File: 512-275
277
5120277-(2)

UNCLASSIFIED

149

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

CAPITAL ASSISTANCE PAPER

Proposal and Recommendations
For the Review of the
Development Loan Committee

BRAZIL - SOUTHERN STATES HIGHWAY MAINTENANCE EQUIPMENT

512-22-310-275
512-22-310-277
512-L-067
512-L-068
512-L-069

A.I.D.
Reference Center
Room 1656 NS

AID-DLC/P-592

UNCLASSIFIED

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

UNCLASSIFIED

AID-DLC/P-592
June 7, 1967

MEMORANDUM FOR THE DEVELOPMENT LOAN COMMITTEE

SUBJECT: Brazil - Southern States Highway Maintenance Equipment

Attached for your review are the recommendations for authorization of a loan in an amount not to exceed $31,600,000 to the State Highway Departments of Rio Grande do Sul, Santa Catarina, and Parana for equipment for highway maintenance and betterment, for technical assistance to the Highway Departments of each State, and for reorganization of the several Highway Departments.

This loan proposal is scheduled for consideration by the Development Loan Staff Committee at a meeting on Monday, June 12, 1967.

Annex VI, the Loan Authorization, will be distributed before the DLSC meeting. The conditions are set forth fully on pages v, vi, and vii of the Summary and Recommendations section of the paper.

Rachel C. Rogers
Assistant Secretary
Development Loan Committee

Attachments:
Summary and Recommendations
Project Analysis
ANNEXES I-V
ANNEX VI - To be distributed

UNCLASSIFIED

UNCLASSIFIED
AID-DLC/P-592
June 7, 1967

BRAZIL - Maintenance Equipment and Technical Assistance for the Highway Maintenance Department of the States of Rio Grande do Sul, Santa Catarina and Paraná

Table of Contents

	Page
SUMMARY AND RECOMMENDATIONS	i to vii
SECTION I - PLACE OF THE LOAN IN THE PROGRAM	1
SECTION II - DETAILED DESCRIPTION OF THE PROJECT	
A - History and Background	3
1. World Bank Transport Study	4
2. Master Planning Studies for the Southern States	4
B - Borrowers	5
C - Engineering Analysis	6
1. Present Level of Maintenance	6
2. Technical Description of the Project	6
3. Equipment Program	7
4. Present Level of Maintenance and Proposed Maintenance Procedures	17
5. Labor Intensive Considerations	21
6. Engineering Plan for the Execution of the Project	24
D - Economic Analysis	29
1. Economic Description of the States	29
2. Population	29
3. Agriculture	30
4. Industry	31
5. External Sector	32
6. Transport Sector	32
7. Benefit Cost Analysis	34

/...

Page

SECTION II - DETAILED DESCRIPTION OF THE PROJECT (Cont'd)

E - Financial Analysis 51
1. Financial Schedule 51
2. Financial Plan 52
3. Title IV Counterpart Wheat Fund 53
4. Source and Application on Funds 54
5. Cost of the Proposed Maintenance Programs 57
6. Highway Department Financial Capacities to Support Proposed Maintenance Program 59
7. Repayment Capacity 62
8. Loan Terms and Interest Rates 62
9. Investment Program 64

A N N E X E S

I - Statutory Checklist
II - Miscellaneous Exhibits
III- Engineering Data
IV - Economic Data
V - Financial Data
VI - Loan Authorization

(For detailed listing, see next page)

ANNEXES

I - Statutory checklist

II - Miscellaneous exhibits

Exhibit 1 - SUDENE Highway Maintenance loan
Minas Gerais Highway Maintenance loan
Sao Paulo Highway Maintenance Equipment loan
Decree Law No. 122

Exhibit 2 - Legal Description of the Borrowers

Exhibit 3 - Exchange of letters between USAID and the DNER

Exhibit 4 - Maps of the Southern States

III - Engineering data

Exhibit 1 - Equipment needs and cost estimate charts

Exhibit 2 - Maintenance organization of the State Highway Departments

Exhibit 3 - Highway maintenance training in the U.S.

Exhibit 4 - Example of labor intensive methods

Exhibit 5 - Consultant technical assistance program

Exhibit 6 - Detailed equipment list and estimated cost

IV - Economic data

Exhibit A - Cost of vehicle operations

Exhibit B - Operating cost of user benefit calculations

Exhibit C - User benefit flows

Exhibit D - User benefit from conversion of earth roads to gravel roads

Exhibit E - Paved roads, gravel roads, earth roads; producer benefits for paved

Exhibit F - Cost of maintenance

Exhibit G - Internal rate of return calculations

Exhibit I - Average daily traffic

ANNEXES (continued)

V - Financial data

Exhibit 1-A - Cash flow, Parana

Exhibit 1-B - Cash flow, Santa Catarina

Exhibit 1-C - Cash flow, Rio Grande do Sul

Exhibit 2 - Economic data of states' finances

Exhibit 3 - Summary review of the states' finances

UNCLASSIFIED
AID-DLC/P-592
June 7, 1967

BRAZIL - Maintenance Equipment and Technical Assistance for the Highway Maintenance Departments of the States of Rio Grande do Sul, Santa Catarina and Paraná

SUMMARY AND RECOMMENDATIONS

1. BORROWERS: The Borrowers will be the State Highway Department of Rio Grande do Sul (DAER/RGS), the State Highway Department of Santa Catarina (DER/SC) and the State Highway Department of Paraná (DER/PR). The loans will be guaranteed by the GOB and by the respective states.

2. PURPOSE OF THE LOANS: The projects are designed to accomplish the following objectives: (1) to provide DAER of Rio Grande do Sul and the DER's of Paraná and Santa Catarina with the necessary highway maintenance equipment to adequately maintain and upgrade the road networks of their respective states; (2) to provide the necessary technical assistance to accomplish reorganization of the Highway Departments of each state; (3) to assist each state Highway Department in the assuming of maintenance responsibilities for all federal roads, in each state, which are presently being maintained by the DNER (the National Highway Department).

3. AMOUNT AND TOTAL COSTS: Not to exceed in total value US$ 31.6 million to cover the direct foreign exchange costs for goods and services to be purchased in the United States. The cost breakdown for this project is shown below:

U.S. Maintenance Equipment/Technical Assistance

(US$ Millions)

	Rio Grande do Sul	Santa Catarina	Paraná	
U.S. Dollar Loan				
Maintenance Equipment	8.1	4.3	6.4	
Spare Parts	1.1	.5	.8	
Shipping and Insurance	1.8	1.0	1.5	
Technical Assistance	1.0	1.0	1.0	
Engineering Training U.S.	.1	.1	.1	
Contingencies	1.2	.6	1.0	
TOTAL	13.3	7.5	10.8	31.6
Loan from Title IV Counterpart Wheat Fund				
Maintenance Equipment and Spare Parts 1/	2.0	1.6	1.6	
Technical Assistance	.2	.2	.2	
TOTAL	2.2	1.8	1.8	5.8
State Contribution of Locally Purchased Equipment and Spare Parts 1/ 2/	6.0	5.4	4.6	16.0

Total Amount U.S. Dollar Loan.....US$31.6
Title IV Counterpart Fund .....US$ 5.8
Total Amount of States Contribution.....US$16.0
Total Amount of Project in U.S.Dollars..... US$53.4

1/ All cruzeiro figures are based on March 1967 exchange rate of NCr$2.70 - Cost of local equipment have been inflated by 25% to cover the estimated average inflation of 25% over a two year disbursement period.

2/ The states are presently spending from $2.9 million (Santa Catarina) to $4.4 (Paraná) to support the current cost of maintenance programs; these amounts will increase to between $4.6 million and $6.4 million to support the proposed programs.

4. BACKGROUND: In March 1965 the Mission received requests for highway maintenance equipment loans from the states of Rio Grande do Sul, Santa Catarina and Paraná as part of a national program designed to upgrade and modernize the maintenance capability of Brazil's individual state highway departments. A Danish consulting firm, "KAMPSAX", was already working on transport master planning studies for the Southern states sponsored by the World Bank and the GOB. Because of the Southern states' proposed maintenance projects, the Bank agreed to modify the master plan's scope of work to include maintenance feasibility studies which the consultant submitted to the Mission in March 1966.

These feasibility studies did not possess sufficient information for developing an equipment loan.

The Mission was told, however, that the necessary information required for a loan document would be available in the transport master planning studies completed in October 1966. Upon examination of the master plan it was discovered that more information was still needed. To solve this problem, the consultant prepared a supplementary maintenance feasibility report which was presented to the Mission on December 20, 1966. This supplementary report along with the master plan, original maintenance feasibility studies and the findings of several trips to the Southern states undertaken by the Mission offices of Capital Development and Engineering, constitute the information presented in this Capital Assistance Paper.

