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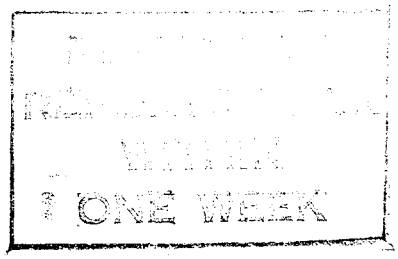

Report No. 1409

Project Performance Audit Report

MADAGASCAR HIGHWAY RECONSTRUCTION PROJECT

(Credit 90-MAG)

January 3, 1977

Operations Evaluation Department

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Project Performance Audit Report

MADAGASCAR HIGHWAY RECONSTRUCTION PROJECT

(Credit 90-MAG)

Preface

This report is a performance audit of experience under the Highway Reconstruction Project in Madagascar, which was supported by an IDA credit (90-MAG) of US$10 million signed in August 1966.

The performance audit is based on the attached Project Completion Report, a review of IBRD/IDA files, and a short visit by Operations Evaluation Department staff to Madagascar in May 1976. The valuable assistance of the Government of Madagascar is gratefully acknowledged.

Exchange Rates: Malagasy francs (FMG)

1966-68	US$1 = FMG 247
1969	US$1 = FMG 278
1970	US$1 = FMG 276
1971	US$1 = FMG 284
1972	US$1 = FMG 278
1973	US$1 = FMG 284
1974	US$1 = FMG 272
1975	US$1 = FMG 262
1976	US$1 = FMG 215

PROJECT PERFORMANCE AUDIT BASIC DATA SHEET

MADAGASCAR: HIGHWAY RECONSTRUCTION PROJECT (Credit 90-MAG)

	Amounts (in US$ mln)			As of 12/31/75	
	Original	Disbursed	Cancelled	Repaid	Outstanding
Credit 90-MAG	10.0	10.0	-	-	10.0

Project Data

	Original Plan	Revisions	Actual or Est. Actual
Conception in Bank	-		07/64
Negotiations	-		04/66
Board Approval	-		07 / 28 /66
Credit Agreement	-		08 / 02 / 66
Effectiveness	10 /31 /66		10 / 11 / 66
Physical Completion	-		07 / 74
% of original project actually completed	100		160
Loan/Credit Closing	12 /31 /70		12 / 74
Total Costs (US$ mln)	12.8		12.5
Econ. Rate of Return (%)	11-12		about 15

Mission Data

	Month, Year	No. of Weeks	No. of Persons	Manweeks	Date of Report
Identification) Preparation) Preappraisal)	No separate missions carried out during economic mission.				
Appraisal	01/65	3	2	6	05/24/66
Subtotal		3		6	
Supervision I	06/67	/a	1	/a	/a
Supervision II /b	02/68	1	1	1	03/18/68
Supervision III	01/69	1	1	1	03/13/69
Supervision IV	03/69	½	1	½	05/12/69
Supervision V	10/69	1	2	2	11/10/69
Supervision VI	07/70	1	1	1	08/27/70
Supervision VII /c	04/71	1	1	1	/a
Supervision VIII	11/71	1	1	1	01/17/72
Supervision IX	09-10/72	1	2	2	10/25/72
Supervision X	09/73	- /d	1	- /d	11/13/73
Supervision XI	08/74	2	1	2	09/26/74
Completion Report	04/75	- /d	2	- /d	01/09/76
Subtotal /e				11.5	

Follow-on Project: Cr. 134/Ln. 570-MAG of US$8.0 mln, signed 11/12/68 for Second Highway Project.

Date of Conception in IDA is date IDA first recorded project was being considered for financing and began to follow up that decision in a serious continuous way (Project Negotiations or Country General Files). Actual Credit Closing Date is date of last disbursement out of the Credit, as given by Controller's Department data.

/a No report available in files.
/b Simultaneous to appraisal of Second Highway Project.
/c Simultaneous to appraisal of Third Highway Project.
/d Less than ½ week.
/e Estimated.

Project Performance Audit Report

MADAGASCAR HIGHWAY RECONSTRUCTION PROJECT

(Credit 90-MAG)

Highlights

The Highway Reconstruction Project was the first World Bank project in Madagascar. It provided for the paving of the remaining unpaved stretch of a main highway. The project outcome was highly successful, although the final results depend on adequate future road maintenance and better Government control in the reduction of excessive truck loads.

Bank supervision of the project was initially inadequate, and works were allowed to fall dangerously behind schedule. Appropriate measures were subsequently taken to complete on time the components originally included in the project.

Costs were much lower than anticipated, and a series of complementary studies and works were financed with the unused portion of the credit. The credit closing date was postponed by four years in order to complete the supplementary project components.

The following issues may be of particular interest:

- Difficulties in estimating rates of return (PPAM paras. 7 and 8, PCR para. 5.10)
- Contribution of IDA supervision (PPAM para. 12, PCR para. 5.15)
- Deficiencies of IDA supervision (PPAM, paras. 9-11, PCR paras. 4.09 and 6.04)
- Road maintenance (PPAM paras. 13 and 14, PCR para. 2.07)
- Government vehicle weight and pricing controls (PPAM paras. 15 and 16, PCR para. 5.11)
- Interference of political factors (PPAM paras. 17 and 18, PCR para. 4.30 and 4.31)
- The lack of induced economic impact (PPAM para. 6, PCR paras. 5.02 and 5.03)

Project Performance Audit Memorandum

DEMOCRATIC REPUBLIC OF MADAGASCAR HIGHWAY RECONSTRUCTION PROJECT (CREDIT 90-MAG)

I. PROJECT SUMMARY

1. The Highway Reconstruction Project (Credit 90-MAG) was the first IBRD/IDA operation in the Democratic Republic of Madagascar. The project was intended to improve the last unpaved section of highway RN4, linking Tananarive, the capital, to Majunga, the main port on the western coast of the island, and to the north through the junction with RN6. In July 1964, an economic mission identified the proposed project, which was subsequently supported by a feasibility stud prepared by the Government. In January/February 1965 an appraisal mission reviewed the proposal. The mission found the project suitable for IDA financing but insisted on changes in design standards, which were finally accepted. It also suggested that detailed engineering should be carried out so that realistic cost estimates would be available before negotiations and delays avoided thereafter in starting implementation. Detailed engineering was agreed to be completed by the time of negotiations and financed retroactively.

2. The project components included (i) detailed engineering, reconstruction, and supervision of reconstruction for two sections of RN4 between km 165 and Andramy (then totalling 160 km but reduced to 145 km after realignment), and (ii) an economic study of alternatives (one 14 km and the other 28 km) and detailed engineering for the Andramy-Boinakely section of RN4 including a bridge over the Betsiboka River (see maps). The project was estimated to cost US$12.8 million (FM3.17 billion), including physical and price contingencies of about 30% on construction costs. IDA was to contribute US$10 million, or 78%. Procurement was to be by international competitive bidding. The rate of return on the road construction component was estimated at about 11%.

3. As regards negotiations and Board presentation, the former went smoothly. During the latter, questions were raised about the cost of reconstruction, which seemed high, and the staff responded that it reflected the unusual amount of work required as a result of the road realignment, the difficult terrain, and the high contingencies allowed to safeguard against underestimation of costs for this first operation in Madagascar.

4. Despite initial delays (para. 9), construction of the 145 km road sections was completed on time at a total cost, including administration and supervision costs, of US$8.36 million, or 66% of the original estimate including contingencies. The quality of the completed work was satisfactory. The economic study and detailed engineering of the Andramy-Boinakely section, also

completed on time, cost about double the original allocation (US$187,000 instead of US$95,000, including contingencies). A total of about US$4.3 million of the original project cost and a commensurate credit amount were thus saved. Of this saving about US$4.0 million were used to finance additional items (PCR para. 3.05 and Table 5): (i) detailed engineering, paving, and supervision of the Andramy-Boinakely section (28 km) and reinforcement of the Betsiboka River bridge, in accordance with the conclusions of the study included in the original project (costing about US$1.4 million); (ii) five road studies (US$1.5 million): and (iii) a study deleted from the Second Highway Project (Loan 570-MAG/Credit 134-MAG of November 1968 for US$8.0 million) because of a shortage of IDA funds at the time of project approval (US$1.1 million). The remainder of US$0.3 million were not spent. Credit funds were fully disbursed by December 1974, four years after the original closing date.

5. Procurement was in line with procedures agreed at negotiations for all contracts except the one for the largest road study, estimated at US$1.35 million. The lowest priced bid for this study was submitted by the major French firm that had been awarded the contracts for all other studies. The Government, however, awarded this largest contract to another French firm, which was new to the country, because it wished to diversify its experience with consultants. This diversification is now seen, even by the firm not awarded the contract, as having been sound.

6. The project results are highly satisfactory. The economic rate of return on construction works, based on actual costs and traffic counts (up to 1974), is calculated in the PCR to be between 15% and 20% in constant 1970 prices. The evaluation team has no basic disagreement with these estimates but feels that a number of qualifying factors, not allowed for in the PCR, should be mentioned. The estimate assumes a 20-year project life, which was somewhat overoptimistic in the absence of increased road maintenance costs to repair road sections which deteriorated due to excessive truckloads. Furthermore, this rate of return does not take into account costs resulting from the rapid increase of serious accidents due to excessive speeding on the paved road. Also, no secondary benefits from induced development in the areas along the road have been included in the rate of return calculation; admittedly, these would at best be minimal according to preliminary indications and would not compensate the adverse effects mentioned above. Finally, although most studies proved useful, the economic calculations included in one of them proved to be of limited value, as socio-political considerations dominated the Government's final decision (paras. 17 and 18). While the evaluation team feels these shortcomings must be mentioned, it believes that the construction works and studies financed under the project contributed significantly to transport development in the Democratic Republic of Madagascar.

II. ISSUES

Uncertain Appraisal Statistics for Economic Rate of Return Calculation

7. At appraisal, use of the road by trucks larger than 5 tons was considered to be impractical under the then prevailing conditions. Therefore, for the economic rate of return calculation all goods were assumed to be transported in 5-ton trucks under the "without" project condition. The rate of return was projected to be about 11%, and about one-third of the project benefits were expected to be derived from vehicle operating cost savings resulting from the use of larger trucks.

8. Various statistics now available show that the average truck capacity at the time of appraisal actually exceeded 5 tons. If the appraisal mission had been aware of these statistics, lower total vehicle operating cost savings would have been calculated. 1/ The interaction of those lower/ vehicle operating cost savings with the then assumed project cost would have resulted in a rate of return below 10%, and this might have caused the Bank Group to reject the project. As it turned out, the rate of return on the completed project ranges between 15% and 20%, for reasons quite different from those assumed at appraisal. This case illustrates the weakness of the rate of return calculation as a prominent basis for judging the validity of project proposals when returns are calculated on the basis of uncertain data and even less certain projections.

Contributions and Deficiencies of IDA Supervision Efforts

9. The project construction works were initially delayed for various reasons, well explained in the PCR. Although a February 1968 supervision mission reported these delays, it also stated that generally "works were well in hand." The backlog as a result of the delays grew so large, however, that in August 1968 the Government rescheduled works. Despite this new schedule, work fell further behind, and by late 1968 only 55% of the work scheduled to be completed was actually finished.

10. Regular progress reports conveying this situation were circulated in the Bank with the comment "no action required." The only conclusion that can be drawn is that the reports, which were in French, were not properly reviewed in the Bank, as a routine supervision mission in January 1969 "discovered" the extent of the backlog and cabled the Bank that "immediate action was required." In a somewhat different context, the progress reports do not seem to have been reviewed before the Bank agreed to award the main contract under the Second Highway Project to the same contractor in 1968. In the end, neither project suffered excessively from the delays, as studies for further works were also delayed. The issue here, however, is the Bank's failure to use progress reports prepared according to Bank criteria and sent regularly to the Bank to monitor project implementation.

1/ Savings on vehicle operating costs for trucks calculated on the basis of those statistics would have been larger than in the absence of trucks of over 5-ton capacity; but these total benefits to the project would remain below those finally used by the appraisal team.

11. Supervision was adequate toward the end of project implementation, but fell short of requirements during the first three years, 1/ when it averaged only one man-week of field visits per year. This inadequate supervision may have contributed to the situation in which the consultant studying the alternatives for the Andramy-Boinakely section of RN4 and the bridge (para. 2 and Map 2) was commissioned to prepare detailed engineering for the alternative which finally was not chosen. This failure of Bank supervision efforts in properly reported in the PCR.

