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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT PERFORMANCE AUDIT

ZAMBIAN HIGHWAY PROJECTS

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Operations Evaluation Department

PROJECT PERFORMANCE AUDIT

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PREFACE

Loans 469-ZA of October 4, 1966 and 563-ZA of October 5, 1968 were closed in July 1972 and the following report represents an audit of achievements under the loans against the objectives on the basis of which they were approved.

The valuable assistance provided by the Government of Zambia in the preparation of the report is gratefully acknowledged.

Note: Currency Equivalent (Kwacha):

1965 - February 1973: K 1.00 = US\$ 1.40

Since February 1973 : K 1.00 = approx. US\$ 1.60

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SUMMARY

The Bank lent \$17.5 million in October 1966 (Loan 469-ZA) and \$10.7 million in October 1968 (Loan 563-ZA) to the Government of Zambia for reconstruction of long stretches of the country's two main trunk roads - the Great North Road (GNR) from the center of the country to the Tanzania border and the Great East Road (GER) to the Malawi border. Final disbursements under both loans occurred only in mid-1972 due to delays in the settlement of contractor claims.

Both loans were made in an era of considerable uncertainty brought about mainly by political developments and prospects in neighboring Rhodesia which lies astride the main traditional link between Zambia, landlocked but dependent for 40% of its GDP and nearly all foreign exchange earnings on copper exports, and the sea. Anxious to reduce dependence on Rhodesia Railways and to improve links with neighbors to the north and east, the Government of Zambia in April 1965 requested Bank assistance with a large project, which would have included upgrading of the GNR and GER in their entirety as well as several other roads, and it proceeded with the letting of construction contracts for sections already engineered, adhering to the Bank's international competitive bidding procedures. In the face of uncertainties about how much international traffic for how long might be diverted to the GNR by Zambia's difficulties with Rhodesia and how much might be diverted from the GNR were Zambia and Tanzania to proceed with the projected Tan-Zam Railroad along the same route, the Bank agreed to finance sections of both roads that were largely justified by anticipated domestic traffic - all the GER except for the central section which was already being upgraded by the Roads Department and the southernmost 120 miles of the GNR. Nonetheless, as compared with the roads recommended in the Bank-sponsored NEDECO survey of 1964, these links did have the important additional characteristic of providing some insurance against transport interruptions on the southern routes to the sea. In the face of further deterioration of relations with Rhodesia over the following years the Government let contracts for the remaining sections of the Great North Road, and the Bank proceeded with great expedition in 1968 to approve a second loan covering reconstruction of the remainder of the 500-mile GNR except for the 150-mile central section for which the contract had been negotiated, without international competitive bidding.

Despite difficulties resulting from the changing political situation in the region, both projects were completed by the appraisal reports' target date of December 31, 1969 after correction of construction defects pointed out by the supervising engineers or by the Bank's frequent supervision missions. The first project cost only \$23.4 million compared with \$29.0 million allowed in the Bank's appraisal, while the second cost \$17.8 million compared with \$17.5 million projected.

Even before Rhodesia's closure of the border in January 1973 and Zambia's subsequent refusal to permit its reopening diverted substantial additional amounts of traffic to the GNR and GER, traffic has generally been at

or above the appraisal reports' forecasts. Currently more than 50% of Zambia's international trade passes via Tanzania (half this amount by the oil pipeline completed in 1968) compared with only 13% in 1967, and the share of the Malawi route has nearly doubled over the same period; to reach 7% in 1973.

Adequate information is not available about actual trends in road user costs on the roads improved, but whatever indications there are suggest they have fallen roughly in line with expectations. Hence the main factors causing the returns to the investments assisted by the Bank to differ from estimates made at the time of appraisal are the abovementioned savings in construction costs and higher volumes of traffic. Adjustment for these factors suggests that actual economic returns to the sections included in the first project will be a few points above the 11-14% originally estimated and that they will be in the range of 12-15% for the northernmost 230 miles of the GNR covered by the second project.

Despite frequent reminders by Bank supervision missions and in follow-up letters the Government of Zambia has not adhered to most of the agreements specifically negotiated in connection with the two loans. The difficulties posed to the authorities by the recurring emergency situations which they faced do not seem fully to explain the failure to live up to the agreements made.

Failure to control vehicle overloading and to carry out adequate maintenance, both topics covered in the loan agreements, have resulted in some deterioration of the surface of the Great North Road. Weigh bridges financed under the second loan became operational only in 1971-72, owing to delay in import of peripheral equipment and lack of trained operators, but control remains ineffective due to operation during day-time only and limited application of penalties. Maintenance and betterment work have not grown in line with the road network and traffic, apparently mainly due to shortages of budgetary funds and of Roads Department staff, and no maintenance work was undertaken on the Bank-assisted sections prior to 1973. The Great East Road remains in good condition, but the pavement surface dressing is beginning to deteriorate on some sections of the Great North Road; postponement of action increases the cost that will eventually be incurred for resurfacing. In retrospect, given the shortfalls in respect of maintenance and control of overloading, it probably would have been preferable to lay an extra bitumen coat of $\frac{1}{2}$ -1 inch on some sections at the time of construction, especially the steeper gradients (which would not have increased the overall cost of the project by more than 2 or 3 percent). The possibility of overloading should probably have been explicitly considered in the extensive probability analysis carried out by the Bank to help deal with the exceptionally difficult question of design standards selection in this case.

Contrary to the agreements reached in connection with the first loan, Roads Department staff does not seem to have been maintained at the strength then obtaining, and little progress has been made with Zambianiza-

tion at the higher levels despite the intentions expressed in connection with the second loan. Departmental strength (excluding clerical) dipped to 86 in 1968 and reached only 97 in 1972 or 60% of approved establishment. Expatriates, discouraged for lack of career prospects and from various external pressures, continue to hold all the senior professional positions. Budgetary restrictions, low salaries and an absolute shortage of Zambian engineers seem to be the main causes. The Bank might have helped more by encouraging the Government authorities to try to identify individuals who could have been specially prepared for senior positions or by accepting even some temporary lowering of standards, compensated by foreign technical counterparts, but the very dominance of the Roads Department by expatriates made it reluctant to accept even what measures the Bank did suggest and implementation of these steps would not have been easy.

The Government never carried out the study of road carrier competition which it undertook to do, as a condition of the first loan, to meet the Bank's concern that dominance of the trucking industry in Zambia by a few large firms might limit the reduction in freight charges and the stimulation of local traffic that should result from the road improvements. However, in 1967, it did loosen licensing criteria and a large number of smaller vehicle operators have come into being. Moreover the large companies seem to be efficiently run and whatever evidence is available does suggest that road tariffs have declined, at least in real terms. The road improvements assisted by the Bank do seem to have contributed to the remarkable expansion in maize production in the southern portions of the area traversed by the Great North Road, but they have not led to the expected increases in production of tobacco and groundnuts in the Eastern Province - partly due to more fundamental problems, of Government farm price policy, as well as to bad harvests in recent years. Progress in the rural areas has been slow, and not much assisted by the roads.

It is now foreseen that after the stabilization of the transport situation following completion of the Tan-Zam Railway late in 1974, the emphases on feeder roads and roads with regional developmental impact recommended in the 1964 NEDECO report will once again be pursued. Bank assistance for maintenance, including technical assistance to help attain a more economic allocation of available resources among different tasks, would also appear very worthwhile.

PROJECT PERFORMANCE AUDIT: ZAMBIAN HIGHWAY PROJECTS

Background

On October 4, 1966, the Bank made its first highway loan to Zambia in the amount of US\$17.5 million (Loan 469-ZA). This was followed by another loan of US\$10.7 million on October 5, 1968 (Loan 563-ZA). Both projects were for reconstruction of long stretches of the two main trunk roads in the country -- the Great North Road from the center of the country to the Tanzania border and the Great East Road to the Malawi border. Although further possible loans for highway development in Zambia have been discussed, none has yet reached fruition.