5. INTEREST OF OTHER FINANCIAL AGENCIES: The Ex-Im Bank, IDB and IBRD have indicated no interest in financing this project. Other free world financing is not available on reasonable terms for this project.

6. STATUTORY CRITERIA: All Statutory Criteria of the U.S. Foreign Assistance Act of 1961, as amended, have been met. (See Exhibit 1, Annex I).

7. COUNTRY CLEARANCE: COCAP approved this project for A.I.D. financing in June 1967.

8. ISSUES:

1. Borrowers' Contributions to the Projects

The total cost of the proposed highway maintenance projects for the Southern states is US$53.4 million. USAID will finance $31.6 million, 59 percent, the states will finance US$15.7 million, 30 percent, and the GOB will loan to the states from the Title IV, Counterpart Fund, US$5.8 million, 11 percent of the proposed projects. In addition to this, the highway departments of the three states will be required to make annual expenditures of between $4.6 million and $6.4 million for maintenance costs as well as support major road construction programsto be financed by the World Bank and the states. (See Investment Program in Financial Analysis, page 64). The Borrowers' contribution to these projects, therefore, appears adequate.

2. Santa Catarina's Ability to support the proposed Maintenance Project

The Highway Department of Santa Catarina is presently spending 48% of its total budget and 57% of its assured sources of revenues on maintenance. The proposed project will require the department to spend 38 percent of its total budget and 71% of its assured sources of revenue in 1970. This financial burden is high in relation to Santa Catarina's sister states. The state should be able to support the proposed program for the following reasons:

(a) The highway department and the state shall covenant in the Loan Agreement that maintenance operations will be given priority over road construction and that road maintenance will have first call on all state highway department funds.

(b) The financial and economic benefits presented in the economic analysis are substantial for the proposed investment.

9. RECOMMENDATIONS: It is recommended that three loans be authorized as follows:

(a) A loan to the State Highway Department of Rio Grande do Sul (DAER) not to exceed US$13.3 million.

(b) A loan to the State Highway Department of Santa Catarina (DER) not to exceed US$7.5 million.

(c) A loan to the State Highway Department of Paraná (DER) not to exceed US$10.8 million.

These loans will be subject to the following terms and conditions:

(a) The repayment of the loans by the Borrowers within fifteen (15) years of the date of the disbursement, including a three (3) year grace period.

(b) Interest rate of 3-1/2% will be charged on all disbursed loan funds including those during the grace period.

(c) Interest and principal to be repaid in U.S. dollars in semi-annual installments.

(d) All equipment and material financed under this loan will have their source and origin in the United States. All technical services except for local engineering services will have their source and origin in the United States. Local engineering services will be funded from PL 480 funds to the extent possible.

(e) Supervisory engineering services will be contracted with a firm satisfactory to A.I.D. and under USAID approved conditions.

(f) The two-step option will be offered to the GOB with repayment schedule at forty (40) years including a ten (10) year grace period with interest of one (1) percent during the grace period and two and one-half (2-1/2) percent thereafter.

(g) The GOB will guarantee the loans.

(h) The states shall also guarantee the loans and shall commit themselves to provide any additional funds necessary for the projects.

Other terms and conditions:

(a) The Borrowers and the DNER shall covenant and provide evidence satisfactory to A.I.D. that their contributions to the projects will be made available as needed for the continuing maintenance of equipment purchased and for the continuing operation of the highway departments.

(b) The Borrowers shall covenant to make adequate funds available to carry on an equipment replacement and procurement program after the completion of the projects.

(c) The Borrowers shall covenant that maintenance operations will be given priority over road construction and that road maintenance will have first call on the states highway departments' funds.

(d) The states shall covenant that all new road construction will follow the general priorities established in the World Bank sponsored master planning studies.

(e) The states shall covenant that contract procedures for road construction will be amended so that the roads will be fully completed before being turned over to the various DER's for maintenance.

(f) Each state highway department will develop and present an operational maintenance program satisfactory to AID prior to the procurement of equipment.

(g) The states shall covenant that they will enforce vehicle weight and dimension legislation on their highway network.

(h) Concurrent with the signing of the loan agreement with the states, the DNER, USAID and the Borrowers will sign separate agreements which will guarantee the transfer of the DNER maintenance responsibilities, equipment and personnel in the Southern states to the respective state highway departments and will establish a reasonable time-table for this transference. The DNER will also agree to pay the various state highway departments for assuming the maintenance responsibilities of the federal highway network.

(i) The loan will be subject to other terms and conditions as A.I.D. may deem advisable.

9. PROJECT COMMITTEE:

Loan Officer/Chairman	- J.M.Prindiville-USAID/B-ADCD
Engineers	- J. Campbell-USAID/B-ENRH K. Schedler-USAID/B-ENRH
Equipment Specialist	- P.Tysinger-USAID/B-ENRH
Economists	- C.Bischoff-AID/W-LA/CD J.Tendler-USAID/B-DPEC
Legal Officer	- J.Heller-USAID/B-LGS
Drafting Officer	- J.M.Prindiville-USAID/B-ADCD

Approved by:

L.V.Perez-USAID/B-ADCD _____
W.A.Ellis-USAID/B-DDOM _____
S.H.VanDyke-USAID/B-DOM _____

SECTION I - PLACE OF THE LOAN IN THE PROGRAM

1.01 - Brazil's state highway departments are now confronting a very serious problem caused by (1) the rapid expansion of the nation's highway network in the past 10 years and (2) its alarming early deterioration attributed to improper maintenance and poor road construction.[1] This has caused highway officials to focus their attention on proper maintenance and construction methods to ensure that the existing investment in the highway systems will not further deteriorate and future investments in construction will fully realize their economic potential.

1.02 - One of the goals of USAID's assistance to Brazil's transport sector as outlined in the 1968 Capital Assistance Program Manual is to foster a more efficient and effective operation of selected state highway departments of Brazil. Consequently, the Mission is giving particular attention to (i) highway department organization; (ii) planning, programming and highway operations; (iii) the management of highway construction by contract; (iv) modern mechanized highway operations which include equipment needs and their adequate maintenance; and (v) highway maintenance.

1.03 - The proposed projects are designed to make a significant contribution towards the solution of Brazil's serious transport problem, by financing the dollar cost for highway maintenance equipment and technical assistance in an important region of the country. It is the fourth project in a series of projects that commenced over three years ago with a $20.0 million technical assistance and maintenance equipment loan to SUDENE, authorized on

---

1/ During 1955-1965, Brazil total highway network expanded from 387 to over 690 thousand Km.

November 18, 1964. Since the, USAID has authorized two other similar loans. One for $15.0 million to the DER of Minas Gerais, authorized on May 28, 1965 and the other, a $20.0 million loan to the DER of São Paulo, authorized on August 18, 1966. This amounts to a total of $55.0 million that has been authorized to deal specifically with highway maintenance in Brazil. Except for São Paulo, these projects are from 65 to 90 percent complete. Although slow in initial stages of implementation, they are now progressing satisfactorily. (Annex II, Exhibit 1, shows the present status of USAID financed highway projects in Brazil.) The proposed projects are a logical consequence of GOB and USAID's plan to upgrade and modernize the highway departments of Brazil and will constitute the fourth, fifth and sixth loans of this category establishing a definite identification of USAID with a road betterment, maintenance equipment and technical assistance program.

1.04 - In addition to this, the World Bank is presently planning to conduct the second phase of transport master planning studies in thirteen states. USAID will participate in these studies by financing the master plan for the State of São Paulo, using $1 million of funds lent to the State for this purpose as part of the A.I.D.-financed highway maintenance program. These master plans include USAID approved highway maintenance feasibility studies in their scopes of work. It is anticipated that these studies will provide additional highway maintenance and technical assistance projects in the future for USAID financing.

SECTION II - DETAILED DESCRIPTION OF THE PROJECT

A. History and Background

2.01 - In January 1965 the Mission began discussions with the DNER on a program designed to upgrade and modernize the maintenance capability of Brazil's individual state highway departments. The program that evolved from these discussions contemplated the following goals:

(a) The eventual divesting of all maintenance responsibilities of the DNER, of the Federal road network and the transference of these responsibilities to the individual states. The DNER would then assume a position in Brazil's transport sector similar to the U.S. Bureau of Public Roads by being responsible only for planning road construction, establishing standards and assist, where applicable, the DER's in arranging financing.

(b) The upgrading and modernizing of the operational and managerial capabilities of the individual state highway departments by providing the necessary highway maintenance equipment and technical assistance.

2.02 - On July 27 and October 8, 1965, an exchange of letters (see Annex II, Exhibit 3) by the Mission and the DNER established a Combined Special Work Group to organize and develop a national highway maintenance program. On September 23, 1965, the DNER informed the states which had requested financial assistance for maintenance equipment that the GOB and USAID were considering a national highway maintenance equipment and technical assistance program to cover their needs.