12. The detailed engineering for the alternative which was not selected nevertheless proved somewhat helpful, as it revealed that construction costs would be higher than the estimates employed in the economic analysis for the alignment selection. This finding was subsequently utilized effectively by the Bank. A two man-week supervision mission thoroughly reviewed the consultant's study and recommended use of the most economical of the consultant's two alternatives - improving the existing alignment and reinforcing the existing bridge, rather than constructing a new road and bridge. This recommendation was implemented and resulted in a saving of US$1.35 million on the construction works.

Inadequate Road Maintenance and Lack of Enforcement of Truckload Regulations

13. The Government agreed in the credit agreement (Section 4.05) to adequately maintain its highway system. In 1966, it took steps in the right direction by increasing the maintenance allocation to 26% of the annual road budget (in 1964 the allocation had been 18.7%). But between 1968 and 1974, the Government decreased this allocation progressively to 14.4% and in 1976 increased the allocation to 16.7%. Despite the initial effort to meet its obligation under the credit agreement, the Government has generally failed to do so. For example, in regard to maintenance of RN4, the Majunga provincial government is being allocated only one-third of the budget funds it requested. These funds are generally being used for reconstruction of road sections that had been poorly maintained rather than for regular maintenance. There has been minimal maintenance of project works, but this is all that has been necessary to this point except for repairing cave-ins (para. 15).

14. The problem of inadequate allocation of funds for road maintenance exceeds the context of this project and possibly even of Madagascar. Governments may have a justifiable tendency to finance construction of urgently needed new roads with their own funds and capital obtained on soft terms, assuming that similar funds will subsequently be available to reconstruct the deteriorated roads, rather than provide for satisfactory maintenance of existing roads which are believed to have a less immediate developmental impact. The Government and IDA are aware of this problem and are discussing ways to attempt to overcome it. IDA will assist the Government in this endeavor under the Fourth Highway Project (Credit 641-MAG of June 1976 for US$22.0 million).

15. Although the project road sections still are in good condition, rapid deterioration seems to be starting in a few areas, with cave-ins,

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1/ Starting from the date of credit effectiveness.

particularly on fills, impeding traffic. Various explanations have been given for this deterioration: poor performance of the contractor who rushed to complete the last works to compensate for the initial backlog, unexpected soil conditions requiring unforeseen additional work, and excessive truckloads. The latter explanation seems the most plausible.

16. Design standards agreed upon at negotiations were set, as regards the load factor, in accordance with existing regulations. These regulations were promulgated in Decree No. 869 of March 1964, which is still valid. The Decree fixes maximum loads as follows:

Per single axle: two wheels: 6 tons
four wheels: 10 tons

Per double axle: 14 tons (7 tons per axle)

Statistics show that truckloads have exceeded these limits by considerable margins. In 1970 cement trucks, in particular, were regularly overloaded, and since 1973, these loads have further increased. In 1973, following truckers' active opposition to the restrictions imposed at the Maevatanana weighbridge 1/ (map 1), fines for overloading were abolished (although trucks continue to be weighed so that statistics may be collected). The evaluation team feels that the Government's failure to ensure compliance with Decree No. 869 is the principal cause of deterioration of the project road sections. Unless the Government takes measures to enforce regulations or increases road maintenance allocations, the average life of the project road sections is not likely to reach the estimated 20 years. The Fourth Highway Project provides funds for weighbridges.

Effect of Socio-political Considerations on the Project

17. The US$1.36 million study of the road links between Tananarive, Lake Alaotra, and the eastern coast concluded that paving of the Moramanga-Tamatave Road was the least economically justified of the alternative alignments in view of the expected improvement of the railway 2/ running parallel to the road. The Government, nevertheless, obtained in 1976 financial assistance from the People's Republic of China for paving this alignment.

18. The authorities who decided that the road should be paved now acknowledge that the decision was based largely on socio-political considerations and made before the study had been initiated. In this perspective, the Government seems to have believed that the economic analysis included in the study was a mere formality for obtaining IBRD/IDA funds, rather than

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1/ Allegedly as a reaction to the Government's attempts to regulate transportation tariffs.

2/ Supported by Credit 488-MAG of January 1974 for US$6.0 million.

necessary for deciding which alignment should be chosen, as suggested in the consultant's terms of reference. One can imagine that a more appropriate focus could have been given to the consultant's study from the onset, had the basis for Government's decision-making been clearer. In this case, IBRD/IDA staff apparently were unable to properly gauge the Government's motives for undertaking the consultant's study.

III. CONCLUSIONS

19. The first IDA credit to Madagascar was implemented successfully with only minor delays. The economic rate of return is satisfactory, and the cost lower than anticipated. On the whole, IDA's contribution to the project was good, particularly its active participation in efforts to reduce the project cost. However, IDA's contribution could have been even better as regards reacting to information presented in the initial progress reports and realizing the importance of socio-political constraints in preparing one of the studies supported under the project.

20. The Ministry of Public Works effectively supervised the project. Inadequate budgetary allocations for road maintenance and weakness in dealing with truckers, resulting in weight limits being regularly exceeded, are likely to significantly curtail the life of the road. The Fourth Highway Project attempts to respond to these problems as it includes provisions for assisting the Government with both road maintenance and axle-load control.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT COMPLETION REPORT

DEMOCRATIC REPUBLIC OF MADAGASCAR

FIRST HIGHWAY PROJECT

CREDIT NO. 90-MAG

December 1975

Regional Projects Department
East Africa Regional Office

CURRENCY EQUIVALENTS

Except as otherwise stated, all figures are quoted in US$ equivalents.

The exchange rate varied between FMG 280 and FMG 210 for US$1.00 during the disbursement period (1967-1974). Dollar equivalents are calculated at actual exchange rates. Exchange rate at appraisal (1966):

US$1.00	FMG 247
FMG 1000	US$4.0486

Average exchange rate of disbursement period:

US$1.00	FMG 256.2
FMG 1000	US$3.9032

WEIGHTS AND MEASURES

1 meter (m)	3.28 feet (ft)
1 kilometer (km)	0.62 miles (mi)
1 metric ton (m ton)	2,204 pounds (lbs)
1 sq km (km^2)	0.386 sq miles (mi^2)

GLOSSARY OF ABBREVIATIONS

adt	average daily traffic
BCEOM	Bureau Central d'Etudes pour les Equipements d'Outre Mer
CITROA	Compagnie Internationale de Terrassements, Routes et Ouvrages d'Art
CTS	Central Technical Service
FAC	Fond d'Aide et de Cooperation
FMG	Malagasy Franc
LNTPB	Laboratoire National des Travaux Publics et du Bâtiment
MOW	Ministry of Works
RN	Route Nationale
SETEC	Société d'Etudes Techniques et Economiques
SGTE	Société des Grands Travaux de l'Est
SINTP	Société d'Interêt National des Travaux Publics

DEMOCRATIC REPUBLIC OF MADAGASCAR

FISCAL YEAR

January 1 - December 31

DEMOCRATIC REPUBLIC OF MADAGASCAR

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

PROJECT COMPLETION REPORT

PROJECT DATA

Name of Borrower:	**Democratic Republic of Madagascar**
Name of Beneficiary:	Ministry of Works
Amount of Credit:	US$10,000,000
Amount Disbursed:	US$10,000,000
Amount Cancelled:	None
Amount Repaid:	None
Amount Sold:	None
Amount Outstanding:	US$10,000,000
Project Conception Date:	n.a.
Project Identification Mission Date:	n.a.
Project Preparation Mission Date:	July 1964
Project Preappraisal Mission Date:	n.a.
Project Appraisal Mission Date:	January 1965
Negotiations Date:	April 18, 1966
Board Approval Date:	July 28, 1966
Credit Agreement Date:	August 2, 1966
Effective Date:	
Original:	October 31, 1966
Postponements:	None
Actual:	October 11, 1966
Supervision Mission Dates:	2/68;3/69;10/69;7/70;11/71;9/72; 9/73;8/74
Closing Date:	
Original:	December 31, 1970
Postponement:	12/31/72; 12/31/73; 6/30/74; 12/31/74
Final Disbursement Date:	December 15, 1974
Credit Term:	50 years
Grace Period:	10 years
Interest Rate:	None
Service Charge:	0.75%
Amortization:	Payments will be made semi-annually for 40 years, commencing October 15, 1976 at 0.5% for 10 years and 1.5% thereafter to April 15, 2016
Fiscal Year of Borrower:	January 1 - December 31
Appraisal Report Number:	TO-508b
Appraisal Report Date:	May 24, 1966

Exchange Rates: Name of Currency - Malagasy Franc (FMG)

Appraisal Year:	US$1 = 247 FMG
Present Year:	US$1 = 220 FMG

SUMMARY

i On August 2, 1966, a Credit Agreement (Credit 90-MAG) of US$ 10 million was signed between the Malagasy Government and the Association to help finance the foreign cost (about 78%) of:

a) detailed engineering, reconstruction and supervision of reconstruction to two-lane paved standards of 160 km of Route Nationale No. 4 (RN 4) between km 165 and Andramy; and

b) final design, including review of the economic justification, of a section of 14 km of RN 4 between Andramy and Boinakely including the bridge over the Betsiboka River at Boinakely.

Local costs were to be financed by the Government. As execution costs were lower than estimated, the initial Credit Agreement was amended several times to incorporate the following elements agreed between the Government and the Association:

c) detailed engineering and reconstruction to paved standards of an additional 28 km of RN 4 between Andramy and Boinakely, plus reinforcement of a major bridge;

d) a review of the economic justification and detailed engineering of the Ikopa River crossing, including about 37 km of feeder roads;

e) detailed engineering of 74 km of RN 1 between Arivonimamo and Analavory;

f) feasibility studies and preliminary engineering of the most favorable road links between:

(i) Tananarive-Tamatave, including a detailed study of road-rail modal split;
(ii) Tananarive-Fianarantsoa; and
(iii) Lake Alaotra-Vavatenina (and about 60 km of feeder roads in the Vavatenina area)

g) an assessment of transport demand and supply in different regions of the country;

h) a review of the road user fiscal and regulatory systems; and

i) a disbursement of US$1,060,000 from the Credit to finance cost overruns under the Second Highway Project (134/570-MAG).

ii Due to this considerable expansion of the original scope of the project, the Credit Closing Date was postponed several times. The Credit was finally closed on December 31, 1974, four years later than initially scheduled.

iii Although this was the first Bank/IDA project financed in Madagascar, communication and cooperation between the Government and the Association were excellent. Performance of consultants and the contractor employed was also satisfactory.

iv The quality of the construction works is good, and the road constructed under this project is being adequately maintained. All objectives

of the initial, as well as of the extended project have been achieved. An economic reevaluation of the project road construction confirms its economic justification. Taking into consideration actual construction costs and the actual traffic growth to date, the rates of return, as compared to 12% and 11% at appraisals, are 15% and 20% for km 165-Andramy and Andramy-Boinakely sections respectively.

1. INTRODUCTION

1.01 Madagascar achieved independence in June 1960 and became a member of the Bank Group in September 1963.

1.02 This project is the Bank Group's first lending operation in Madagascar. An IDA economic mission visited Madagascar in July 1964, and the Government prepared a preliminary engineering and feasibility study in accordance with its recommendations, and shortly thereafter submitted an application to IDA requesting financial assistance for the reconstruction of two sections of the Tananarive-Majunga Road (RN 4) and for other related minor projects (pavement repairs, access roads). An IDA appraisal mission visited Madagascar in January-February 1965 and found the project as submitted by the Government suitable for financing. However, to confirm cost estimates and to avoid unnecessary delay between signature of the credit agreement and start of construction, it was agreed that final engineering design of the two sections of RN 4 be completed before credit negotiations and financed retroactively. The final design was completed in November 1965 and negotiations took place during April 1966.

1.03 In June 1966 a law was passed in Madagascar authorizing the Government to borrow from the Association the amount proposed during negotiations, and Board presentation took place on July 28, 1966. The Credit Agreement became effective on October 11, 1966.

1.04 The present report is based on:

i) quarterly progress reports prepared by the Ministry of Works (MOW);

ii) findings of IDA supervision missions undertaken during and after project execution;

iii) Bank/IDA highway division files;

iv) consultants' reports (BCEOM, SETEC); and

v) MOW traffic counts.

2. BACKGROUND INFORMATION

2.01 The world's fourth largest island, Madagascar (590,000 km^2) lies in the Indian Ocean 400 km off the east coast of Africa, from which it is rather isolated economically and culturally. Its climate is marine tropical; frequent cyclones and heavy rainfall, particularly on the east coast, periodically disrupt transport and the economy. The population, estimated at 6 million in 1966, has been growing at 3.3% p.a. and has now reached about 8 million.

