Faculty Working Papers

SOME OBSERVATIONS ON RAIL AND
ROAD TRANSPORT IN COMMONWEALTH
TROPICAL AFRICA

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Transportation Research Paper #14

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April 6, 1977

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The railway systems of tropical Africa were products initially of the colonial period, with minor exceptions, being inaugurated around the turn of the century and progressing slowly, primarily built inward from the ports, without connections to adjacent countries. They were built partly for noneconomic reasons, partly to facilitate export of minerals and agricultural products.[1] They were built cheaply, with light rails -- some no more than 35 pound -- and universally with a gauge less than the 4'8½" standard of western Europe and North America. Primarily they are either metre or the 1.067 metre gauge that began in the Cape Colony in South Africa. Inadequate as the rail lines were -- they never constituted a "system" except in the southern third of the continent -- they were playing a significant role in the economies of the countries at the time of independence. Road systems, while greater in mileage at independence, were largely unsurfaced and unsuitable for heavy traffic.

The purpose of this paper is to survey the development of the lines, with primary emphasis on post-independence policies, to consider

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*The author is greatly indebted to the officials of the Ministries of Transport and the railways in the various countries. Any views expressed are solely those of the author unless otherwise indicated.

[1]The first railway in tropical Africa was built in 1885 between Dakar and St. Louis in Senegal.

the relationships between rail and road transport and economic viability of the rail lines, and to review the studies of the effects of the railways upon economic development.[1]

Emphasis is placed upon the Commonwealth countries of East and Central Africa and the neighboring areas, with brief reference to Commonwealth West Africa. No claim is advanced that the paper reflects original research; it is based upon existing published material, some not widely known, and interviews in the respective countries in the early months of 1976.

EAST AFRICAN RAILWAYS

In the late 1960s, the East African Railways (EAR) was the model railroad of tropical Africa and the developing world, with 3300 miles of line, most of it in first class shape, modern equipment, plans for complete dieselization, and a heavy volume of traffic relative to most African lines. A decade later, EAR, as an entity, had disintegrated; the railroad is essentially operated in three portions and is in the process of becoming virtually three separate roads. It has lost substantial traffic and is desperately short of equipment to handle the traffic it has retained. But it still remains an important artery of commerce in East Africa and there are hopes for major improvements in the constituent parts.

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[1] A summary of regional studies of transportation in tropical Africa prior to 1968 is provided in African Development Bank, Survey of African Regional Transport Studies, 1968: 2 vol.

The Origins

EAR was developed from three separate and originally disconnected systems.[1] The major route, the Uganda Railway, was built by the British, in part for political reasons, from the port of Mombasa, beginning in 1896, to link Uganda with the outside world. Track reached the site of Nairobi in 1899; Kisumu, the lake port, with connecting steamer service to Uganda, in 1902; and directly to Kampala in 1931. Major extensions were completed to Kasese, in the west of Uganda, in 1956, and to Pachwach, on the Nile in Northern Uganda, in 1964. The main line, Mombasa to Kampala, is 844 miles in length; the total from Mombasa to Kasese, 1052.

The second element was the Tanganyika Railway, started by the Germans westward from Dar es Salaam in 1905; it reached Morogoro in 1907, Tabora in 1912, Kigoma in 1914 to play a role in World War I, and from Tabora to Mwanza in 1928. This is known as the Tanganyika (now Tanzania) Central line. The third element, the first to be started, was built west from the port of Tanga in 1896 but did not reach Moshi until 1911 and Arusha in 1929. This line was connected to the Mombasa-Nairobi main line in 1916, and the Tanzania Central line in 1960.

The lines were merged in 1945 to become the East African Railways, an element of the East African Common Services Organization, later the East African Community, and thus jointly owned by the

[1] M. Hill, Permanent Way (Nairobi: East African Railways and Harbors, 2 vol., 1949 and 1957), provides a detailed history of the lines; a semi-popular but excellent volume, relating the railroad to overall development, is that by Charles Miller, The Lunatic Express (New York: Ballentine, 1971).

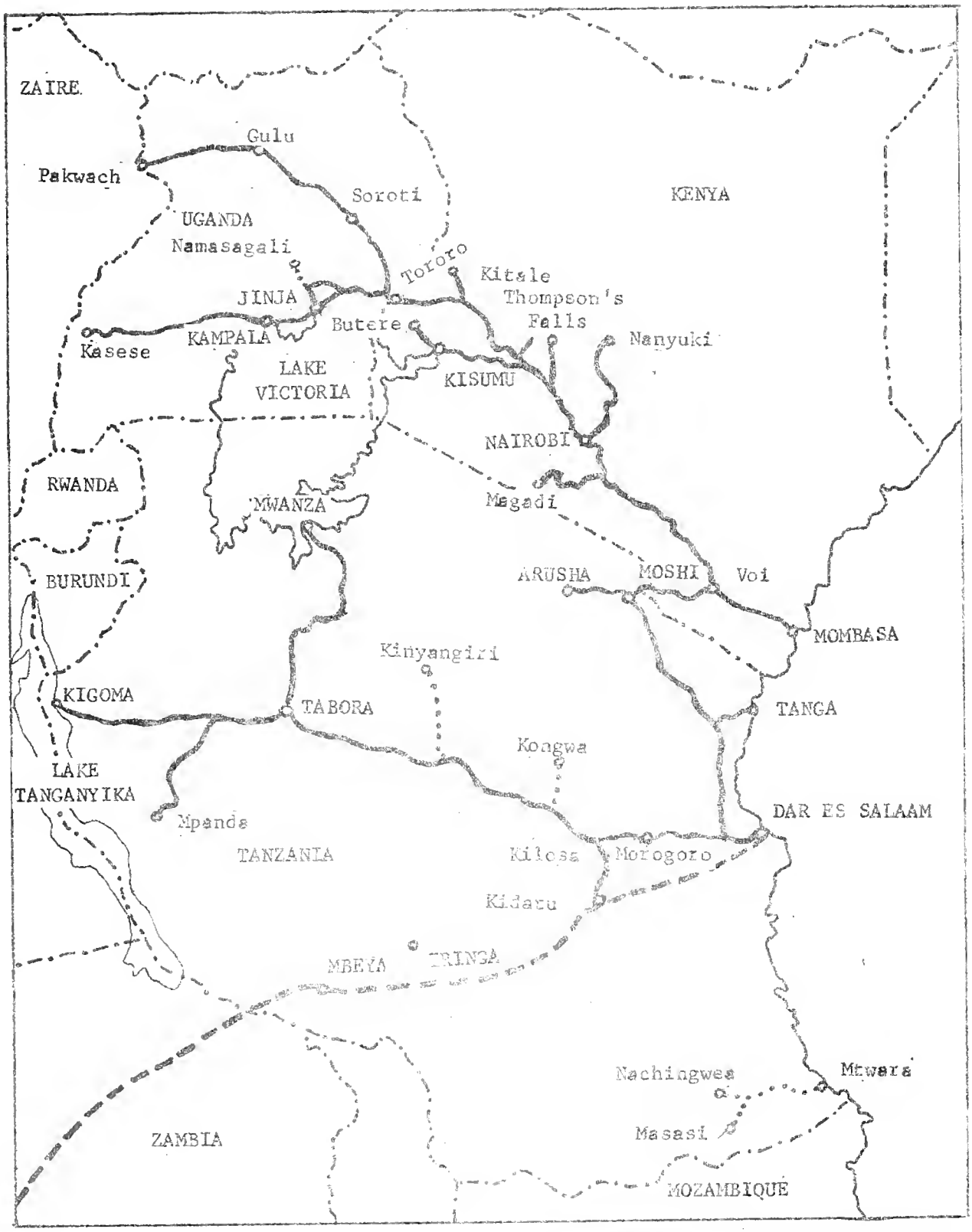

Figure 1:

Railways in East Africa

East African Railways

TAZARA Railway

Abandoned lines

50 0 100

governments of Kenya, Uganda, and Tanzania. The administrative headquarters, main repair shops, and training school were located in Nairobi.

Traffic

The total freight traffic increased steadily up to a high in the year of 1970, as shown in Table I.

Table I

Total Freight Ton Miles
East African Railways, Selected Years

year	millions of gross ton miles	
1948	769	
1957	1,454	
1964	1,986	
1968	2,545	
1970	2,768	(peak year)
1973	2,676	
1974	2,500	(approx.)
1975	2,250	(approx.)

Source: Annual reports, EAR, and information supplied by railway sources

Passenger traffic rose through 1973 and then dropped slightly.

The total mileage in 1975 was 3,663; the gross ton miles per mile of line in 1970 therefore was 730,548. The net figure would be slightly less than half this figure. This is light by comparison with the United States, but high relative to the railways in most developing countries. The average figure is misleading because of the great variation by line. For 1968 (in subsequent years the relative figures for most lines would not differ greatly) the figures were as follows:[1]

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[1]Source: Annual Reports, East African Railways.

	Miles	Gross Ton miles per mile (000s)
Main Kenya-Uganda Line		
Mombasa-Voi	104	8,750
Voi-Nairobi	226	8,471
Nairobi-Nakuru	112	6,652
Nakuru-Eldoret	125	4,358
Nakuru-Kisumu	136	2,631
Tanzania Central Line		
Dar es Salaam-Morogoro	126	3,216
Morogoro-Dodoma	164	2,594
Dodoma-Tabora	240	2,308
Tabora-Mwanza	236	1,215
Tabora-Kigoma	251	1,027
Tanga Line		
Tanga-Moshi	218	937
Connecting links		
Voi-Moshi	107	1,075
Karogu-Ruvi	129	502
Selected branches		
Nanyuki	100	1,222
Kasese	208	410
Pachwach	313	240
Mpanda	207	123

Thus the main line Mombasa-Nairobi carries nearly three times the traffic of the Tanzania Central line; the Tanga line has relatively light traffic, as do most of the branches.

The principal traffic categories were petroleum products (which have yielded about 25% of the total revenue), grain, cement, sugar, coffee, and cotton.

Passenger traffic is substantial but a minor source of total revenue. As of 1973 daily service was operated Mombasa-Kampala, requiring about 38 hours; daily service Dar es Salaam to Mwanza (and four

times a week to Kigoma), twice a week Dar es Salaam to Arusha and to Nairobi; and service on the branches varying from three trains a day to a train twice a week.

Tariffs and Rates

In 1969, the average revenue was 18 Kenya cents per ton mile, or roughly 2½ U.S. cents, compared to a figure of 1.3 cents in the United States in that year, but low by comparison with the light traffic railways of most LDCs. But this figure is misleading, in view of the wide range of rates under the differential tariff. The development and nature of East African tariffs has been analyzed in detail by Arthur Hazlewood.[1] The tariff originally was built entirely on a value of service basis, with the deliberate objective of aiding exports and placing high rates on imported goods, with rates ranging at one time as high as a shilling per ton mile. As early as the 1930s the development of road transport led to some squeezing together of the rates, but as of 1960 the rates charged ranged from 13.2 EA cents on export traffic to 36.5 EA cents for top rated commodities, per ton mile on medium distances. The range in 1969 was 10.9 EA (Kenya) cents to 38.5 EA cents.[2] While the intent was to aid exports -- as a form of export subsidy -- Hazlewood concluded that, given cost differences (the relatively low cost of handling the bulk commodity exports), there was in fact no "subsidization" of most export crops.

By the late sixties it was recognized that the rate structure was obsolete in light of conditions, and lengthy studies were

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[1] Rail and Road in East Africa (Oxford: Basil Blackwell, 1964).

[2] The monetary units of the three countries, which are kept at par, are the successors to the East African currency unit.

undertaken to revise the structure in line with costs, to which little attention had been paid in earlier years. But progress was slow; the governments, particularly that of Tanzania, wanted retention of low rates on fertilizer, maize, and livestock, and Tanzania was unwilling to approve changes until it received concessions on greater regionalization of the system. One consequence of the delay was that rates were virtually frozen from 1969 to 1974 despite sharp increases in costs, particularly of fuel.

Ultimately, basic changes were agreed upon. First, the taper for distance was revised drastically. The Hazlewood studies showed that the taper was not nearly steep enough initially (with the short distance rates too low), but continued much too far, on the basis of costs.[1] Thus the rates on short hauls were raised sharply. Secondly, the differential between the high rates and low rates was reduced, with the attempt to raise on commodities with figures below out of pocket cost and reduce the top rated goods to lessen road transport competition. Finally, lower rates were provided for large volume shipments to provide incentive to ship in larger amounts. The general effect was to shift substantially from a value of service oriented tariff structure to one more closely related to costs, and to raise the overall level in view of higher fuel costs. The net effect of the change was to cause some loss in traffic but to raise revenues. There still remains considerable differential among commodities, some based upon value of service.

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[1] Rail and Road, op. cit., Chapter 7.

After deficits in early years of the constituent parts, East African Railways earned a profit continuously up until 1967, when small deficits began to occur.[1] But basically the system was much more successful financially than that of many developed countries, as well as LDCs. But it was generally believed that the high density profitable Mombasa-Nairobi-Kampala line subsidized the lighter traffic Tanzania Central and Tanga lines.

Rail Operations

The system was operating as of 1960 with a wide variety of steam locomotives, from ones dating back to the German days in Tanganyika to a group of Beyer-Garretts, built by Manchester in England, in the mid-1950s, among the most powerful steam locomotives in the world, used on the high traffic lines.[2]

Some diesels were introduced in the early 1950s, and in the early sixties plans were made for complete dieselization.[3] But this was never completed, for reasons noted below. As of 1976, for example, on the Tanzania lines there were 50 line and 16 switching diesels, and 98 steam locomotives, of which 50 were Beyer-Garretts. Some of the others were as much as 60 years old. As the steam locomotives become

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[1] In 1970, for example, K sh. 36 million; or about 4.3 million dollars.