Zambia is a land-locked country with an area of about 291,000 square miles and a population which was estimated in mid-1971 at 4.25 million inhabitants. Nearly half the population lives in the Copperbelt and the Line-of-Rail (see Map 2), where almost the entire "modern" sector is concentrated. The rest is scattered over the country and is mainly engaged in small-scale agriculture. Zambia continues to be dominated by the copper industry, which in 1970 contributed 40 percent of GDP, 95 percent of exports, and about 60 percent of total Government revenue. Because of low population density and the importance of copper exploitation, the transportation system is chiefly geared to the two objectives of integrating the main regions of the country with one another and ensuring reliable import-export trade routes to the sea.

Historically, most of the import-export trade was conducted through the 665-mile Zambian Railways which connect with the Rhodesian Railways network to the Mozambique sea-ports of Beira and Lourenço Marques. The Zambian section of the railway contributes little to the internal exchange among regions. Road transportation emerged as the single most effective means for controlling outlying provinces and maintaining a minimum trade flow between regions. In 1965, there were about 20,800 miles of public roads, all of which were gravel and earth roads except for the highway parallel to the line of rail. The road improvement program undertaken between 1965 and 1972 raised the mileage of fully bituminized roads to 2,420 miles of which 1,600 miles constituted territorial main roads. As there was very little new construction during this period, the total mileage of designated roads in 1972 (21,850 miles) was, however, only slightly more than what it was a decade ago.

The financing of the Great North Road (GNR) and the Great East Road (GER) was preceded by a Bank mission to Zambia in 1963 to advise on the economics of a proposed railway link with Dar es Salaam, and a subsequent survey of the transportation sector commissioned by the Bank in 1964. This survey was undertaken by the Netherlands Engineering Consultants (NEDECO). It recommended a comprehensive development plan for each sub-sector for the period 1966-1970. For highways, which were

the main element in the plan, emphasis was laid on the promotion of a regional infrastructure consisting of development roads and feeder roads. Except for three small sections on the trunk routes (Chipata-Katete and Chongwe-Rufunsa at each end of the GER and Kapiri Mposhi-Mkushi on the GNR), almost all the roads recommended for improvement were internal roads in the Western, Northern and Luapula Provinces. No work was envisaged for the GNR and GER in their entirety until after 1970.

Political and strategic considerations caused the Government of Zambia, which became independent of British rule on October 24, 1964, to attach greater importance to improvement of transport links with its neighbors to the north and east. The need to reduce the country's dependence on the Rhodesia Railways for its vital international trade became even greater with Rhodesia's Unilateral Declaration of Independence (UDI) in November 1965. Rhodesia demanded that Zambia prepay in foreign currency copper freight charges on its railways. The international embargo on oil for Rhodesia following UDI affected Zambia's petroleum imports. Periodic fuel shortages occurred, causing a 15% drop in refined copper production in 1966. To alleviate the situation, emergency fuel supplies were brought from Dar es Salaam over the GNR and to a lesser extent via the Malawi Railways and the GER. In addition, a large-scale airlift of oil products and copper was started early in 1966 by the U.S., U.K. and Canadian Air Forces via Zaire and East Africa.

It was against this background that negotiations for the first highway loan took place. The \$70 million project proposed to the Bank in April 1965 consisted of improvement of the GNR and GER in their entirety plus three additional road sections to the west of Lusaka. Upon the Bank's urging to reduce the size of the first loan and to provide firm cost estimates for each section being considered, the project finally agreed upon was of US\$29 million. Whereas the Zambians were anxious to improve as much of the two trunk routes (i.e. the GNR and GER) as possible, the Bank was somewhat skeptical about the long-term economic merit of these roads. In particular, the determination of the Zambian and Tanzanian Governments in going ahead with their plans for a rail connection between Dar es Salaam and Lusaka^{1/} raised the possibility of overinvestment if the Great North Road were reconstructed as well. Also, it was uncertain how long the emergency situation with regard to the use of the Southern route would last and how much traffic would be diverted to the Great North and Great East Roads. Because of the difficulty in assessing these aspects, the Bank agreed for the time being to

^{1/} The 980-mile railway from Kapiri Mposhi to Dar es Salaam has been a topic of discussion for decades. Despite recommendations by the Bank, the NEDECO team, USAID and other Governments and study groups to postpone such a link on financial and economic grounds, the Governments of Zambia and Tanzania went ahead with the project in 1969 with the financial and technical assistance of the People's Republic of China. At a cost of some \$400 million, this railway line is now expected to be operational in late 1974.

finance only the Kapiri Mposhi-Serenje section of the Great North Road as it served an important agricultural center (Mkushi District in the Central Province), and improvement of the southern part (i.e. up to Mkushi) had been recommended by the NEDECO Group as well. For the Great East Road, it was decided to finance the reconstruction of the entire road except for the central section (Rufunsa-Nyimba), which was already being upgraded to Class II Gravel by the Roads Department. In the view of the Bank, this road would serve the dual function of an exit route to the Mozambique ports as well as bringing the agriculturally rich Eastern Province closer to the line-of-rail consumption centers.

The project finally agreed upon for the first loan, therefore, was (i) the engineering, reconstruction and bituminous paving of the Great East Road, from Chelston to Rufunsa (92 miles) and from Nyimba to three miles east of Chipata (159 miles); (ii) the engineering, reconstruction and bituminous paving of the Great North Road from Kapiri Mposhi to Serenje (122 miles); and (iii) the final design of the Great North Road from Serenje to Mpika (147 miles).

Between conclusion of the first and second loans, the border problem with Rhodesia worsened. Oil lift operations continued over the Great North Road from Dar es Salaam until construction of a pipeline in 1968.^{1/} The newly formed Zambia-Tanzania Road Services, Ltd. (ZTRS) began plying over this route from 1966, carrying copper to Dar es Salaam for export and bringing back miscellaneous import cargo. In October 1967 the Rhodesia Railways increased the charges on Zambian copper by 50 percent and at the same time on other Zambian traffic by an average of over 25 percent. Owing to this surcharge and the greater expense in the use of alternate routes (Lobito and Dar es Salaam mainly), the cost of transporting copper to the sea rose from US\$44.80/ton in 1965 to over US\$72.80/ton in 1967/68. In May 1968 the United Nations placed a total embargo on trade with Rhodesia. In view of the urgency the Government attached to improving the Great North Road, the Bank tried to expedite greatly its consideration of the Mpika-Tunduma section in the second project.^{2/} The Serenje-Mpika section was, however, considered ineligible for Bank financing as the contract had been negotiated^{3/} without international competitive bidding. As regards the Great East

1/ The pipeline between Dar es Salaam and the Copperbelt was constructed at a cost of US\$48 million and came into operation in October/November 1968. Oil traffic on the GNR, constituting almost half of the total traffic, was subsequently diverted to the pipeline except for some special oil grades not amenable to pipeline transfer.

2/ The speed of negotiation for the second project may best be seen by the fact that after an application was submitted in January 1968, the project was appraised in March/April 1968 and the loan approved on September 24, 1968.

3/ With ZECCO, a Yugoslav company, which subsequently formed a joint venture with the Government (which took 51% ownership in January 1971). This is the only important contracting company in Zambia today.

Road the Bank turned down the Zambian request that it finance upgrading of the central section to bituminous paved standard but agreed to cover the cost of the requisite engineering studies.

The second project therefore finally consisted of: (i) the detailed engineering and reconstruction to two-lane bituminous paved standard of the Mpika-Tunduma section (235 miles) of the Great North Road and the access roads from Isoka and Nakonde; (ii) the procurement and installation of three weigh bridges on the Great North Road; and (iii) the detailed engineering of the Luangwa River-Nyimba section (63 miles) of the Great East Road.

On January 9, 1973 Rhodesia closed its border with Zambia completely, and the latter then refused to agree to the proffered reopening. As a result, Rhodesia Railways' share of Zambian traffic, which had been gradually falling in previous years, has dropped to almost nil in 1973. This is reflected in the following table, based on international trade statistics by frontier (see Annex Table I), which approximately shows the changing use of Zambia's main links with the outside world.