2.02 Per capita GDP (presently about US$ 140 equivalent) increased at about 1% p.a. between 1967 and 1971. Since 1972 per capita GDP has declined by about 3% p.a. in real terms. The transport sector contribution to GDP, estimated at 9% in 1966, has not changed since then.

2.03 No significant changes have taken place in transport modes. Railway freight traffic (presently about 260 million ton-km p.a.) has been growing at 5% p.a. since 1967, shipping tonnage (presently about 1.8 million tons p.a.) at 3% p.a., and air traffic at 13% and 9% for passengers and freight, respectively (presently about 264 million passenger-km and 9 million ton-km).

2.04 At present, the highway network comprises about 32,000 km of roads of which 3,840 are paved, an increase of 1,670 km since 1966. Table 1 shows the development of the primary road system since 1964. In spite of the increase in the paved road length, to which the present project has contributed, there are still considerable gaps in the road network and there remains much to be done in reconstruction and maintenance before the network can provide economic transportation.

2.05 According to traffic counts, average road traffic has been growing at 5% p.a. and at 10% p.a. on paved roads between 1965 and 1972; this is corroborated to some extent by a similar growth in the estimated fleet and a 7% p.a. increase in fuel consumption (Tables 2 and 3).

2.06 Since 1966 the general highway administration has undergone several reorganizations; the last occurred in early 1975. While the functional organization is still adequate, the staffing situation has deteriorated considerably. Most of the French experts that had been filling senior technical posts in the highway organization left the country after the 1972 revolution and were not replaced by nationals of the same qualification. This has not affected new construction, design or supervision, where use of consultants is possible, but maintenance has deteriorated because the Malagasy staff is inadequately trained. The situation is aggravated by the fact that since 1973 the MOW has taken over responsibility for the maintenance of the secondary road network from local authorities. Government is preparing nationals to fill positions formerly occupied by expatriates and to assist in this, in its Fourth Highway Project IDA is proposing to finance a study of training needs and subsequent implementation of its findings.

2.07 Road maintenance expenditures (Table 4) show a sharp increase in 1966. It can be assumed that this is a result of Government's honoring the maintenance covenant of the Credit Agreement which stipulated that budget allocations for highway maintenance would be increased in the light of a maintenance study which was then carried out by the Bureau Central d'Etudes pour les Equipements d'Outre Mer (BCEOM). However, since 1969 highway expenditures have decreased in real terms and are no longer adequate, in particular for road maintenance.

3. PROJECT DESCRIPTION

A. Components of Initial Project

3.01 The project initially consisted of:

i) detailed engineering, reconstruction to paved standards and supervision of reconstruction of two road sections then totalling 160 km between km 165 and Andramy of RN 4, linking Tananarive and Majunga; and

ii) final design, including review of the economic justification, of a section of 13 km of RN 4 between Andramy and Boinakely and of the bridge over the Betsiboka River at Boinakely.

B. Appraisal Cost Estimates

3.02 The costs of the initial project were estimated as follows:

		FMG million	US$ million
i)	Reconstruction	2,480	10.00
ii)	a) Engineering and supervision of reconstruction	200)	
	b) Feasibility study and final engineering, Andramy-Boinakely road section	) 20)	0.90
iii)	Contingencies, about 17.5%	470	1.90
	Total	3,170	12.80

3.03 The estimates had been based on final design quantities and on unit prices derived from similar works carried out at that time in Madagascar. Construction cost estimates included a 10% allowance for quantity contingencies. A 17.5% price contingency on all project components had been added for possible price increases over the scheduled four-year period of execution. The foreign cost component of the project was estimated between 68% and 78%, depending on whether a foreign contractor or local subsidiary of a foreign firm received the award. IDA agreed to finance 78% of the project cost, or US$10 million, because Government's financing of one-third of its total highway program from its own funds between 1964 and 1968 represented a heavy burden on the national budget.

C. Components of Project as Executed

3.04 Since the cost of executing the project described above was substantially lower than expected (para. 4.07), the Government and the Association

agreed to extend the scope of the project and amended the Credit Agreement accordingly 3 times.

3.05 The project, as finally executed (Maps 1 and 2), included the following elements:

National Road No. 4

i) (original project item) engineering, reconstruction to paved standards and supervision of reconstruction of two sections between km 165 and Andramy (km 352) totalling 160 km but reduced through reconstruction to 145 km;

ii) (original project item) detailed engineering and review of the economic justification of RN 4 between Andramy and Boinakely (km 380) via Ambahavadiala; and

iii) detailed engineering and reconstruction to paved standards and supervision of reconstruction of the RN 4 between Andramy and Boinakely via Mahatsinjo, totalling about 28 km, including reinforcement of the existing bridge over the Betsiboka River.

Other Road Studies

iv) a review of the economic justification and detailed engineering of the Ikopa River crossing near Maevatanana, including about 37 km of access road;

v) detailed engineering of RN 1 between Arivonimamo and Analavory, totalling 74 km;

vi) feasibility studies and preliminary engineering of the most favorable road link between:

a) Tananarive and Tamatave, including a detailed investigation of the rail-road traffic split;

b) Tananarive and Fianarantsoa; and

c) Lake Alaotra and Vavatenina (and about 60 km of feeder roads in the Vavatenina area);

vii) an assessment of transport services in demand and supply in different regions of the country;

viii) a review of the road user fiscal and regulatory systems; and

Project Cost Overruns

ix) financing of Second Highway Project cost overruns.

3.06 The final costs of the project as compared with the initial estimates are given in Table 5.

4. PROJECT IMPLEMENTATION

A. Construction Works

Procurement

4.01 Procurement of the construction works for the two sections between km 165 and km 352 (Andramy) conformed to Bank/IDA guidelines for international competitive bidding. Contractors were prequalified before Board approval of the project; invitations for bidding were sent to prequalified contractors the day the Credit was approved (July 28, 1966). Bid opening took place on September 30, 1966. A total of five bids from French, Italian and German firms were submitted. The lowest bid was made by SGTE-CITROA, a joint venture of the French Societe des Grands Travaux de l'Est and its Malagasy subsidiary, Compagnie Internationale de Terrassements, Routes et Ouvrages d'Art. The second lowest bid was submitted by a French-German joint venture and was 4% higher than that of SGTE-CITROA. The Association agreed with the Government's recommendation to award the contract to SGTE-CITROA.

4.02 When reconstruction of the 28 km from Andramy to Boinakely (km 352 to 380) of RN 4 and the strengthening of the Betsiboka River crossing was added to the project in early 1970, the Association agreed that the contract for these works could be negotiated directly with SGTE-CITROA on the basis of the original contract prices without international competitive bidding. It was obvious that negotiations with the contractor already on site would lead to the lowest prices obtainable.

Contract and Contract Modifications

4.03 Within the initial project scope, the contract between Government and SGTE-CITROA amounted to US$7.9 million and was signed on December 28, 1966, with work scheduled to be completed within three years. Also within the initial project scope, the Association agreed to the following modifications:

i) reconstruction of an obsolete bridge at km 213 which, because of rapid deterioration, could not be conserved as initially intended. The additional cost of US$60,000 was approved by IDA on January 11, 1968; and

ii) a change in the typical crossroad profile by replacing individual drains with a continuous filter in the pavement structure. IDA approved the additional cost of US$70,000 on May 9, 1968.

4.04 After the scope of the project had been widened, the following additions were made to the original contract:

i) reconstruction to two-lane paved standards of 10 km of road between km 352 (Andramy) and km 362 (Mahatsinjo). Cost US$625,000;

ii) strengthening of the existing bridge over the Betsiboka River. Cost US$135,000; and

iii) strengthening of 18 km of existing pavement between km 362 and km 380 (Boinakely). Cost US$610,000.

Construction Time and Cost

4.05 After some difficulty in getting the original construction works started, the contractor made good progress and finished all works within the time limits of the original contract. The last works on the two road sections between km 165 and km 352 were completed on January 12, 1970 (Table 5).

4.06 The additional construction works were also completed within the time limits stipulated in the contract addenda. Physical completion of the road reconstruction between km 352 and km 362 was reported on September 11, 1970, three months ahead of schedule, and the pavement strengthening between km 362 and km 380, on December 14, 1970. Completion of the Betsiboka River bridge strengthening was somewhat delayed because of a change in the strengthening method and because additional reinforcement was needed after some deterioration on the bridge had been observed. Final acceptance of the bridge took place in early September 1972, after tests carried out by the Public Works Laboratory (LNTPB) had proven its stability.

4.07 Construction costs for the two road sections between km 165 and km 352 had been estimated at appraisal at US$11.75 million (including a US$1.75 million price contingency). The final cost was US$8.0 million (32% lower than estimated). This includes a US$0.5 million price increase and payments of US$140,000 made to and accepted by the contractor on a submitted claim of US$1.3 million for force majeure and unforeseen costs. The difference between estimated and final cost, mainly due to lower unit prices and a slighter price increase than expected, can only be explained by the fact that the Bank had no previous project in Madagascar and had to rely on information given by the Government, which in turn had no previous experience with a project of this magnitude.

4.08 Total costs for the additional works between km 352 (Andramy) and km 380 (Boinakely) were US$1.4 million. In spite of the increased scope of construction works, the total construction costs were still US$2.35 million lower than initially estimated costs.

Performance of Contractor

4.09 From the beginning, construction of the works in the initial project fell behind schedule and was only 40% complete by April 1969 as compared with 70% in the original implementation schedule. The delay was attributed to difficulty in shipping supplies from France (because of the closing of the Suez Canal) as well as the inadequacy of the contractor's organization. Although CITROA had been prequalified, its local management was inexperienced in works of the magnitude and standards involved and lost considerable time in trial and error before equipment and personnel were put to effective use. After constantly urging the contractor to accelerate the pace of the works, in November 1968 the Government formally summoned the contractor and requested him to take immediate steps to remedy the situation. The contractor responded by appointing a new field manager, increasing the amount of equipment and personnel, opening a second job site on the road, and submitting a new work schedule aimed toward completing the works within contractual limits. From then on, fast progress was made without lowering the quality of work and construction of all works in the original and expanded project were completed within the contract periods. SGTE received additional contracts from the Government under the Bank/IDA-financed Second and Third Highway Projects.

B. Consultant Services

Engineering and Supervision of Construction

4.10 Government's application for assistance in financing the reconstruction of RN 4 was based on preliminary engineering carried out by the Central Technical Service (CTS) of the MOW. Detailed engineering was also carried out by the CTS, assisted by local surveying firms to whom topographic work was subcontracted. Also, because of time constraints, CTS employed a consulting firm for the final design of a part of the project. Soil and material studies were carried out by the LNTPB. Since detailed engineering was scheduled for completion prior to credit negotiations, the Association agreed to retroactive financing of the costs, which amounted to US$150,000.

4.11 Design standards employed (see Table 6) and quality of engineering were adequate. Only a few modifications of the project had to be made during execution.

4.12 Supervision of reconstruction was carried out by the MOW, assisted by the LNTPB which was responsible for all soil tests and material investigations. From the quality of the road construction and particularly from the quality of the pavement, which is still adequate after more than five years of service, it can be concluded that the supervision was satisfactory.

Feasibility Study and Detailed Engineering of Betsiboka River Crossing

4.13 After paving the km 165-km 352 (Andramy) sections, the only unpaved part of the 600 km RN 4 would have been a stretch of 10 km between Andramy and km 362 (Mahatsinjo). Also 18 km between km 362 and km 380, though paved, were narrow and winding with poor surface condition. The Betsiboka river was crossed by a one-lane steel bridge constructed in 1944, which had been seriously damaged by a cyclone. Two large spans on the approaches had been replaced by Bailey trusses. Another bridge, 8 km to the north and on a shorter road alignment, had been destroyed during World War II. At appraisal in 1965, it was not certain whether upgrading of the existing 28 km road and bridge via Mahatsinjo, or construction of a new bridge at the site of the destroyed bridge and reconstruction of 14 km of access road via Ambavahadiala, or a completely different bridge site would be the most economical solution (Map 2).

4.14 In August 1966, Government invited consulting firms, on an international basis, to submit priced proposals for a study to select the most economical bridge and road site for the Betsiboka river crossing, in terms of total costs (bridge and access road construction, vehicle operating costs and road maintenance) and for detailed engineering of the selected solution. Proposals were received in October 1966 from American, German and French firms. In December 1966, Government proposed to select the French, Bureau Central d'Etudes pour les Equipements d'Outre-Mer (BCEOM), mainly because it was represented in Madagascar. There followed a lengthy exchange of correspondence between Government and the Association concerning the criteria for selecting consultants and the scope and price of the study. In May 1968, with the approval of the Association, Government finally signed a contract with BCEOM amounting to US$200,000, considerably above the US$80,000 estimated at appraisal.