[2] The Beyer-Garrett is essentially two locomotives in one, designed to distribute the weight of the engine on the light-rail lines of the developing countries.

[3] As of 1957, there were 129 Beyer-Garretts, 222 standard steam locomotives, 56 tank locomotives (used for switching) and 46 diesels. (John R. Day, Railroads of Northern Africa. London: Arthur Barker, 1964, p. 39.)

older, repair costs increase, and the advantages of dieselization are being lost. East Africa has no coal; if it did, and the steam locomotives were coal burning, there would be some incidental benefit in retaining them. There are still, of course, plans to dieselize in both countries; Kenya plans complete dieselization by 1980-81.

Passenger equipment is relatively modern on the Nairobi line, but in Tanzania, most of the coaches date back to the mid 1920s.

The main line Mombasa-Kampala track remains in good condition, the other Kenya lines in satisfactory condition but many needing heavier rail. The main Tanzania lines are in fair condition, but the Central line was built cheaply, and the management believes that complete rebuilding is essential. Some of the branch lines in Uganda are reported to be virtually inoperable.

The gauge is one metre, and thus differs from the track in all of Southern and Central Africa, which is 1.067 metres. The problem will be discussed below.

The Deterioration[1]

In the late sixties a major development plan for the railway was prepared, involving change in the tariff structure, and new equipment and other features. But this was not to be implemented, except for the tariff changes noted; the system began to deteriorate in 1973 and the process culminated in 1975 in the breaking up of the system into two and to some extent three parts. The source of the difficulty

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[1] A detailed description of the disintegration of the East African Community is provided by Arthur Hazlewood, Economic Integration: the East African Experience (New York: St. Martins, 1975).

was political, not to any extent economic or technical. Relations among the three member states of the East African Community became increasingly strained. Under military dictatorship Uganda became increasingly disorganized economically for essentially political reasons, beginning with the expulsion of the Asians, and increasingly hostile to Kenya, culminating in claims to a portion of Kenyan territory early in 1976. At times Kenya railroad employees were reportedly mistreated in Uganda; Kenya at times stopped rail (and road) service to Uganda; and, after Uganda had built up large debts, restricted exports to Uganda. The issues became very complicated, in part a result of Uganda's volatile behavior. But one net effect was a decline in both import and export rail traffic to Uganda and passenger travel.

The difficulties between Kenya and Tanzania involved less in the way of personalities than differences in political-economic philosophy, and the long standing belief that Kenya benefitted at Tanzania's expense as a result of the common market. Socialist Tanzania became more and more unhappy with essentially free-enterprise Kenya and more and more determined to make its economy self sufficient. There was now a belief in Tanzania that the Tanzania lines were subsidizing the main Nairobi line, partly because Kenya was favoring road transport.

There were several consequences of these political differences (which affected other issues as well and culminated in 1977 in the liquidation of East African Airways).

1. The countries could not agree on the provision of funds to EAR for major capital improvements, and foreign lenders were inclined

to provide funds to the countries rather than the Community.

2. Tanzania and Uganda failed to remit to headquarters in Nairobi funds collected from shippers in their countries. Partly this reflected the desperate foreign exchange positions in which both countries found themselves.

3. Tanzania began to divert the Moshi-Arusha traffic to Tanga and Dar es Salaam rather than to Mombasa, the more logical outlet and the dominant one even as late as 1970 for this area.

4. Following Tanzania's action in barring Kenya road transport from hauling goods from Mombasa to Zambia (by setting uneconomically low weight limits), and belief that Tanzania was not returning freight cars, in 1975 Kenya cut the Voi-Moshi line at the border by removing two sections of rail, and the rail connection between the two parts of the system ended.

5. Disputes among the three countries resulted in the ending of all ship service on Lake Victoria, thus bringing to an end the operation of the two car ferries and rail service to Musoma, which has rail lines for loading cars to go on the ships, but no overland rail connections.

Thus by 1975 management control over the system came to an end. The Tanzania portion operated on its own, managed by regional personnel in Dar es Salaam, but cut off from the training school and the main repair shops. The portion is doing the best that it can in its own shops in Morogoro (steam) and Dar es Salaam (diesel). The main line is managed from the old headquarters in Nairobi, but the control over the Uganda portion is tenuous at best. There are other problems as well. There is a serious shortage of motive power and

cars, the major elements of the system unable to handle the traffic available. The steam locomotives are becoming increasingly obsolete; the sight of a great Beyer-Garrett taking the Moshi passenger train out of the old Dar station in March of 1976 was impressive -- but not a mark of efficiency. Several have, however, been completely rebuilt. There is a serious lack of parts, aggravated in Tanzania by the extreme shortage of foreign exchange, which makes it difficult for the railway to acquire needed items. Failure to modernize as planned, acute shortages, and obsolete equipment constitute an increasingly serious problem. Morale of employees declined sharply as the system disintegrated. The decline should not be exaggerated; the trains do run, and substantial volumes of freight and passengers are carried. But the deterioration is serious.

The system has suffered as well from increased road transport competition. Part, as noted, has resulted from inadequate capacity of the railroad, deterioration in service, and the value-of-service tariff. Road transport could easily take the high rate merchandise traffic even though its costs were higher than overall rail costs. Kenya and Tanzania, and particularly the latter, had followed, in colonial and early post-colonial periods, a very strict road transport licensing policy to protect rail traffic. But a few years after independence this policy was abandoned. Kenya encouraged African entrepreneurship in the road transport field, stressed the building of trunk roads competitive with the railroad lines, and let weight limits go unenforced. The result was a shift of much of the high rate traffic, including petroleum, from rail to road. Tanzania, with its stress on cooperatives, encouraged cooperative trucking ventures. Uganda had

never employed restrictive licensing of road transport. Furthermore, in both Kenya and Tanzania, the road licensing control was tending to break down with the development of more and more private carrier operations, with goods often handled illegally for other firms on the back haul.

As noted, these shifts should not be exaggerated. A 1976 estimate of the Tanzania government is that 42% of all traffic moves by rail, 54% by road, and 3% by water, although much of the country is not served by the railway. The volume of traffic on the Kenya line remains heavy -- but now is substantially less than in 1970.

The Immediate Solutions

With the collapse of EAR as an operating entity, the railroads have essentially, in fact, become direct agencies of the three governments (little is known of what has actually happened in Uganda). Both Kenya and Tanzania have provided funds to cover operating deficits and limited funds for improvements. (Tanzania provided sh. 37 million in 1976.) This trend will undoubtedly continue. A World Bank sponsored study by a Canadian firm, completed in 1976, concluded that regionalization of the system was essential, given political realities. Separation into three elements does not necessarily mean great loss in operating efficiency, especially if cooperation is resumed among them, and the separation offers one great advantage. In the past, while roads and road transport were regarded as a national activity, EAR was not -- to the inevitable neglect by each government of rail transport and overstress on road transport. With both rail and road instruments of each government, it should be much easier to attain an appropriate balance.

Separation, of course, will not solve the problem of loss of traffic arising out of political difficulties -- the ending of the ship service on Lake Victoria, the Tanzania-Kenya service, the collapse of the Uganda economy. It is unlikely that the Moshi traffic will ever flow through Mombasa again to any extent. But some intercountry traffic may be restored in time if the three countries again begin to cooperate.

Road Transport

Road transport in East Africa began at an early date, certainly by the 1930s, but it developed slowly, partly because of very inadequate roads, partly because of general shortage of capital, partly because of highly restrictive road licensing policy on the part of Kenya and Tanganyika.[1] The relatively long distances likewise deterred the growth. Only in Uganda, with its early development of good roads, no restrictive licensing, and relatively short hauls did road transport develop to any extent prior to independence.[2] Since the early 'sixties, there has been a very rapid increase in road transport throughout East Africa, both in non-rail areas and in competition with the railroad, particularly in Kenya, on the important Mombasa-Nairobi segment. General economic development, rapid construction of trunk roads. to which Kenya gave particular attention until 1975 (surfacing of the Nairobi-Mombasa road was completed in 1968), ending

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[1]The volume by Rolf Hofmeier, Transport and Economic Development in Tanzania (Munich: Weltforum Verlag, 1973) stresses road transport in Tanzania.

[2]E. Hawkins,, Roads and Road Transport in an Underdeveloped Country: A Case Study of Uganda (London: Colonial Research Study #32), 1962.

of the restrictive road licensing policy, failure to enforce weight limits in Kenya, deliberate governmental encouragement of cooperatives in Tanzania and of African entrepreneurship in Kenya, lack of adequate rail capacity and deteriorating rail service all contributed to the rapid growth.

The structure of the road transport industry differs among the countries. The dominant firm in Kenya is KENATCO, owned by the government of Kenya, but with much of its hauling done by independent private contractors. There are a number of independent firms. In Tanzania there have been several attempts to develop cooperative trucking enterprises; and considerable trucking is carried on by the various cooperatives and parastatals. There are some private firms, but many of these, it is reported, have been squeezed out in recent years by rising costs and fixed rates. Uganda has had much more of a private enterprise regime in trucking.

There has been little rail-road coordination. East African Railways developed an extensive road transport network (freight and bus) only in the Southern Highlands of Tanzania, particularly in the Mbeya-Iringa area, not reached by a rail line. There has been no piggy back development and little use of containers. It is argued that, given the cheapness of labor, there is little gain in containerization; in addition, there is a serious directional unbalance of traffic. But the trend to containerization in ocean freight is strong, and there is obvious potential gain for the railway from increased container use.

The road transport sector was the setting for one of the most bitter disputes in the East African Community. In 1974, because of the congestion in the harbor in Dar es Salaam, Kenya and Zambia arranged

for road transport of substantial Zambia traffic from Mombasa. In 1975 Tanzania brought this traffic to a halt by limiting road transport vehicles to 19.4 tons, without a trailer, making the traffic uneconomic. There were several motives. The announced reason, which was probably at least a partial one, was the damage being done by these trucks to the Tanzania roads. But a more significant one was the desire by Tanzania to ensure that the traffic to Zambia passed through Dar es Salaam or Tanga. In addition, there was a good bit of criticism of Kenya capitalism; while KENATCO had the contract, much of the trucking was done by private firms as subcontractors. One consequence of the action was Kenya's action in severing the rail link west of Voi.

Relative Rail and Truck Costs

Good general data on relative costs of rail and road transport are difficult to obtain. The most exhaustive study was that undertaken by the Economist Intelligence Unit for the East African Community, under World Bank sponsorship, in 1969.[1] The basic rail cost figure is well known -- in the early seventies, about 20 K cents per ton mile. Revenues are as low as 11 cents on median hauls and 8 cents on long ones. This suggests that the direct costs are at least this low, under the assumption (not necessarily correct) that the railway has not set rates below out of pocket cost. An estimate by Hazlewood for road transport in Kenya was K40 cents per ton mile;[2] O'Connor estimates, for Uganda, U50 cents if there is traffic only one way,

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[1] East African Transport Study (London: 1969).

[2] Rail and Road, op. cit., p. 66.

30 cents if there is traffic both ways.[1] Some estimates, however, indicated costs for road transport as low as 8 cents -- a figure not generally believed to be accurate. While these figures are somewhat obsolete in an absolute sense, the relationships between road and rail have probably not changed much.

Other studies suggest similar figures. East African Railways road services in Tanzania charge from 30 to 35 Tanzanian cents a ton mile for larger shipments. Costs of moving rice from Mbeya to Dar es Salaam were shown by Hofmeier to be 25 cents a ton mile,[2] of shipments from Dar to Arusha, 28 cents, whereas rail charges were as low as 7.6 cents on long haul bulk movements. Other figures for Tanzania show road costs as low as 15 cents per ton mile with a full load in both directions, 28 cents with an empty return.

The net conclusions of these and other studies are that average rail costs are lower than truck costs, but the differences are not tremendous. The great difference is between road transport costs and long distance bulk rail commodity rates, some of which, of course, may be below marginal cost. The very rapid growth in road transport in East Africa, therefore can be explained only partly in terms of lower rates; the other major factors have been inadequate rail capacity to handle the traffic (this was particularly important in shifting petroleum from rail to road between Mombasa and Nairobi), deteriorating rail service with delivery time of from two to three weeks; the greater flexibility of trucking, the emphasis of the Kenya government upon the

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[1] Railways and Development, op. cit., p. 128.

[2] Transport, op. cit., pp. 193, 196.

need for African entrepreneurship in the road transport industry; and the advantages of private carrier operation to many business firms.

The Kenya line is faced with drastic loss in traffic -- as much as 20% -- with the completion of the pipe line from Mombasa to Nairobi by the end of 1977. Originally all of this traffic moved by rail; in recent years a substantial amount shifted to road, partly because of shortage of rail tank cars, the available supply being reserved for the longer haul to Uganda. The pipe line will bring an end to all rail, as well as truck, movement; the cost reduction is estimated to be between 64 and 74 percent of present rail and road costs. The line will carry initially 1.44 million tons of petroleum a year, ultimately 5.12 million tons. There has been some controversy in Kenya over this project, but the general attitude of the government has been that the pipeline will free rail capacity for other purposes and the cost reduction will more than offset any loss to the railway. But the immediate effect is certain to be adverse to EAR.

Some Policy Issues

Some major issues relating to transport remain to be resolved in East Africa, and the future is by no means clear, partly because it depends to such a great extent on political relationships among the three countries.

1. Future rail vs. road relationships. This issue is common to all African countries and will be analyzed in the overall summary section. The particular problem of the past in East Africa was that there was no coordination of road investment and road hauling control policy, whereas the railroads were unified. If there are to be three

separate railroads in the future, this problem will be avoided, but overall coordination of transport in East Africa will be much more difficult.