2.03 - The first states to be considered under this program were São Paulo, Rio Grande do Sul, Santa Catarina and Paraná. The São Paulo project has already been authorized, and the Southern states represents the second phase of this program.

1. World Bank Transport Study

2.04 - Prior to USAID involvement with the DNER a World Bank Mission came to Brazil to investigate the possibility of conducting a transport study. Preliminary findings were that the country faces a very serious crisis in the Transport Sector and that significant improvements in planning administration and operations of various transport facilities are urgently required.

2.05 - In order to remedy this situation, the Bank and the GOB entered into an agreement, the terms of which required the Bank to select and finance foreign consultants to conduct transport studies in Brazil. A special agency GEIPOT (Grupo Executivo de Integração da Política de Transportes) was created to coordinate and implement the transport studies and during the first phase accomplished the following:

1. A French consulting firm drew up a transport master plan for the State of Minas Gerais.

2. A Danish consulting firm, KAMPSAX, drew up a similar master plan for the Southern states of Rio Grande do Sul, Santa Catarina and Paraná.

3. A Dutch consulting firm studied the major ports of Rio de Janeiro, Santos and Recife.

4. A U.S. consulting firm, Coverdale & Colpitts, studied the railroad and acted as overall coordinator for the transport study.

All the field work for above studies was completed by November, 1966. The reports for the ports and railroads have not yet been released, however.

2. Master Planning Studies for the Southern States

2.06 - The master plan recommends the construction and completion of a large program of primary and feeder roads as well as a major equipment program in the Southern States. The Bank and GOB will finance approximately $40.0 million worth of construction and

asphalting on a matching basis with the states. The financial plan for the construction program has not yet been established. This program will undoubtedly put a heavy strain on the resources. It is proposed that the maintenance budgets of the states' maintenance programs will have first call on the states highway departments' funds. If necessary, the construction program will be executed with additional resources including, if required, new road user charges. The Bank has no objection to giving priority to the maintenance programs.

B. The Borrowers

2.07 - The three state highway departments in the proposed project were created by the following state laws: Rio Grande do Sul, Law No. 750 of August 11, 1937; Santa Catarina, Law No. 217 of September 12, 1946; Paraná, Law No. 1052 of October 20, 1952.

2.08 - The organization and functions of all state highway departments are essentially similar. One of the principal sources of funds (derived from a sole tax on lubricants and fuels) for the state road programs is their allotted share of the National Highway Fund. This Fund is administered by the National Highway Department (DNER). Funds are also obtained by the DER's performing maintenance and construction delegated to the states under agreements with the DNER.

2.09 - The DER's of Paraná, Santa Catarina and the DAER of Rio Grande do Sul are subordinated to the State Departments of Public Works. They are, however, financially and administratively autonomous and are empowered to contract proposed loans.

2.10 - The organizational structures and procedures of the highway departments are essentially similar in the states of Santa Catarina and Paraná and slightly different in Rio Grande do Sul. (See Annex II Exhibit 2 for a complete legal description of the Borrowers).

C. Engineering Analysis

(1) Present Level of Maintenance

2.11 - From a technical stand point, the road networks in the Southern states both state and federal are maintained far below an acceptable level. The reasons for this are as follows:

1. Insufficient maintenance equipment much of which is old and worn out and shortage of trained personnel.

2. Existing roads are poorly designed and badly constructed, resulting in deficient drainage, defective road shoulders and ditches.

3. New roads, though now generally built by better construction methods, are seldom fully completed because funds have been eroded by inflation, and contractors are not presently required to deliver to the state highway departments completely finished roads. This forces the maintenance divisions to assume the responsibility of completing the roads, diverting money, equipment and personnel from regular maintenance operations.

4. Since both the DNER and the state highway departments are maintaining state and federal roads in the same area, there exists unnecessary duplication of facilities and equipment.

2.12 - The net result of the above is inefficiency and uneconomical operations for both the state and the road users.

(2) Technical Description of the Project

2.13 - The purpose of the proposed projects is to correct the existing deficiencies in the highway departments of the Southern states by (a) providing highway maintenance equipment, spare parts and tools to:

1. Adequately maintain the state and federal highway systems,

2. Upgrade the existing road networks through road betterment so that they may be readily maintained by normal maintenance procedures,

3. Rehabilitate the existing maintenance equipment,

and (b) providing technical assistance to:

1. Implement a reorganization of the state highway departments, to improve management capabilities, planning, programming and administration.

2. Establish modern engineering criteria, standards and procedures for both maintenance and construction.

3. Assist in developing and establishing training programs for the use and care of maintenance equipment, modern shop facilities, spare parts depots, and material warehouses.

4. Implement the orderly transfer to the state highway departments of the DNER facilities, equipment, personnel and maintenance responsibilities.

(3) Equipment Program

2.14 - The basic equipment list for these projects was drawn up by the consultants and is based on the following:

1. The number of kilometers of earth, gravel, and paved roads in each of the Southern states' federal and state highway networks.

2. The average daily traffic for these roads.

3. A reclassification of highways for which major improvements and construction are contemplated until 1970.

4. A list of usable equipment taken from state records.

5. The number of maintenance residencies to be equipped with tools and spare parts.

2.15 - The consultants designed the equipment list for maintenance operations by Swedish standards. USAID Engineers in their analysis of the project altered the equipment list to adjust the mix of types of equipment to more realistically meet Brazilian standards and take into account the present conditions and traffic of the roads. To accomplish this, USAID Engineers reviewed the consultants' recommendations with DER and DNER officials in each state. They travelled extensively over the state and federal highway networks, spot checking the condition of existing equipment and the operations of the various residencies.

2.16 - Based on their observations and experience gained from the Minas Gerais highway maintenance project and countries with similar road conditions as Brazil, the USAID engineers established that:

> Equipment needs, labor, material, and supervision will be heavier for these projects, in order to attain a satisfactory level of maintenance than in similar projects in the United States.[1] The Brazilian requirements are greater because
>
> (a) The roads are poorly constructed (having little or no ditches, unstable cuts and inadequate completion of sub-grade, base, and surface courses).
>
> (b) rainfall is more intensive.
>
> (c) traffic for earth and gravel roads is heavier (with 70 to 80 percent truck traffic as compared with 10 to 15 percent in the United States on equivalent roads).
>
> (d) Legal axle loads exceed those in the United States (18,000 pounds in the U.S. and 22,000 pounds for Brazil).
>
> (e) maintenance personnel are less skilled than in the United States.

1/ It should be pointed out that conditions in the U.S. and Brazil are really not comparable. The above comparisons to the U.S. are not to imply the application of some sort of U.S. standard, but rather to give the reader a point of reference.

2. Because of poorly constructed roads, substantial betterment must be undertaken in order that the most important and basic principle of highway maintenance can be achieved, that is, the rapid discharge of surface water from the highways. In order to accomplish this, ditches must first be cleared or constructed. This operation requires extra motor-graders and auxiliary coverage per kilometer. In addition to this, rock ledges and boulders in the road beds and ditch areas must be removed before a road can be graded. This requires special equipment. Sub-standard curves, peaks and dips should also be improved and earth roads should be gravelled to have an all weather capability. These operations are necessary for road betterment, and equipment must be provided.

2.17 - The selection of the equipment and the establishment of the number of kilometers which the equipment is able to maintain are based on the judgment of the USAID Engineering staff. This judgment as mentioned previously is based on experience in Brazil and other foreign countries and the evaluation of the consultants reports. It is also based on discussions with maintenance engineers and officials from the three state highway departments and on the basis of observations and analysis of the available data.

2.18 - For road maintenance and betterment operations, the Mission engineers have proposed 8 types of work crews to perform the required work, and have also estimated the equipment needed for each crew and the number of kilometers which each crew can adequately maintain. A description of these crews and their equipment are contained in Annex III, Exhibit 1.

2.19 - A discussion of the considerations which went into the establishment of the equipment list for each crew is as follows:

Crew I

2.20 - Earth Road Maintenance (235 km per crew). Crew I will use a motorgrader for every 78 km. In the U.S. a motorgrader could cover approximately 75 miles. Due to heavier rainfall, poor compaction, obstructions in surfaces and ditches, and 5 to 6 times heavier truck traffic, the U.S. standard has no meaning in Brazil. The equipment listed for Crew I represents an engineering judgment of the type and numbers of auxiliary equipment necessary to complement the motorgrader operation for (1) excavating and removing rocks from ditches, (2) removing unstable material from road ways and slopes, (3) compacting the roadway, and (4) removing and disposing of excavated material. The equipment list is balanced in that the numbers of auxiliary units, such as dump trucks, loaders, etc., are assigned in the numbers necessary to complement the motorgrader operation without incurring losses in idle time.