4.15 In this contract the scope of the study had already been reduced to a choice between two bridge sites, determined by CTS in a preliminary study to reduce consultant's cost, and the detailed engineering of the final choice (Map 2). The existing bridge site and the site of the destroyed bridge were the two alternatives to be examined.

4.16 Consultants submitted a first phase comprehensive report which included detailed traffic, vehicle operating cost and tariff analyses, preliminary engineering estimates and economic evaluations. 1/

4.17 The consultants found that constructing the road via Ambavahadiala, which would reduce the distance by 14 km, and constructing a new one-lane bridge on the site of the destroyed one was the better solution. Detailed engineering was carried out accordingly; the resulting construction cost estimate (US$2.1 million) was 40% above preliminary estimates and yielded an expected return of 14.3%. The cost of upgrading the alignment via Mahatsinjo and strengthening the existing bridge was estimated, based on preliminary engineering, at US$0.93 million yielding a 13.9% return. But if construction cost estimates for the Mahatsinjo alternative were to be increased, as the cost difference between preliminary and final design for the Ambavahadiala alignment suggested, the return for the Mahatsinjo route would be even lower, thus reinforcing the consultants' selection.

1/ BCEOM "RN 4, Tananarive-Majunga, Franchissement de la Betsiboka", September 1969.

4.18 Bank staff reviewed the consultants' analyses, making several changes in the inputs. 1/ As a result, upgrading the Mahatsinjo alignment yielded a 12% rate of return. The only benefit unique to the shorter Ambavahadiala alignment was reduced vehicle operating cost due to shortened travel distance, but this benefit was estimated to produce only a 9% return on the US$1.35 million cost differential between the two investment alternatives.

4.19 Based on these findings, the Association and the Government chose the reconstruction of the Mahatsinjo alignment alternative and requested consultants to prepare documentation for reinforcing the existing bridge. In view of the justification of the works and the fact that an undisbursed balance was foreseen remaining in the Credit account, the Association agreed to finance them under the Credit and made the necessary changes in the Agreement in January 1970. In spite of considerable initial delay in awarding the contract and the enlargement in the scope of consultants' works, the detailed engineering for the IDA-Government selected alternative was available before construction between km 165 and Andramy was completed, and the flow of works on RN 4 was not interrupted.

Feasibility Study and Detailed Engineering of Ikopa River Crossing

4.20 In agreement with the Association, in August 1969, the Government signed a US$ 40,000 contract with BCEOM for a feasibility study and detailed engineering of the Ikopa River crossing near Maevatanana on the road between RN 4 and Mahazoma. The study was to investigate the economic feasibility of replacing the existing ferry (5-ton capacity) by a bridge or by an improved ferry with larger capacity. A preliminary report submitted to the Government by the consultants in October 1969 clearly demonstrated that the construction of a bridge was not justified and that there was no need for a more detailed study. Subsequently, the contract with BCEOM was amended in July 1970 to delete detailed engineering of the bridge and to include instead the detailed engineering of the road between RN 4 and Mahazoma (37 km), leaving the contract amount unchanged. Construction on this road started in May 1975, financed out of the local budget.

Detailed Engineering of RN 1 Between Arivonimamo and Analavory

4.21 The MOW had made a feasibility study of reconstructing the Arivonimamo-Analavory section of RN 1 and found the work justified. The Bank then intended to include financing of detailed engineering in the Second Highway Project (Credit/Loan 134/570-MAG). Due to a shortage of IDA funds, it became necessary to reduce the credit amount and the study was dropped from the project during negotiations in September 1969. When it became apparent that a surplus would remain in the Credit account of the First Highway Project, the Association agreed

1/ Cost estimates for the Ambavahadiala alignment were increased from US$2.1 million to US$2.5 million and for the Mahatsinjo alignment from US$0.93 million to US$1.15 million; traffic estimates for the opening year (1972) were reduced from 131 to 111 adt and traffic growth from 6.5% to 5%; and time and safety benefits were excluded from the calculations.

to finance the study under that project (exchange of letter dated January 23, 1970). The Association agreed that a US$190,000 contract be directly negotiated with BCEOM (letter of December 16, 1969), again mainly on the grounds that BCEOM was represented in Madagascar. The contract between Government and BCEOM was signed in June 1970. Detailed engineering was completed in June 1971 for the contract amount and within the contractual time limit.

4.22 Financing of reconstruction of this road was included under the Third Highway Project, but when the lowest bid was 70% higher than the appraisal estimate, upgrading to the standards proposed in the study was no longer justified. Reduced standards were proposed, but in the meantime cost overruns in the other elements of the Third Highway Project had more than absorbed the available funds. Thus, construction of this road was deleted from the Third Highway Project and an economically justified lesser improvement of RN 1 will now be included in a Fourth Highway Project (expected rate of retun, 12.9%).

Other Feasibility Studies and Master Plans

4.23 Background. By 1968 Government had realized the need to prepare a plan for upgrading the two main road axes in the country, Tananarive-Fianarantsoa and Tananarive-Tamatave, and a feasibility study for a road connecting Lake Alaotra and the East Coast and roads to feed it, as justified (Map 3). 1/ Because UNDP and FAC could not finance these studies and implementation of the findings was expected to yield a 11-15% return, IDA agreed upon Government request to include the studies in the First Highway Project Credit Agreement since funds were available. Accordingly, the Closing Date was postponed from December 31, 1970 to December 31, 1972.

4.24 Procurement. Terms of Reference were ready by April 1970 and five firms 2/ submitted proposals. These were opened in August 1970 and Government selected SETEC, based on analyses of each firm's methodology, technical means and experience, staff and timing. BCEOM, for reasons not clear from the files, contested the selection of SETEC, and despite IDA's subsequent request to see both SETEC and BCEOM's proposals, only SETEC's proposal was received by IDA, and that almost a year later, in June 1971. The contract was awarded to SETEC with the approval of IDA in September 1971; it called for: (a) the preparation of a master plan including preliminary engineering for the roads Tananarive-Fianarantsoa (two sections totalling 300 km) and Moramanga-Tamatave (260 km) (Tananarive-Moramanga was already paved); and (b) feasibility study of a road linking Lake Alaotra to Vavatenina (160 km) and 60 km of associated feeder roads. Works were to be carried out in 22 months at a fixed price of FMG 324 million, or US$1.35 million.

1/ For economic justification, see "Appraisal of the Betsiboka Crossing and Highway Studies to be included under Credit 90-MAG. Back-to-Office and Full Report", quoted in Annex 1.

2/ BCEOM (France), SETEC (France), COMTEC (Italy), Scott, Wilson, Kirkpatrick and Partners (UK), Walter Ingenieur Beratung (Federal Republic of Germany)

4.25 Execution. Consultants performed satisfactorily. Although the contract called for the study of Moramanga-Tamatave, it became evident that alternative alignments for connecting Tananarive to Tamatave would be better and therefore they were also studied (Map 3). The first phase report was presented in June 1972 to Government and IDA and reviewed without delay. Due to the inter-modal aspects covered, both the Highways and the Railways Divisions participated in the review. Three months after presentation of the report, a supervision mission went to Madagascar and discussions were held between SETEC, Government and IDA. It was agreed that the consultants' analysis had not dealt adequately with allocation of future traffic between rail and road, particularly in the Tananarive-Tamatave corridor. Government had advised consultants to assume that no changes in the railways would be made, an unrealistic assumption in view of the railway modernization program envisaged by then. Supplemental terms of reference for the consultants were therefore agreed upon by the three parties for the consultants to study the impact of railway modernization on the Tananarive-Tamatave corridor. Tentative agreement was also reached on the scope of the second phase study scheduled for completion by July 1973. It comprised preliminary engineering for the road sections selected in the first phase report, because more accurate cost estimates were needed. It was based on the assumption that the impact of the railway modernization would not fundamentally alter the order of priority of selected alternatives.

4.26 At all times communication was good between the parties, as well as between the Bank's Divisions concerned. For instance, a SFTEC railway expert was in Madagascar at the same time that the Railway Project was appraised, so all findings could be discussed immediately. At these discussions, the need for better inter-modal coordination in Madagascar became apparent and thus financing for a transport planning and coordination team was included in the Railway project (Credit 488-MAG).

4.27 Also in 1972, Government was planning to (i) regulate the road transport industry; (ii) set up Government-supervised regional freight forwarding offices; and (iii) introduce other regulatory measures, such as route licensing and tariff fixing. Due to these developments, the consultants' contract was amended to include two additional studies, one covering detailed traffic surveys and another the road transport fiscal and regulatory systems.

4.28 The final report, comprising 25 volumes, was completed in December 1973, only 6 months after the original completion date and practically at the originally-agreed upon cost despite the contract extension (US$ 1.36 million instead of US$ 1.35 million). (Annex 2 contains an index and a summary of findings of the report.)

4.29 The road sections that SETEC found justified are indicated in Table 7, together with their construction costs, rates of return, length, and adt expected in 1985. Construction costs are estimated at FMG 13,100 million. The consultants presented an implementation program phased over 1974-81.

4.30 Although the studies were satisfactorily completed, there has been almost no follow-up. No Bank Group funds have been available for any of the projects identified by SETEC. The proposed Lake Alaotra-East Coast improvements have not been started, and no financing seems available.

4.31 With Malagasy funds, the Government-owned construction enterprise (SINTP) is paving a 40 km section of the selected Tananarive-Tamatave corridor, from Ankazondandy to Anjozorobe. In 1975 the Government contacted Chinese sources, which had shown interest in financing the Tananarive-Tamatave road construction. Despite the study's finding that a new alignment via Anjozorobe-Ambatondrazaka was the most justified and would yield an 18% return (Annex 2), which will be even higher now since the road is being paved as far as Anjozorobe, it appears now that the Chinese and the Government have agreed to construct the road following the present alignment paralleling the railway alternative that showed the lowest return (10%). The decision was apparently taken for political reasons.

4.32 Concerning the fiscal and regulatory recommendations, the Ministere des Transports et du Ravitaillement is studying the possibility of fixing transport tariffs. In May 1975 the Government eliminated the subsidy that it had been paying on fuel, not as a result of the SETEC study but because of financial budgetary constraints. The Bank-financed transport planning team has been attached to the Ministry and will assist in further analysis of the recommendations.

C. Performance of Borrower

4.33 Although this project was the first Bank Group operation in Madagascar, there were no communication problems between the Government and the Association except concerning the BCEOM and SETEC contract awards. IDA supervision missions visited Madagascar at regular intervals, and most problems were solved on the spot. The Government looked after the execution of the project diligently and efficiently. Dealings with contractors and consultants were correct and straightforward. The Government has met all obligations it assumed under the Credit Agreement.

4.34. During project execution the Government substantially increased budget allocations and expenditures for primary road maintenance from US$ 2.8 million to US$ 5.2 million per year (Table 4). Since then, however, expenditures for road maintenance have declined in real terms and are no longer adequate.

4.35 Of concern to supervision missions, although not covered by a Credit covenant, was the staffing situation in the Highway Administration and Government's policy towards maintaining the staff at appropriate levels. During project execution, a trend to replace expatriates in key positions by less experienced Malagasy engineers was observed. Personnel provided under French Technical Assistance were sharply reduced during 1968 and 1969, but the situation later stabilized without deterioration of the Borrower's performance. However, in 1972 and 1973, political changes in the Government caused a further reduction of qualified expatriates who have not been replaced by nationals with comparable qualifications. The professional standard and strength of the Highway Administration has since dropped to an inadequate level. In a proposed Fourth Highway project, measures to remedy this situation are recommended (para 2.06).

D. Credit Disbursement

4.36 Because the appraisal report did not contain a disbursement schedule, a comparison between estimated and actual disbursements is not possible. From correspondence it appears, however, that at the beginning disbursement was slow. The Association sent letters to the Government and the Permanent Mission in Nairobi to initiate the forwarding of withdrawal applications (letters of June 9 and August 18, 1967), and the first disbursement was finally made one year after Credit effectiveness, despite the agreement to finance retroactively consultants' services rendered from June 1, 1965. The reasons for that delay are not clear, but it appears that the Government did not act promptly to overcome administrative difficulties linked to a first withdrawal application since the amount expended on the project during the first year was only US$ 170,000. Table 8 shows the flow of disbursements during the period of project execution and Table 9 shows the final allocation of the Credit by category. The fluctuation of the exchange rate between US$ and FMG meant that an additional FMG 160 million (US$600,000) could be financed out of the Credit.

5. REVIEW OF ECONOMIC EVALUATION OF RN 4 SECTIONS

5.01 RN 4 continues to be one of the most important trunk routes in Madagascar, since it is the only paved road linking the central plateau with the west coast, which are about 600 km apart, and with the north via RN 6.