2. Possible extension of rail lines. In the last decade, Tanzania has been much more enthusiastic about construction of new rail lines than Kenya (most of the new mileage since 1960, other than the TAZARA, has actually been in Uganda). But currently the one project that is under serious consideration (bids have been requested) is for a line in the Kerio Valley in Kenya, extending from Kampi ya Moto to Tenges (10 miles), Kimwarer, and Koloa, a total of 62 miles, designed to serve fluorspar and other mineral deposits. A cut off from the main Kenya line to the Arusha line to shorten the distance to Nairobi has long been considered but is unlikely to be built, given present conditions. A much more serious project is one from the Moshi line to Musoma, on Lake Victoria, to enable the traffic from Musoma to move directly by rail through Tanzania, and give Uganda a route to the sea independent of Kenya (no great advantage at the moment, since relations between Uganda and Tanzania have been worse than those between Uganda and Kenya).[1]

3. Improvement of the rail lines. While the main Kenya line remains in good physical shape, the branches are in need of heavier rail, and the entire Tanzania Central line requires substantial rebuilding, it is reported by the Tanzanian authorities.

4. The problem of the light traffic branch lines. There are a number of lines with relatively light traffic -- under 300,000 net ton miles per mile per year. The Mpanda branch in Tanzania is the worst, with less than 50,000 net ton miles per mile; built to serve

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[1] There has also been discussion of a line to connect Kenya with the Sudan railways.

lead mines that have ceased operating, it has been kept in service by direct subsidy of the Tanzania government because of limited road facilities in the area. But the long Kasese and Packwach branches in Uganda have traffic under 300,000 net ton miles. Studies elsewhere indicate that such services are particularly likely to be sources of deficits -- yet they may be important for regional development purposes.

5. Gauge. As discussed in the following section EAR and TAZARA gauges are different and no interchange of traffic is possible.

The Effects of the Railways upon Economic Development in East Africa

Two studies in the last decade have considered the question of the effects that the building of railway lines have had in East Africa, that by A. M. O'Connor on Uganda,[1] and of Rolf Hofmeier in Tanzania.[2] The studies suggest that the building of the Kenya-Uganda line from Mombasa to Kisumu, with the steamer connection to Uganda, the Tanga-Moshi, and the Tanzania Central lines all significantly aided economic development, by allowing the development of export-oriented agriculture and other activities and importation of manufactured goods. In doing so they perpetuated the export-of-materials, import-of-manufactured-goods approach to development, from which a break has been made only in recent years. The whole pattern of economic activity of Tanzania centered around the two rail lines, whereas the Southern Highlands, with many economic advantages, lagged badly. The Kenya-Uganda railway was almost solely responsible for the existence

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[1] Railways and Development, op. cit.

[2] Transport and Economic Development, op. cit.

and dominance of Nairobi.

But there is strong evidence that later rail building had much less economic effect, even the rail line from Kisumu to Kampala. Economic activity in Uganda never has clustered around the railway as in many other African countries. The Kasese line in Uganda, while allowing the development of copper mining, contributed little to overall economic development of western Uganda, given the availability of road transport. The Mpanda line in Tanzania did little to create activity, and the Manyoni-Kinyangari line built in the 'thirties in central Tanzania into the Singidi region had so little effect that it was abandoned in 1947. The extreme case was the line from Mtwara to Nachingwea and Masasi in southern Tanzania. Built as an element in the groundnut scheme, it had so little effect on development that it was abandoned in 1962, eight years after building (and 4 years in the case of Masasi branch), following the end of the scheme. Abandonment may have been premature but certainly there was no evidence of stimulus to economic activity.

ZAMBIA AND OUTLETS TO THE SEA

The development of few if any African countries has been influenced as much by the railroad as Zambia. Virtually all commercial activity has developed in the narrow belt up through the center of the country known as "line of rail". Furthermore, no other country has had its pattern of rail traffic so disrupted in recent years as Zambia, and it has shared with Tanzania the most important rail construction project in the developing world in the last several decades.

Development of Railways to Zambia[1]

Unlike other tropical African railways, the line reaching Zambia was not built directly in from the nearest port, but came north out of southern Africa. In the early 1890s, the South African railway system reached Mafeking (famous for the great siege in the Boer War) and the Rhodes interests (British South Africa Co.) pushed a line across the deserts of Bechuanaland (now Botswana) to reach Bulawayo in 1897. Already there were European settlers in Southern Rhodesia. The line, later called Rhodesia Railways (RR), was designed in part to provide access to the settlers and the farm land, but Rhodes was also lured by the known but as yet undeveloped mineral resources in what are now Zambia and Zaire, and by his dream of a Cape to Cairo railway. The line reached the coal mines of Wankie in 1903, crossed the Zambesi into Northern Rhodesia at one of the few feasible spots, just below Victoria Falls in 1903, and reached the lead-zinc mining area of Broken Hill (now Kabwe) in 1906. A siding about half way up through Northern Rhodesia was labeled Lusaka; three decades later (1935) the site was designated to become the capital of the colony. A line also was extended north from Bulawayo to Salisbury, (1902) and in 1899 another BSA railroad had reached Salisbury from the port of Beira in Mozambique. In 1909 in an effort to obtain an outlet for copper mines they were developing in Katanga in the southern Congo, British interests headed by Sir Robert Williams built south from the Congo to join Rhodesia Railways at Broken Hill. This line, as far as the Congo border, was taken over by RR in 1928. Rhodesia Railways was an element in the great BSA complex in Central Africa; BSA ruled Northern Rhodesia politically as well as economically until 1924, when the area became a crown colony.

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[1] A survey of the development of the rail lines to Zambia is provided in the chapter by R. M. Bostock, "The Transport Sector", in C. Elliott, ed., Constraints on the Economic Development of Zambia (Nairobi, Oxford Univ. Press, 1971), pp. 377-96.

Tanganyika Concessions, Ltd., the Williams enterprise, also built the Benguela Railway, extending from the port of Lobito in Angola to the Congo border, reached in 1931, connecting with the Congo lines, thus providing the Katanga mines and those of Zambia with another outlet to the sea. Likewise in 1928, Belgian interests completed a line from the Katanga area to Port Francqui (now Ilebo) on the Kasai River, from which water transport was available. In 1947 Rhodesia Railways was nationalized; after 1949, under a statutory authority of the countries involved, and following the formation of the Federation of Rhodesia and Nyasaland in 1954, the system was transferred to the Federation. The center of operations and the main shops were in Bulawayo. Another route to the sea from the Bulawayo-Salisbury line to Lourenco Marques in Mozambique -- providing a less congested route for Zambia traffic than the Beira line -- was completed in 1955.

Thus at the time of independence of Zambia in 1964, virtually all import traffic (including petroleum) and export traffic to Zambia was handled by Rhodesia Railways;[1] few countries in the world were so completely dependent on rail transport for their access to the outside world. Most Zambia traffic moved via Beira and Lourenco Marques; there was likewise substantial through rail traffic between Zambia and South Africa, traditionally the supplier of processed foods and many other commodities for the country. There was only a limited

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[1] Even the headquarters of Zambia Customs and Excise was (and still is) located in Livingstone.

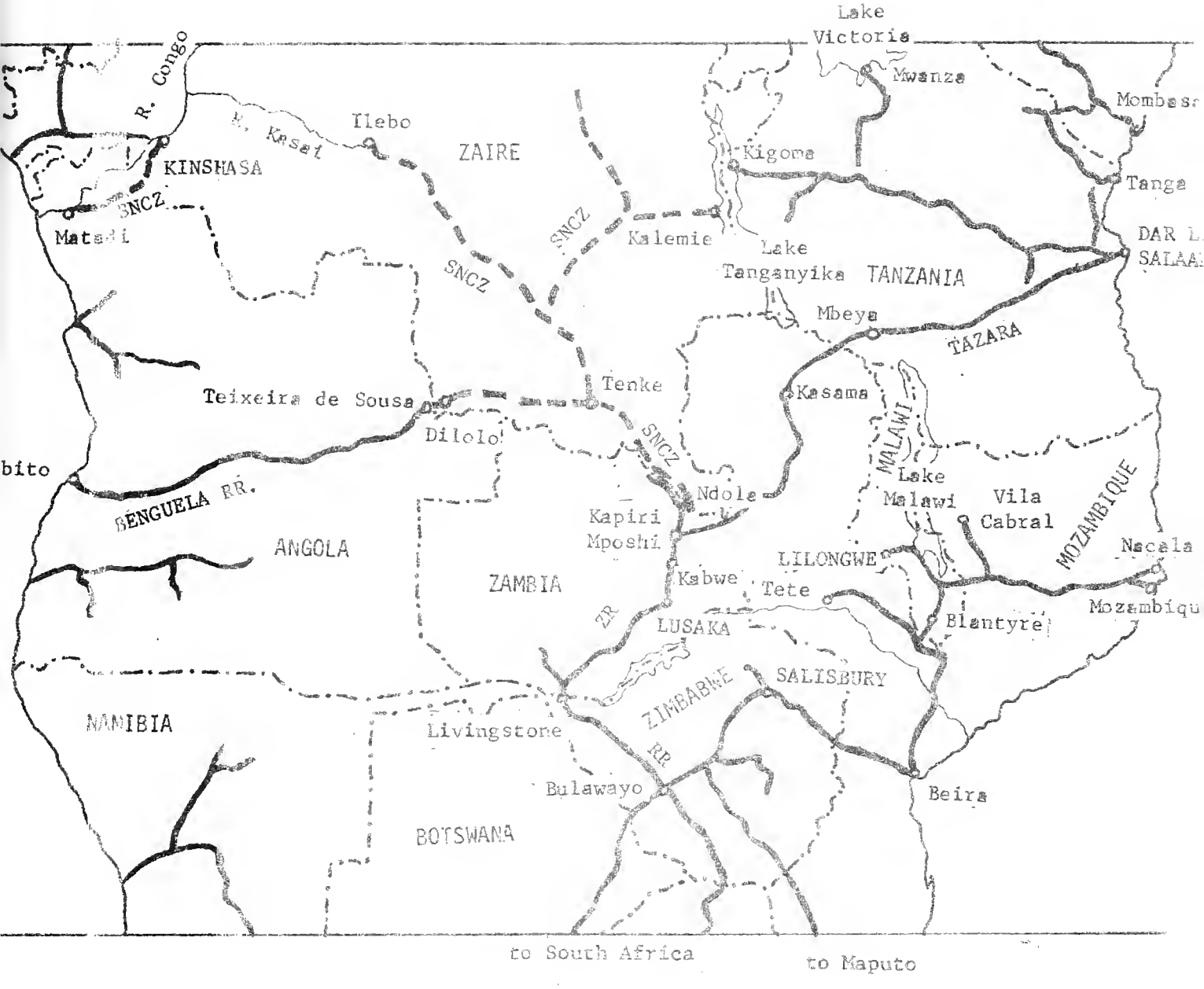

Fig. 2

Railways of Central Africa

0 50 100 250
Miles

amount of road transport, primarily with Rhodesia.[1] Initially after independence Rhodesia Railways was owned and controlled jointly by Zambia and Southern Rhodesia, still a Crown colony. The Lobito route via the Benguela handled little Zambia traffic.[2] Zaire copper moved partly via the Benguela, partly via the Port Francqui route, under pressure from the Zaire government. Most of the Benguela's traffic came from within Angola.

Disruption of Traffic Patterns

The twelve year period from 1965 through 1976, and particularly 1973-1976 saw several major disruptions in access routes to the sea and in traffic patterns within the country. These disruptions resulted entirely from political events, which can be noted briefly:

1. In 1965 Rhodesia declared itself independent from Great Britain. UDI -- Unilateral Declaration of Independence, as it was called -- under a white regime was viewed with great disfavor in Zambia. Zambia forced the dissolution of Rhodesia Railways as a joint venture as of July 1, 1967, and took over operation of the portion north of the Victoria Falls bridge, but with loss of most of the employees (the great majority were white and most preferred to stay in Rhodesia), and with an inadequate share of rolling stock and engines.[3] For a time

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[1]The rail distance from Lusaka to Salisbury was almost three times the road distance. A direct rail link, crossing the Zambesi at Chirundu, was long planned.

[2]This was a product of agreements between the railways and the copper companies. In 1936 the copper companies agreed to ship entirely via RR in exchange for low rates. In 1957 under pressure of the companies, RR agreed to let a specified amount of copper move out via Lobito, but then quoted such a low rate on this segment that it also moved via Rhodesia.

[3]The first year of Zambia Railways operation was one of chaos, derailments, and inability to keep coal moving to the mining complex. Toronto Globe and Mail, October 11, 1968, p. 2.

all engines had to be sent to Bulawayo for repair, until Zambia completed its own repair shops at Kabwe (formerly Broken Hill). Even the billing was done from Bulawayo for a time. Zambia was committed to use RR for all rail traffic or pay a penalty on any traffic diverted, under the terms of the breakup.

Secondly, the government began to divert a substantial amount of traffic via truck transport to Dar es Salaam, under great difficulties because of the bad condition of the Great North Road, and via the Benguela. After Rhodesia cut off petroleum supplies, the country was drastically short of petroleum products, which had to be trucked from Dar es Salaam until a pipe line was completed from Dar es Salaam to Ndola in 1968. Despite these changes, however, a substantial portion of the copper exports and imports of necessity still came via Rhodesia Railways (Table 2). There were endless feuds with Rhodesia over car supply -- in general Rhodesia would permit only the same number of cars to go into Zambia as returned from Zambia.