Crew II

2.21 - Maintenance and betterment of side ditches, shoulders, embankment slopes, bridges, culverts and drainage pipe on asphalt roads (120 km per crew). A motorgrader has been assigned for each 60 km of asphalt highway. Traffic on asphalt roads is of higher priority than on earth roads, thus the difference in motorgrader coverage. A selection of complementary equipment was made on the same basis as for Crew I.

Crew III

2.22 - Asphalt Sealing (615 km per crew). Type III work crew will place an asphalt surface treatment on paved roads in order to make them impervious to the damaging effect of water upon wearing courses under the pavement. In the U.S., such treatment is normally applied every four to five years. It is required every two years in Brazil because of local conditions, namely: heavy truck traffic, weaker base and sub-bases, inferior surfacing materials and poor drainage.

2.23 - Consequently, approximately twice the amount of equipment is used by Crew III as compared to the requirements on an equal stretch of road in the U. S. This equipment list is also balanced to prevent any idle time.

Crew IV

2.24 - This work crew will provide gravel for about (400 km) of gravel and earth roads at a rate between 30 to 50 km per year. The equipment designated is in a slightly higher ratio than it would be the U. S. The extra flexibility will allow these crews to provide gravel surfacing to heavily travelled and weak sections of the earth road system.

Crew V

2.25 - This work crew will provide the surface maintenance for asphalt highways to patch the surfaces and apply spot leveling courses to replace the original cross sections and grades. Each crew will cover approximately 120 kilometers. A similar crew in the U.S. could cover twice the kilometrage. Heavier traffic, poor highway construction and inferior asphalt pavement, however, require the recommended assignment of equipment.

Crew VI

2.26 Asphalt plants have been assigned to every 235 km of asphalt roads because of the heavier traffic and poor road construction. One-half the number of plants would suffice in the U.S. for an equal number of miles of asphalt road. These plants will supply type III work crews.

Crew VII

2.27 - Rock crushers and quarry plants. This work crew is equipped to provide crush rock from quarry sources in those areas where river gravel is not available. The need for this equipment is based on known location of river gravel and computed gravel requirements.

Crew VIII

2.28 - Maintenance of gravel and macadam roads (210 km). For this work crew a motorgrader will cover 65 miles versus 75 to 100 miles in the U.S. The reasons for this are a much heavier truck traffic (4 to 5 times greater than in the U.S.) and the poor condition of the existing gravel and macadam roads.

2.29 - As can be seen from the above description the relatively heavy equipment requirements for these projects are necessary because of the poor condition of the existing highway networks. Consequently, provisions have been made for road betterment operations which will eventually result in significantly reduced maintenance costs and considerably longer road life. This betterment program will be completed in approximately 4 to 5 years with the proposed equipment. After the completion of this program, the betterment equipment will still have considerable remaining economical life to be assigned to routine maintenance of the existing highway system. It should be noted here that in spite of the heavy equipment requirements for maintenance as compared to the U.S., the benefits for these projects are very high (See internal rate of return calculated in Economic Section).

2.30 - After establishing the total maintenance equipment requirements for the southern states, the USAID engineers subtracted the number of units of maintenance equipment on hand which were still economically usable. The lack of operation and maintenance records in these states required the judgment of USAID engineers rather than other methods for determining the economically usable life of the existing equipment.

2.31 - In the U.S., the following criterion for replacing motor vehicles is used.

(1) total mileage
(2) age
(3) adverse maintenance records

2.32 - USAID engineers and the equipment specialists used the following to determine the depreciation rate of existing equipment in the Southern States:

(1) The Kampsax report;

(2) Spot inspection of the equipment in the residencies of the three highway departments;

(3) Information from state highway officials;

(4) The study of maintenance equipment operations in the state of Minas Gerais;

(5) Experience with previous projects in Brazil and other countries with similar road and climatic conditions.

2.33 - In the judgment of the engineers the intensive maintenance requirement in the southern states results in greater equipment depreciation than would be experienced by maintenance equipment in U.S. highway departments. For example: a motorgrader would have an average life of 12 years for maintenance operations. In the proposed projects 10 years is used as the average economic life.

2.34 - While this method of determining the average useful life of maintenance equipment is not based on precise cost data. it does incorporate the

experience acquired in Brazil and countries with similar road conditions and makes allowance for the special conditions in the southern states. This method of determining useful economic life is considered to be reasonable.

2.35 - The following are the "economically useful average lives" of the major units of equipment which were taken into consideration in developing the equipment list.

	Economical Life of Equipment (In years)	
	(A) Maintenance Equipment to be used in Southern States	(B) Maintenance Equipment in the U.S.
Motor Graders	10	12
Tractor Dozers	8	10
Front Loaders track type	8	10
Front Loaders wheel type	7	10
Dump Trucks	5	5
Cars (Pickup & Jeeps)	5	5
Stone Crushers (large)	15	15+
Asphalt Distributor	15	15+

2.36-The inventory of the economically usable existing equipment was subtracted from the total equipment requirements for each State. The new equipment requirements were then divided according to sources of procurement, either from the U.S. or Brazil. Only those items which Brazilian industry is presently unable to manufacture will be procured in the U.S.[1/] This list was priced from current catalogues with alllowances for lower prices to be obtained from competitive bidding. Spare parts requirements have been estimated at approximately 10 percent of the total purchase in Brazil and at 15 percent for equipment to be purchased in the United States. The cost estimates thus obtained are considered to be reasonable and satisfy the Section 611 of the Foreign Assistance Act. A detailed list of equipment can be found in Annex III, Exhibit 6. A summary of the equipment is located on the next page.

1/ With minor exception discussed on page 27, para. 2.69.

(US$ Thousands)

	Rio Grande do Sul		Santa Catarina		Paraná	
	Dollar Costs	Local Costs in US Dollars	Dollar Costs	Local Costs in US Dollars	Dollar Costs	Local Costs in US Dollars
1. Road Maintenance & Betterment Equipment	6,132	5,243	2,983	4,755	4,630	3,903
2. Portable Scales & Field Laboratories	62		43		28	
3. Quarry Plant & Supporting Equipment	1,130	266	678	132	1,130	266
4. Asphalt Plants and Supporting Equipment	32	203	16	102	40	252
5. Concrete Pipe Plant		10		52		67
6. Shop Tools & Equipment	300	244	300	244	300	244
7. Computer	140		140		140	
8. Radio Equipment	327		90		162	
9. Spare Parts	1,074	624	502	505	831	448
10. Training	100		100		100	
11. Consulting Services	1,000		1,000		1,000	
12. Shipping and Insurance	1,840		983		1,452	
13. Contingencies	1,158	1,648	684	1,448	981	1,245
	13,340	8,238	7,519	7,238	10,794	6,425

See Annex III, Exhibit 6 for a detailed equipment list.

2.37 - The equipment list will be further refined by the consultant consultants to be hired by the Borrowers during the implementation period of the projects by (1) a detailed inventory of the condition of the equipment in all state and federal maintenance residencies, (2) a complete inventory of all roads and maintenance requirements as determined by traffic count, actual road conditions and priorities. This is a normal procedure for projects of this type and any adjustment can be covered by contingencies.

(4) Present Level of Maintenance and Proposed Maintenance Procedures

2.38 - The consultant estimates that presently the state and national highway networks are being maintained at about 60 percent of a satisfactory level of maintenance. Practically speaking, all the roads in both the state and federal system need some form of road betterment. The existing condition of these roads and the proposed maintenance to be provided for the three basic types is described below:

Asphalt Roads*

2.39 - The quality of the existing 3,664 km of the asphalt road network in the Southern states is extremely poor. Cracked and badly repaired holes on these roads permit water to saturate and weaken the base and sub-base allowing traffic to create a pumping action that pumps silt and clay into the base courses causing further road deterioration, and subsequently reducing the supporting characteristics and life of the road. The consultants investigation reveals and USAID engineers concur that this condition is attributable to both poor surfacing practice and inadequate maintenance.

2.40 - For asphalt roads, the equipment will be utilized to perform the following maintenance:

(1) Repairing of all damaged areas

(2) Placing a leveling course at a rate of 15 percent annually.

* Account for 15 percent of the total state and federal highway network in the Southern States.

(3) Application of new wearing course at the rate of 15 percent annually.

(4) A program for the completion of road shoulders, ditches, and side slopes.

2.41 - The average ADT (average daily traffic) for asphalt roads in the Southern states is 900, and the consultants estimate that a maintenance crew will be required for every 120 km. Annex III, Exhibit 1 shows the maintenance crew and equipment requirements for each state for the proposed maintenance of asphalt roads.