A. Road Sections Between km 165 and Andramy

5.02 The gravel-surfaced 160 km to be improved under the original project were narrow, winding, with sharp curves and steep gradients. Many structures were obsolete and dangerous. Slides and erosion often made the road impassable. By reconstructing the road to paved standards and by numerous realignments and relocations, the length was reduced to 145 km. Through freight traffic is more important than local traffic on the project section, and it consists mainly of cement, sugar, cotton and tobacco for Tananarive, and general cargo for Majunga. Despite the upgrading, little seems to have changed in the area adjacent to the project road section, though local people express opposite views.

5.03 Income per capita in the road's area of influence is about US$50 per year and is derived from agriculture (paddy, tobacco, manioc, groundnuts, and livestock). Although the production potential of agriculture in the area is high, it requires a program for development, but almost no action has been taken. Since 1963, population has grown about 2.8% p.a., and there are only about 4 persons/km^2 in the project area. Migration has produced a 9.5% p.a. growth in the town of Maevatanana which had about 8,000 inhabitants in 1975, the only town on the road section with more than 1,000 inhabitants.

Traffic

Appraisal Estimates

5.04 Traffic counts were being taken regularly on RN 4 by the MOW before project appraisal. However, the appraisal mission in 1965 requested new counts in order to get a better picture, and when carried out at one station vehicles were also weighed and their freight/passengers recorded.

5.05 According to those counts, an average of 30 5-ton trucks[1/] and 50 passenger cars per day was considered representative for 1966. For the opening year of the road (1970) adt was estimated at 80 passenger cars and 50 5-ton trucks, carrying 91,000 tons[2/]. Annual growth rates were estimated at 10% until 1975, tapering off to 3% toward 1990. It was assumed that in the first five years after construction, truckers would shift to larger units, and that only 50% of the freight would continue to be carried by 5-ton trucks, and 30% and 20% would instead be carried by 8 and 20-ton units, respectively. In addition, growth of induced traffic was estimated at 15% p.a. over the first 5 years.

Ex-Post Data

5.06 In 1970 however, adt was about 200, about 50% more than estimated, and more than one-third of the trucks was larger than 5-ton. From 1965 to 1970,

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1/ The appraisal indicated that in 1966 trucks larger than 5-ton carrying capacity were impractical. However, according to traffic counts conducted in 1965, trucks that size were already being used.

2/ Page 13 and Table 5, Appraisal Report.

trucks from 6 to 10 tons total weight were the most commonly used. Average loading capacity utilization was stable at .6, but 75% of the freight moves from Majunga towards Tananarive and an increase of loading capacity utilization from .765 to .9 was measured in this direction, while returning loads showed a decrease from .5 to .3.

5.07 If instead of averages we consider separately the results of the two traffic counting stations on the project road, at km 197 and at km 336, we find that in 1965 the first recorded 43 adt and the second, 92 adt; in 1970, both recorded the same traffic level (210 adt) which was only slightly below traffic on adjacent sections (Table 10). A comparison gives growth rates of 20% and 5% p.a. at the respective stations. By deducting normal traffic growth from the total traffic increase, induced traffic in the opening year appears to have been 65% at km 336 and 25% at km 197; mainly car trips produced this increase.

5.08 Traffic also grew in 1971, but in 1972 due to political disruptions, passenger traffic dropped to 1970 levels. However, the 225 adt in 1972 was still above the 175 adt calculated on appraisal hypotheses. After 1972 the country experienced unexpected economic stagnation, and traffic counts were discontinued. We estimate a maximum 5% traffic increase p.a. from 1972 to 1975, resulting in 260 adt in the latter year, which is lower than the 280 adt implied in the Appraisal Report. However, a recovery in the economy may still lead to faster traffic growth than estimated. There has been a shift towards larger units, probably not because of the road improvement, but due to the general developments in the transport industry.

Savings in Transport Costs

Appraisal Estimates

5.09 The Appraisal Report assumed that the road improvement would lead to a 40% reduction in vehicle operating cost/km. In addition, benefits of about FMG 53 million in opening year from using larger trucks over the whole length of RN 4 were attributed to the road upgrading. Table 11 shows appraisal estimates for vehicle operating costs. Total operating savings were estimated at FMG 152.8 million for 1970. The Appraisal Report did not consider time savings in the benefits, but mentioned the possibility that trucks could make the trip between Tananarive and Majunga easily in one day, instead of needing a night stop, as was the case before the improvement. The appraisal also did not include any developmental benefits, although some were expected to accrue.

Ex-Post Data

5.10 The appraisal reduction in vehicle operating cost seems underestimated, in the light of more recent estimates and tariff reductions. On the other hand, benefits from the use of larger units as a result of the road improvement seem overestimated, since the shift was occurring anyway. Essentially due to higher than expected traffic, actual benefits were almost double those expected. Operating costs used for the reevaluation are also shown in Table 11.

5.11 The ton-km rate[1/] between Tananarive and Majunga (see Table 12) decreased about 17% from 1966 to 1968, possibly due to other ongoing road improvements. From 1968 to 1971, the rate reduction varied from 25% to 50%, despite a 10% general price escalation in that period. If the present revised Bank estimate of 55% operating saving per vehicle/km on the 145 km project section is spread over the whole length of RN 4, the average tariff reduction should have been only about 17%. This indicates that competition was strong and operating cost reductions were more than entirely passed on to customers. Since 1972, rates have gone up only as much as prices in general. There was no passenger tariff reduction from 1966 to 1968, and only about a 15% decrease from 1968 to 1971. Thus, vehicle operating cost reductions were not fully passed to passengers.

5.12 It seems correct to have included neither time savings nor development benefits. Trips mostly continue to include a night stop, and no agricultural programs have taken place in the area. Road maintenance costs decreased approximately as estimated.

Rates of Return

5.13 For the km 165-Andramy reconstruction, the Appraisal Report indicated about 11% as a conservative return estimate, while expecting an actual rate somewhat higher. Based on information to date, we obtain a basic 20.4% return (Table 13). The difference between the two rates of return is due to lower than estimated construction costs (FMG 2,100 million instead of FMG 2,480 million) and higher than estimated benefits, due to higher adt and unit vehicle savings, especially in the first years after opening (for example, FMG 293 million instead of FMG 153 million in 1970). If in the calculations vehicle operating costs are reduced because of the road improvement by only 40% as in the appraisal, the rate of return becomes 15.3%.

B. Road Sections Between Andramy and Boinakely (Betsiboka River Crossing and Access Road)

5.14 With the information now available, the rates of return for the two alternatives discussed in paras. 4.13-.18 have been recalculated. Because conditions on the road sections are similar, unit vehicle operating savings and unit maintenance costs are those used for the reevaluation of the road sections between km 165 and Andramy. The calculations include actual construction costs for the implemented upgrading via Mahatsinjo, which were 20% above appraisal estimates but only 5% above the consultants' revised estimates, and on estimates from detailed engineering and the 16% higher appraisal estimates for the alternative alignment via Ambavahadiala. The flows of costs and benefits are shown on Table 14.

1/ Tariffs are freely fixed, with the exception of cement freight, which is FMG 15/ton-km from Majunga to Tananarive. (Government is considering regulating the whole transport industry.) Tariffs from Majunga to Tananarive can double those in the other direction, reflecting demand pattern. Mainly transport companies undertake long distance transportation, and traders provide short distance services as a secondary activity.

5.15 The construction works carried out on the alignment via Mahatsinjo yield a 14.7% rate of return. If the appraisal cost estimates for the construction of the road via Ambavahadiala were correct, the rate of return for this alignment would be about 13%, and the choice of alternative correct. If, however, the consultants' cost estimate for the Ambavahadiala alignment were correct, its rate of return would be 15%, slightly better than that of the executed Mahatsinjo alignment. No residual value is given in either case to the bridge, although after 20 years a new bridge should have a higher residual value than a restored one. This would further increase the rate of return for the Ambavahadiala alignment. In any case, with the information now available, it is difficult to say whether the best solution was adopted at that time, since both alternatives appear almost economically indifferent.

6. CONCLUSIONS

6.01 All objectives of the project have been satisfactorily achieved, even more so considering it was the first Bank Group project in Madagascar. Throughout the project all parties maintained good communication and flexibility with minor exceptions. The project components remain justified.

6.02 The contractor executed good quality work within the contract period and with only minor price revisions in the agreed cost. The experience he gained under the project helped him obtain further contracts. The consultants performed adequately, adapting their studies when new information so required, virtually without changing contract amounts, and finishing within agreed execution periods.

6.03 The Borrower responded satisfactorily to IDA's concern about adequate highway maintenance[1/], and efficiently prepared studies and detailed engineering and supervised construction works well.

6.04 IDA appropriately agreed to retroactive financing of detailed engineering to avoid delays after credit effectiveness and to obtain more accurate cost estimates; took timely decisions; showed concern about sectoral issues and staffing of the Ministry; and agreed to Credit amendments when required. Frequency and timing of supervision missions were adequate. However, IDA should also have:

- reviewed the Betsiboka river crossing feasibility study before consultants proceeded with the detailed engineering for their selected solution, which afterwards was not implemented (paras. 4.17-.19);
- insisted on reviewing BCEOM's proposal for the feasibility studies which were finally awarded to SETEC (para. 4.24); and
- explained disbursement procedures better to Government to avoid payment delays (para. 4.36).

6.05 Cost estimates were generally inaccurate, probably due to IDA's lack of experience in the country. The cost of construction was only 68% of appraisal estimates. The cost of the Betsiboka river crossing studies were twice the original estimate. More than US$ 3 million would have remained undisbursed if the project had not been enlarged. The added project components had high priority and are justified.

6.06 The road construction included in the initial project yields an ex-post rate of return of 20%; the additional works on RN 4 yield 15%. Detailed engineering of RN 1 between Arivonimamo and Analavory will be used for works financed under the proposed Fourth Highway Project (expected rate of return 13%). The Ikopa engineering study is being used for construction of the RN 4-Mahazoma road, which started in 1975. Only the results of SETEC's feasibility studies have not been adequately followed up.

1/ Although the budget later became inadequate again.

TABLE 1

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Development of the Primary Road System, 1964-74
(km)

Year	Paved	Gravel	Earth	Total
1964	2,096	1,028	4,932	8,056
1965	2,167	962	4,927	8,056
1966	2,271	903	4,997	8,171
1967	2,490	865	5,008	8,363
1968	2,510	865	4,988	8,363
1969	2,560	815	4,988	8,363
1970	2,942	490	4,953	8,385
1971	3,336	412	4,832	8,580
1972	3,502	405	4,688	8,595
1973	3,650	390	4,560	8,600
1974	3,838	379	4,400	8,617

Source: MOW, April 1975

December 1975

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Motor Vehicle Registration, 1958-71

Year	Cars	Trucks	Pickups	Buses	Semi-trailers and Trailers	Special Vehicles	Totals
1958	14,261	14,293	1,283	487	167	301	30,792
1959	15,981	15,667	1,414	529	253	338	34,182
1960	17,921	16,990	1,567	560	283	355	37,676
1961	20,080	18,287	1,677	559	303	366	41,272
1962	22,143	19,478	1,804	599	346	385	44,755
1963	24,488	20,613	1,888	629	375	413	48,406
1964	27,021	21,665	1,960	662	405	448	52,161
1965	29,540	23,034	2,063	737	443	466	56,283
1966	32,117	24,200	2,130	818	554	484	60,303
1967	34,992	24,824	2,123	1,626	594	531	64,690
1968	37,613	25,872	2,142	2,028	637	584	68,876
1969	40,544	27,538	2,381	2,446	693	660	74,262
1970	43,096	29,220	2,684	2,866	736	738	79,340
1971 1/	45,763	30,898	2,954	3,215	804	773	84,407
% p.a. Growth Rates							
1958-71	9.4	6.1	6.4	15.6	12.9	7.5	8.1
1966-71	7.3	5.0	6.8	31.0	7.8	9.9	7.0
			Estimated Circulation				
1958 2/	12,720	13,388	1,247	459	129	225	28,168
1971 3/	35,794	20,606	2,128	2,889	669	554	62,640
% p.a. Growth Rates							
1958-71	7.7	3.4	4.2	15.2	13.5	7.2	6.4

1/ Provisional data; no later information available.
2/ Minus vehicles registered in 1944 or earlier.
3/ Minus vehicles registered in 1955 or earlier.