2. In 1973, Zambia closed the border completely with Rhodesia, following temporary closing by Rhodesia, as a result of political disputes. This resulted in immediate and drastic changes in traffic patterns, as two thirds of the imports and over half the exports were still moving via Rhodesia. Most of the exports and a large portion of the imports formerly going via Rhodesia were shifted to the Benguela route, causing serious congestion at the port of Lobito. This pattern continued through the first half of 1975. Road transport to Dar es Salaam, Malawi, and Mombasa in Kenya rose sharply in 1973.

3. In 1975, the Benguela route was disrupted and finally closed in August by hostilities in Angola.

Table 2. Percentages of Zambia Import and Export Traffic Via Various Routes

Exports

	1953	1959	1963	1967	March 1968	1969	1970	1971	1972	1973	1974	1975	1976[2]
Lobito and Zaire	0	15	0	23	21	17	22	22	20	54	55	40	13
Dar - Road			0	31	24	35	30	28	26	35	35	45	38
- Rail												6	38
Kenya	0	0	0	0	0	0	0	0	0	6	9	neg.	1
Malawi	0	0	0	8	8	0	1	1	1	5	1	9	5
Kazangula	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodesia	100	85	100	34	32	48	47	49	54	1	0	0	0
Mozambique	0	0	0	0	0	0	0	0	0	0	0	1	4
Kigoma	0	0	0	0	5	0	0	0	0	0	0	0	0
Air	0	0	0	5	9	0	neg.	neg.	neg.	0	0	0	0

Imports

	1970	1971	1972	1973	1974	1975	1976[2]
Lobito and Zaire	7	16	11	49	45	29	neg.
Dar - Road	15	18	19	23	28	35	34
- Rail	0	0	0	0	2[1]	8[1]	42
Kenya	0	0	0	8	9	3	3
Malwai	1	2	3	13	13	15	10
Kazangula	neg.	1	neg.	1	2	5	neg.
Rhodesia	77	64	66	4	0	0	0
Mozambique	0	0	0	0	0	3	7
Kigoma	0	0	0	0	0	0	0
Air	0	0	1	3	3	2	3

Source: based on data in Annual Reports, Bank of Zambia and Economic Reports, Ministry of Development Planning, Zambia.

[1]Road-rail combination.
[2]First 11 months.

At the same time, in October of 1975, the new TAZARA rail was opened for limited service, as explained in detail below. But initially TAZARA had only limited carrying capacity, and Zambia was forced to increase reliance on the Dar es Salaam and Malawi truck routes substantially -- in a period when equipment had been declining in anticipation of opening of TAZARA. To complicate matters still further, late in 1974 Tanzania effectively halted road transport from Mombasa -- the most efficient port in the entire region.

The rerouting following the border closing in 1973 had increased transport costs by an estimated Kwacha 20 million (about $30 million U.S. dollars) in that year, and K 30 million in 1975 -- adding to inflationary pressures in Zambia.[1]

Zambia Railways

The internal rail system of the country is now entirely operated by Zambia Railways (ZR), wholly owned by the government, but operated as a separate government corporation, in the same fashion as Zambia Airways. Its own line is 650 miles in length, and it also operates about 75 miles of the former Zambesi Sawmills Railway, as an agent for the government. The main ZR line extends in a general north-south direction from the connection on the Victoria Falls bridge with Rhodesia Railways via Lusaka to the Copper Belt, specifically, via Ndola and Kitwe and Chililabomwe to Konkola, on the Zaire border, with branches,

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[1]In the period 1973 until May of 1976 K = U.S. $1.55; after devaluation that month K = U.S. $1.25. For some years prior to 1973 K = U.S. $1.40.

all in the Copper Belt, to Mufilira, to Luanshya, and from Ndola to Sakamia to connect with the Zaire lines. There are no other branches except a short one serving the Maamba coal mines. The former Zambezi Sawmills Railway, built to serve the timber industry in the Southern province, extends northwestward from Livingstone to Mulobezi. The line once extended another 50 miles to Kataba for the handling of logs, but this portion is not now operated (though shown on most maps).

ZR was built to the 1.067 metre gauge -- known as Cape Gauge -- used by all main lines from Zambia and Zaire south. Track is in good condition; the sawmills line, which had deteriorated, has been rebuilt in the last two years. ZR is entirely dieselized, with 80 diesels; 10 were received in 1975 and 8 more are on order. These are U.S. General Electric built engines, with which the system is well satisfied. A number of the Beyer-Garretts inherited from Rhodesia Railways are still in the yards in Livingstone awaiting ultimate scrapping. A number of new freight cars (wagons) have been acquired, typically with 40 ton capacity, and another 1000 are on order. Cars are freely interchanged -- in normal times -- with the Benguela and Zaire, Rhodesian, South African, and Mozambique lines.

Gross revenue of the railway in 1975 was K 27.9 million; in 1976 an estimated K 35 million. Despite the complete disruption of traffic patterns in recent years (when copper moves out via the Benguela, ZR receives little revenue, and not much more with TAZARA), the great increase in road transport on the import-export routes, the petroleum pipe line, and the shift to petroleum from coal by the mining complex for many purposes, the road has avoided large deficits (the figure in 1975 was only K 600,000) and hopes to be covering all

costs in the immediate future.

Since independence the road has been assisted in many ways by Canadian National Railways. A formal management contract expired in November 1975, with management entirely Zambianized, but CNR still provides technical assistance. Almost the entire staff of employees has been new since 1967. Headquarters and main shops are in Kabwe.

The traffic patterns, as noted, have shifted dramatically. Prior to 1967 virtually all imports came in via Livingstone and were taken north almost the entire distance of the line to the Copper Belt and over half of the entire line to Lusaka. This traffic included very heavy volumes of petroleum products coming from Beira, coal from the Wankie mines in Rhodesia, and products from South Africa, including fertilizer, coke, farm and mining equipment, processed foods, etc. The copper and other exports (copper constitutes about 95% of the total) came down the entire distance from the Copper Belt to the Victoria Bridge. Currently nothing for Zambia comes in at Victoria Falls, although in the last two years the road has handled substantial transit traffic for Zaire from Rhodesia (copper going out, particularly after the closing of the Benguela, coal and maize coming in). By agreement with Zaire, Zambia handles this traffic, although it will not handle any Zambia traffic from Rhodesia.

The principal ZR traffic items in recent years have been copper, hauled the relatively short distance to the Zaire border and now to the junction with TAZARA at Kapiri Mposhi; some lead and zinc from Kabwe to Kapiri; substantial movements of maize, mostly from southern Zambia points to the Copper Belt and for export to Zaire and Tanzania; and coal, from the Maamba mines to the Copper Belt. The government has

been moving all petroleum products within the country by road, but some of this is likely to be returned to rail. In 1975, 59 percent of ZR traffic was domestic, the rest, export traffic.

Traffic volume was 1,323 million ton miles in 1973, 1,105 million in 1974, and about 1,300 million in 1975, or 2.2 million ton miles per mile of line. The revenue is about 2.6 ngwee per ton kilometer, compared to an estimated average of 5 to 6 ngwee for heavy volume trucking. The 2.6 figure is roughly equal to 4.6 U.S. cents per ton mile at current exchange rates. The traffic volume is not as heavy as on the main Mombasa-Nairobi line of EAR, nor the expected volume on TAZARA when it is in full scale operation; it is somewhat comparable to that of the Tanzania Central line and adequate to allow reasonably low cost.

The tariff is basically a class tariff comparable to that of East African Railways in many respects, with 14 classes, classification based on cost, value of service, and essentiality considerations, plus separate rates for tank cars and mineral products (the lowest figures) and special rates on copper. There has been less concern thus far about the loss of high rate commodities to road transport than in some countries because transport is so completely controlled by the government, given the scarcity of facilities.

For many years, daily passenger service was operated Lusaka-Livingstone, and overnight 3 times a week Lusaka to the Copper Belt. The initial equipment after independence consisted of ancient wooden open vestibule cars of Rhodesia Railways. These were replaced by diesel motor trains, and in 1975 by new equipment manufactured in

Japan. Since that time two trains a day are operated each day, the relatively fast Kafue and the slower Luangwa. The former provides three classes -- sleeper, standard, and economy, the latter standard and economy. In 1976, the sleeper fare Livingstone-Lusaka was K 16.60; standard K 8.30; economy K 5.50. These are roughly 6, 4, and 2 U.S. cents a mile fares. About 1,200,000 passengers are carried per year.

Internal Road Transport

Road transport in Zambia is dominated by Contract Haulage, formerly Central African Road Services, a parastatal organization. CH maintains a fleet of its own trucks and contracts with private trucking firms. It also handles the Malawi export-import road service as a part of the Dar es Salaam traffic as a subcontractor. Rates range (1974) from 1.2 to 4.6 ngwee per ton kilometer. Both CH and private firms contract with NAMBORD, which controls all farm product marketing, for transport of farm products, on a set rate schedule, which in 1974 was as follows: fertilizer and maize: ng per t/KM 7.50 up to 80 km, 6.75, 81-160 km; 6 over 160; cotton, ng per t/m 9. NAMBORD's policy is to use rail wherever feasible, partly because it is cheaper, partly because of general government policy.

In the days before independence, the Federation restricted road competition with the rail system drastically, and while present policy is less restrictive, there is no free competition, and so much of the total traffic is by or for parastatal organizations that the

picture differs markedly from that of Kenya.

The Export Routes

The major export routes noted above can be described briefly.

1. Rhodesia Railways to Beira and Lourenco Marques (Maputo)

As noted, this route carried virtually all traffic, import and export, prior to 1967. The line was well built and the equipment modern. The revenues rose steadily up until 1966, but the operating ratio was relatively high, averaging 84 in this period.[1] Rate policies were influenced by the desire to hold the copper traffic from the Benguela, but the usual pattern was to keep copper rates at relatively high figures, except on the marginal traffic that could, by agreement, go via the Benguela. This amounted to a type of profits tax on the railway, benefitting the Federation and reducing the amount that Northern Rhodesia and then Zambia could raise by an income tax on the copper companies' profits. Particularly high rates were charged at times on Zaire copper, but the Zaire firms could not effectively avoid it because they had to rely on RR for their coal from Wankie.

After years of profit, except in the 1962-63 period, the loss of traffic and rising costs resulted in small deficits in the early 1970s; in 1974, the first full year after closure of the border, the system incurred a net loss of K 10 million (about $15.5 million), and in 1975 K 21 millions ($31 million). Guerilla warfare has resulted in

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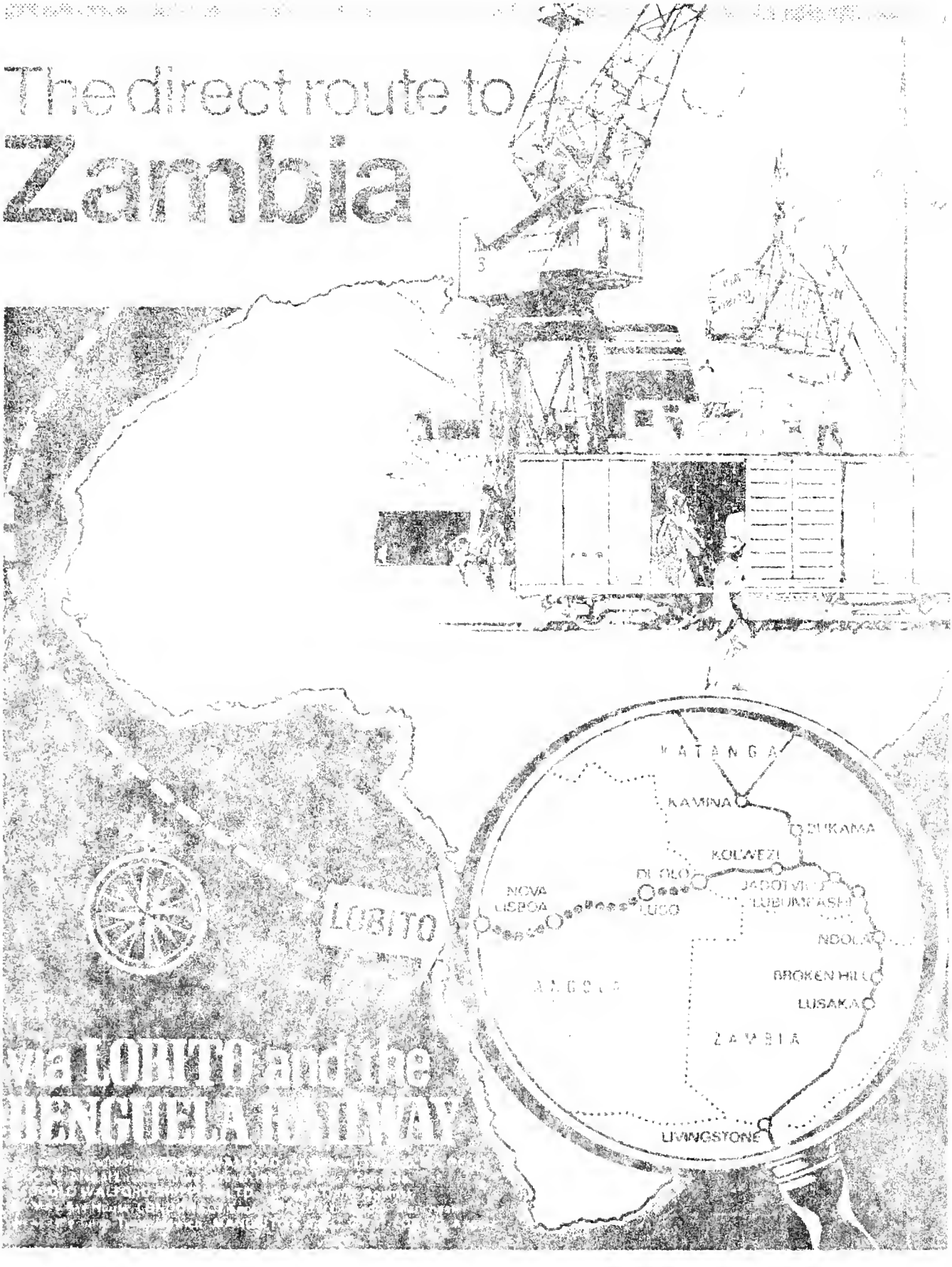
[1] A. R. Prest, Transport Economics in Developing Countries (New York: Praeger, 1969), p. 95.

some damage to the lines.