Table 1

Zambia: Total Import/Export Traffic by Route

	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972^{a/}</u>	<u>1973^{b/}</u>
Total ('000 tons) ^{c/}	<u>3320</u>	<u>3040</u>	<u>2990</u>	<u>2870</u>	<u>2870</u>	<u>2550</u>	<u>1840</u>
<u>Disposition by Route (%)</u>							
Rhodesia Railways ^{d/}	74	64	62	59	50	50	1
Benguela Railway ^{e/}	9	12	8	11	15	12	37
GNR	13	22	17 ^{f/}	17	20	18	28
Pipeline	-	-	11	12	14	18	27
GER	<u>4</u>	<u>2</u>	<u>2</u>	<u>1</u>	<u>1</u>	<u>2</u>	<u>7</u>
	100	100	100	100	100	100	100

a/ Estimate.

b/ Extrapolation based on first six months and reflecting actual disposition of traffic in that period.

c/ Including oil via pipeline from Dar es Salaam since 1969.

d/ Including certain amounts by road from Rhodesia.

e/ Linked via the BCK Railway through Zaire.

f/ Reduction due to completion of parallel pipeline.

The reduction over the years in the total tonnage of Zambia's international traffic reflects relatively constant production of copper (due to various factors, including temporary fuel shortages and the Mufulira mine disaster of September 1970) and periodic curbs on imports, partly due to shortages of foreign exchange, particularly since February of this year. While the Benguela route has been the principal substitute for Rhodesia Railways, particularly in 1973, the GNR and GER have been increasingly important and played a key role in the latest crisis. It is expected that the GNR's share of copper exports, already 45% at present, may reach 65% next year due to congestion at Lobito, the terminal port to the Benguela line.

As a result of studies that it carried out in connection with the granting of the first loan the Bank required assurance from the Government on the following: (a) maintenance of the Roads Department's strength, (b) adequate budgetary allocations for maintenance of the two roads financed, (c) encouragement of road carrier competition on these roads, (d) effective restriction of vehicle loading and (e) improvement of data collection for planning purposes. In connection with the second project the Government undertook to give adequate attention to maintenance of sections financed by the Bank and to promote development of Zambian professional skills to meet the Department's senior staffing needs.

Project Execution and Maintenance

Despite difficulties resulting from the changing political situation in the region, both projects were completed by the target date of December 31, 1969 adopted in the Bank's appraisal reports. The first project was completed at a total cost of only \$23.4 million compared with the \$29.0 million allowed in the Bank's appraisal, including substantial contingencies to provide for the uncertainties of the situation. The second project was completed for \$17.8 million compared with \$17.5 million allowed in the appraisal. The quality of work performed under both projects was also ultimately judged to be satisfactory; whatever local defects were pointed out by the supervising consultants or by the Bank's frequent supervision missions were satisfactorily corrected without delaying the opening of the roads to traffic.

Close conformity to cost estimates results partly from the rather low payments eventually made by the Government (in December 1971) against the substantial claims pressed by the contractors on the basis of increases in wages and in prices of materials and equipment which occurred during the construction period, partly as a result of Government actions including import controls. In addition some increases in physical work arose during construction as a result of unexpectedly poor quality of locally available material and the need to repair and rebuild certain sections after damage from oil spills and vehicle overloading due to the emergency situations. The Government actually paid only \$0.71 million against \$3.44 million claims under the first project and \$0.54 million against \$3.07 million under the second one. The claims were probably inflated, but the contractors who presented them

have apparently withdrawn from further operations in Zambia.

As foreseen in the cost estimates and tenders, the further each road-section was from the line of rail the higher the cost per mile of construction and engineering, as shown in the following table.

Table 2

Variation of Unit Cost with Distance from Line of Rail

<u>Section</u>	<u>Distance to the line of rail (miles)</u>	<u>Cost per mile of construction (\$/mile)</u>	<u>Cost per mile of Engineering (\$/mile)</u>
Chelston-Chongwe (GER)	10-37	35,710	4,510
Kapiri Mposhi-Serenje (GNR)	0-123	48,900	4,480
Chongwe-Rufunsa (GER)	37-77	58,460	4,830
Nyimba-Chipata (GER)	190-343	64,900	5,380
Mpika-Tunduma (GNR)	270-420	68,000	6,550

In order to obtain some impression regarding the present quality of the roads and the appropriateness of design standards used, the mission visited the Kapiri Mposhi-Serenje section of the Great North Road and the Chipata-Petauke section of the Great East Road. For the remaining sections interviews were held in Nairobi, with USAID and with officials of the UK Road Research Laboratory which had recently inspected some sections of the GNR in connection with highway design studies sponsored by the Bank, and in Lusaka, with various transport companies, consultants (Edwards & Burrow), the Roads Department^{1/} and ZECCO, the major contractor in Zambia which was responsible for construction of one of the sections financed under the first loan.

While the Great North Road has stood up remarkably well to the difficult conditions -- of heavy traffic, deficient maintenance and continuous overloading of trucks -- the pavement surface dressing is beginning to deteriorate on some sections. The Kapiri Mposhi-Serenje section, which handled the heaviest traffic since completion, already shows some signs of surface deterioration (cracking in the wheel tracks, loss of chippings, appearance of sporadic wave formations probably due to wear of the sealing course, and a general roughness). Similar characteristics were reported by the UK Road Research Laboratory personnel for some parts of the Mpika-Tunduma section; due to inadequate maintenance and clearing of the side drains, moisture has seeped under the tarmac, and accentuated overloading has resulted in some wave formations, mainly

^{1/} The Department was unfortunately not able to supply data such as Benkelmann beam test results, so that technical judgments had to be made on a qualitative basis.

on the steepest gradients.

The Great East Road is in much better condition, probably because of less traffic and relatively infrequent vehicle-overloading problems, at least prior to this year. The Chipata to Petauke section (crushed stone base dressed with a 3/4 inch bituminous overlay) is still in perfect condition after three years of operation, although some patching had to be done on a stretch 15 miles from Petauke.

Because of the uncertainties about traffic volume the Bank gave considerable attention to the matter of pavement design standards on these roads. The decision to build the GNR to 'normal' rather than 'heavy duty' standards does seem to have been quite correct; the road base appears entirely adequate and should be able to cope quite adequately with the expected maximum annual traffic of 800,000 tons on the GNR immediately prior to the opening of the new rail link in late 1974, as now planned. At the time of project appraisal it was also expected that, with heavy additional traffic, pavement strengthening would be undertaken after about three years; and the Second Loan Agreement included a specific covenant to the effect that the Borrower would keep the road sections financed, and the traffic on them, under observation "and shall strengthen the pavement by overlays when and if necessary." Despite the high traffic and heavy overloading this has not in fact been done. In retrospect, given the Government's failure to carry out adequate maintenance and to control overloading, it probably would have been preferable to lay an extra bitumen coat of 1/2 - 1 inch on some sections, especially the steeper gradients (which would not have increased the overall cost of the project by more than 2 or 3 percent). The possibility of overloading should probably have been explicitly considered in the extensive probability analyses carried out.

Traffic

In general, recorded traffic over the roads financed with the Bank's assistance has shown a greater increase, even before 1973, than expected in the appraisal reports. Annex Table IV shows the actual traffic recorded in selected years 1964-73. Average Daily Traffic (ADT) recorded between Kapiri Mposhi and Serenje on the Great North Road increased from 223 (51% trucks) in 1964 to 308 (60% trucks) in 1970 and 580 (65% trucks) in 1973, compared with a figure of about 300 (55% trucks) that appears to have been envisaged for 1973 in the appraisals, under the "middle" assumption regarding international traffic (which is closest to actual development). Traffic on the other sections of the Great North Road has grown more rapidly, although it remains much less in absolute terms, and seems to have been fairly close to forecasts until it rose somewhat above them in 1973. Traffic on the Great East Road has also grown fast, for instance from about 105 vehicles per day in 1966/67 on the Nyimba-Chipata section to 200 (33% trucks) in 1970 and 360 (44% trucks) in 1973; the latter figures correspond to forecasts of 180 (36% trucks) for 1970 and 225 (38% trucks) for 1973.