Gravel Roads *

2.42 - The existing 11.842 km (47 percent) of the gravel road network is in unsatisfactory condition and suffers extensive weather damage as a result of improper drainage, insufficient gravel and inadequate maintenance. This situation leads to extensive wash-out areas and wash-board conditions. Seventy percent of the traffic of these roads consists of trucks which further accelerates deterioration of the roads.

2.43 - The maintenance and betterment to be provided for gravel roads is as follows:

(1) supplying the gravel

(2) grading of the roads

(3) completion of ditches, shoulders and side slopes.

2.44 - The average ADT for gravel roads in these states is 200 and the consultants estimate that a maintenance crew will be required for every 235 km. Annex III, Exhibit 1, shows the maintenance crew and equipment to be used by each state.

* Accounts for 47% of the total state and federal highway network in the Southern States.

Earth Roads *

2.45 - The earth roads in the Southern States comprises 9,481 km of the road systems and are impassable during the rainy season and become rutted dust roads during the dry season. Approximately 80 percent of the traffic of these roads consists of trucks providing farm-to-market transportation. The consultants estimate that efficiency of these roads can be greatly improved by:

(1) grading of the road surfaces

(2) supplying gravel and stone to correct critical stretches of the roads

(3) a program of completion of ditches, shoulders and side slopes.

2.46 - The average ADT for earth roads in the Southern tates is 150. As explained in the economic analysis, substantial benefits will be gained from the conversion of earth roads to gravel. The equipment to be provided under proposed projects will, therefore, be used in a systematic program of providing gravel surface at the rate of 1,000 km per year, with emphasis to be given to the roads with the highest ADT. A maintenance crew will be required for every 235 km of earth roads. Annex III, Exhibit 1 shows the required crews and equipment for the proposed maintenance of earth roads.

(5) Maintenance Priorities

2.47 - In general, the use of a lower than optimum level of maintenance is appropriate where roads have a low ADT, because of the lower level of benefits to be obtained in relation to cost. This question is important in determining the size of the necessary equipment stock because traffic density is one of the major factors affecting maintenance costs.

2.48 - In the road network of the Southern states, traffic density is unusually high. The consultants found that 85 percent of the asphalt roads have ADT's of 500 or above, 80 percent of the gravel roads have ADT's of 250 or above, and 85 percent of earth roads have ADT's of 150 or above. In fact,

*Accounts for 38 percent of the state and federal highway network in the Southern States.

the consultants state that most of the roads are carrying traffic loads in excess of designed capacity. They recommend substantial upgrading of roads, particularly in the case of gravel. The consultants further estimated that only 5 percent of the road network had an ADT of less than 50.

2.49 - These ADT levels provide very high cost benefit ratios as shown in the Economic Analysis; therefore, optimum maintenance is desirable for a large percentage of the road system.

2.50 - While detailed traffic counts and projections of every road in the system were not attempted, allowance has been made in the size of the new equipment stock to reflect the fact that a small percentage of the road system has lower than average ADT.

2.51 - The phrase "optimum maintenance" is used herein to mean fully adequate maintenance as opposed to any level of maintenance which falls short in some respect of maintaining the road to its original design standards and performance. Where ADT's are high, maintenance at some level just below optimum would yield slightly lower economic returns because total maintenance cost is a fraction of total vehicle operating costs, which means that up to the optimum level of maintenance, the returns from road user benefits are proportionately greater than the maintenance investment necessary to achieve them. /1

1/ According to consultants "the cost of vehicle operations depend to a great extent on the condition of the road, and changes of the level of maintenance will have considerable impact on the operation cost. Since the cost of maintenance is small compared to the cost of operation, about 10% with a traffic of 1000 ADT and less than 3% with 6000 ADT, it is evident that a major improvement of maintenance can be justified to give a relative little unit reduction of the cost of vehicle operation". Source: Supplementary Road Maintenance Study - Dec. 1966 - Highway Study for the Three Southern States, p.41.

(6) Labor Intensive Considerations

Substitution of labor for equipment

2.52 - USAID engineers investigated the possibility of using intensive labor in place of machines for road maintenance. It was found that such large quantities of workmen would be needed per kilometer to achieve a satisfactory level of maintenance, that the cost to the state highway departments would be prohibitive. For example, a front-end loader can load a truck 10 times faster and at 1/15th of the cost of using manual labor at Brazilian wage rates. Furthermore the logistical problems of transporting men over the entire highway network as well as supervision and housing would be extremely difficult to solve without great cost increase to the highway departments. (A detailed cost comparison for using labor intensive methods vs equipment in highway maintenance is located in Annex III, Exhibit 4).

Equipment Repair vs. Replacement

2.53 - As explained in paras. 2.33 through 2.36, the estimate of economically repairable equipment was based on U.S. standards adjusted for Brazilian Conditions. The consultants and USAID engineers estimated that on this basis approximately 50% of existing equipment was worth rehabilitating. A more refined method of measuring the relative cost of repair vs. replacement is not feasible now owing to lack of data on hours of equipment operation or condition of equipment. However, during the implementation phase of the program, the consultants will assist the states in establishing a refined method of comparing the relative costs and benefits of repair vs. replacement which takes account, among other things, of the lower costs of Brazilian skilled labor.

Equipment Maintenance

2.54 - In the Southern states as in all developing areas maintenance equipment is used more intensively and is more subject to breakdown and a shorter life. In order to meet these conditions a better than average equipment maintenance service is required.

2.55 - USAID engineers review of the condition of existing equipment disclosed that the Southern states maintenance departments are not getting maximum use out of the equipment because of improper preventive maintenance.

2.56 - For this reason the projects will provide major assistance for intensive equipment maintenance. This will require (1) additional mechanics, (2) additional training for existing mechanics, (3) more shop facilities and (4) additional training for equipment operators and supervisors.

(7) Transfer of DNER Maintenance Responsibilities to the State DER's

2.57 - The GOB is committed to having the DNER transfer its maintenance responsibilities to the state highway departments. Since the 14th February 1967, the World Bank and GEIPOT through their consultant, KAMPSAX, have been conducting reorganizational studies of the Southern states highway departments. One of the main goals of these studies is to set up an effective time-table for the transference of maintenance operations.

2.58 - This transfer will take place gradually during the implementation phase of the projects. The consultants estimate and USAID engineers concur that the state highway departments of Rio Grande do Sul and Paraná now have the technical and managerial capability of absorbing the federal highway networks in their states.

Financial and other arrangements will have to be made between the DNER and the various state highway departments prior to the implementation of the projects. An agreement in principle was reached

in a meeting with the Director of the DNER on April 10, 1966. A condition of the loan will be a definite agreement on this matter between the various states and the DNER.

2.59 - Presently, the DER of Santa Catarina does not have the capacity to maintain its entire federal highway network. The technical assistance to be provided by this project will assist the DER/SC in developing the necessary managerial and technical capabilities to assume the additional maintenance responsibilities. It is envisioned that the DNER will be able to transfer its maintenance operations to the DER/SC during the four year implementation period of the project. Already the DER/SC is maintaining about 250 km (20 percent) of the federal highway network and is reorganizing its forces to assume even more maintenance of the Federal system.

2.60 - The DNER's ultimate objective is to relinquish all its operating activities in the Southern states and assume a role similar to the Bureau of Public Roads in the United States by dealing only with financing, programming, maintaining standards and promoting highway safety.

(8) Procurement Schedule

The procurement of equipment will take place in two phases. No procurement of equipment will take place, however, until after preparation of a maintenance plan satisfactory to USAID. In the first phase equipment will be procured only to maintain the state highway network. After negotiations with the DNER have been completed for the transference of maintenance responsibilities of the federal network to the states, equipment will then be procured for the maintenance of federal road system.

(9) Technical and Economical Advantages of Integrated Maintenance

2.62 - Integration of the DNER with the various state highway departments will permit the elimination of the DNER

central office, and warehouse as well as several residencies in each of the three states which will permit the remaining DER residencies to be better equipped and managed. This will provide more efficient services by reducing overhead and operating costs. Maintenance forces will also be able to work and concentrate on uninterrupted sections of the road without unproductive travel to and from work, permitting one machine or maintenance group to maintain more kilometers per working day. USAID engineers estimate that savings of up to 30% can be achieved by integration of maintenance .

(10) Engineering Plan for the Execution of the Project Highway Maintenance

2.63 - Each one of the highway departments will be required to hire a qualified consultant for a period of four years to assist in implementing the projects. Their duties and responsibilities will be as follows:

1. Review KAMPSAX reorganization studies and assist the DER's to make all necessary recommendations and changes.

2. Conduct status inventories of all maintenance equipment in each of the state and federal residencies to determine the precise components and spare parts requirements and actual equipment assignments.

