening of track (Replace ment of PCC tie)	1	15								(case 1) 50% -0.685							10.25	0.685	3.298	310.8
Improvement of Coupling device	1	15		5% up					(case 1) 5% 0.334					(case 1) 10% -0.081			2.36	0.415	1.998	118.2
Improvement of Signalling (Electronic Token)	2	10		5% up					(case 2) 5%					(case 2) 10% -0.122			3.42	0.700	2.928	116.8
Improvement of Transport system	1	20	50% up	50% up					(case 1) 50% 3.335							(case 1) 25% 1.493	5.26	1.842	9.548	55.1
Strengthening of Transport system	3	20	50% up	50% up					(case 3) 50% 7.70							(case 3) 40% 4.776	68.16	2.924	15.157	449.7
Electrification	2	20	20% up	20% up					(case 2) 20% 2.31			(case 2) 7% -1.05				(case 2) 10% 0.896	32.50	2.464	12.773	254.4
Containerisation	2	10							(case 2) 10% 1.116							(case 2) 5% 0.448	3.72	0.668	2.794	133.1
Mombasa South Port	1	20							(case 1) 4% 0.267							(case 1) 2% 0.119	1.64	0.148	0.767	213.7

2.6 Short/Medium/Long Term Planning

Table 2-6-1 shows the time schedule and each scheme for a span of 17 years to the year 2000 under the plan for fundamental development, expansion of transport capacity, and modernisation of the transport system.

(1) Short-term Plan

The 5th Plan includes the improvement of transport capacity and the project at the Southern Port of Mombasa under the containerisation scheme, in addition to the fundamental development of the transport system. The funds required are estimated at 1,025 million Kshs.

(2) Medium-term Plan

The 6th Plan includes the unfinished portion of the fundamental development scheme except for the replacement of couplers, aiming at 500 km tie replacement and conversion to an electronic token system for a 150 km section between Nairobi and Nakuru.

Transport capacity will be expanded by 150 percent. A container terminal will be opened at Nakuru.

A length of 150 km will be chosen as the test section for electrification under a national project. The funds required are estimated at 750 million Kshs.

(3) Long-term Plan

The 7th Plan aims at expanding traffic capacity by 225 percent of the present level. Container service will be started at Eldoret and Kisumu with 5 container stations in operation.

Electrification will enter the 2nd stage and will be nearly completed for the section between Mombasa and Nairobi.

The funds required are estimated at 1.67 billion Kshs. In the year 2000, the unfinished portion of electrification at the 2nd stage will be completed. Cost of that work is estimated at 83 million Kshs.

It should be noted, however, that the scheme of transport capacity increase (Phase II) under the 7th Plan may be deferred depending upon circumstances. It is also probable that the 2nd-stage work for the containerisation at Kisumu may be incorporated into the 6th Plan.

The 3rd-stage electrification scheme is pending at this moment.

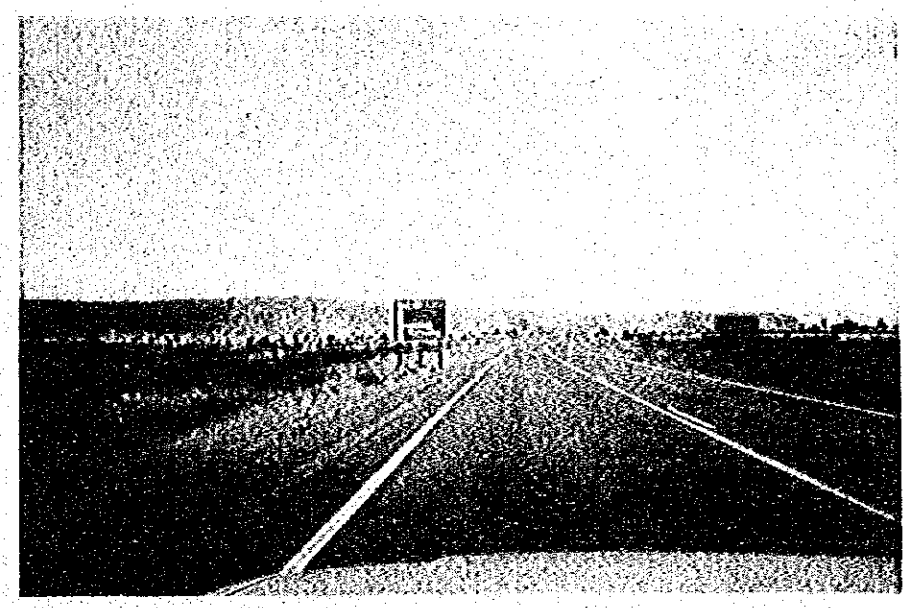
The main themes for the short, medium, and long term plans are:

Short term:	Fundamental development of transport
Medium term:	Strengthening of transport capacity
Long term:	Modernisation of transport system

Table 2-6-1 Time Schedule for each Project

Projects	Quantities & Original Units	5th 5 Year Plan					6th 5 Year Plan					7th 5 Year Plan					Cost 100 million kshs				Desirable Sequence	Remarks
		84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000	Local	Foreign	Σ	
1. Fundamental development of transport																						
1.1 Standardisation	person ksh/person 3000@7.9x10⁴					0.95					1.19					0.24			138	100	238	A	
1.2 Improvement of coupling device	ksh/car 8,700@2.72x10⁴					2.36													100	136	236	A	
1.3 Track and Signalling																						
Replacement of PCC ties	Km ksh/Km 650 @157.9x10⁴					2.36					7.89								400	625	1025	B	
Electronic token	Km ksh/Km 650 @52.63x10⁴										0.79					2.63			042	300	342	B	
Total																						
2. Strengthening of Transport capacity																						
2.1 Improvement of system	point ksh/point 120 @2,000x10⁴					3.76					1.5								100	426	526	A	
2.2 Expanding capacity	Km ksh/Km 650 @421x10⁴															40.9		27.26	1000	5816	6816	B	
2.3 Mombasa South Port	Km ksh/Km(track) 18 @373.7x10⁴					0.82					0.82								064	100	164	A	
	3 Km @2,405x10⁴ " (Bridge)																					
Total																						
3. Modernisation of transport system																						
3.1 Containerisation																						
Phase 1	tonnes ksh/50x10⁴ tonnes 1@50x10⁴ @13,579x10⁴										1.86								066	120	186	A	
Phase 2	103car @52,63x10⁴kshs/car tonnes ksh/50x10⁴ tonnes															1.86						
Phase 3	2@25x10⁴ @13,157.9x10⁴ 103car @ 52.63x10⁴kshs/car																		066	120	186	B	
3.2 Electrification																						
Phase 1	Km ksh/Km 150 @550x10⁴										7.5								250	500	750	B	
Phase 2	Km ksh/Km 500 @550x10⁴															16.7		8.3				
Phase 3																			800	1700	2500	C	
Total																						
Grand total	A					7.89					5.37					20.24			468	832	1300		
	B					2.36					16.18					45.39		27.26	1758	7361	9119		
	C															16.70		8.30	800	1700	2500		
	Σ					10.25					21.55					62.33		35.56	3026	9943	12969		

PART III. ROADS/ROAD TRANSPORT



1. Current Condition and Issues

1.1 Current Transport Characteristics

(1) Motor Vehicles in Use

Data relating to motor vehicle registration are kept by the CBS (Central Bureau of Statistics). However, since the number of discarded vehicles has not been surveyed, no actual statistics exist on motor vehicles presently in use. Tables 1-1-1 and 1-1-2 show the respective trends and spatial distribution of the estimated number of vehicles of each type. The last column in Table 1-1-1 shows the rate of the number of remaining vehicles each year employed for the estimation. Average growth rate of the vehicle numbers during the last seven years is a moderate 3.3%. From 1981 to 1982 the rate was only 0.7%, due to the restraints imposed on vehicle imports.

Concerning the spatial distribution, Nairobi overwhelms the other provinces in terms of the number of vehicles in use, which is followed by Rift Valley, Coast and Central Provinces. The bottom row of Table 1-1-2 shows the number of vehicles per head in each province. In this sense Nairobi also has a relatively high rate of 0.148 veh./head which is followed by 0.018 veh./head in Coast and 0.010 veh./head in Rift Valley.

(2) Automobile Transport

The study team performed a nationwide OD traffic survey on principal trunk roads in March of 1983 (referred to hereunder as the OD survey). Through the analysis of the survey data, national OD tables for vehicular movement, passenger movement and freight movement between districts including the movement to and from the neighbouring inland countries have been calculated. The general results from the analysis are as follows:

Total number of vehicle trips	=	25,125 veh./day
Total vehicle km	=	3,077,701 veh.km/day
Average trip length	=	123 km