Freight transport to and from Dar es Salaam is provided almost entirely by ZTRS. It operates 535 of its own vehicles (almost all 30-ton Fiat trucks with trailers) and has on its books about 150 sub-contracted vehicles. Recently another 300 heavy trucks and 400 trailers have been ordered from the United States, 140 vehicles from West Germany, 150 from Japan and 56 from Britain. Most of these will be used along the 1000-mile Tan-Zam highway (Great North Road) though a few will also be put into service along the Great East Road to rail-heads in Malawi. Most of the freight transport along this road, however, is in the hands of the other major Zambian haulers, Contract Haulage Ltd.,^{1/} and the Malawian UTM.^{2/} The latter operates 100 vehicles (5-7 tons) on the route, while Contract Haulage runs 46 of its own vehicles (25 tons) on the route and sub-contracts another 100-150 vehicles.

Passenger road transport is now mainly in the hands of the United Bus Company of Zambia (UBZ) which was formed as a Government-owned enterprise in 1969 to take over the bus operations of the former CARS. As of the end of 1971 there was a total of 311 UBZ buses plying on different routes in the country, compared with 203 CARS buses in 1968. Besides UBZ there are also 37 companies with a total of 89 buses operating on various local routes. There are now 41 buses operating out of the Eastern province to other provinces compared with only 2 in 1968; 80% of them ply on the Great East Road between the Eastern province and the line of rail. Similarly 8 buses now operate between the Northern province and the line of rail compared with only 2 earlier on.

Freight Costs and Tariffs

Although it has not been possible systematically to verify expected savings in vehicle operating costs as a result of improvement of the roads, the partial data that are available do suggest that costs have fallen roughly in line with expectations. Accounting data supplied by ZTRS for its large trucks running between the Copperbelt and Dar es Salaam suggest that average direct running cost^{3/} per mile (in 1972 prices) has fallen about 30% from 100 US cents/mile in 1968 to 70 in 1972 (Annex Table V). Less precise information from Contract Haulage Ltd. suggests a rather similar reduction for its operations on the Great East Road, from about 94 US cents/mile in 1967 to 72 in 1972 (in 1972 prices).

Freight rates are hard to interpret because of implicit Government controls and possible cross-subsidization. ZTRS rates for copper export

1/ Formed in 1969 by merger of the freight section of the old Central African Road Services (CARS) with Smith and Youngson Ltd.

2/ United Transport of Malawi.

3/ Direct vehicle operating cost is here defined to include fuel, lubricants, tires and tubes, maintenance and depreciation.

are calculated on a cost-plus basis, but costs have been reduced not only by the reduction in per-mile operating costs but also by better coordination of traffic, resulting in better loads of general imports on the back-haul from Dar es Salaam. Average freight rates for copper exported by road have fallen substantially, while the railway rates have moved up, as the following table shows.

Table 3

Average Freight Rate Paid for Copper Exports on Various Routes
(in K per ton)

	<u>1965</u>	<u>1968</u>	<u>1972</u>
Benguela route: Ndola - Lobito	32	48	52
Rhodesia route: Ndola - Beira	32	48	48
GNR route: Ndola - Dar es Salaam	-	61	48

Sea freight rates from Dar es Salaam to London are only slightly above those from Lobito to Beira, so that the GNR route for copper is now very competitive.

Vehicle turn-around time on the Great North Road has also improved considerably. Compared with an average 10-14 days taken per single trip between Ndola and Dar es Salaam in 1967, the current average is about 4-6 days. This has increased the average number of round-trips per month from 1.1 to the present 2.3 for new vehicles, and it is foreseen that, with better coordination and complete modernization of the vehicle fleet, as many as 3.0 trips per month will soon be possible.

On the Great East Road, tariffs have been set by bilateral agreements between the Zambian and Malawian Governments. Average rates for cargo between Lusaka and the railhead at Salima (Malawi) have remained unchanged at around K 37/ton (US\$51.80) between 1968 and now. Rates negotiated by NAMBOARD^{1/} and private companies for the transport of maize from the Eastern province to depots along the line of rail are of the order of K 22.0/ton (US\$30.80) and have, if anything, been reduced in the past three years.

Local Development Impact

The two roads have served to broaden the zone of influence of the Copperbelt and line of rail to more outlying areas of the Central, Eastern and, to a lesser extent, Northern provinces. However, despite various Government programs such as Regional Marketing Boards and

^{1/} National Agricultural Marketing Board.

Intensive Development Zones^{1/} (IDZ), progress in this regard has been slow. Mineral prospecting has tended to be concentrated along the roads.^{2/} But the general impression is that rural to urban product movement remains generally small compared with urban to rural movement, mainly of consumer goods. The Great East Road, for instance, was to have facilitated greater movement and hence production of the main cash crops grown in the Eastern province -- tobacco and groundnuts. As can be seen from Annex Table VI there has in fact been a sharp decline in the production of these crops with a compensatory increase in maize production instead. This has been on account of bad harvests in the past few years and, to a certain extent, Government price policies which have tended to favor maize. Thus, groundnut production in the Eastern province dropped from an all-time high of 13,700 metric tons in 1967 to 5,800 in 1972. Tobacco sales dropped from 5.3 million lbs. in 1965 to only 1.5 in 1970. Maize production, on the other hand, rose from 7,300 tons in 1965 to 30,300 tons last year. While the improvement of the road has certainly facilitated the movement of maize to the line of rail (where there is presently a major surplus), the increase in production cannot be directly attributed to reduction in transport costs since NAMBOARD pays a uniform price (of K 4.00-4.30/bag), which is the same as the retail price along the line of rail, for maize delivered to any of its silos (including one at Chipata).

The Mkushi district, traditional supplier of maize for the Copperbelt, does seem to have benefitted more directly from the improvement of the southernmost portion of the Great North Road, linking it with the line of rail. Easier transport to the silos at Kapiri Mposhi seems to have been a factor in the phenomenal increase in maize production there from 120,000 tons in 1969 to 500,000 tons in 1972. Farmers operating their own vehicles up to Kapiri Mposhi are believed to have enjoyed savings up to K 500 per vehicle per year as a result of the improvement of the road.

Postponement of effort on feeder roads in favor of improvement of trunk routes has been felt most strongly in the Central province. The main arteries are presently on watersheds whereas a large section of the rural population lives along the rivers and is engaged in fishing and

1/ In the past, the government expenditures for agriculture were, for reasons of equity, thinly spread over the country and did not have much impact. IDZs were established with a view to forming trigger points for future rural development and to encourage people to stay on the land and increase production.

2/ It is interesting to observe the pattern of mineral prospecting over the past 3-4 years. Completely surveyed areas are now generally along the Great East Road near Petauke, Chipata and portions of the Luangwa River and along the Great North Road near Isoka, Mpika, Serenje and Kapiri Mposhi. The Geological Department considers these two roads as important mineral access routes for the future.

subsistence farming. Earlier access by these groups to the main roads would, in retrospect, have helped them in broadening their market also.

Estimated Actual Rate of Return

While it has not been possible to recalculate the economic rate of return, an attempt was made to see if there were any significant changes over the assumptions made by the appraisal missions. This comparison was based merely on growth of traffic and actual construction costs as no accurate information was available on road user savings and reductions foreseen in maintenance costs. Also, no fine distinction between various categories of traffic was attempted though due consideration was taken of the percentage of trucks in the average daily traffic.

On the Great East Road, actual construction costs were below appraisal report estimates for each section and truck traffic has grown more rapidly than expected, especially on the Nyimba-Chipata section. Allowing for these factors, the following adjustments to the rate of return are proposed for sections on the Great East Road.