Source: MOW, October 1972; MOW, Ministere des Finances, 1975

December 1975

TABLE 3

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Fuel Consumption, 1960-73
(thousand m^3)

Year	Petrol	Gas oil	Total
1960	74.0	54.0	128.0
1961	75.5	50.1	125.6
1962	76.5	54.9	131.4
1963	78.0	59.0	137.0
1964	83.0	66.0	149.0
1965	84.0	70.1	154.1
1966	88.0	80.0	168.0
1967	90.4	91.0	181.4
1968	99.0	117.0	216.0
1969	103.1	131.2	234.3
1970	104.6	136.6	241.2
1971	111.3	158.5	269.8
1972	112.2	158.6	270.8
1973	115.4	164.2	279.6
% p.a. Growth Rates			
1960-71	3.8	10.3	7.0
1970-73	3.3	2.3	2.7

Source: MOW, 1972
INSRE, "Situation Economique au 1er Janvier 1974", 1975

December 1975

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Highway Expenditures, 1964-75
(FMG millions)

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975[1/]
A. Current Expenditures												
1. Administration[2/]	695	748	666	918	969	949	986	1,010	1,050	990	1,010	1,010
2. Primary Road Maintenance												
- maintenance	480	460	487	551	555	555	555	579	635	698	699	689
- resurfacing	120	100	247	360	380	434	606	575	600	105	87	170
- equipment renewal	80	85	272	258	282	282	132	80	132	118	15	26
Subtotal	680	645	1,006	1,169	1,217	1,271	1,293	1,234	1,367	921	801	885
3. Secondary Road Maintenance	368	447	388	484	500	638	464	436	431	579	406	262
Total Current Expenditures	1,743	1,840	2,060	2,571	2,686	2,858	2,743	2,680	2,848	2,490	2,217	2,157
B. Investment Expenditures[3/]	3,867	3,867	3,867	3,867	3,867	4,773	4,699	5,152	3,755	5,309	6,146	5,618
TOTAL HIGHWAY EXPENDITURES	5,610	5,707	5,927	6,438	6,553	7,631	7,442	7,832	6,603	7,799	8,363	7,775

1/ Budget provision.

2/ Estimate of Ministry's total cost share attributable to Highways.

3/ Including equipment.

Source: MOW, April 1975

December 1975

TABLE 4

TABLE 5

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

PLANT BIOMASS PROJECT - CREDIT 90-MAG

Project Costs and Implementation Data

IDA Category	Details	Road Length 1/ km	Design and Supervision Consultants	Contractor	Contract No.	Appraisal Estimate Costs FMG 000	Appraisal Estimate Costs US$ 000	Actual Costs FMG 000	Actual Costs US$ 000	Date Commenced	Completion Date Scheduled	Completion Date Actual	Remarks
IA	Reconstruction of RN 4 between km 145 and km 352	145	Administration LNTPB	SOTE-CITROA	4488-PE/66	2,488,888	10,000	2,112,360	8,869	1/14/67	1/14/70	1/12/70	
	Reconstruction of RN 4 between km 352 and km 362	10	BCEOM LNTPB	SOTE-CITROA	4488-PE/66	n.a.	n.a.	161,300	636	3/23/70	12/23/70	8/11/70	
	Strengthening of Betsiboka Bridge		BCEOM	SOTE-CITROA	4488-PE/66	n.a.	n.a.	35,000	136	7/10/70	1/2/71	9/72	Delayed because of changes in design
	Strengthening of RN 4 between km 341 and km 380	18	BCEOM LNTPB	SOTE-CITROA	4488-PE/66	n.a.	n.a.	150,000	607	9/20/70	12/20/70	12/14/70	
IB	Preliminary Studies and Detailed Engineering	.345	Administration		n.a.			37,630	148	1966	n.a.	11/65	
	Supervision of Constr.	173	LNTPB		4536-PE/66	300,000	830	42,630	168	1/20/67	5/14/70	9/72	Delay due to extension of scope of project
	Topographic Control	173	Administration		4848-FRDE/R/67			4,250	16	8/29/67	1/29/70	12/14/70	
	Betsiboka Study	30	BCEOM		5155-FRDE/R/68	30,000	88	49,000	187	5/2/68	2/2/70	2/70	
IIA	Ikopa River Crossing	27	BCEOM		5683-FRDE/R/69	n.a.	n.a.	10,600	43	8/69	6/70	8/71	Change in scope of study
IIB	Detailed Engineering RN 1	99	BCEOM		5987-PE/70	n.a.	n.a.	47,670	191	6/70	6/70	6/70	
IIC	Feasibility Studies		SOFRE		6418-FRDE/R/71	n.a.	n.a.	322,230	1,257	9/15/71	7/15/73	7/15/73	
III	Unallocated; Disbursement for RN11 Credit/Loan 134/570-MAG		Various	Various	Various	470,000	1,900	227,100	1,064				
				TOTAL		3,170,000	12,000	3,211,560	12,665				

1/ Road length after construction

DECEMBER 1972

TABLE 6

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Design Standards

	Terrain	
	Rolling	Mountainous
Design velocity	65 km/h	40 km/h
Minimum curve radius	100 m	50 m
Stopping sight distance, min.	90 m	60 m
Vertical curve radius, min.		
Crest	2,500 m	1,000 m
Sag	1,000 m	400 m
Vertical grade, max.	6 per cent	8 per cent
Roadway width	8.50 m	8.50 m
Pavement width	6.00 m	6.00 m
Shoulder width	1.25 m	1.25 m
Slope of pavement	2-1/2 per cent	2-1/2 per cent
Slope of shoulder	4 per cent	4 per cent
Type of pavement	Dense graded asphalt plant mix	
Type of base	Crushed Stone	Crushed Stone
Type of subbase	Stabilized soil or free draining granular	
Width of right-of-way, min., in open country	60 m	60 m
Structures, width face to face curbs	7 m	7 m
Structures, design load	In accordance with Cahier des Prescriptions Communes	

Source: Appraisal Report No. TO-508b, May 1966

December 1975

TABLE 7

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Summary of Road Construction
Justified in SETEC Feasibility Study

	Construction Cost FMG 10^9 /1	Rate of Return %	Length km	1985 adt
Tananarive-Tamatave				
Anjozorobe-Ambatondrazaka-Tamatave (paved, 8.5m base, 6 m width)	9.9	18.4	276	636
Lake Alaotra-East Coast (feeder roads 5.5m base, 4m width)				
Sahavaty-Ambohimahanoro	.8	16.7	26	54
Vavatenina-Miarinarivo	.6	17.2	29	73
Anjahambe-Saranambana	.6	19.1	16	65
Tananarive-Ambatolampy (paved, minimum improvements 5.5 m width)	1.2	10.9	58	2,533
TOTAL	13.1		405	

/1 Including taxes and at 1973 prices.

Source: SETEC Feasibility Study, September 1973

December 1975

TABLE 8

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Schedule of Disbursements
(US$ thousand)

IDA Fiscal Year and Quarter	Actual Disbursements	Appraisal Estimates	First Supervision Estimates 8/27/70
1967/68			
September 30, 1967	129		
December 31, 1967	371		
March 31, 1968	712		
June 30, 1968	845		
1968/69			
September 30, 1968	1,200		
December 31, 1968	1,979		
March 31, 1969	2,276		
June 30, 1969	2,731		
1969/70			
September 30, 1969	3,800		
December 31, 1969	4,851		
March 31, 1970	6,085		
June 30, 1970	6,440		
1970/71			
September 30, 1970	6,799		7,140
December 31, 1970	7,157		7,700
March 31, 1971	7,336		8,100
June 30, 1971	7,336		8,460
1971/72			
September 30, 1971	7,535		8,690
December 31, 1971	7,535		8,870
March 31, 1972	7,535		9,050
June 30, 1972	7,535		9,300
1972/73			
September 30, 1972	7,535		9,480
December 31, 1972	7,535		10,000
March 31, 1973	7,824		
June 30, 1973	9,539		
1973/74			
September 30, 1973	9,539		
December 31, 1973	9,539		
March 31, 1974	9,539		
June 30, 1974	9,539		
1974/75			
September 30, 1974	9,907		
December 31, 1974	10,000		
Closing Date:	12/31/74	12/31/70	12/31/72

Appraisal report did not include schedule for disbursements

Source: IBRD/IDA Supervision Reports

December 1975

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Credit Allocation

IDA Category	Details	Contractor Consultant	Amount Allocated (US$)	Actual Disbursement	Average Exchange Rate (FMG to US$ 1.00)
IA	Construction	GTE-CITROA	7,300,000	7,358,633.66	261.8
IB	Supervision & Engineering - Preliminary Studies - Supervision - Topographic Control - Betsiboka Study	 Administration LNTPB Administration BCEOM	500,000	406,900.17	266.7
IIA	Ikopa River Crossing	BCEOM	40,000	33,353.43	249.8
IIB	Det. Engineering RN 1	BCEOM	160,000	148,879.06	249.8
IIC	Feasibility Studies, etc.	SETEC	940,000	992,233.68	256.4
III	Disbursements for Highways II Credit/Loan 134/570-MAG	Various	1,060,000	1,060,000.00	214.3
			10,000,000	10,000,000.00	256.2

Source: IBRD/IDA Controller's Department, January 1975

December 1975

TABLE 9

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

TABLE 10

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Traffic on RN 4 Between km 165 and km 352 (Andramy), 1965-72
(adt)

Year	TOTAL	Total Passenger Vehicles	Bus and Taxi-Brousse	Cars	Total Trucks	Pick-ups	Trucks: Less than 6 Tons	Trucks: 6 to 10 Tons	Trucks: More than 10 Tons	Trucks: Semi-Trailer
Poste 2, km 336 (9 km south of Maevatanana)										
1965	92	52	28	24	40	10	20	8	2	-
...										
1968	100	49	19	30	51	7	2	4	28	10
1969	111			n.a.				n.a.		
1970	191	128	36	92	63	10	23	15	10	5
1971	209	140	40	100	69	17	2	38	8	4
1972	208	126	41	85	82	25	-	50	2	5
% growth p.a.:										
1965-69	4.8									
1969-70	72									
1970-71	9	9	11	7	10	70	-	153	-	-
Poste 1, km 197 (2 km north of Mahasinjo)										
1965	43	25	n.a.		18			n.a.		
...										
1969	140		n.a.							
1970	202	127	48	79	75	19	6	25	15	10
1971	241	147	60	87	94	22	7	39	19	7
1972	214	122	51	71	92	22	6	47	13	4
% growth p.a. 1970-71	20				25					

		1965	1971	Increase: Number	Increase: %
North of section:	Tsaratanana (km 422)	110	282	172	256
Within section:	Maevatanana (km 336)	92	209	117	227
	Mahasinjo (km 197)	43	242	199	563
South of section:	Ankazobe (km 93.5)	152 1/	285	133	188

Source: 1965 Government study, done by IBRD request, at Maevatanana; other years from Rapport sur le traffic routier à Madagascar.

1/ IBRD estimate (1975 est.)

December 1975

TABLE 11

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Vehicle Operating Costs, 1966[1/] and 1970[2/]

	FMG per km			
	Earth Gravel		Paved Poor	Paved Good
Cars	(13)	31	23	(8) 16
Pick-ups		46	32	23
Buses		70	48	32
Trucks < 6 tons	(53)	62	43	(32) 31
Trucks 6 to 10 tons	(68)	92	60	(41) 46
Trucks > 10 tons		109	76	52
Truck-trailer		142	98	(70) 67

1/ Numbers in brackets correspond to appraisal estimates (1966)

2/ Based on SETEC's "Etudes de factibilité routière," 1973.