From a longer range standpoint, African rule of Zimbabwe (Rhodesia) will undoubtedly result in some resumption of traffic from Zambia via Victoria Falls and Mozambique ports, and trade between Zambia and Zimbabwe, although the Salisbury-Lusaka-Copper Belt traffic except in bulk commodities is almost certain to go by road. Opening of the border at Victoria Falls would also result, in all likelihood, in resumption of rail traffic in fertilizer from South Africa, and in beef and other products from Botswana. But never again is this likely to be a major route for exports and imports for Zambia

2. The Benguela Railroad, via Zaire and the port of Lobito

This route involves, in traffic from the Copper Belt, a relatively short haul on Zambia Railways, thence via the Zaire system (SNCZ) through Lubumbashi to Tenke, on the main line to Port Francqui, and westward to Dilolo, and thence westward on the Benguela to the port of Lobito. The Benguela has been a subsidiary of Tanganyika Concessions, Ltd., a British firm, and unique in its reliance on wood burning steam locomotives. The line was to revert to Portugal in the 1980s; its present status is not clear, but undoubtedly it has been or will be nationalized. This route offers one very significant advantage: since Lobito is on the Atlantic, the total haul is substantially less than via Indian Ocean ports, and substantial time -- as much as two weeks -- is saved. This is particularly important on imports. But use of the route was long restricted by the agreements between the mining companies and Rhodesia Railways and by rate policies of the latter; by the fact that the port of Lobito was less satisfactory


The direct route to
Zambia
LOBITO
via LOBITO and the
BENGUELA RAILWAY
KATANGA
KAMINA
DUKAMA
KOLWEZI
DILOLO
JADOTVILLE
LUBUMBASHI
NOVA LISBOA
LUCO
NDOLA
BROKEN HILL
LUSAKA
ANGOLA
ZAMBIA
LIVINGSTONE

in handling cargo than Beira; by limitations on capacity on outbound traffic because of the handling of large quantities of Angolan manganese and iron ore; and, in the period between Zambian and Angolan independence, the reluctance of the Zambian government, for political reasons, to make use of this route.

Once Zambia closed the Rhodesia route completely, it was forced as a practical matter to make greater use of the Benguela, in part because Lobito alone could handle some types of heavy cargo. Furthermore, Angolan independence was by then assured. In 1972 this route handled only 14% of Zambia's imports and exports; in 1974, about 50%. In that year, for example, the port handled some 104,000 tons of wheat for Zambia; 51,000 tons of coke; 259,000 tons of general import cargo. But this sudden shifting of traffic onto the Benguela coincided with substantial unrest in Angola as independence approached and loss of Portuguese technicians, which led to congestion in the port, surcharges by the shipping firms, and delay in handling cargo. Then came the final breakdown in late 1975 as military action resulted in severe damage to the line, and destruction of two major bridges, at Lumeje, west of Luso, and at Luau, close to the Zaire-Angola border. Continued unstable conditions resulted in delays in rebuilding the line and bridges. About 800 Zambia Railway freight cars were stranded in Angola, new diesels for the railway, and substantial quantities of copper.

Up until recent disorders, the Benguela has been a consistently profitable venture, with an average operating ratio for 1955-60 of 60,[1] and consistent dividend payments. Partly, of course this was a

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[1]Prest, op. cit., p. 96.

product of the absence of road transport competition; there are no roads of any kind between Zambia and Katanga (now Shaba) and the Atlantic. Secondly, it handles a substantial volume of traffic, although much of it is of low value and rates.

Over time, the Benguela should again become a significant outlet to the sea for Zambia, particularly for import traffic, given the importance of speed. While Zambia is committed in principle to concentrate traffic on the Dar es Salaam route, there is substantial feeling that the country should never allow itself to be dependent solely on one route. Possible completion of an all-Zaire route would hurt the Benguela to some extent, but renewed development in Angola should in time more than offset this.

The capacity of the Benguela was greatly increased by the completion, in 1974, of the Cubal variant, 128 km of relocated line beginning about 350 km east of Lobito, built to eliminate severe grades that reduced train speed and length drastically.

The lines in Zaire were built by several private firms, allied with the mining complex in Katanga and to some extent with the Benguela. The most important was BCK (Bas-Congo au Katanga), later KDL (Kinshasa-Dilolo-Lubumbashi), the main route from the Zambia border to Port Francqui (now Ilebo).[1] A second major route extends northeastward from Kamina, on the Ilebo line, to Kindu as a part of rail-water-rail route to Kisangani and of the original all-Congo route to the ocean. From Kabalo a branch (built in 1915) extends eastward to Kalemi (Albertville) on

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[1]The portions from Lubumbashi to Kamina and the junction at Tenke to Mutshatsha are electrified -- the only electified system in all Tropical Africa.

Lake Tanganyika.[1] This system was not connected with BCK between Kabalo and Kamina until 1957. These lines have been nationalized in recent years, consolidated as the Societe Nationale de Chemins de Fer Zairois (SNCZ). The all Congo route to the sea requires transfer to steamer at Ilebo on the Kasai River, transfer back to rail at Kinshasa, and to ocean going vessels at Matadi, Zaire's only ocean port. There have been extensive discussions about the building of a connecting link from Kinshasa to Ilebo, through difficult terrain. Completion of this link would result in substantial diversion of Zaire traffic from the Benguela. Thus far Zaire has been unable to obtain financing for this project.

Apart from the export traffic to Lobito, there is a considerable volume of traffic between Zambia and Zaire, consisting largely of maize exported to Zaire. Some 41,000 tons were reported in 1975. As of 1977, some Zaire copper traffic is moving to the ocean via Zambia and TAZARA, as noted below. From a longer range standpoint, there is substantial traffic potential between the two countries. The road system of Zaire is very limited.

3. The Kenya Route

The port of Mombasa is one of the most modern in the world, one of the few good natural harbors in all Africa. It has not been congested in recent years, in part because of the diversion of the Arusha-Moshi traffic to Tanzanian ports. In 1973 KENATCO, the Kenya-government-owned road transport firm, commenced to haul Zambian copper out, primarily sulphur and lubricants in, to the point at which

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[1] This line was operated by the Compagnie de Chemins des Fer du Congo Superior aux Grands Lacs Africains.

it was handling about 9 percent of the Zambia traffic. Much of the hauling was done by private Kenya firms under contract to KENATCO. As noted, in late 1974 Tanzania put an abrupt end to this traffic by setting a 19.4 ton maximum load and banning trailers, thus making road haulage uneconomic.

4. The Malawi Route

The original rail line to Malawi (then Nyasaland) was built north from Beira via Blantyre to Salima, on Lake Nyasa. In 1970 a line was completed east and west from Nova Freixo on the rail line from the port of Nacala and Mozambique (city) to Vila Cabral, in Mozambique east of Lake Nyasa to connect with this line north of Blantyre, at Nayuci. The Malawi route with road transport to Salima was used for Zambia traffic to some extent from 1967 on. After the closure of the border with Rhodesia and the serious port congestion at Dar es Salaam, greater use of this route was undertaken, primarily for the handling of fertilizer, which comes from South Africa -- and Tanzania will not handle any traffic originating in South Africa. By 1975, 75% of all fertilizer was coming by this route, and considerable general cargo, and about 10% of the export of copper. Several problems arose very quickly: lack of freight cars by Malawi Railways and congestion in the ports of Nacala and Beira, due in part to loss of Portuguese technicians after independence. The hauling to the railhead has been done by Contract Haulers, owned by the Zambia government, but it has been possible to handle only 12.5 ton loads, given the roads. Extension of Malawi Railways to Lilongwe has shortened the road haul somewhat. There has also been some road hauling from Zambia to Moatize, near Tete, the rail head in Mozambique, but the

road conditions are particularly unsatisfactory.

From a longer range standpoint, this route, with improved roads and/or a rail connection, as noted below, may have some potential, but for the Copper Belt traffic it can scarcely be competitive with TAZARA.[1]

5. Kazengula Route

With the Rhodesian border closed, Zambia was cut off from direct contact with both Botswana and South Africa except by the Zambezi River crossing at Kazangula. The state of roads in Botswana prevented this road route from being a significant avenue of commerce, but it has been used for the handling of some mining equipment and supplies from South Africa, which, together with fertilizer, have been the only items Zambia has been purchasing from that country. This traffic in general moved through by road to the Copper Belt destinations.

6. The Lake Tanganyika Routes

A route which traditionally was used for some traffic to Zambia involved rail movement on EAR's Tanzania Central line to Kigoma, transfer to steamer for the trip down Lake Tanganyika, and road transport from Mpulungu at the south end of the lake. In the late sixties, for example, considerable copper moved out this way, and gasoline for northern Zambia came by this route. But it was a slow route at best, requiring twice the time of the road haul to Dar es

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[1] Malawi Railways, with relatively short hauls, has not been highly profitable; the operating ratio 1960-65 averaged 80, with an upward trend. Prest, op. cit., p. 95.

Salaam, and two transfers. Use came to an end when the engines of the sixty-year old EAR steamer Liemba, the only vessel in the service, gave out in the early 'seventies. An alternative route, involving rail movement through Zaire to Kalemie, crosslake transfer, and EAR from Kigoma, has not been a viable one.

7. Air Freight

For a time, following the initial attempt to restrict traffic via Rhodesia and the petroleum shortage, air transport between the Copper Belt and Dar es Salaam was used to haul copper out and supplies in. But this proved to be very costly, and improvements in the Great North Road allowed the cessation of this traffic. Air freight, however, continues to be important for importation of some goods from Europe and Kenya, and meat from Botswana. It amounted to only 2.8% of the Zambia imports in 1975 and yet required 17 percent of the country's payments for external freight traffic.

8. The Dar es Salaam Route -- Road Transport

At the time of independence in Zambia, the Great North Road to Dar es Salaam was a bare trek through the semi-desert, impossible in bad weather. Following UDI in Rhodesia, the government of Zambia began an organized effort to haul copper out and imported goods in by road transport over this road. The result was a sharp increase in cost and very substantial damage to imported goods -- but a substantial volume of goods flowed both ways. Gradually, with U.S. aid, the road was surfaced and the flow became much more regular. But it never handled more than half of the total flow of traffic. In the year 1974, 70,000

tons of steel, 40,000 of chemicals and fertilizer, 16,300 tons of timber, 145,000 tons of general merchandise were hauled in. In that year there were 11,625 trips out, 12,613 in, or about 30 a day each way. Some 245,000 tons of copper were carried out, and 73,000 tons of maize to Tanzania. Zambia-Tanzania Road Services (ZTRS), owned by the two governments and an Italian firm, had the basic contract and carried about half the traffic in its own trucks; Contract Haulage (CH), owned by the government of Zambia, a portion; and private subcontractors the remainder. ZTRS used trucks in the 25 to 30 ton range, averaging 23.1, Contract Haulage, 21.5 (net cargo). ZTRS was using 442 trucks; CH, 105; and the other subcontractors, 419. The vehicles averaged from 1.3 to 1.7 round trips per month. As of 1974, the rate on copper was K 54 per ton, on general cargo, K 49. The latter rate was 2.45 ngwee per ton kilometer, the equivalent of about 6.7 cents per U.S. ton mile at 1975 exchange rates or 5.3 cents at the more realistic 1977 exchange rate. All in all, this was a very impressive performance, particularly considering the fact that it was started from almost nothing, on the one hand, and phasing out, or at least great reduction, was ultimately planned.

9. TAZARA -- The Dar es Salaam Rail Route

The idea of a railroad from the Copper Belt directly to the Ocean had been considered long before Zambian independence. The first serious study was made by a consultant for the British Colonial office, published in 1952;[1] after independence, studies were made by the World

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[1]United Kingdom Colonial Office, Report on Central African Rail Link Development Survey, 2 vol. (London: HMSO, 1952).

Bank (1964) and the Economic Commission for Africa, which found such a railroad to be uneconomic.[1] But the government of Zambia was extremely anxious to end reliance on the Rhodesian outlet, and Tanzania was highly sympathetic to a rail line across the southern part of the country. The presidents of the two countries agreed on the desirability of the line in 1964. While the World Bank, the United Kingdom, and the Soviet Union all rejected requests to assist, a Canadian study (1966) indicated the economic feasibility of the line, even if the other routes could be used.[2] In 1967 Zambia and Tanzania reached an agreement with mainland China to build the line.[3] The original plan to build to a connection to EAR was abandoned because of the gauge difference, and the final plans called for a line all the way to the Dar harbor. Construction began in 1970, the Zambia border was reached in 1973, and a connection with Zambia Railways at Kapiri Mposhi was completed in October of 1975. The railroad is known as TAZARA.[4]

The route passed through Mbeya (but not Iringa, the other major city in southern Tanzania), and Kasama and Mpika in Zambia. The final length was 1852 kilometres, or 1158 miles, to the junction; thus the distance to Lusaka is about 1275 miles. Many observers were skeptical for several years that the line would be built, and there were rumors that

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[1] A Brookings Institution study was also very critical on the grounds of unnecessary duplication. See E. T. Haefele and E. B. Steinberg. Government Controls of Transport -- An African Case (Washington: Brookings, 1965).