<u>Section</u>	<u>Traffic 1973</u>				<u>Rate of Return (%)</u>	
	<u>Forecast</u>		<u>Actual</u>		<u>Forecast</u>	<u>Actual Estimate</u>
	<u>Total</u>	<u>Trucks</u>	<u>Total</u>	<u>Trucks</u>		
Chelston-Chongwe	370	130	390	170	14	above 15
Chongwe-Rufunsa	170	100	260	140	11	14 or above
Nyimba-Chipata	225	85	360	160	11-12	above 17

For the Great North Road section Kapiri Mposhi-Serenje (first project) three rates of return were appraised on the basis of the following assumptions: (i) normal traffic -- 12 percent; (ii) permanent additional traffic of 600,000 tons -- 12.5 percent; and (iii) permanent additional traffic of 1.2 million tons -- 15 percent. As there was a saving of 9 percent in the actual cost of construction and the import-export level of traffic is around 600,000 tons per annum, and will reach probably 800,000 tons in the next year, it is likely that the rate of return will be above the 12.5 percent indicated under the second assumption.

The appraisal of the Mpika-Tunduma section of the Great North Road was a more complex matter. A range of probabilities was assigned to the following major events: 1) expected volume of traffic diverted to the GNR from the Rhodesian border, 2) the duration of the period of the emergency and 3) the possible completion date of the Tan-Zam railway. Three hundred rates of return were computed ranging from 2.1 percent to 29.2 percent, corresponding to alternative combinations of the above

events. In retrospect, it seems that a 12-15 percent rate of return will ultimately be realized given the permanent closure of the Rhodesian border and the high level of present traffic. The return would probably have been slightly higher if earlier resurfacing had been done (because of lower quantities involved). Also, the rail link is now expected to be completed by late 1974 instead of the envisaged date of 1976.

Vehicle Loading Regulation

Despite the repeated efforts of Bank supervision missions and USAID officials on the Zambian and Tanzanian sides, respectively, of the Great North Road, the problem of overloaded axles remains serious. Earlier, there was some ambiguity in the law on the subject and permission for overloading was often given easily for particular operators during the emergency following the 1968 embargo. To help control overloading, the Bank financed three weigh bridges at a total cost of US\$136,000 as part of its second project. Two of these bridges were installed in 1970 -- one at Kafulafuta (Copperbelt) and the other at Kapiri Mposhi. However, owing to the delay in importing peripheral equipment and a lack of trained operators, the Kafulafuta bridge was only opened in February 1971 and the Kapiri Mposhi one in January 1972. In February 1973 a third bridge was opened near Mpika and yet another is likely to be operational near Tunduma later in the year.

The installation of the weigh bridges has given a better idea about how much overloading is actually taking place. A sample taken recently of 420 vehicles (day and night traffic) passing through the Kapiri Mposhi weigh bridge indicates that about 28 percent of them were in fact overloaded. The average axle weights recorded for overloaded vehicles were the following.

Table 4

Axle Weights of Overloaded Vehicles

<u>Vehicle Type</u>	<u>Observed Axle Load</u> tons	<u>Maximum Axle Load Allowed</u> tons
1. Single axle (2 pairs of wheels)	12-13	10.0
2. Double tandem axle (4 pairs of wheels)	18-19	14.5
3. Double tandem axle (8 pairs of wheels)	19-22	16.3

An analysis of the distribution of the overloaded vehicles by category indicates that the damage to the road caused by these vehicles is 2.7 times higher than that caused by the same number of vehicles of standard 18,000 lbs/axle. In terms of tonnage supported, these vehicles represent the equivalent of a 48 percent increase over the nominal annual loading. There have been no effective penalties for overloading.

Cargo-wise, copper trucks represent about 60 percent of all vehicles overloaded and another 20 percent is accounted for by maize carriers. Among all types of vehicles overloaded the Fiat trucks of ZTRS represent 75 percent. At least for recent years it does not appear that overloading has been necessitated by shortage of trucks.

The Ministry of Power, Transportation and Works and the Roads Department are fully aware of the problem but have not acted so far. It is now being proposed to give patrolling authority to the Road Traffic Commissioner and to operate the bridges on a 24-hour basis instead of the day-time only that is normal at present.

Road Maintenance

Shortages of budgetary funds and Roads Department staff have apparently been the main factors limiting maintenance and betterment work below what was required by the increase in the road network and traffic. This has been particularly the case in the last two years.

Table 5

Roads Department: Mileage Maintained and Total Recurrent Expenditures

<u>Year</u>	<u>Roads for which Department Responsible^{a/}</u>				<u>Recurrent Expenditures</u>	
	<u>Total Network</u>		<u>Class I Bitumen</u>		<u>K'000^{b/}</u>	<u>Index</u>
	<u>Miles</u>	<u>Index</u>	<u>Miles</u>	<u>Index</u>		
1968	6,600	100	913	100	4,940	100
1969	6,788	103	1,075	118	5,360	109
1970	11,000	167	1,756	193	7,870	159
1971	11,250	170	1,875	205	8,880	180
1972	11,488	174	2,375	260	5,302	107
1973	-	-	-	-	5,280	107

a/ At end of year.

b/ Inflated to 1972 prices, using the wholesale price index for all manufacturing.

In 1973 only 360 miles out of a total of 4,750 miles of gravel road (i.e. 7.5%) are expected to be regravelled; only 63 miles out of 2,250 miles of paved road (2.8%) are expected to be resealed. Withdrawal of Roads

Department vehicles without replacement has been another factor necessitating that a progressively larger share of the betterment and maintenance program be contracted out. During the last five years about 50 percent of such work as resealing, premix, regravelling and shoulder improvement has been accomplished on a contract basis. Even then, a large part of the actual work needed to be done has not been undertaken.

As regards the road sections to which the Bank contributed capital financing and the maintenance covenants specifically referred, maintenance work was not undertaken before 1973, when K 147,000 was scheduled to be spent on the GNR and K 105,000 on the GER. No extensive resealing has been done on the GNR despite the large volume of traffic. Only 14% of the GER, mainly the central section built with Government budgetary funds, has been resealed. Progressive resealing on sections showing signs of stress on both roads is now envisaged for 1974.

Roads Department Staffing and Zambianization

Contrary to the agreements reached in connection with the first loan, Roads Department staff does not seem to have been maintained at the strength then obtaining, and little progress has been made with Zambianization at the higher levels despite the intentions expressed in connection with the second loan. Approved strength for the Department for 1964/65 was 170 (excluding 40 clerical) while actual strength on August 1, 1965 was 103. By 1968, the next year for which figures are available, approved strength had been cut to 128 while actual strength (at year end) was only 86. It increased slightly from that level in 1971 to reach about 96 for the last two years (see Annex Table VII), but this is less than 60% of approved establishment. Expatriates, discouraged for lack of career prospects and from various external pressures, continue to hold all the senior professional posts as the following list shows:

<u>Posts</u>	<u>Zambian</u>	<u>Non-Zambian</u>
Director of Roads	-	1
Deputy Director of Roads	-	1
Senior Executive Engineer	-	4
Executive Engineer	-	15
Senior Materials Officer	-	1
Senior Road Inspector	1	6
Draftsmen	2	-
Engineering Assistant	5	5
Materials Officer	2	2
Road Superintendent	<u>7</u>	<u>11</u>
	17	46

Reduction of establishment in the middle 1960s and maintenance of the Department well below approved levels apparently result mainly from budgetary restrictions and partly from difficulty of recruiting qualified

Zambians. The training school of the Department has been working at capacity since 1967 and has produced some 175 technicians, but most of them have gone to local Government units and other bodies and only a portion have joined the lower ranks of the Department. The prospects for rapid Zambianization at the higher levels are not bright. Because of the preference of Zambian youth for humanities and social sciences only 100 students (5% of total enrolment at Zambian universities) are now enrolled for an engineering BSc, and the number emphasizing civil engineering is only in single figures. Higher salaries paid by private industry add considerably to the difficulties of recruiting well-qualified Zambians. The Minister of Power, Transportation and Works considers, probably correctly, that appointment of a Zambian at the head of the Roads Department is crucial to get more momentum behind the Zambianization effort. An appropriate candidate was identified but lost, mainly for salary reasons, and the contract of the present Director has consequently been extended another three years.