Table 1-1-1 Motor Vehicles in Use, 1976–1982

Type of Vehicle \ Year	1976	1977	1978	1979	1980	1981	1982	Ratio of Remaining Vehicle
Saloon	84,224	86,944	90,047	90,182	92,210	92,242	92,402	0.95
Station Wagon/Tourer	15,723	17,328	19,074	20,316	21,483	21,955	22,308	0.95
Box Body/Panel Van	44,543	48,264	50,203	52,249	55,524	57,969	58,977	0.93
Lorry/Truck	20,732	21,007	22,185	23,115	23,594	23,956	23,539	0.93
Buses and Coaches	3,049	2,995	2,976	3,023	3,005	3,033	3,128	0.93
Mini Buses	1,657	1,777	1,849	1,962	2,070	2,399	2,559	0.95
Special Purpose	692	753	793	1,114	1,214	1,311	1,343	0.95
Trailers	8,806	9,152	9,876	10,360	10,567	10,915	10,867	0.95
Roller, Grader, Crane	1,318	1,307	1,317	1,382	1,494	1,578	1,574	0.94
Wheeled Tractor	10,391	11,568	12,784	13,090	13,266	13,663	13,616	0.94
Crawler Tractor	284	320	421	556	553	586	594	0.94
Motor and Auto Cycles	11,870	12,763	13,746	14,573	15,343	16,345	16,780	0.94
Three Wheelers	157	173	176	173	176	180	180	0.94
Total	203,446	214,351	225,447	232,095	240,499	246,132	247,867	-

Source: CBS

Table 1-1-2 Distribution of Motor Vehicles in Use by Provinces, 1982

Type of Vehicles \ Provinces	Nairobi	Central	Coast	Eastern	North Eastern	Nyanza	Rift Valley	Western	Total
Saloon	59,801	6,151	11,105	2,585	29	3,455	8,212	1,064	92,402
Station Wagon/Tourer	13,477	1,762	2,441	882	53	854	2,494	345	22,308
Box Body/Panel Van	28,278	7,653	3,742	3,863	177	3,537	10,420	1,307	58,977
Lorry/Truck	11,538	2,788	2,748	1,265	160	1,276	3,323	441	23,539
Buses and Coaches	1,291	389	505	272	9	313	234	115	3,128
Mini Buses	1,580	148	561	53	0	72	119	26	2,559
Special Purpose	684	66	169	51	9	63	198	103	1,343
Trailers	5,373	577	729	440	23	954	2,442	329	10,867
Roller, Grader, Crane	1,090	74	158	50	4	57	121	20	1,574
Wheeled Tractor	2,778	1,756	549	745	42	1,388	5,577	781	13,616
Crawler Tractor	336	48	60	22	9	32	77	10	594
Motor and Auto Cycles	6,701	1,565	3,382	1,064	31	1,089	2,291	657	16,780
Three Wheelers	125	16	27	1	0	2	8	1	180
Total	133,052	22,993	26,176	11,293	546	13,092	35,516	5,199	247,867
Number of vehicles per capita	0.148	0.009	0.018	0.004	0.001	0.003	0.010	0.003	0.015

Tables 1-1-3 and 1-1-4 show the trends in veh.km for each vehicle type (1970–1982) and veh.km by vehicle type and class of road (1982), respectively. The veh.km are derived through analysis of the 60 Point Census Data following a method presently employed by the MOTC. These estimates exclude regional trips such as those within cities and towns. In this respect the survey circumstances are similar to those of the OD survey.

The total veh.km in 1982 was 6,702,164, an estimate which is approximately double the value obtained in the OD survey. Since the results from the OD survey do not include trips which occur completely on class C or lower level roads (D, E, etc.), the estimates given here may be less than the actual veh.km. The number of these trips against the total trip number, however, is considered very small. In this sense the estimates the MOTC method provides could be somewhat larger than the actual fact.

It may be possible, however, to observe some characteristics in the trends of vehicle km in the table which is discussed below. From Table 1-1-3 it can be computed that the average growth rate of vehicle km during the last 10 years was about 4.8% p.a. The average growth rate from 1970 to 1975 was 8.6% p.a., whereas it declined to 2% during the years 1977–1982.

In Table 1-1-4, the total road class shows that the use of Light Goods Vehicle is notable (48% of the total). Trunk roads were the class most frequently used.

(3) Passenger Transport

Vehicles used for passenger transport in Kenya are the car, matatu and bus. Here 'car' includes taxis and station wagons whose seating capacity is not more than 9 persons (including the driver). The matatu is a minibus whose seating capacity is about 14 to 25 (converted pick-up, minibus, combi, etc.). Its legal status will be reviewed later. Table 1-1-5 shows the current transport characteristics of these three modes as obtained by the OD survey. Concerning vehicle trips, cars accounted for 55% of the trips per day and the car is also highest among the three modes in vehicle km (58%). Concerning the number of passengers, however, the bus and matatu are about equal with their shares being 42% and 41%, respectively. The bus has the highest proportion passenger km (50%). The matatu has the smallest average trip length, 90 and 91 km for vehicle and passenger trips, respectively. The average trip lengths of the car of vehicle and passenger (117 km and 118 km, respectively) are less than those of the matatu. The bus has the longest average trip length.