December 1975

TABLE 12

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Transport Tariffs on RN 4 Between Tananarive and Majunga

	Year	Majunga-Tananarive (FMG)	Tananarive-Majunga (FMG)
Ton-km:	1966	11 to 18	5 to 10
	1968	9 to 15	4 to 10
	1971	6 to 9	3 to 5
	1975	10 to 15	
Pass.-km:	1966	2 to 3	
	1968	2 to 3	
	1971	1.6 to 2.5	
	1975	2 to 3	

Source: Appraisal Report Fourth Highway Project, September 1975

December 1975

TABLE 13

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Economic Reevaluation of RN 4 Construction Between km 165 and Andramy
(FMG millions, at 1970 prices)

Year	Construction Cost	Maintenance Savings	Vehicle Operating Savings
1967	153		
1968	446		
1969	1,307		100
1970	47	3	293
1971		3	347
1972		4	358
1973		4	376
1974		88	395
1975		4	414
1976		5	435
1977		-109	457
1978		88	480
1979		5	504
1980		5	529
1981		6	555
1982		88	583
1983		6	612
1984		-109	643
1985		6	675
1986		88	709
1987		6	744
1988		6	781
1989		6	821

Basic Rate of Return:	20.4%
Sensitivity Analysis:	R.R.%
1) Proportion of benefits per kilometer as used in appraisal	15.3
2) Traffic growth of 2 % instead of 5% p.a.	18.5
3) p.a. traffic growths: none from 1973 to 1974, 10% from 1975 to 1980 and decreasing to 5% from 1976 to 1989	16.5
4) 15% additional benefits	23.0

Source: IBRD estimates

December 1975

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Economic Reevaluation of RN 4 Construction Between Andramy and Boinakely
(FMG millions, at 1970 prices)

Year	Actual Construction Cost	Maintenance Savings	Vehicle Operating Savings	Construction Cost Estimates By IDA	Construction Cost Estimates By Consult.	Maintenance Savings	Vehicle Operating Savings
	Improving Mahatsinjo alignment			If Ambavahadiala alignment was done			
1970	269.0			287.0	250.0		
1971	63.0		30.0	288.0	250.0		
1972		0.3	40.0	69.0	60.0		68.0
1973		0.3	42.0			1.4	71.4
1974		0.3	44.1			1.4	75.0
1975		0.3	46.3			1.4	78.7
1976		4.9	48.6			1.4	82.7
1977		0.8	51.1			11.4	86.8
1978		-5.2	53.6			1.9	91.1
1979		0.8	56.3			4.8	95.7
1980		0.8	59.1			1.9	100.5
1981		4.9	62.1			1.9	105.5
1982		1.1	65.2			6.0	110.8
1983		1.1	68.4			7.6	116.3
1984		1.1	71.8			2.2	122.1
1985		-4.9	75.4			2.2	128.2
1986		4.9	79.2			5.1	134.6
1987		1.3	83.2			6.0	141.4
1988		1.3	87.3			2.4	148.4
1989		1.3	91.7			7.8	155.9
1990		1.3	96.3			2.4	163.7
1991		-	-			2.4	171.8
Basic Rates of Return:			14.7%	13.1%	15.0%		
Sensitivity Analyses:			R.R.%	R.R.%	R.R.%		
1) Proportion of benefits per kilometer as used in appraisal			10.5	9.4	11.0		
2) Traffic growth of 2% instead of 5% p.a.			12.2	10.8	12.4		
3) 15% additional benefits			16.8	14.9	17.0		

Source: IBRD estimates
December 1975

TABLE 14

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

FIRST HIGHWAY PROJECT - CREDIT 90-MAG

Background Information on Road Projects Studied by SETEC[1/]

Vavatenina-Lake Alaotra (160 km and 60 km of feeder roads)

1. This is a section of the road to connect the Lake Alaotra region with Fenerive and other population centers along the Coast, including the main port of Tamatave. The Alaotra region, in a depression of the North Central Plateau, comprises 7,250 sq km and a population of 150,000 that is growing at 5% per annum due partly to immigration from surrounding areas. The area is highly developed agriculturally and contains large plantations owned and managed by foreign firms as well as many smaller indigenous units. The predominant crop is rice, totalling 120,000 tons a year of which 70,000 are marketed along the coast or shipped abroad through Tamatave. Other crops of importance are coffee (30,000 tons), ground nuts (3,500 tons), bananas (5,000 tons), and vegetables (4,000 tons). The cash crops produced annually by the average family in the area has an ex-farm value of US$120 which is high for Malagasy agriculture.

2. In spite of being the most agriculturally developed area in the country, the Lake Alaotra region is connected with its markets only by a circuitous and inefficient railway. For example, the distance between Imerimandroso in the region and Fenerive, an important rice consuming center along the east coast, is 549 km by road, rail and road at present. It would be only 159 km if the proposed road were built. For export/import trade, the distance from Imerimandroso to Tamatave is 444 km by rail and road at present, as against 254 km with the proposed road.

3. The region has considerable agricultural potential, both in terms of unutilized land and of possible increases in yields, and FED has been quite active in road construction here. Most of the funds committed under the second FED program for road construction, but not yet utilized, will be applied to upgrading the 196 km Andilanatoby-Amboavary road that connects the western part of the district with the Tamatave-Tananarive railway. A feeder road of similar length, leading to Andriamena and the chromium ore areas in the west, will also be financed from FED funds.

1/ Quoted from Annex 3 to "Appraisal of the Betsiboka crossing and Highway Studies to be included under Credit 90-MAG. Back to Office and Full Report", November 10, 1969.

4. The proposed road will service an area near the coast three times as large as the Alaotra region and will reduce transport distance by 200-400 km depending on the points of origin-and-destination of individual goods. The following specific benefits should result:

(i) transfer of rail traffic to road: traffic on the present railway line varies from 94,000 tons at Moramanga junction to 21,000 tons at Ambatondrazaka. About half this traffic would be diverted to the new road, amounting to about 30-40,000 tons at present traffic levels;

(ii) generated traffic: a direct connection of the two population and economic concentrations - one around Lac Alaotra and the second along the Coast, separated by a distance of only 250 km - will generate considerable amounts of new traffic; and

(iii) agricultural benefits: all along the Coast considerable amounts of rice are grown as insurance against periods of cyclones when the coastal areas are cut off from their rice suppliers. This coastal land is much better suited for the production of coffee, cloves and other spices. With the assurance of a steady supply of rice provided by a direct road, these agricultural areas could be put to more profitable use.

5. A preliminary calculation suggests a rate of return on the road construction investment of about 15%. The Malagasy authorities have hitherto given this road project low priority mainly in order to keep the railway going and assure it maximum tonnage. This consideration is now mitigated by the fact that the railway is assured of an additional 100,000 tons of chromium ore with the start of mining operation at Andriamena, and the Government has changed its mind about the priority of this project. It has applied to FAC for financial assistance to execute the necessary studies.

Tananarive-Fianarantsoa

6. This 391 km link is the backbone of the country's road network and especially of the Central Plateau. It serves the provinces of Tananarive and Fianarantsoa, which, although comprising only 20% of Madagascar's land area (i.e. 120,000 sq km), accounts for half of the national population of 6.5 million, about half the output of paddy and fresh vegetables and all potato and temperate fruit production, and supports one-third of the country's cattle. It contains 80% of Madagascar's urban population of one million -- including the towns of Tananarive (350,000), Fianarantsoa (60,000) and Antsirabe (30,000) -- and more than half of its industrial activity, consisting mainly of cured tobacco, cigarettes, chemicals, beverages, canning, textiles, printing, leather and woodwork.

7. The main trunk road serving these two provinces has a bituminous surface but its alignment, dating from 1910, is obsolete. On many sections driving speeds average only about 40 km/hr for light vehicles and 30 km/hr for medium-sized trucks. Traffic is relatively heavy for Madagascar, varying between 400 and 1,200 vpd, with an average about 500. The rate of traffic growth has been 10-15% per year in the past five years, depending on the section, and this trend is likely to continue due to urbanization, industrialization and intensification of agricultural activity in the Central Plateau.

8. Major new industrial and agricultural developments are expected, including (i) the establishment of two pulp factories of 250,000 tons capacity, which together will generate about one million tons of traffic; (ii) the establishment of a 150,000-ton annual capacity cement factory; and (iii) a citrus scheme that will generate 250,000 tons of traffic. About half this additional tonnage will have to be carried on the Tananarive-Antsirabe railway to Finarantsoa, as part of the UNDP-financed rail study. This study, however, indicates that even under the most optimistic conditions there is little justification for constructing this rail line. The case for improving the present road does not depend on realization of the above-mentioned agricultural and industrial projects, but rather on present traffic volumes, normal growth, and the inadequacy of the present alignment and road base. The object should be not to reconstruct the 400 km road all at once, but to selectively improve certain sections on the basis of a master plan. Rates of return for such selective improvements are estimated to be on the order of 15%; moreover, if one or more of the projects referred to in this paragraph are realized, upgrading of the present road would become more urgent and the prospective rates of return higher. The Government has now applied to UNDP for financial assistance to execute the necessary studies.

The Tamatave-Tananarive Road

9. This is the most important transport axis on the island, connecting Tananarive, the island's capital and most populous industrial city, and Tamatave, the second largest city and most important port. All through traffic on this axis is now handled by the 370 km railway that carries about 500,000 tons per year. The road, which is 280 km long and roughly parallels the railway, is deliberately kept in poor condition. Under best dry weather conditions, a light vehicle can average 30 km/hr, during the rainy season the road becomes impassable. The railway itself is very slow. Passenger trains make the 370 km run in 12 hours and goods trains are slower. Although adequate for long hauls and bulky goods, the railway serves local traffic needs poorly.

10. The lack of adequate transport inhibits development of certain areas near the capital and Tamatave. Moreover, a series of small towns along the railway -- such as Manjak, Moramanga and Perinet (within 120 km of Tananarive), which have agricultural hinterlands, tourist possibilities and small industrial establishments -- are severely handicapped by the restrictive railway policy. The position of Brickaville vis-à-vis Tamatave is similar. The improvement of selected sections of the road within the framework of a master plan could generate substantial amounts of new traffic without diverting any of the long haulage between capital and Coast. The application to UNDP includes a study of this road.

DEMOCRATIC REPUBLIC OF MADAGASCAR

PROJECT COMPLETION REPORT

SETEC ROAD FEASIBILITY STUDY

A. Volume Index of Phase 2, Alignment Selection

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Volume 1.2 Fiscal and regulatory road transport systems

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Volume 2.2 General economy and traffic forecasting models
Volume 2.3 Transport organization and operating costs
Volume 2.4 Rentability estimates
- Volume 1 Methodology
- Volume 2 Results (Tananarive-Tamatave excluded)
- Volume 3 Results (Tananarive-Tamatave)

Volume 2.5 Survey results
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Volume 3.2 Plans
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Feeder roads of Vavatenina area

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6. ALIGNMENT SELECTION IN PHASE 1

Volume 6.1 Tananarive-Ambatolampy
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Volume 6.4 Moramanga-Antsirandava
Anjozorobe-Vohidiala
High valley of Ivondro
Feeder roads of Vavatenina area

B. SUMMARY

1. The road sections that SETEC found justified are shown in Table 7, together with their construction costs, lengths, vpd's expected in 1985 and rates of return. The Tananarive-Tamatave and Lake Alaotra-East Coast regions are shown on Map 3. Construction costs amount to FMG 13,100 million, and consultants presented an implementation program phased over 1974-81.

Tananarive-Tamatave Master Plan

2. Four alternative alignments were analyzed in the first phase, by way of:

(i) Moramanga-Brickaville (222 km); this is the shortest route but has the highest construction costs per km and resulted in the lowest rate of return: 10.2%; it was not studied further;

(ii) Moramanga-Vohidiala-Ambatondrazaka (288 km), yielded a return of 23.2%;

(iii) Moramanga-Didy-Ambatondrazaka (298 km), yielded a return of 22.4%; and

(iv) Anjozorobe-Ambatondrazaka (254 km), was shown as the best, with 25.8% return. (See comments on paras. 3.31, 3.32.)

The alternative (iv) was retained for further studies in the second phase, but less than half the traffic included in the first analysis was assumed due to new assumptions about improved railway services. Even so, the return was a satisfactory 18.4%. Analyzing improvements by sections, from Lake Alaotra to Tamatave, the return was 19.1%, and from Anjozorobe to Lake Alaotra, 16.4%. Proposed standards were 8.50 m base and 6 m paved road width, at an estimated cost of FMG 9,900 million.

Lake Alaotra-East Coast Feasibility Study

3. The link from Imerimandroso to Vavatenina (135 km) showed the highest return of all analyzed road improvements in the first phase, 27.9% with a construction cost of FMG 5,050 million. However, in the second phase, with reduced traffic, the section from Imerimandroso to Sahatavy was no longer justified (5.2%), while feeder roads to Vavatenina showed good returns. A total of 77 km of feeder roads recommended in the first phase was reduced to 71 in the second, with a 5.50 m base width, 4 m roadway and one-lane bridges, yielding 17.5% at a cost of FMG 2,000 million. Upgrading the Ambatosoratra-Imerimandroso section (28 km) was also justified with a return of 13.3% and at a construction cost of FMG 573 million for a 7 m base and 5.5 m roadway width.

Tananarive-Fianarantsoa Master Plan

4. From Tananarive to Ambatolampy, only reinforcing of the existing road was justified, with minimum alignment improvements to shorten the length from 62 to 58 km and maintaining existing 5.50 m width at a FMG 1,181 million cost, and a 10.9% return. Ambatolampy to Antsirabe had been recently improved, and for Antsirabe-Finanarantsoa, both first and second phases yielded returns around 6%.