Road Carrier Competition

As one condition of the first loan, the Government undertook to investigate road carrier competition in the areas affected by the road improvements financed by the Bank and to initiate steps to encourage competition. The study was never done. However, in 1967, the Government revised its transport licensing policy to permit the Traffic Commissioner to give licenses on the basis of an applicant's ability to provide a service rather than a somewhat strict evaluation of the "need" for the service. This has permitted the growth of a large number of vehicle operators who either sub-contract their services to one of the large companies -- UBZ, ZTRS or Contract Haulage, or run on routes defined for them by the licensing authority. In regard to the latter, it is still very difficult for an individual operator to obtain permission to ply on the trunk routes (especially the GreatNorth and Great East Roads) since his case is evaluated with the participation of the three major companies who are already capable of providing the same service. It is easier for him to obtain a restricted license specific to a group of provincial routes. Therefore, though some progress has been made in allowing small transport companies to establish themselves, it is still the large companies that dominate. However, they seem to be efficiently run and whatever evidence is available does suggest that the end-result has been declining road tariffs, at least in real terms.

Data Collection and Planning

Basic Data have continued to be collected about the operation of the highway system, but the improvements called for in connection with the first loan do not seem to have occurred, and the Bank's economic approach to allocation of Roads Department resources seems to have generated little interest. ADT data are collected at the 50 points established in 1962/63 by the UK Road Research Laboratory, but the counts are too infrequent (three times a year at each on average) and not enough attention

is given to night traffic. Information about vehicle overloading is collected at the weigh stations, but it is not coordinated or collated. Work has not been done on vehicle operating costs, specifically mentioned in the loan documentation. The Department's Planning Unit consists of one expatriate only, and economic studies of planned works are not done.

Conclusions

Although, and perhaps to some extent because, the investments assisted by the Bank have proved much more important for the crucial international traffic than for expected impact on regional integration, there is no doubt that the decision of the Government and the Bank to select only major routes, i.e. the GNR and the GER, instead of other roads within the priority list of the NEDECO study was a wise one. But it also seems clear that even if the Bank had acted more quickly than it did on the GNR, the construction of the Tan-Zam rail link would not have been postponed, because of the very high priority that the Government gave to a fuller and more flexible transport system to the sea-ports and centers of East Africa.

The conception of both projects was very sound, and the judgment of the Bank, given the political uncertainty in the region, seems to have been fair and realistic. For the Great North Road in particular, sufficient account was taken of the many possible combinations of circumstances that might occur, and an appropriately designed project emerged, that could only have been improved at the margin by slightly better allowance for the deficiency of maintenance and loading regulation that was to occur.

Construction of the road improvements was satisfactorily accomplished within the time schedules expected by the Bank and generally within cost estimates. The Bank's supervision missions played a useful role in pointing to deficiencies during the physical execution of the project and these deficiencies were satisfactorily rectified.

Major weaknesses in the Government's fulfillment of commitments made at the time of loan signature were noted by the Bank's supervision missions and follow-up letters were sent on a number of occasions -- but with very little result. The problem of vehicle overloading is only now beginning to receive serious attention, and the weigh bridges financed under the second loan have so far had very little effect, except to illustrate the need for action. Road maintenance has generally been low, particularly on the roads financed under the loans. The manpower strength of the Roads Department deteriorated through about 1970 and, despite some recent improvement, remains much below needs. The difficulties posed to the Zambian authorities by the recurring emergency situations which they faced do not seem fully to explain the failure to live up to the agreements made.

In retrospect it is easy to say that earlier and greater emphasis should have been given to Zambianization, but it is not clear that it would have been easy to implement. The Bank did take the matter up seriously in connection with the second loan, including among the agreements reached what was then a rather novel type of supplementary letter, stressing development of local skills. But the Roads Department, dominated by expatriates, displayed even less receptivity to the Bank's advice on this matter than on others; and the Government as a whole has only come to put major emphasis on Zambianization in more recent years. The Bank might have helped more by encouraging the Government authorities to try to identify, even at pre-university level, a number of individuals who could be specially prepared for senior positions in the Roads Department. Some relaxation of standards, especially as to the specialization of a graduate engineer's training, might even have been desirable, in order to Zambianize some senior positions, with expatriates acting for a limited period as technical counterparts. Such high-level training would probably also have helped to develop more conviction that planning is important and economic studies and data collection useful.

Even though the Bank's original objectives of a more developmental highway program had to be sacrificed in favor of trunk routes for access to the sea, it is now foreseen that after the stabilization in the transport situation following the completion of the Tan-Zam Railway late in 1974, these objectives will again be pursued. Bank assistance for maintenance, including technical assistance to help attain a more economic allocation of available resources among different tasks as suggested by a recent Bank mission and supported by the Minister of Power, Transportation and Works, would also appear very worthwhile.

ZAMBIA

Total Imports and Exports by Frontier
(In Thousand Metric Tons)

FRONTIER	1968			1969			1970			1971			1972 (Estimated) 2/			1973 (Estimated) 3/		
	By Road	By Rail	Total	By Road	By Rail	Total	By Road	By Rail	Total	By Road	By Rail	Total	By Road	By Rail	Total	By Road	By Rail	Total
1. TANZANIA BORDER																		
Imports	424.5	-	424.5	240.9	-	240.9	248.3	-	248.3	337.3	-	337.3	249.1	-	249.1	200.6	-	200.6
Exports	229.5	-	229.5	243.7	-	243.7	253.4	-	253.4	221.4	-	221.4	225.4	-	225.4	315.0	-	315.0
Total	654.0	-	654.0	484.6	-	484.6	501.7	-	501.7	558.7	-	558.7	474.5	-	474.5	515.6	-	515.6
2. RHODESIA BORDER																		
Imports	408.9	1,141.8	1,550.7	103.1	1,256.0	1,359.1	70.6	1,222.9	1,293.5	216.9	831.1	1,048.0	143.3	713.4	856.7	N/A	N/A	8.6
Exports	2.8	393.2	396.0	1.6	488.2	489.8	3.3	1,395.2	398.5	1.4	388.5	389.9	2.7	436.1	428.7	N/A	N/A	4.5
Total	411.7	1,535.0	1,946.7	104.7	1,744.2	1,848.9	73.9	1,618.1	1,692.0	218.3	1,219.6	1,437.9	146.0	1,139.4	1,285.4	N/A	N/A	13.1
3. MALAWI BORDER																		
Imports	61.8	-	61.8	56.2	-	56.2	18.4	-	18.4	29.1	-	29.1	38.7	-	38.7	80.2	-	80.2
Exports	8.9	-	8.9	7.8	-	7.8	5.7	-	5.7	8.9	-	8.9	4.8	-	4.8	41.8	-	41.8
Total	70.7	-	70.7	64.0	-	64.0	24.1	-	24.1	38.0	-	38.0	43.5	-	43.5	121.8	-	121.8
4. ZAIRE BORDER																		
Imports	-	151.5	151.5	-	121.5	121.5	-	117.7	117.7	-	268.9	268.9	-	164.7	164.7	-	313.8	313.8
Exports	-	197.5	197.5	-	123.4	123.4	-	187.3	187.3	-	149.5	149.5	-	148.5	148.5	-	373.0	373.0
Total	-	349.0	349.0	-	244.9	244.9	-	305.0	305.0	-	418.4	418.4	-	293.2	293.2	-	686.8	686.8
5. PIPELINE (TANZANIA)																		
Imports	-	-	-	-	-	-	-	-	340.4	-	-	406.4	-	-	451.4	-	-	500.0
Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	340.4	-	-	406.4	-	-	451.4	-	-	500.0
6. OTHER 1/																		
Imports	6.6	-	*18.0	0.4	-	*13.0	1.4	-	*3.8	2.3	-	*7.0	1.0	-	*7.9	N/A	N/A	2.4
Exports	1.6	-	*2.1	2.0	-	3.2	3.6	-	3.6	2.7	-	2.7	-	-	-	-	-	NIL
Total	8.2	-	*20.1	2.4	-	*16.2	5.0	-	*7.4	5.0	-	*9.7	1.0	-	*7.9	N/A	N/A	2.4
7. TOTALS																		
Imports	901.8	1,293.3	2,206.5	400.6	1,377.5	2,119.3	338.7	1,340.6	2,022.1	585.6	1,100.0	2,096.7	432.1	858.1	1,748.5	280.6	313.8	1,105.6
Exports	242.8	590.7	834.0	235.1	611.6	867.9	266.0	582.5	848.5	234.4	538.0	772.4	232.9	574.5	807.4	356.2	373.0	734.1
Imports Excluding Pipeline	-	-	2,206.5	-	-	1,790.7	-	-	1,681.7	-	-	1,690.3	-	-	1,297.1	-	-	605.6