Figure 1-1-1 shows the share of traffic flow for bus and matatu along the roads. On roads A109 and A104 – which long trips are likely to use – the bus has a larger share than matatu. The share seems equal near the large cities.

Table 1-1-3 Vehicle km by Road Class, 1970–1982

(veh.km/day)

Year	Trunk Roads	Primary Roads	Secondary Roads	Minor	Total
1970	2,723,791	695,148	273,296	187,668	3,879,903
1971	2,910,663	810,582	424,270	57,744	4,203,259
1972	3,859,828	932,694	461,738	90,225	5,344,485
1973	3,814,426	1,185,822	520,144	375,336	5,895,728
1974	3,672,298	1,073,568	512,430	173,232	5,431,528
1975	4,095,392	1,410,648	198,360	162,405	5,866,805
1976	1,681,190	1,511,454	513,532	32,481	3,738,657
1977	4,386,228	1,462,482	190,646	122,706	6,162,062
1979	5,426,855	1,401,744	479,370	299,547	7,607,516
1980	4,253,641	1,591,272	647,976	173,232	6,666,121
1981	4,712,267	1,946,160	480,472	220,149	7,359,048
1982	4,410,245	1,386,162	591,774	313,983	6,702,164

Source: MOTC 60 Point Census

Table 1-1-4 AADT and vehicle km by Vehicle Type and Road Class, 1982

(Upper: AADT, Lower: vehicle km per day)

	Car	Light Goods	Medium Goods	Heavy Goods	Buses	Total
Trunk (329)*	3,565 1,172,885	5,661 1,862,469	2,460 809,340	911 299,719	808 265,832	13,405 4,410,245
Primary (318)*	787 250,266	2,682 852,876	662 210,516	39 12,402	189 60,102	4,359 1,386,162
Secondary (1,102)*	59 65,018	278 306,356	161 177,422	3 3,306	36 39,672	537 591,774
Minor (3,609)*	5 18,045	58 209,332	24 86,616	0 0	0 0	87 313,983
Total	4,416 1,506,214	8,679 3,231,023	3,307 1,283,894	953 351,427	1,033 365,606	18,388 6,702,164

Source: MOTC 80 points census

* : Average road length covered by each class of road.

Table 1-1-5 Passenger Transport Characteristics

Vehicle Type	Number of Vehicle Trips per Day	Vehicle km per Day	Average Vehicle Trip Length (km)	Number of Passenger Trips per Day	Passenger km per Day	Average Passenger Trip Length (km)	Average Passengers Carried per Vehicle
Car	6,635 (55)	775,222 (58)	117	17,850 (17)	2,105,810 (17)	118	2.69
Matatu	3,946 (33)	353,776 (27)	90	45,675 (42)	4,156,744 (33)	91	11.58
Bus	1,405 (12)	204,300 (15)	145	43,786 (41)	6,203,495 (50)	142	31.16
Total	11,986	1,333,298	111	107,311	12,466,083	116	8.95