3. Assist each residency in conducting a detailed road maintenance requirement inventory (including the location of new quarries and gravel sources).

4. Assist the highway departments in establishing long range equipment replacement schedules.

5. Assist the Borrowers in developing central work shop facilities and adequate warehouses to support the new additional and existing equipment.

6. Develop specifications for local and U.S. procurement.

7. Implement training programs for the maintenance and use of the new equipment both local and U.S. purchased.

8. Assist the state highway departments in developing accurate cost records, and budget systems which will permit each residency to systematically plan highway betterment in addition to normal maintenance.

9. Assist state highway departments in establishing a total maintenance budget to assure USAID of proper funding for the proposed maintenance projects.

10. Assist the Borrowers in the implementation of a program enforcing Legal Loan Limits.

11. Assist the Borrowers in absorbing operations and facilities of the DNER in their respective states.

12. Assist the Borrower in developing an operational maintenance program to be revised annually.

(11) New Road Construction

2.64 - The consultant will also look into the problem of highway maintenance as related to poor construction practices on the state and federal roads. They will develop (1) adequate construction standards on current and future highway and (2) assist the DER's in setting up a department that will be responsible for checking the quality of construction work being done by contractors. One of the covenants of the loan will insure the enforcing of standards and inspection for highway construction. A detailed description of the cost of technical assistance can be found in Annex III, Exhibit 5.

Technical Description of the Borrowers

(12) Capacity of the Borrowers to Absorb Program

Rio Grande do Sul

2.65 - As mentioned previously, in the opinion of the Mission highway engineers and the Bank's consultant, DAER has the experience and capability to take over the maintenance of the federal highway system within the state of Rio Grande do Sul in the relatively near future. The highway department is well managed and doing a creditably good job in maintenance, in spite of the lack of proper equipment, spare parts and shop facilities.

Santa Catarina

2.66 - The Bank's consultant and the Mission highway engineers find that the DER/SC does not presently have the capacity for assuming the maintenance responsibilities of the entire federal highway network within the sate of Santa Catarina. Reorganization, training, new equipment and the technical assistance proposed in this project are absolutely essential before the DER/SC can assume this additional responsibility With the proposed technical assistance and equipment the DER/SC, in the opinion of KAMPSAX and USAID engineers, will be ready to assume this responsibility within two years.

Paraná.

2.67 - The consultant finds and USAID engineers concur, that the DER/PR now has the experience and technical capability to immediately assume maintenance of the entire highway system within the state. The DER/PR is already maintaining 70 percent of the national highway system.

1/ In late May 1967 the DER/SC was made an autonomous highway organization and given overall responsibility for maintenance and construction.

The DER/PR is well managed and has made considerable efforts to modernize its operations. Great progress has been made in spite of the lack of trained personnel and modern equipment. A complete description of the maintenance departments, administration, organization and residencies can be found in Annex III.

13. Law of Similars

2.68 - All the equipment on the list for U.S. procurement represents items to be procured in the United States since they are not manufactured in Brazil, with the exception of blades for the motor graders. CACEX prior approval for import licenses has not been obtained; however, the GOB is currently revising import regulations to make this possible for development loans. A condition precedent to signature of the loans will be CACEX approval.

2.69 - On the list of equipment to be purchased in Brazil are 214 motor graders. Generally speaking, these motor graders are of good quality except for the quality of steel used in the blade. Brazilian blades wear out 6 to 8 times faster than U.S. blades. Because of this, glades for the motor graders will be purchased in the U.S.

14. Procurement

2.70 - The highway maintenance equipment, spare parts, shop equipment and tools, and supplies to be procured from the proceeds of this loan represent equipment and supporting spare parts which are not presently manufactured in Brazil. The equipment list (shown in Annex III) has been approved by the state highway departments of Rio Grande do Sul, Santa Catarina and Paraná. Procurement in the United States of America will be conducted by the BPR and will be limited to those companies which have established parts and services facilities in Brazil and therefore will be able to supply parts and technical assistance for the equipment procured. The acquisition of equipment and supplies in Brazil will be carried out in accordance with local highway department regulations with the assistance of the consultants.

15. Excess Property

2.71 - The Borrower shall utilize, with respect to imported goods financed under the loans to which Borrowers take title at the time of procurement, such reconditioned United States Government-owned excess property as may be consistent with the requirements of the projects as may be available within a reasonable period of time. The Borrowers shall seek assistance from A.I.D. and A.I.D. will assist the Borrowers in ascertaining the availability of and in obtaining such excess property. A.I.D. will make arrangement for any necessary inspection of such property by the Borrowers or their representatives. The cost of inspection and of acquisition, and charges incident to the transfer to the Borrowers of such excess property, may be financed under the loans. Prior to the procurement of any goods, other than excess property, financed under the loans and other having sought such A.I.D. assistance, the Borrowers shall indicate to A.I.D. in writing, on the basis of information then available to them, either that such goods cannot be made available from reconditioned United States Government-owned excess property on a timely basis or that the goods that can be made available are not technically suitable for the use in the projects.

D. Economic Analysis

1. Economic Description of the State

2.72 - Paraná, Santa Catarina and Rio Grande do Sul are the southern-most states of Brazil. They are flanked to the east by the Atlantic ocean, Uruguay to the south, Argentina and Paraguay to the west, and São Paulo to the north. These states comprise a total area of 577,723 km^2, respectively about 6.8% of Brazil's total territory. The areas of each state are as follows:

Rio Grande do Sul	-	282,000 km^2
Santa Catarina	-	96,000 km^2
Paraná	-	200,000 km^2

2. Population

2.73 - The total population of the southern states is about 16 million which represents about 18% of Brazil's total population. The population by states as of 1965 is as follows:

Rio Grande do Sul	-	6.0 million
Santa Catarina	-	3.5 million
Paraná	-	5.8 million

2.74 - The average annual growth rate for the southern states between 1940 to 1960 and the projected annual growth rate till 1976 are as follows:

	Average Annual Growth Rate		Projected Annual Growth Rate
	1940-1950	1950-1960	1960-1976
Rio Grande do Sul	2.3	2.7	2.6
Santa Catarina	2.8	3.2	3.3
Paraná	5.5	7.3	5.0

Paraná annual growth rate of 7.3 is especially high in relation to the annual population growth rate of Brazil which is about 3.6% (See Annex IV). This reflects the high rate of colonization that has taken place in the state. Paraná is now and will continue to be one of the fastest growing states in the country. This growth is reflected in the increasing number of municipalities which have grown up in these states over the past decade.

	1940	1950	1960	1964
Rio Grande do Sul	88	92	152	201
Santa Catarina	44	51	102	195
Paraná	47	80	162	274

3. Agriculture

2.75 - Because of their geographic location, excellent climate, and wealth of natural resources, the southern states have great potential for diversified agricultural production. The soil is adequate for intensive agricultural development, a factor of great importance to the country's overall economy. Rainfall is evenly distributed throughout the year,and long droughts are not of common occurrences. The seasons of the year are well defined, contributing to diversified agriculture activities. Production of wheat, soybeans, wool and rice surpasses the output of all the other Brazilian states. Paraná is one of the greatest coffee producers and exporters of the country.

2.76 - The southern states in 1960 accounted for about 28.2% of Brazil's total agriculture production. Their share was as follows:

	Agriculture Production	Territory	Population
Rio Grande do Sul	11.3%	3.3%	7.7
Santa Catarina	4.1%	1.1%	3.0
Paraná	12.8%	2.3%	6.0

2.77 - Although nearly 70% of the area of the three states is occupied by farms, only 14% is cultivated. This is attributed to large areas being used for livestock production and to generally poor transportation.

2.78 - In 1960, agriculture accounted for 41%, 51% and 64% of the total production in Rio Grande do Sul, Santa Catarina and Paraná respectively.

2.79 - The following is the share of the three states in Brazil's total production of:

a.	soybeans, wheat, wool and pine	90-100%
b.	potatoes, tobacco, corn, hogs, meat	45- 55%
c.	coffee, rice, beans, manioc, cotton, beets	17- 44%
d.	bananas	less than 17%

4. Industry

2.80 - Though agriculture is the most important sector of the southern states' economy, industrialization of the states' many available resources has been greatly developed in the last 15 years. Construction and expansion of existing power plants and transmission lines is making possible the creation of new industries, fostering industrial development and placing these states into the main stream of the industrial structure of the nation. This is especially true in the state of Paraná which has embarked on a successful industrial development program.