* Includes modes of transportation other than road and rail.

1/ Includes air cargo from Johannesburg via Botswana.

2/ Source - U.N. Security Council Report and Central Statistical Offices provisional figures.

3/ Source - Data for January-July 1973 from Transport Contingency Secretariat, Lusaka.

4/ Excluding non-available items. These are, however, small.

ZAMBIA
LOAN 469-ZA
ESTIMATED AND ACTUAL COSTS AND COMPLETION DATES

Item	Length of Section (miles)	Time of Award	Estimated Completion Date	Actual Completion Date	Nature of Work Performed	Contractors	Tender Sum	Unit: US\$ million equivalent (including contingencies)	Appraisal Cost	Actual Cost	Cost Overrun	Cost/mile (US\$)
A. Construction												
1. Great East Road												
Chelston-Chongwe	26.6	May 1965	April 1966	Jan. 1967	Improv., Reconst., Paving to Cl. I	L. J. Whyte Zecco C. Torno	0.90 3.88 8.06	1.23 5.31 11.14	0.95 3.87 9.89	-33 -28 -11		35,710 58,460 64,900
Chongwe-Refunsa Nyimba-Chipata	66.2 152.4	Aug. 1966 Sept. 1966	Feb. 1968 June 1969	June 1968 Dec. 1969	" "	Edwards & Burrow Brian Colquhoun Edwards & Burrow	12.84	17.71	14.71	-17		60,000
SUB-TOTAL	245.2											
2. Great North Road												
Kapiri Mpoashi-Serenje Plus: Slurry seal by Roads Department	122.7	July 1966 June 1968	July 1968 Dec. 1968	May 1969 May 1970	Improv. Bituminous Paving to Cl. I	Holzmann Roads Dept.	6.08 0.45	8.68 a/	5.58 0.42	-36 -		48,900
SUB-TOTAL	122.7						6.53	8.68	6.00	-31		48,900
TOTAL CONSTRUCTION	367.9						19.37	26.36	20.71	-21		56,290
B. Engineering												
1. For Section of Actual Project												
Chelston-Chongwe Chongwe-Refunsa Nyimba-Chipata Kapiri Mpoashi-Serenje	Same as const. " " " " " "	Same as const. " " " " " "	Same as const. " " " " " "	Same as const. " " " " n.a	Detailed engineering Supervision of const. " "	- - - -	n.a. n.a n.a n.a	n.a. n.a n.a n.a	0.12 0.32 0.82 0.55	- - - -		4,510 4,830 5,380 4,480
SUB-TOTAL	367.9							2.18	1.81	-17		4,920
2. For Section Serenje-Mpika Great North Road												
SUB-TOTAL	147.0							0.46	0.83	+80		5,650
TOTAL ENGINEERING	514.9							0.46	0.83	+80		5,650
TOTAL PROJECT COST	514.9							29.00	23.35	-19		

2/ Not estimated during appraisal.

Source: Roads Department, MPTW, Lusaka.

ZAMBIA

LOAN 563-7A

ESTIMATED AND ACTUAL COSTS AND COMPLETION DATES

Item	Length of Section (miles)	Time of Award	Original Completion Date	Actual Completion Date	Nature of Work Performed	Consultants	Contractors	Tender Sum	Unit: US\$ million equivalent		% Cost Overrun	Cost/mile (US\$)
									Appraisal Cost (including contingencies)	Actual Cost		
A. Construction (Great North Road)												
Mpika-Chinsali	105	July 1967	Dec. 1968	Dec. 1969	Reconst., Bituminous Paving Cl. I	Edwards & Burrow	Frederici	7.67	8.02	7.51	-6.4	71,520
Chinsali-Tunduma	130	Sept. 1967	Oct. 1969	Aug. 1969	"	Pettit & Partners	Stirling-Astaldi	6.70	7.99	8.47	+6.0	65,150
TOTAL CONSTRUCTION	235							14.37	16.01	15.98	-1.8	68,000
B. Engineering												
1. For sections of actual project												
Mpika-Chinsali		same as const.	same as const.	same as const.	Detailed engineering & supervision of const.	Edwards & Burrow	-	n.a.	0.55	0.98	+78.0	9,330
Chinsali-Tunduma		"	"	"	"	Pettit & Partners	-	n.a.	0.68	0.57	-16.0	4,380
2. For section												
Luangwa River-Nyimba (Great East Road)	63	n.a.	n.a.	n.a.	Detailed engineering	Edwards & Burrow	-	n.a.	0.11	0.11	0	1,750
TOTAL ENGINEERING	298								1.34	1.66	+24.0	5,500
C. Procurement and Installation of three Weigh Bridges												
TOTAL PROJECT COST								n.a.	0.14	0.13 ^{a/}	- 8.0 ^{a/}	-
									17.49	17.77	+1.6	-

a/ Purchase of machinery, installation and construction of parking facilities were included in the project. The average cost per Weigh Bridge was US\$28,000. An additional expenditure of US\$28,000 per bridge is forecast in order for them to operate on a 24-hour basis (lighting and housing facilities).

Source: Roads Department, MPTW, Lusaka.

ZAMBIA

AVERAGE DAILY TRAFFIC

(Selected Years)

<u>Sections</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1970</u>	<u>1971</u>	<u>1973</u>
<u>Great North Road</u>						
1. Kapiri Mposhi-Serenje						
ADT	223	240	325	308	364	580
% trucks	51	49	66	60	63	65
2. Serenje-Mpika						
ADT	80	81	195	173	201	280
% trucks	53	60	80	72	70	70
3. Mpika-Chinsali						
ADT	23	32	108	100	141	180
% trucks	44	51	86	82	69	78
4. Chinsali-Tunduma						
ADT	24	23	108	155	180	240
% trucks	42	37	91	76	65	75
<u>Great East Road</u>						
1. Chongwe-Rufunsa						
ADT	94	98	62	122	289	240
% trucks	54	51	61	50	25	55
2. Nyimba						
ADT	50	58	69	109	181	250
% trucks	36	34	57	41	44	50
3. Chipata						
ADT	140	158	141	282	351	480
% trucks	27	31	28	23	24	32

Source: Roads Department, MPTW, Lusaka.