Transport fiscal and regulatory measures study

5. Consultants arrived at three main conclusions regarding fiscality:

(i) gasoline and diesel oil should be equally taxed;

(ii) a tax per axle should be enforced, increasing with load per axle up to a maximum of FMG 500,000 per truck a year; and

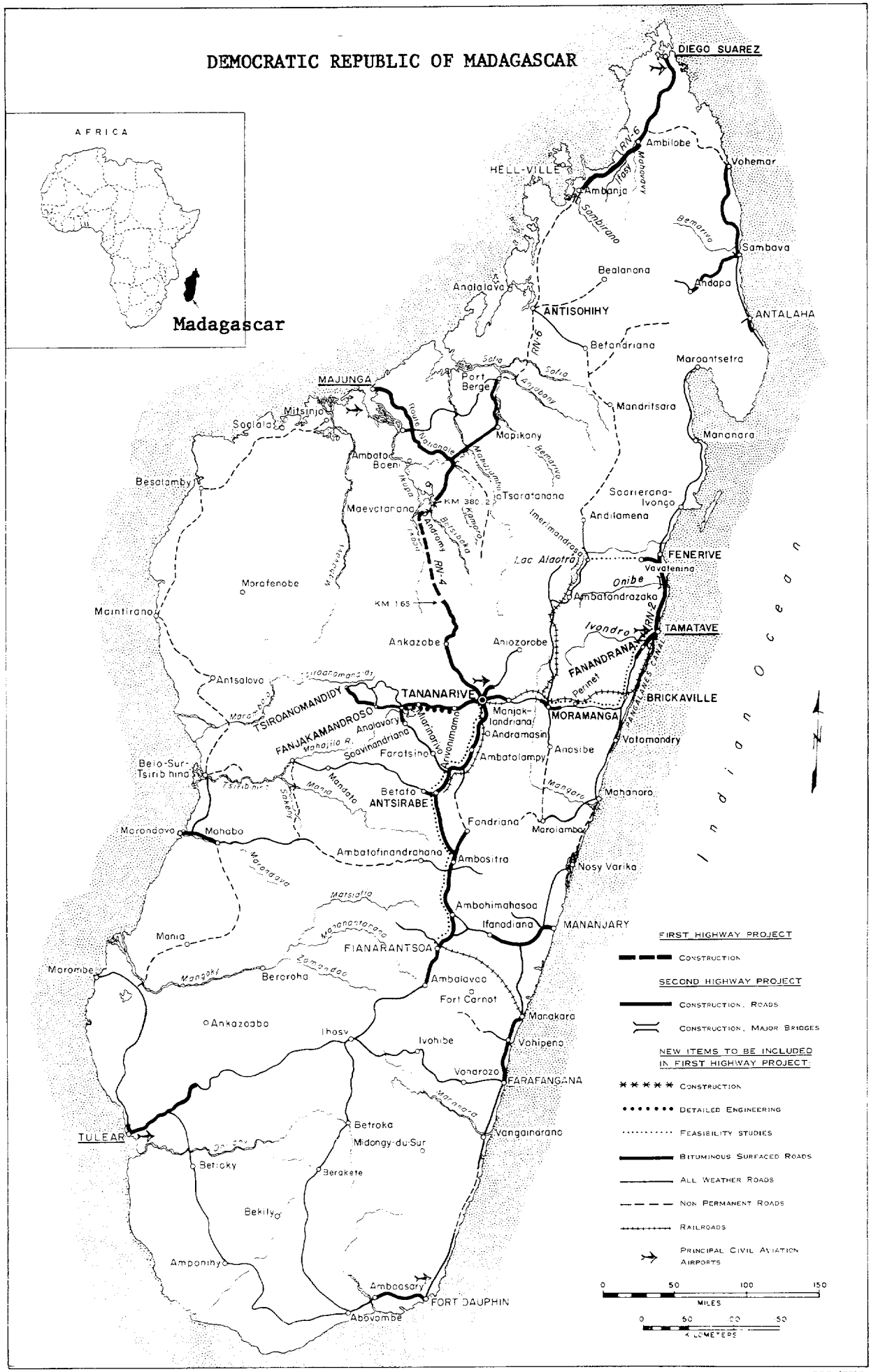
(iii) total road transport revenues should be adjusted to cover expenditures primarily by adapting fuel tax levels and secondarily by changing fixed vehicle-taxes.

6, Regulatory measures covering the following were proposed:

(i) road security: inspecting vehicles; controlling axle weights; educating drivers; setting maximum working hours for drivers;

(ii) road transporters organization: grouping of individual transporters; organizing specific training recognized by certificate of professional aptitude; and

(iii) road transport market: reforming credit availability for vehicle purchasers; imposing quotas on vehicle imports; granting monopolies to certain transporters on low profitability itineraries; publicizing tariffs; and adopting legislation to avoid unwanted monopolistic situations.



JANUARY 1970

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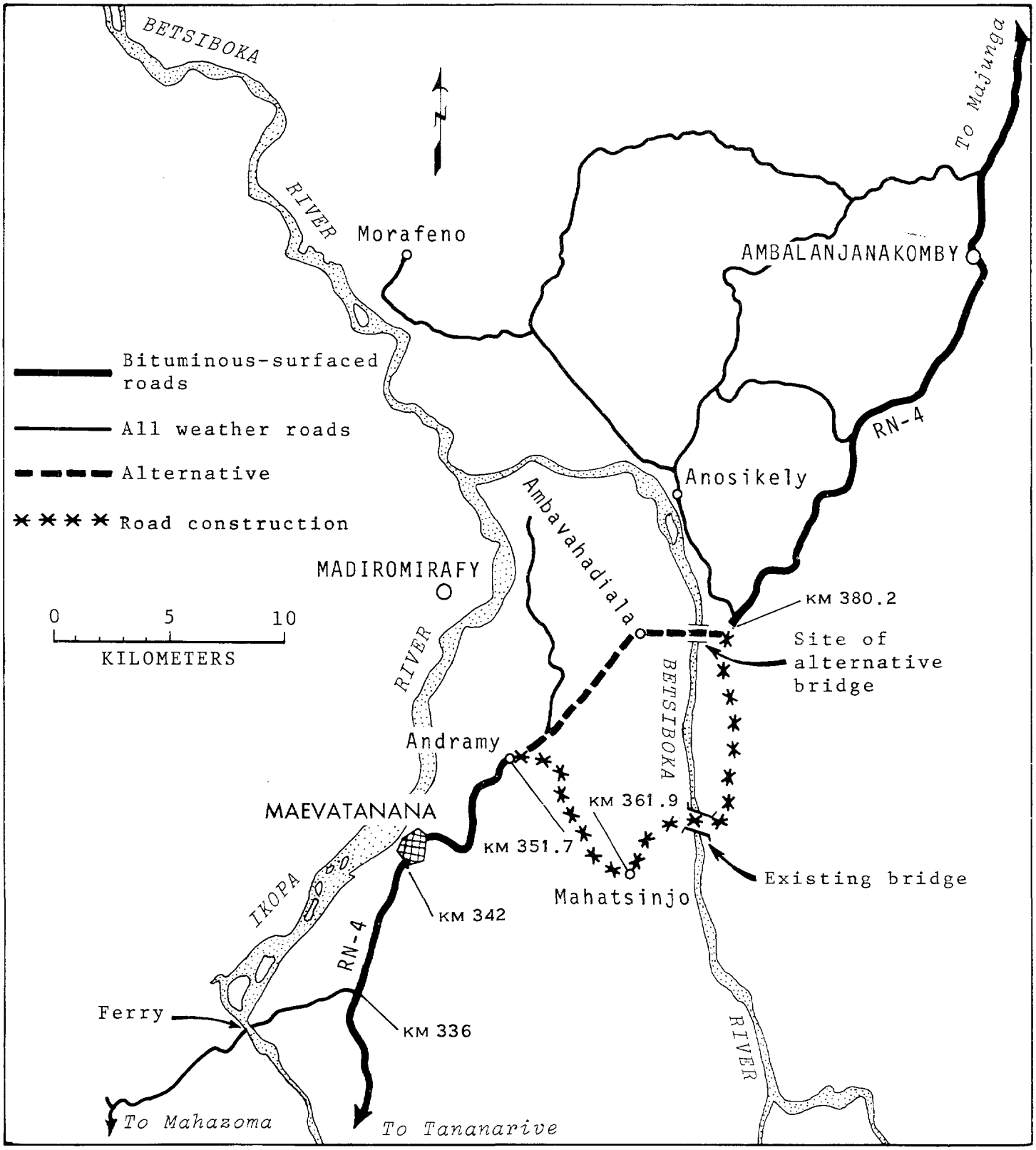
DEMOCRATIC REPUBLIC OF MADAGASCAR

THE BETSIBOKA CROSSING



DECEMBER 1969

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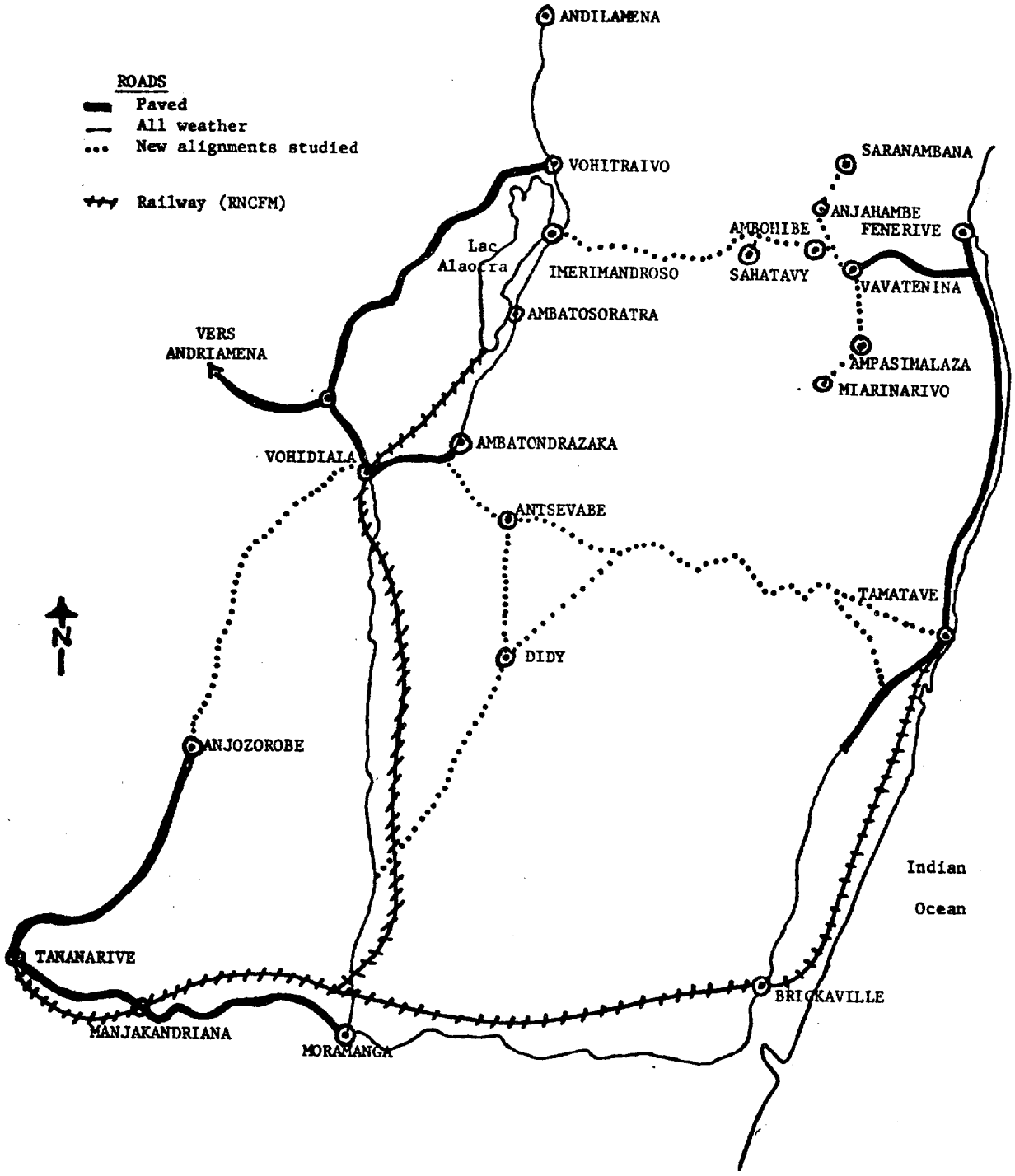
MAP 3

TANANARIVE - TAMATAVE AND LAC ALAOTRA - EAST COAST REGIONS



DECEMBER 1975