2.81 - The following is a comparison of sectors of production for the southern states in 1960:

	Rio Grande do Sul	Santa Catarina	Paraná	All of Brazil
Agriculture	41%	51%	64%	28%
Industry	16%	21%	10%	26%
Service	42%	28%	26%	46%

2.82 - Based on calculations of the real value of production in the three states, the following indices show the value of production in 1960 in relation to its value in 1955 (1955=100)

	Rio Grande do Sul	Santa Catarina	Paraná
Agriculture	96	118	244
Industry	114	124	133
Services	119	130	180
Total Production	109	132	227

5. External Sector

2.83 - In 1960, the total value of exports to national and foreign markets from the three southern states amounted to 35% of the income generated in the region and to 53% of the value of goods produced. Foreign exports represented about 18%, the rest being delivered to the other Brazilian states demonstrating how much the economies of the three states are integrated to the national economy and dependent on external markets and transportation.

2.84 - Paraná has the largest share in foreign exports, about 50%. This consists mainly of coffee and cotton. Rio Grande do Sul and Santa Catarina exported 28% and 22%, respectively, of their production. The region had in 1960 a favorable trade balance with foreign countries resulting in a surplus of 30%.

6. Transport Sector

(a) Present Vehicle Fleet

2.85 - The consultants findings show that the total vehicle fleet for the southern states in 1964

was the following:

	Rio Grande do Sul	Santa Catarina	Paraná
Passenger cars	85,355	28,873	66,407
Pick-up	8,110	5,012	10,745
Trucks	30,943	15,922	40,173
Buses	3,020	963	1,668
Total	127,428	50,770	118,993

(b) Growth Rate of Present Vehicle Fleet

2.86 - The consultants calculated the rate of growth for the vehicle fleet as follows:

Projected Annual Growth Rate from 1966 to 1976

	Passenger Cars	Heavy and Medium Trucks	Buses
Rio Grande do Sul	11.1%	8.4%	5.5%
Santa Catarina	9.1%	6.7%	4.5%
Paraná	12.3%	9.5%	6.2%

2.87 - The above figures do not include the generating effect on traffic of improved roads and future highway construction. It can be assumed, however, that these rates of growth will be increased with the availability of well maintained and new roads.

Benefit Cost Analysis (Consultant's Study)

2.88 - The purpose of these loans is to bring the road systems of the three Southern States to a condition of maintainability and then to apply satisfactory maintenance to the system on a continuing basis. Presently, some 80% of the system is unable to benefit from normal maintenance.

2.89 - In viewing loans of this type in benefit-cost terms, the benefits to the system's users in the form of reduced vehicle operating costs and any benefits to the system's owners (the three Southern States) are balanced against additional costs (capital & operating) to the owners as a result of the investment. A satisfactory maintenance level is considered to be that at which the system fully delivers the services for which it was designed, or, put another way, the road is restored to and sustained at nearly its original condition. When this is achieved, owners and users alike are assured of the benefits which were anticipated and which were used to justify the original construction of the roads in the system.

2.90 - There are undoubtedly important additional economic and social returns to an investment in highway maintenance. As in the case of a construction project, there may be productivity effects, such as improvements in education, health services, postal service, and other benefits for the region being served. However, these are extremely difficult to quantify, and in practice this is not usually attempted.

2.91 - In the feasibility study underlying these loan proposals, lack of statistical data and time constraint dictated that the comparison of the present state of maintenance of the system with the desired maintenance level be done on the basis of representative examples of the different types of roads and conditions actually encountered in the Southern States.

2.92 - The consultants concluded from examination of all types of roads in the area that to reach the desired level of

maintenance and to sustain that level over a 7-year cycle 1/ of normal annual and periodic intensive maintenance would require additional annual investment of approximately 66% over the present level. Put another way, the present inadequate level of maintenance results from annual expenditures which are only 60% of the amount that should be allocated and spent for this purpose.

2.93 - The consultant compared the saving in vehicle operating costs resulting from properly maintained roads as against the extra cost of improving the present level of maintenance. For gravel roads (47% of existing mileage in the three Southern States), the benefit cost ratio was 4.7. For earth roads (38% of mileage), the ratio was 6.3. For paved roads (15% of mileage), the ratio was 5.0. For paved roads, the benefit cost ratio for the owner (the state DER), based on savings on reconditioning, was 4.5.

2.94 - The ADT and cost figures used for the benefit-cost ratio refer to "average" roads, and are based on the consultant's detailed examination of traffic and cost data for various types of roads during the preparation of a five-volume Master-Plan for highway construction in the three southern states.

1/ The satisfactory maintenance cycle for paved roads in the region is considered to be seven years (i.e., beginning with a paved road in prime condition, maintaining it annually to the desired standard, and putting it back to original condition by resurfacing at the end of seven years). By coincidence, conditions in the region are such that seven years is considered a logical "life of the project", based on average life expectancy with normal care of the equipment mix making up the large bulk of the loan.

Gravel Roads

2.95 - Gravel roads make up 47%[2/] of the mileage in the three southern states. A normal traffic load for these roads is 400 [3/] ADT. Given the breakdown of traffic into heavy trucks, medium trucks and buses, the passenger cars, the per km annual expenditure on vehicle operation is NCR$ 48,455: (All cost expenditures are as of January 1967 expressed in new cruzeiros). If the roads were maintained at optimum level, this cost [4/] would be reduced to NCr$ 42,134 per year -- an annual saving of NCr$ 6,320. Annual maintenance costs per km, on the other hand, amount to NCr$ 2,019 at the present level of maintenance. With satisfactory maintenance practices, these costs [5/] would rise to NCr$ 3,365 per year -- an increase of NCr$ 1,346. Comparing the savings in vehicle operating cost to the cost of increased maintenance yields a benefit-cost ratio of 4.7.

2/ This proportion will not change significantly during the time it would take to implement the loan.

3/ The consultant's definition of ADT is a summation of the various kinds of vehicles (see Table I), rather than a conversion of all traffic to passenger-car equivalents.

4/ The consultant arrived at the cost of present vehicle operation by calculating first the level of operating costs on an optimum maintained road, and then estimated the increase in vehicle operating costs due to the substandard level of present maintenance to amount to 15%. The cost of present-level vehicle operation is achieved by multiplying the optimum-level cost by 1.15.

5/ Maintenance cost estimates were derived according to the following procedure: Costs of operation and administration of the present level of maintenance for existing equipment and replacements were calculated for the three southern states for the year of 1967. The same costs were calculated for the satisfactory maintenance program. Present level maintenance costs for the three southern states for 1967 would be NCr$ 26 million, and satisfactory level costs would be NCr$ 43 million. The former figure is 60% of the latter; in order to arrive at present level maintenance costs per kilometer-year for the various types of roads, 60% of the cost estimate for satisfactory maintenance per kilometer-year for each respective type of road was taken.

Earth Roads

2.96 - The same procedure is used for earth roads, which account for 38% of the mileage in the three southern states. Normal traffic for earth roads in southern Brazil is 200 ADT. Average annual expenditure for vehicle operation is NCr$40,876. 6/ With the proposed improvement in maintenance, this expenditure would be reduced to NCr$37,160 -- a saving of NCr$3,716. At the present level of maintenance, average annual per km maintenance costs are NCr$878. At the optimum level, costs would rise to NCr$1,463 -- an increase of NCr$585. The benefit cost ratio is, accordingly, 6.3.

Paved Roads

2.97 - The benefit cost ratio for paved roads, 15% of road mileage in the three southern states, is based on annual figures over a 7-year period, the maintenance cycle for this type of road. User benefits are, as for earth and gravel calculations, the average annual savings in vehicle operating costs as compared to the increased cost of maintenance. Owner benefits refer to the decreased cost of reconditioning an optimum-maintained road, as compared to the increased costs of maintenance.

6/ The consultant estimated that present-level vehicles operating costs on earth roads are 10% greater than they would be on a satisfactorily maintained road.

2.98 - The consultants assumed a normal bus and truck traffic on paved roads in Southern Brazil is about 400 ADT[11]. The consultant assumes a 6% growth rate 7/ for traffic over the next seven years, which gives an average of 500 ADT for bus and truck traffic 8/ during this period. Passenger vehicles are assumed to make up make up 52% 9/ of total traffic, or 340 ADT which gives a total ADT of 1040. Present vehicle operation costs per km on paved roads are NCR$75,868 per annum. With the optimum level of maintenance, these costs 10/ would be reduced to NCr$70,209 per annum -- a saving of NCR$5,659. Maintenance costs per km are NCr$1,712 per annum. At the optimum level of maintenance, costs would be NCr$2,853 -- an increase of NCR$1,141. The savings in vehicle operation costs, as compared to the increased level of maintenance costs, gives a benefit cost ratio of 5.0.

7/ KAMPSAX and other estimates generally plane annual traffic growth rate at a conservative 6-7% aacross the board.

8/ The consultant chose the most conservative of the various ADT growth rates it had estimated for roads in the Master Plan.