Annex Table V

VEHICLE OPERATING COSTS
US Cents/Vehicle-Mile
(1972 Constant Prices)

	ZAM-TAN ROADS SERVICES LTD. <u>1/</u> FIAT 30T + TRAILER DIESEL		BCEOM ESTIMATES <u>2/</u> 25 Ton Unit DIESEL	
	1968	1972	Gravel	Paved
FUEL	14.4	13.3	13.6	11.7
LUBRICANTS	1.1	0.9	2.8	2.4
TIRE & TUBES	12.2	9.8	12.5	10.4
MAINTENANCE				
Labor	29.2	14.7	13.9	8.8
Parts	<u>27.4</u>	<u>21.8</u>	<u>7.3</u>	<u>4.5</u>
Subtotal	84.3	60.5	50.1	37.8
Depreciation	<u>15.7</u>	<u>9.2</u>	<u>22.8</u>	<u>16.3</u>
Total Running Cost	100.0	69.7	72.9	54.1

1/ Accounting Costs

2/ Theoretical estimated costs: BCEOM, 1969

Annex Table VI

ZAMBIA

AGRICULTURAL PRODUCTION

<u>Year</u>	<u>1. Eastern Province</u>				<u>2. Central Province</u>	
	<u>Ground Nuts</u> (M. tons)	<u>Maize</u> (M. tons)	<u>Seed Cotton</u> ('000 lbs.)	<u>Tobacco</u> ('000 lbs.)	<u>Mkushi Dist.</u> <u>Maize</u> (M. tons)	
1960	8,700		5.8	634.6	7,519	
1961	11,600		4.9	998.6	8,326	
1962	12,700	N/A	48.2	1,620.2	13,913	
1963	14,400		nil	3,228.3	37,912	
1964	2,300	8,000	26.1	4,122.0	N/A	
1965	5,800	7,300	110.3	5,271.2	60,000 ^{a/}	
1966	10,900	13,700	520.8	2,540.2	N/A	
1967	13,700	13,600	588.7	1,457.3	120,000 ^{a/}	
1968	4,700	10,700	1,128.2	1,640.2	54,000 ^{a/}	
1969	6,900	2,300	2,961.3	1,424.4	179,000 ^{a/}	
1970	2,600	1,400	1,718.1	1,460.8	500,000 ^{a/}	
1971	5,500	13,800	1,567.7	N/A		
1972	5,800	30,300	573.4	N/A		

a/ Obtained from Governor, Mkushi District - estimates.

ANNEX Table VII

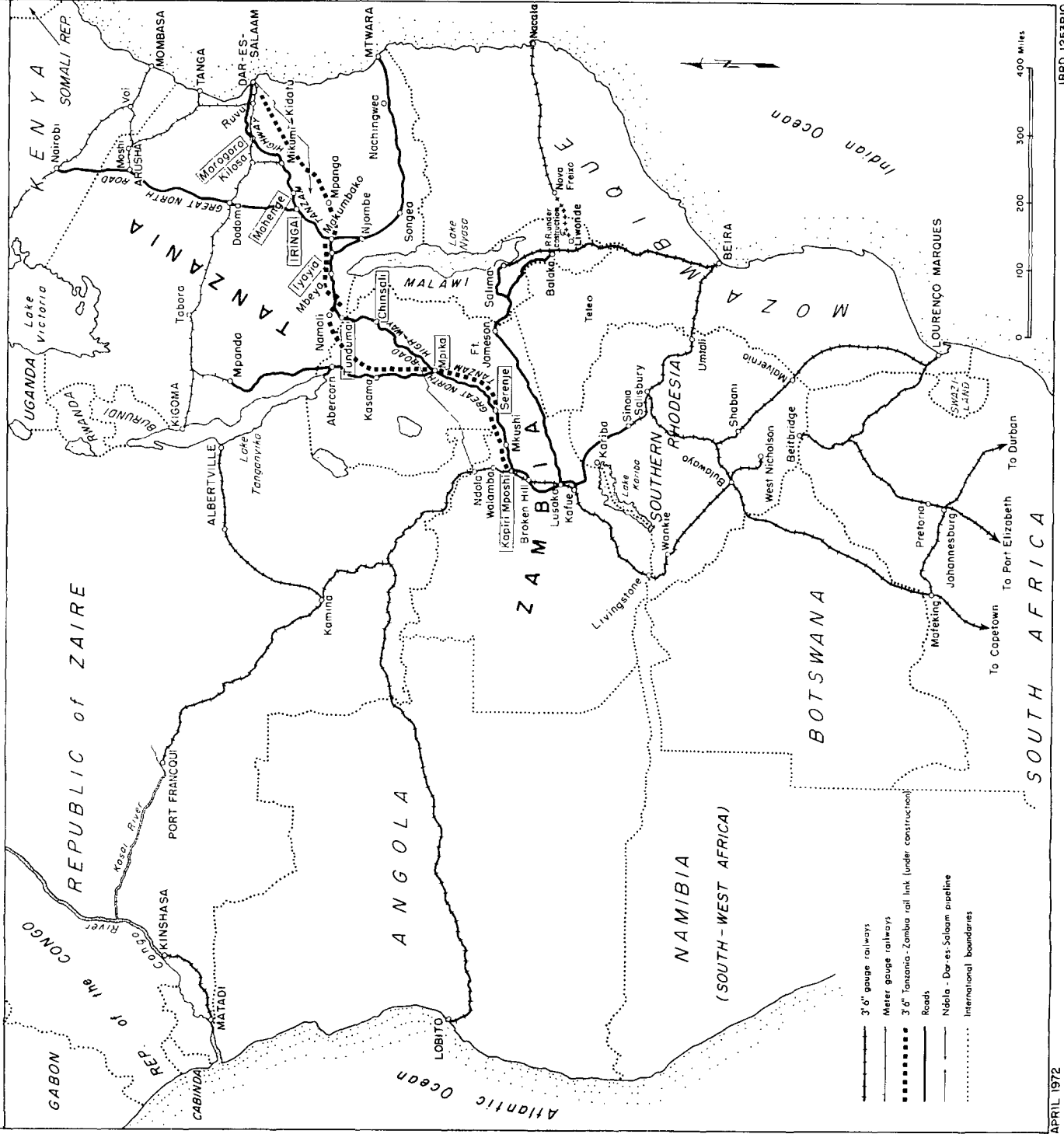
A. ROADS DEPARTMENT STAFF - SITUATION DECEMBER 31

	1968		1969		1970		1971		1972	
	Authorized Strength	Actual	Authorized Strength	Actual	Authorized Strength	Actual	Authorized Strength	Actual	Authorized Strength	Actual
Super-scale officers	8	7	7	6	8	4	9	7	9	6
Professional officers	23	14	19	13	22	15	22	12	22	15
Senior executive officers	1	1	2	1	2	1	2	2	2	2
Other executive officers	10	6	5	2	8	7	8	7	8	6
Chief and Senior Technical officers	5	3	5	4	25	16	9	7	17	10
Other technical officers	81	55	74	61	91	43	108	61	107	58
Subtotal	<u>128</u>	<u>86</u>	<u>112</u>	<u>87</u>	<u>156</u>	<u>86</u>	<u>158</u>	<u>96</u>	<u>165</u>	<u>97</u>
Clerical and Analogous	<u>46</u>	<u>28</u>	<u>50</u>	<u>33</u>	<u>25</u>	<u>13</u>	<u>25</u>	<u>13</u>	<u>25</u>	<u>11</u>
TOTAL	174	114	162	120	181	99	183	109	190	108
Percent Authorized Strength		65.5		74.0		55.7		59.6		56.8

B. ROADS DEPARTMENT STAFF
Vacancies - Recruitments

	1968	1969	1970	1971	1972
Approved establishment					
Strength 1 January	174	162	181	183	190
Strength 31 December	134	114	120	99	100
Vacancies	114	120	99	109	108
Recruitment	60	42	82	74	82
Casualty	10	31	22	32	26
	30	25	43	22	14

PRINCIPAL TRANSPORT LINKS IN EAST & CENTRAL AFRICA



ZAMBIA HIGHWAY SYSTEM

- Interterritorial roads
- Main roads
- District roads
- Railways
- Provincial boundaries
- Construction, Second Highway Project
- Construction, First Highway Project
- Engineering, First Highway Project
- Engineering, Second Highway Project
- Proposed Tanzania-Zambia rail line