[2] British-Canadian Report on an Engineering and Economic Feasibility Study for a Proposed Zambia-East Africa Rail Line (London: 1966).

[3] A good survey of this development is to be found in Richard Hall, The High Price of Principles (London: Hodder & Stoughton, 1969), Chapter 14, and George T. Yu, "Working on the Railroad: China and the Tanzania Zambia Railway," Asian Survey, Vol. 11 (Nov. 1971), pp. 1101-15.

[4] For Tanzania Zambia Railway Authority. It is owned jointly by the two governments.

the U.S. aid for surfacing the Great North Road was designed to head off construction of the railroad.[1]

TAZARA operates to a separate set of docks in the Dar es Salaam harbor used exclusively for Zambia cargo.

Operations began on a limited scale in October of 1975, as a trainload of wheat for NAMBORD reached Kapiri Mposhi as the first cargo. Initially operations were confined to one freight train a day, with 30 cars, and operations were gradually stepped up. In December 1975 20,000 tons of copper were carried, and in June 1976, 58,000 tons. By late 1976, the typical copper traffic was 42,000 tons a month. In the first 12 months of operation, 350,000 tons of freight were carried and 293,000 passengers; in the first eleven months of 1976, 610,000 tons. The initial capacity, once full scale operations are under way, will be 2 million tons in each direction per year -- about twice the present needs of Zambia. In recent years slightly under 1 million tons have moved each way, exclusive of the pipeline traffic, which is almost as great as the surface imports in tonnage. Ultimately capacity is planned to reach 4.3 million tons each way, and finally, 7 million. This would require 17 freight trains a day each way. At present 5 trains each way per day are operated. The entire emphasis in this early period has been upon outbound movements of copper, inbound of bulk shipments, leaving much of the manufactured goods traffic to road transport for the moment. This will be phased down, but some may be retained. Much of the road transport fleet is near the end of its useful life.

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[1] Two books have already appeared on TAZARA; by R. Hall and H. Peyman, The Great Uhuru Railway (London, Gallanz, 1976) and M. Bailey, Freedom Railway (London: Collings, 1976).

Currently the line is also handling a substantial amount of Zaire copper traffic, because of the problems with the Benguela. It is expected that some Zaire products will continue to move over TAZARA. There is also substantial traffic within Tanzania, particularly to the Mbeya area. On July 14, 1976, the road was turned over by the Chinese contractors to the TAZARA authority, but about 1,000 Chinese will remain to aid in instruction, gradually being phased out over the next two years.

While TAZARA connects with Zambia Railways at Kapiri Mposhi, and the gauges are the same, immediate free interchange of equipment was impossible. Zambia Railways, like the entire network of rail lines of central and southern Africa, uses vacuum brakes rather than air brakes, whereas TAZARA equipment was designed with air brakes -- as is East African Railways and most of the rest of the world. ZR converted several of its diesels to air brakes, and thus has been able to bring TAZARA trains to the Copper Belt and to Lusaka. But the cars cannot be mixed in trains and substantial traffic has been off loaded on to road transport at Kapiri Mposhi. The intent is ultimately to change entirely to air brake operation -- but this requires change by the other countries in southern Africa as well.

TAZARA headquarters are in Dar es Salaam, shops are in Dar es Salaam and Mpika.

Tariff

The preliminary tariff, to be replaced in 1977 by a permanent tariff, was based upon that of Zambia Railways. Goods are grouped into 14 classes plus separate mineral and tank car rates. A negotiated rate

on copper is not included in the tariff. Sample figures are shown in the table below:

	Dar es Salaam to	
	Kapiri Mposhi (1852 KM)	Mbeya (850 KM)
	Rates per 1000 Kilograms, Kwacha	
First class	65.40	42.10
Fourteenth class	9.58	4.74
Minerals	8.58	4.25
Tank car	30.06	19.32
Copper	42.04	-

1 Kwacha = U.S. $1.25 (1977)

The minerals rate is about 8 mills per U.S. ton mile, and this is comparable to U.S. rail rates on similar movements. The first class rate is about 7 U.S. cents per ton mile. A tapering rate structure is used though the degree of taper varies with the classes. The degree of tapering is much less than is typical in the U.S.

Rates are established for carload minimum weights only, plus a separate tariff for parcels. The first class rate is above the ZTRS rate, but most of the class rates and the special rates are lower. There are as yet no joint rates with Zambia Railways, although these are expected in time.

Passenger Service and Fares. Passenger service was commenced almost immediately upon the opening of the line, the train leaving Dar es Salaam at 10 in the morning, arriving in Mbeya at 9:05 the next morning, Mpika at 11 o'clock that night, and Kapiri at 7 the next morning -- about 40 hours, averaging little better than 20 miles an hour, but with a total of 55 stops. By the end of 1976, two trains were being operated, one in 36 hours and one in 42 hours. The third

class fare is K6.65 -- about $8.30 for a 1100 mile trip. The first class fare is K28.36 -- about $35.00 -- extremely cheap by comparison with air fares, and a much lower basis than Zambia Railways.

Change is necessary at Kapiri; ultimately cars may be run through to Lusaka, but the brake problem arises here as well. Zambia Railways has been reluctant to run the trains through, partly because of shortages of diesels, partly because of questions about crews.

Additional Traffic Potential. In addition to the through traffic destined to and from the Copper Belt and Lusaka, there is other traffic potential. A truck assembly plant is being established at Kasama in northeast Zambia. Considerable agricultural product traffic to and from the northeast province is almost certain to develop. To Zambia Railways, traffic coming from TAZARA bound for southern Zambia, and maize traffic coming from the south bound for Tanzania are particularly attractive.

Within Tanzania there are potentials as well. Already the railway has taken over traffic from road transport in the Mbeya area. While some claims about future effects of the railway upon the Kilombero Valley are exaggerated, there is bound to be considerable influence. One of the greatest potentials is provided by the coal and iron deposits in the Njombe district, if a branch line were built from Makumbako via Njome to Liganga. The Njombe area is also an important agricultural area, particularly in the production of tea. On the other hand, the line may spell the doom of EAR's Kidatu branch, the previous railhead into the Kilombero Valley.

The possibility of interchange of traffic with East African Railways is restricted by two factors, technical and political. TAZARA uses the 1.067 metre gauge of the southern lines; EAR, metre. It is impossible to lay a third rail, as could be done with the standard and 3 foot gauge lines in the United States, as there is insufficient clearance. There has long been discussion of changing EAR to the broader gauge; currently there is considerable discussion of this question in Dar es Salaam, but none at all in Nairobi. It is not impossible that the Tanzanian lines might be changed while the Kenya lines were not. The task of changing is not an impossible one although some disruption of service would result. Much EAR equipment acquired in recent years has been so designed that an equipment change can easily be made. The main task is to move one rail out three inches.

The main obstacle to through traffic, however, is political. The greatest potential for trade, in the next decade or so, is between Kenya and Zambia, in view of the former's progress in manufacturing in many fields. Even now, Kenya has to some extent replaced South Africa as the supplier of processed foods, butter, tin cans, and other products in the Zambia market. But given the unfriendly relations between Kenya and Tanzania, there is little hope of Tanzania's encouraging rail interchange. From a longer range standpoint, however, there is potential for free movement of commodities among all three countries (and possibly Uganda as well).

Other Potential Rail Lines

Given the emphasis placed on rail transport in Central Africa, there has been substantial discussion of the building of additional

lines, although in all likelihood few of these will come to fruition:

1. A line to connect Lusaka with Malawi Railways at Lilongwe. This would facilitate trade between the two countries and give Zambia another rail outlet to the sea, although one not as good as TAZARA.

2. In conjunction with a line to Malawi or as a separate one built independently, a line from Lusaka to the railhead of the Mozambique system near Tete, crossing into Mozambique at Feira-Zumbo. This would provide a much more direct outlet to Beira than the route via Rhodesia.

3. The so-called Luso variant, a line extending from the Copper Belt through northwestern Zambia, to connect with the Benguela at or near Luso, thus reducing the distance and avoiding the haul via Zaire. This would also facilitate the development of mineral resources in the northwest province of Zambia.

4. As noted above, with an independent Zimbabwe, a direct route from Lusaka to Salisbury, crossing the Zambesi at Chirundu, where the highway crosses.

5. As noted, an all rail outlet to the sea in Zaire.

Conclusion

Zambia now has a good rail route to the coast, with rates less than those available for many years (in real terms, the lowest rates ever available). TAZARA is capable of handling all import and export traffic once full operations are underway, although some traffic will likely continue to move by road, and other routes once opened will undoubtedly be used to some extent. Since the government of Zambia

controls the routing of all freight, it is in a position to determine routes and methods of transport. The volume of traffic on TAZARA will be sufficient, on the basis of studies elsewhere of the relationship of volume of traffic and cost per ton mile and the directionally balanced traffic, to be economically viable and more economical than road transport, although the importance of speed and handling may dictate the routing of some traffic via road.

No studies have been made of the effects of railways upon economic development in Zambia, so far as is known, partly because the results have been so obvious. Without the railway outlet to the sea, the copper complex in Zambia could not possibly have developed when it did. Given high world copper prices, it could operate without railroad access today, given a good road to Dar es Salaam and present road transport operation and costs. But the development of the industry would have been delayed for several decades at least. The significance of the railway for the economy, however, extended far beyond the copper industry. Along the "line of rail", the narrow belt on each side of the railroad, developed commercial agriculture, trade, and limited manufacturing, while the rest of the country for the most part remained in subsistence agricultre. The line of rail became the dominant segment in the economy of the country, although it had no other particular advantages; it just happened to lie in the path of a rail line from Victoria Falls to the Copper Belt. An estimated 85% of all economic activity in the country is in this narrow belt. Over time this small area may lose ground relatively, but it is likely to dominate the economy for a long time to come.

Supplementary Tables

Table 3 shows the distances to the various ports from Lusaka.

Table 3

Distance to the Ports from Lusaka

	Kilometers	Miles
via Benguela	2683	1678
Rhodesia Railway and Beira	2040	1275
Malawi and Beira	1653	1033
Malawi and Nacala	1750	1093
Dar es Salaam Road	2090	1306
TAZARA	2040	1275
Mombasa	2350	1469

The distance from Ndola is about 200 miles less via Lobito, 150 miles less via Dar es Salaam, and 200 miles greater via Beira.

Table 4 provides samples of rates on copper for export at various times.

Table 4

Transport Rates on Copper to Ports, Selected Years

1957	All three ports	K 29.70
1960	via Rhodesia on portion allowed to go via Benguela	19.00
1962	Rail via Rhodesia	30.67
1965	Rail via Rhodesia	30.67
1967 (Oct.)	Rail via Rhodesia	40
1967	Lobito	42.20
1967	Beira via Malawi	54.20
1967	Dar es Salaam Road	43.16
1967	Dar es Salaam, Air	113.00
1968	Road via Dar es Salaam	44.80
1968	via Lobito	45.81
1968	via Rhodesia	45.98
1976	Road via Dar es Salaam	54.
1977	via TAZARA	42.04

COMMONWEALTH WEST AFRICA -- NEGLECT AND DETERIORATION

Of the four Commonwealth West African countries, one, Gambia, has never had a railroad; the Sierra Leone system has now been abandoned; the Ghanaian and Nigerian systems have, from all indications, declined substantially in their importance in the economics -- to a much greater extent than in East Africa, and in stark contrast to the picture in Central Africa.

Nigeria

As the largest country in population in Africa, Nigeria experienced the development of a relatively substantial rail system, a total of 2178 miles (3505 kilometres), but the system's present role in the economy, compared to road transport, is not nearly as great as might be expected.

The system was an outgrowth of two separate lines, one from Lagos, one from Port Harcourt, joining at Kaduna, the British-created capital of the former Northern Region. The line was started north from Lagos in 1896, reached Ibadan in 1901 and the crossing of the Niger at Jebba in 1909, and in 1912 was connected in Minna to the line from Baro, on the Niger, via Minna to Kano, completed to Kano in 1911. The Port Harcourt line was started northward from Port Harcourt in 1912, reached the coal mines of Enugu in 1916, the Benue River in 1924, and Kaduna in 1926, with a branch to Jos in 1927.[1] Branches were extended to Kaura Namoda from Zaria in 1929, to Nguru from Kano in 1930, and in a major construction project, from Jos to Maiduguri in Borno in 1957. One of the major deficiencies is the lack of an east-west line -- while passenger trains

[1] A 2'6" gauge line was built from Zaria to Jos in 1914 to serve the tin mines. This was abandoned in 1957, since the Jos area was served more effectively by the main line.