( ) Percentage of total

Source: 1983 OD Traffic Survey Computed From AADT Traffic Flow

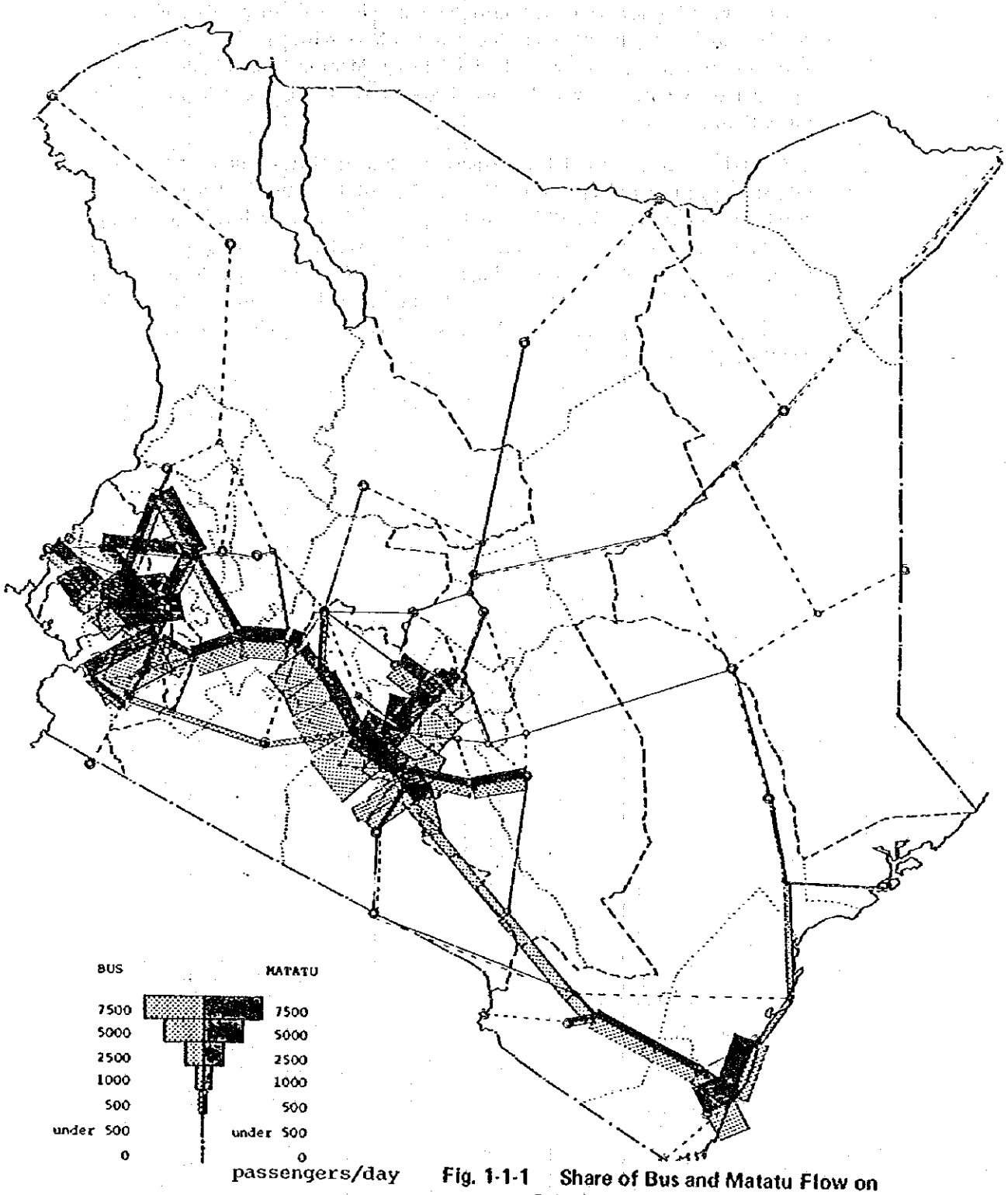


Fig. 1-1-1 Share of Bus and Matatu Flow on Principal Roads

(4) Freight Transport

Freight vehicles are classified into light goods, medium goods and heavy goods vehicles. Light goods are those four-wheel vehicles of a "goods" type with a maximum empty weight of 1,524 kg. Medium goods are defined as 2-axle trucks with six wheels. Heavy goods are those goods vehicles with more than 2-axles.

Table 1-1-6 shows current truck transport characteristics (obtained from the OD survey). The percentage of the number of trips by light and medium goods are relatively high at 53% and 37%, respectively. Vehicle km of these two types are also high, 43% and 35%, respectively. The average trip length of heavy goods trucks is the highest, that of medium goods is second followed by light goods. The average tonnes carried per vehicle is 0.42, 3.51 and 10.32 for light, medium and heavy goods, respectively, and the average of all freight vehicles is 2.51 tonnes.

Table 1-1-6 Freight Transport Characteristics

Vehicle Type	Number of Vehicle Trips per Day	Vehicle.km per Day	Average Vehicle Trip Length (km)	Total Tonnes Transported per Year	Tonne km x10^6 per Year	Transport Distance per Tonne (km)	Average carring tonnes per Vehicle
Light Goods	7,016 (53)	750,877 (43)	107	1,086,782 (9)	139.4 (5)	128	0.42
Medium Goods	4,879 (37)	607,386 (35)	125	6,254,811 (52)	929.9 (33)	149	3.51
Heavy Goods	1,244 (10)	386,156 (22)	310	4,688,016 (39)	1,755.7 (62)	375	10.32
Total	13,139	1,744,419	133	12,029,609	2,825.0	235	2.51

( ) percentage of total

Source: OD survey 1983
Computed from AADT traffic flow