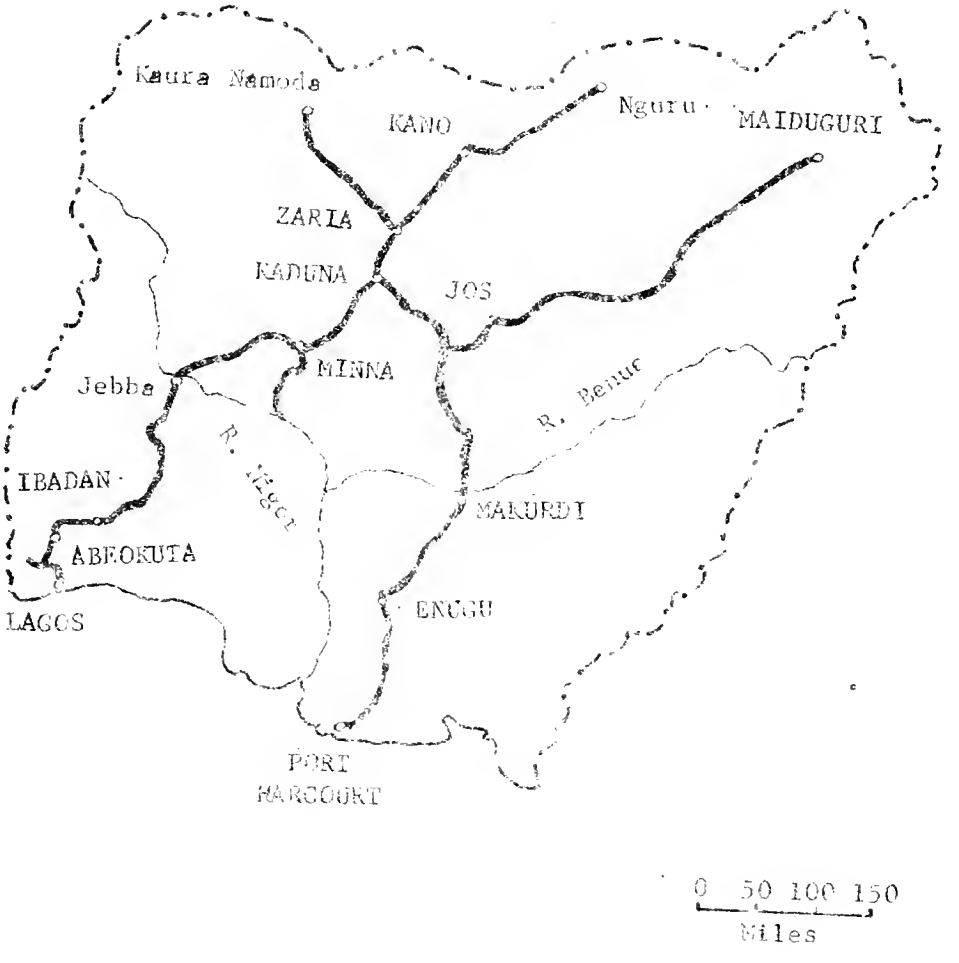

Fig. .

NIGERIAN RAILWAYS

ran through from Lagos to Port Harcourt, for example, on certain days of the week, the time was much greater than on a direct route. The primary traffic item has been ground nuts moving from the north for export, and cola nuts, cotton, timber, and cattle have been among the other major items moved, plus petroleum products and manufactured goods bound for the north. The system used a small number of Beyer-Garretts, but primarily it relied on 2-8-2 steam locomotives, many built in the 1940s and 1950s. In 1955 all motive power was steam (218 line, 55 shunting); by 1974 there were 132 steam and 138 diesel line engines, 43 steam and 39 diesel shunting.

While in earlier years the steam was relatively profitable, the earnings became somewhat erratic. [illegible] 1951-5 period, the operating ratio ranged from 81 (1955-6) to 115 (1965-66), averaging 96.[1] The figure was 107 in 1970, 119 in 1971, 12[illegible] from 1969 on, a loss was incurred, after interest charges, in every year since 1963-64. [illegible] in 1969-70 to 20.3 million in 1970-71 and 23.1 million in 1971-72.[2]

As shown in the [illegible] table on the next page, the railway's traffic has been stagnant since the peak of around [illegible] million ton-miles. The [illegible] than half [illegible] 1971-[illegible] [illegible] half.

Pres. [illegible] Report [illegible], p. 47.

[2] Federal Republic of Nigeria, Third National Development Plan, 1975-1980, (Lagos: Federal Ministry of Economic Development, 1975), p. 214. 1 Naira = US $1.5

1961-62.[1] The declines in tonnage and ton miles have been comparable. Passenger traffic has fallen sharply, from 11 million in 1961-62 to 4.7 million in 1973-74, but passenger miles while falling after 1970, were greater in 1974 than in the early sixties. The freight traffic in 1973-74 was 439,853 net ton miles per mile, a relatively low figure. The average length of haul is about 600 miles. The freight revenue is about 3 U.S. cents per ton mile (1972).

The Third National Development Plan, issued in 1975, provides a detailed analysis of the decline in traffic and operating deficits (apart from the effects of the Biafran war):[2]

1. Decline in agricultural production, particularly for export, a major source of traffic.

2. Sharp decline in coal production.

3. Deterioration in rail transport services. As stated in the Development Plan:

1

Year Ended 31st March	Net Ton Miles (thousands)
1960	1,249,840
1961	1,181,101
1962	1,412,165
1963	1,410,950
1964	1,554,793
1965	1,221,025
1966	1,215,058
1967	1,004,000
1968	986,000
1969	1,094,000
1970	950,147
1971	981,793
1972	750,129
1973	844,000
1974	958,000

Source: Federal Republic of Nigeria: Annual Abstract of Statistics 1972; Federal Office of Statistics, Lagos, 1975.

[2] Third National Development Plan, 1975-1980, op. cit.

In fact, for the past ten years the volume of traffic moved by rail has been limited by the Railways' capacity to carry it. The Railways have even lost considerable long distance bulk traffic to the roads in spite of the fact that they would carry this for a lower charge and at a lower cost to the country's economy. This situation is largely attributable to the unreliability, slowness and inadequacy of Railway goods transport services.

There were several elements responsible for this:

a. Unbalanced traffic, with greater up than down traffic.

b. Rapid decline in wagon (freight car) utilization due to inadequate coordinated scheduling of car use.

c. High downtime of both steam and diesel locomotives. In 1974, availability times were only 17% for the former, 54% for the latter. In general, usable motive power is entirely inadequate.

d. Slow train speeds, due to the excessive curvature and inadequate track maintenance. The maximum speed allowed anywhere on the system is 40 miles per hour, and restrictions as low as 10 miles an hour are common.

e. Inadequate communications, due in part to constant thievery of the copper wire of the communications lines.

4. Substantial increase in road transport at the expense of the railroad, including long distance transport from the north. There was little restriction on road transport and weight limits were not enforced. The increased road transport added seriously to congestion (the two roads from Ibadan to Lagos are regarded as death traps by many drivers). The government pushed its investment in roads and rail was relatively neglected.

In the third development plan, issued in 1975, a major overhaul of the railway system was proposed, involving, essentially, the building of a completely new system, to standard (4'8.5" gauge), serving the same points as the present system, built parallel to it, and being phased in gradually. The plan calls for building about 320 kilometres per year, and thus the plan will not be completed until well into the 1980s. Some N 885 million was allocated to the rail system 1975-80, out of a total of N 4 billion for transport, of which N 714 million will be allocated to the first stage of the new system. Meanwhile, some basic improvements will be made to the present system, and new rail commuter service in the Lagos area will be established.

The plans are based upon a study by consultants completed in 1973; the government is convinced that, given potential growth in the economy, improved rail service will allow lower cost transport than primary reliance on road transport. Whether the proposed system will in fact be carried to completion remains to be seen.

Ghana

The Ghana Railways has suffered much the same fate as Nigerian Railways. The system is essentially A shaped, lines extending from the ports of Sekondi-Takoradi and Accra northward and nortwestward, respectively, joining at Kumasi. These two lines in turn are linked by an east-west line paralleling the coast, permitting relatively direct service between Accra and Secondi. The western line was started northward from Sekondi in 1898, primarily to facilitate gold mining in the area around Tarkwa, reaching that city in 1901 and Kumasi in 1903, 168 miles from the ocean. In 1909 a line was started north from Accra to Kumasi, but did not reach the latter until 1923. The total distance Accra-Sekondi was 363 miles. A long branch was built from the Tarkwa

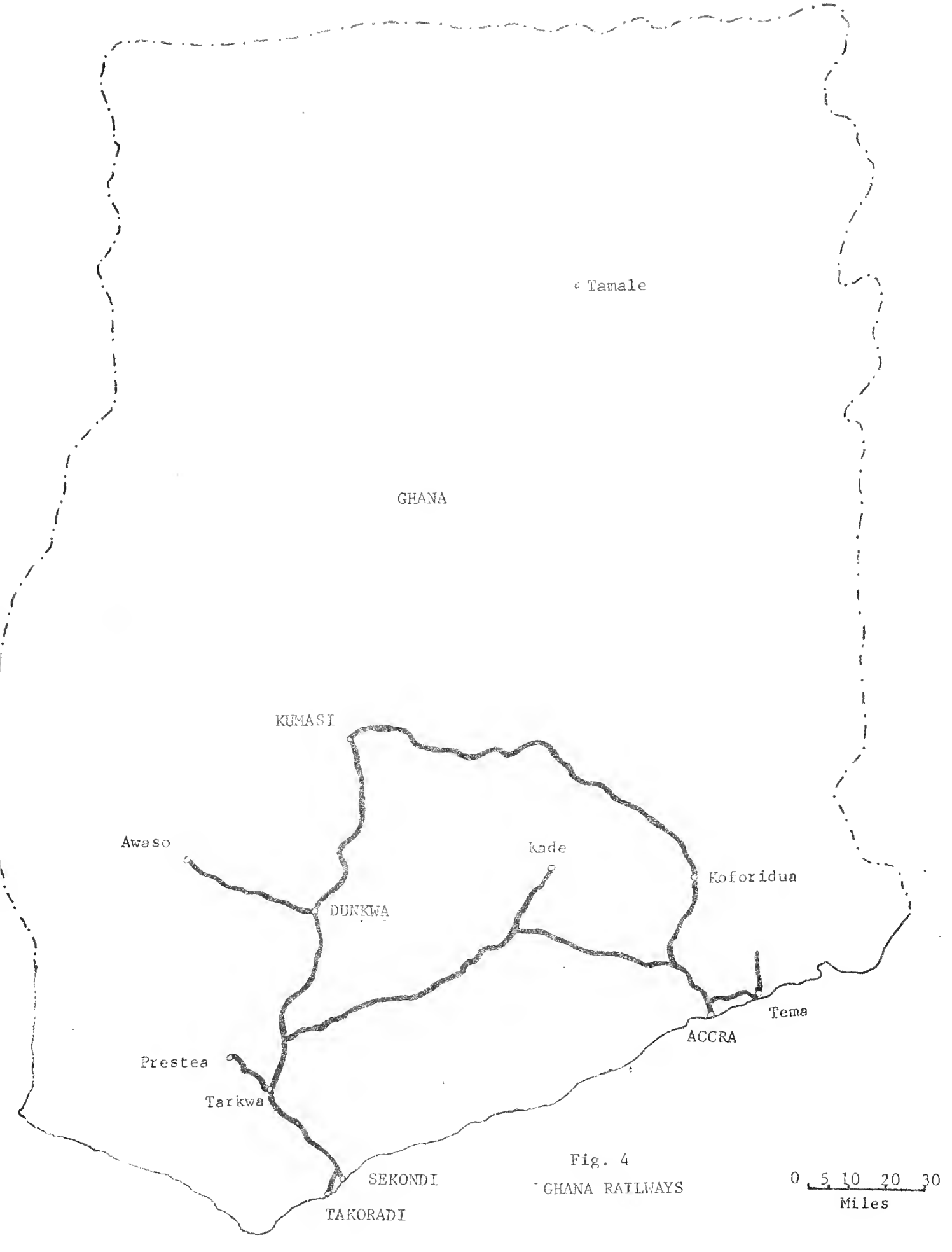

Fig. 4
GHANA RAILWAYS

area to Kade, completed in 1927, and this was connected to the Accra-Kumasi line in 1956. Like Nigerian Railways, 3'6" gauge is used. Dieselization began in 1954 and continued slowly.

The main line of the system is the Western line, Takoradi to Kumasi, 171 miles, which handles about 90 percent of all the traffic. The Eastern line, from Accra and the port of Tema to Kumasi, is 214 miles in length. The Central line, which connects the other two is 120 miles. There are three branches, to Prestea in the west, to Awaso in the northwest, which handles the bauxite traffic, and to Kade, in central Ghana; total mileage is 592 (953 kilometers).

Total traffic in the early seventies was about 1.7 million tons, and 190 million ton miles (1970) -- but, as noted, 90% of this is concentrated on the Western line, to give this line a reasonably high ton mi/m figure of about 1 million. But the rest of the system handles only 200,000 tons, with a ton mi/mi figure of 45,000 -- low by any standards. Over 90 percent of the traffic is southbound, and about 90 percent of the revenue comes from four commodities -- cocoa, timber, manganese, and bauxite. Most of the imports and manufactured goods traffic is by road. The operating ratio averaged 89 from 1958 to 1964, but was increasing.

Marginal cost per ton mileage is estimated to be .86 np (for direct train operating costs), 2.36 np. overall. These figures with exchange rates of the period were equal to about .8 U.S. cents and 2 U.S. cents respectively.

The rate structure has been such as to provide relatively high rates on manufactured goods traffic and on cocoa, the principal export crop, and very low rates on bauxite, designed to make the

Ghanaian bauxite competitive in world markets.

About 7 million passengers were being carried per year in the early 70s, for an average trip of 40 miles. 98% of the traffic was third class.

The general picture of the system since independence has been one of deterioration, despite some improvements. There has been very substantial loss of traffic to road transport. For example, once all cocoa was hauled by rail; by 1966, 30% was moving by road; by the early seventies, nearly half.[1] The high rate, -- NC 12.51 per ton -- was 50% greater than the cost of hauling by road, NC 8.[2] The shift to road was also encouraged by substantial ownership of lorries (trucks) by the cocoa buying agents, and by the inability of the railroad to handle all of the traffic offered. This limited capacity was also an important factor leading to the loss of other export traffic as well, particularly of logs. Inadequate funds were provided for new equipment, and equipment maintenance was often neglected. The result has been continuing deficits and continuing loss of traffic. An inherent source of difficulty is the relatively short haul -- the maximum about 200 miles. Thus road transport has important advantages.

The problem of transport in Ghana has not gone unnoticed by the government. Around 1970, funds were provided for new equipment and improved signalling, particularly to increase capacity. In 1969-70, a major study was undertaken of the entire transport sector

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[1] Edward Vickrey, "Pricing Rail Transport Services in Ghana for Increased Efficiency," Economic Bulletin of Ghana, Vol. 1 (No. 4), 1971, pp. 28-46.

[2] Ibid., p. 46.

by Robert Nathan Associates.[1]

A detailed study of the rate structure by Edward Vickrey, using Nathan data, concluded that much of the difficulty lay in the use of rates that were far in excess of cost for cocoa, somewhat excessive for logs and manganese, and far too low for bauxite (and passenger traffic). At the same time, rates for northbound manufactured goods and other imported goods were greatly in excess of the appropriate cost figures on this backhaul traffic, for which only short run marginal cost is relevant. Thus substantial rate reductions were proposed; much of the traffic loss, in Vickrey's view, was attributable to rates that were far too high relative to road transport costs and rail costs.[2]

What is the long range potential? The evidence suggests that on the heavy traffic Western line, rail costs (not existing rail rates) are less than road costs; the rail line should be maintained and improved to be able to handle the available traffic. But the Eastern line has so little traffic as to be uneconomic; all Kumasi traffic can easily be handled on the Western line. The Central line, despite low traffic, has greater future potential, in the handling of bauxite to the refinery at Tema. The refinery has thus far operated primarily with Jamaican bauxite, but under the terms of the agreement with Ghana, the company is committed to phase in use of Ghanaian bauxite.

There are several related issues. Unlike in many developing countries, road users as a whole are apparently more than covering

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[1] Nathan Consortium for Sector Studies, Ghana Railways, 2 vols. (Accra, 1970).

[2] Pricing Rail Transport, op. cit.

road costs. But there is little good information on the relative burdens on large vehicles, and there is considerable evidence that the heavy lorries are causing substantial destruction of the roads, particularly in the handling of logs. Vickery has noted, incidentally that rail costs are artificially inflated by the success of a strong union in pushing up wages, although reduced somewhat below opportunity costs by exchange control regulations. One other problem of the system is the seasonal nature of the cocoa traffic, resulting in need for more equipment than otherwise would be required.

In 1976 the Government of Ghana began to take action to improve the situation. The 1976 budget provided NC 20 million (about the same number of dollars at current fixed exchange rates) for new freight cars and engines, and the government obtained World Bank assistance for a study of transport requirements. The general philosophy of the government is to retain the rail system, or at least much of it, for the handling of bulk commodities. There is little thought, apparently, that much of the manufactured goods traffic can appropriately be returned to rail. The severe shortages of foreign exchange, however, restrict improvements in the system.

There has long been discussion of extension of the railway about 250 miles north from Kumasi to Tamale, the major city in northern Ghana and the center of an important agricultural area.

Sierra Leone

While other West African commonwealth countries have witnessed the decline of their rail systems, Sierra Leone has, under pressure from the World Bank, phased out its system, which consisted of 311

Sierra Leone Government Railway
2'.6" guage (abandoned)

Mineral Railway
3'.6" guage

0 10 30 40 50
Miles

Fig. 5

RAILWAYS IN
SIERRA LEONE

miles of line.

Construction started from the Freetown area in 1896, reached Bo, the second largest city, in 1903, and pushed rapidly on to Baiima in 1905 and Pendembu in 1908 -- 225 miles from Freetown. At the time this was one of the longest railways in Tropical Africa. A branch was completed to Makemi in 1914.

The line was, for economy reasons, built with 35 pound rail to a 2'6" gauge, miniature by any standards. Much of the line traversed mountainous country, with numerous bridges and grades. A number of Beyer-Garretts were used, the later ones of 66 ton weight. Palm kernels and chrome ore provided most of the traffic. The road was a source of operating losses over most of its history. In the period 1959-1964, for example, the operating ratio averaged 145 -- expenses of operation were nearly 50% greater than revenues. Finally, under strong World Bank pressure tied to grants for highway improvement, the government, despite considerable opposition, agreed to phase out the system. This began in 1968, the main portion from Kenema via Bo to Freetown being retained until late in 1974.

Distinct from this line was the 52 mile line from a point on the river above Freetown to the iron mines at Marampa. The line was completed in 1933. The closing of the mines in 1976 leaves the future of this road in doubt.

A Note on Cameroon and Gabon

Two ex-French African countries have major rail construction projects underway. One is Cameroon. The coastal portion of this country is highly mountainous and heavily wooded, and construction is

difficult. The first line, built by the Germans between 1902 and 1908, was in the far north, extending from the river across from Douala on the coast to Nkongsamba, 100 miles. The central line was started eastward from Douala in 1908, but construction was stopped by the war, and did not reach Yaounde, the capital, until 1927. The two lines were joined by a bridge at Douala in 1955. There had been plans for decades to build northward from Yaounde, and finally, construction began in the mid-sixties. The line is intended to aid in opening up the northern part of the country, which contains important mineral deposits.

The other major project is in Gabon, which adjoins Cameroon on the south. Work was commenced in 1975, linking the ports of Owendo and Santa Clara via Booué with Franceville, the location of manganese deposits. It will also be extended to Belinga, location of iron ore deposits. The line, ultimately 930 kilometers, will cross virtually the entire country. The portion to Franceville is expected to be completed by 1980, the entire system by 1985.

Major reconstruction of the Congo-Brazzaville line, connecting Brazzaville with the port of Pointe Noire, through mountainous country, is underway by an Italian firm.

CONCLUSIONS AND POLICY ISSUES

Table 5 summarizes the traffic data of the systems.

The costs, converted to cents per ton mile, should be regarded as only very rough figures, because of the artificiality of the rates of exchange in many instances.

Table 5

Summary of Traffic and Costs

Railroad	Mileage	Year	Approximate Net Ton Miles per Mile of Line 000s	Cost per Net Ton Mile, US cents
East African				
system	3663	1975	731 gross	2.5
Nairobi-Mombasa	330		8500 gross	
Tanzania Central	530[1]		2700 gross	
Zambia	650	1975	2190	4.6
TAZARA	1158	1977	2000[2]	n.a.[3]
Nigerian	2178	1974	440	3
Ghana				
system	592	1970	170	2
Western line	171		1000	
other lines	421		45	

[1] Dar es Salaam -- Tabora portion

[2] Estimated. Capacity is about twice this great.

[3] Likely around 2c. Existing road transport Zambia to Dar es Salaam, 5.3¢.

Conclusions

Out of this brief survey, some general conclusions can be drawn:

1. The volume of traffic on the main lines -- Mombasa-Kampala; Tanzania Central; Zambia; TAZARA, the Western line of Ghana Railways, and portions of the Nigerian system -- are adequate to allow reasonable attainment of the economies from density of traffic. Studies in the United States indicate that much of the economies are attained at 1 million net ton miles per mile (roughly 2 million gross), and most by 2 million, even though the full economies are not attained until

traffic reaches about 10 million (20 million gross).[1]

2. The cost per ton mile would appear to be lower on the main lines than the cost of heavy volume road transport, but the latter has obtained substantial traffic, partly because of inadequate railway equipment, partly because of the value-of-service rate structures of the railways.

3. A much better picture of relative rail and road costs will be available after a few years of experience with TAZARA, which is replacing heavy volume road transport.

4. There is a substantial mileage, in East Africa and Ghana, of relatively light traffic lines -- with traffic under 100,000 net ton miles per mile. Experience in the United States shows that such lines have substantially higher cost than main lines and that road transport is cheaper.

5. While all of the systems have survived dramatic readjustments in recent decades, they have all (except Zambia Railways) suffered from general deterioration in the last few years, for a number of reasons: governmental emphasis on road development; shortages of equipment due to lack of foreign exchange and governmental neglect; loss of traffic to road transport because of obsolete tariff structures and other reasons; lack of trained personnel in some instances.

6. General attitudes toward the railways differ widely among the countries, from particular neglect in West Africa to strong emphasis in Zambia. In Central Africa broadly defined, including Zambia, Zaire, Angola and Mozambique, the railway remains the dominant transport form, in part, in some areas, because of the lack of intercity roads.

[1] R. G. Harris, "An Empirical and Institutional Analysis of Excess Capacity in the Rail Freight Industry", University of California, Department of Economics Working Paper No. SL-7602, Berkeley 1976.

7. The initial railway tariffs were designed to obtain as much as possible from "luxury" imports and from exports of primary items, allowing low rates on exports of low-value commodities and imports of items regarded as necessary for development. The structures did not universally favor exports, as is commonly argued -- as witness the high rates on copper from Zambia, on cocoa in Ghana. Of the imports, in some instances particularly heavy rates were placed on petroleum products. One consequence of this value of service type of tariff was to encourage loss of traffic to road transport as roads were built. Readjustment of the tariffs in light of changing conditions has been slow.

8. Political considerations have played a major role in railway development. As is well known, the political problems of southern Africa resulted in dramatic shifts in traffic patterns; the political difficulties among the three East African countries have seriously injured East African Railways.

9. From the various studies that have been made, it is clear that the early railway lines had major impact upon economic development in the countries and the shaping of modern present day locational patterns; Nairobi, in many respects the most important city in all tropical Africa, owes its existence to the railway. But there is now clear evidence that under present conditions, the building of railway lines may have little impact upon development, particularly of agriculture, since, on relatively light traffic lines, rail costs are no lower, and may be higher, than road transport costs, and road transport is adequate.

10. The importance of petroleum products in total transport is phenomenally high. The tonnage of petroleum products imported into Zambia by pipe line is about the same as all surface transport import tonnage. For years East African Railways has received about 25% of its revenue from petroleum traffic.

11. Air transport of freight has proven to be very costly, and while important in some instances has not expanded rapidly.

12. Passenger traffic on the railways has changed little in recent years; loss of higher-income and tourist traffic to air and road transport has been offset by increased total passenger travel. Third class dominates the traffic completely today, at fares that are extremely low by comparison with other countries.

Major Policy Issues

The African countries face several policy issues in the transport field:

1. Should new rail lines be built? As suggested above, rail lines are not a magic solution to economic development; there are probably relatively few instances in which new lines are warranted. One is to allow development of mineral products providing substantial volume of traffic. The other is to allow better routes where existing traffic is high -- as in the case of TAZARA and possible connection of Zambia Railways with those of Malawi and Mozambique.

2. Should existing rail lines be preserved? The answer appears to be clearly in the affirmative so far as the main lines are concerned -- partly because costs are lower than those of road transport at existing levels, partly because failure to do so would result

in rapid destruction of the typical African road. In other words, there is reason to believe that heavy road transport does not pay adequately for the damage it does to roads. Taxes on diesel fuel are typically low under the argument that low rates aid economic development. To build roads adequate to allow heavy volume road transport without prohibitive maintenance costs would add tremendously to highway costs. From all indications, preservation and improvement of the heavy-density rail lines will be much more economical.

Doubt can be raised, however, about some of the longer light traffic lines, whose high costs per ton mile raise overall costs and drain the resources of the railway system. But premature abandonment of a line before roads have been developed and before opportunities for economic development have been fully explored may be even more unwise.

A substantial portion of the mileage may be more or less marginal. In comparison of rail and road costs for purposes of determining economic viability of these lines, it is important that true opportunity costs, not simply monetary costs be used. On the one hand, costs for which road transport is responsible but for which it does not pay (additional road costs above those covered by user charges), for example, must be included. Relative drain on foreign exchange at artificially maintained exchange rates should be considered, as well as future relative energy costs, particularly in countries lacking petroleum. The railway is a more efficient user of fuel if traffic is above a relatively low level; if total traffic is no more than a few cars per train, road transport is more efficient.

Another element to consider is the artificial inflation of railway wages in some countries due to strong unions and previous holding of the jobs by non-Africans. Road transport, especially

with owner-operators, is not subject to this effect. The economic cost of railway labor is not the actual wages paid but the opportunity cost -- what these workers could earn in another occupation -- and this is often much lower.

3. When railroads are retained, how can an optimal balance between road and rail transport be attained? First, as noted, tariff structures have resulted in uneconomic diversion of traffic from rail to road in many instances; shift away from value of service to cost related tariffs is obviously required, as noted and as is recognized in most of these countries.

Secondly, experience in other countries suggests that, for a substantial volume of traffic, costs of shipping by rail and road, considering not only transport costs but speed, handling, and loss and damage elements, are much the same. Should governments seek to ensure that this traffic moves by rail rather than road, by restrictive licensing or other means, to lower rail costs per ton mile and avoid deficits? There is obviously some merit in doing so. But the policy is difficult to implement and can easily be overdone, forcing traffic to move by rail when road is far more efficient. In some African countries, in which much of the traffic is controlled by marketing boards and parastatal enterprises, it is relatively easy to ensure that this marginal traffic is moved by rail. But in more strictly free enterprise economies, attempts to restrict road transport by licensing are not likely to be successful; the rules are difficult to enforce, and firms will develop their own road transport fleets -- a practice few countries seek to curtail.

In general the best solutions to reasonably optimal division of traffic appear to be the following:

1. Revision of tariffs to reflect cost rather than value of service
2. A policy that all government enterprises use rail rather than road when costs are comparable
3. Establishment of reasonable weight limits on road transport and enforcement of them
4. Adequate charges on road transport for road use
5. Outright subsidy by government of rail transport in certain instances (to cover costs of a line retained, for example, for regional development purposes, or of passenger service if the government seeks to make cheap passenger transport available) rather than requiring the rail systems to cover all costs from revenue.