9/ The consultant states that this seemingly high percentage of passenger vehicles is in conformity with the actual traffic distribution on some roads carrying the greatest traffic volumes in Rio Grande do Sul. Though the truck percentage on many roads, particularly in Paraná, greatly exceeds 48%, the 48/52 distribution was used in the report in order to keep the benefits at a realistic but conservative level. An increase in the truck percentage would result in greater benefits.

10/ The consultant estimates that operation costs on a present-level-maintained road are the same during the first four years as for unsatisfactory maintained road, and for the last three years are equal to the mean costs of vehicle operation on satisfactory-maintained gravel and paved roads.

11/ The consultant used a "normal" traffic load of 500 in making this Benefit Cost comparison. Actual ADT on paved is nearly double this figure at the present time. Traffic as stated in this report is in motor truck units which is then converted to a traffic distribution by various types of vehicles. See Annex IV, Exhibit 1, for formula. Converting motor truck units to vehicles, the consultant arrived at "normal" traffic loads of earth, gravel and paved roads of 200, 400 and 1040 vehicles respectively. Table 1, shown in Annex IV, Exhibit 1, is a table of traffic expressed in MTU. These can be converted to passenger car units by multiplying by 2.5 or converted to an average traffic using the procedure explained in Exhibit 1.

2.99 - In addition to user benefits in the form of savings on vehicle operation costs, the proposed maintenance program will result in savings to the producers -- the State Highway Departments. On a satisfactorily-maintained road under conditions found in southern Brazil, the application of a new wearing course is needed every seven years in order to restore the pavement to its original condition. The cost of this application is NCr$36,575 per km. At the present level of maintenance, the road becomes so deteriorated that it is necessary to make major repairs of the base. The cost of reconditioning, a paved road at the present-level maintenance, is NCr$61,446 per km, i.e., NCr$24,871 greater than the reconditioning cost of a satisfactorily-maintained road. This figure discounted to present value at a rate of 18% 12/ represents a saving of NCr$7,809 per km to the producer. This saving represents another benefit from the proposed maintenance program, in addition to the user benefits described above.

2.100- The consultant's study is admittedly a quite limited attempt to quantify the benefits resulting from an improved maintenance program. The ADT is not a calculated average, but an assumed one. A traffic growth rate is not included in the analysis for earth and gravel roads. Present-level vechicle operation costs are not based on direct observation, bur rather on estimates of the percentage increase in vehicle operating costs caused by the present substandard maintenance. The cost of present level maintenance is assumed to be the same percentage of optimum maintenance cost for all roads -- taken, as it is, from the total cost figures for maintenance.

2.101- There is a major underestimate, however, which biases the study in a conservative direction. The percentage increase in vehicle operating costs due to substandard maintenance is believed by the consultant to be much greater than the 10% and 15% figures used for gravel and earth roads -- and closer to the level of 30%. In order to be on the safe side, the consultant settled for the lower estimate. Since

12/ The consultants used a discount rate of 18% to be conservative.

The savings in vehicle operating costs are of a much higher absolute value than the increase in maintenance costs (see Table 1), this under-estimation causes a significant conservative bias in the benefit cost ratio. Along with the highly limited area of benefits which the study seeks to quantify, this suggests that the analysis does not fall into errors of over-estimation.

Alternative Method of Measuring Economic Benefits

2.102- Using adjusted actual rather than "average" data compiled by the consultant, an independent approach to the economic return on the projects can be made by calculating the overall internal or discounted rate of return of the investment, i.e., the rate of interest that will equate the flow of benefits and costs for the project in present value terms. The costs in this case are: (1) the capital investment of $53 million, and (2) the annual costs of increased maintenance operations associated with the project. The benefits to result from the project are: (1) the annual savings to road users from lower operating costs resulting from the improved road surface provided by better maintenance and from the betterment of the earth roads to gravel roads, and (2) benefits to the producer, ., the Highway Department, from lower annual costs of reconstruction as a result of better maintenance which avoids the need for premature reconstruction. This equating of benefits and costs provides an internal rate of return for the project of 27 percent. This rate of return is consistent with the high cost-benefit ratios determined by the Consultants. This result is not surprising because of the following factors: As traffic reaches capacity volumes, maintenance costs decline in proportion to vehicle operating costs; this means that investment in improved maintenance under such conditions produces proportionately greater total benefits in terms of road user savings 1/. In this project, where maintenance is substantially below an acceptable level, and where traffic volumes are near or in excess of capacity, it is evident that the benefits to road users must be several times the additional

1/ According to KAMISAX, "the cost of vehicle operations depend to a great extent on the condition of the road, and changes of the level of maintenance will have considerable impact on the operation cost. Since the cost of maintenance is small compared to the cost of operation, about 10% with a traffic of 1000 ADT and less than 3% with 6000 ADT, it is evident that a major improvement on maintenance can be justified to give a relative little reduction of the unit cost of vehicle operation". Source: Supplementary Road Maintenance Study - Dec. 1966 -- Highway Study for the Three Southern States, p. 41.

investment in maintenance. Even with the crude data used herein to quantify the benefits in this project, there can be no doubt that the proposed maintenance investment will yield very high returns to the economies of the Southern states.

Detailed Methodology

2.103 In calculating the internal rate of return, the following data and assumptions were used:

1. The average life of the equipment pool is seven years, and at the end of seven years there is no salvage value. Actually the lives of the individual pieces of equipment vary greatly, with trucks and light equipment having a life of five years, and some of the heavier equipment having a life of 10 to 12 years. However, 7 years is considered to be a conservative estimate of the average life of the total equipment pool.

2. Delivery of equipment takes place over three years with 1/3 of the equipment arriving at the end of 1968, 1/3 at the end of 1969, and 1/3 at the end of 1970. These portions of the pool will be fully expended in 1975, 1976 and 1977.

3. The life of the project was established as 8 years (1968 through 1975), i.e., the 7 year life of the equipment plus one year lag in delivery.

4. The equipment pool is designed to meet the maintenance requirements of the system in 1970; i.e., the roads in service and the traffic on those roads at that date. Traffic has been held constant at the level projected at the beginning of 1970, and the costs of maintenance have been estimated on the basis of the same traffic. It is assumed that equipment needed after 1970 to meet additional ADT requirements will be part of a future project.

5. The internal rate of return has been computed for the entire project, without attempting to compute separate rates of return for each state or type of road.

2.104- The user-benefits to result from the project are the reductions in the annual operating costs of all vehicles operating on all roads to be maintained under the project. Annual operating costs are calculated by multiplying the ADT x vehicle operating costs per kilometer x the number of kilometers x 365 days.

Average Daily Traffic (ADT)

2.105- In this analysis, the ADT was established on the basis of:

1. DNER counts at 25 locations in three states;

2. 535 counts by the state highway departments;

3. An additional 60 and 125 counts by the DNER and the states respectively, made at KAMPSAX's request.

2.106- The consultants believe that the actual traffic counts are representative for 1965 even though the sample is limited. This analysis uses the traffic counts thus developed. For purposes of computing benefits, the results of the counts were averaged to determine the ADT for each type of road; this ADT was then projected to 1970 at the growth rate of 6 percent used by the Consultants in their master plan studies (See Annex IV, Exhibit I for explanation of traffic distribution).

Vehicle Operating Costs

2.107 The consultants developed vehicle operating costs by interviewing truck and bus companies operating vehicles in the Southern states and through direct observation of the cars used by the consultants. These costs were then adjusted downward by the consultants to arrive at the costs of operations on well maintained roads. The costs thus derived are given in Annex IV, Exhibit A and are used in this analysis.

User Benefits

2.108 All user benefits used in this analysis are based on the judgment of consultants, who traveled extensively over the road network in the Southern states. The consultants

conservatively estimate that savings in operating costs at the rate of at least 10 percent to 15 percent, will be realized by raising maintenance to adequate levels. Actually the consultants and the USAID engineers are of the opinion that savings as high as 30 percent could be realized in view of the generally poor conditions of the roads.

2.109 The reasonableness of the 10 to 15 percent savings estimate can be shown by comparison of the differences in operating costs on well-maintained paved, gravel and dirt roads. This relationship is analogous to the effect of improved maintenance because the differences in operating costs are largely accounted for by the difference in the smoothness of the road surface. Taking paved roads as 100 percent, and using data on a medium-sized truck, the following relationship is shown by Exhibit A of Annex IV:

	Percentage increase in operating costs
Paved (=100%)	-
Gravel over paved	33
Earth over gravel	28

User Benefits on Paved Roads

2.110- According to the consultant, paved roads in the Southern states have a life of approximately seven years between resurfacing or major overhaul. During the first four years of life, while a road is in relatively new condition, the present inadequate level of maintenance does not significantly increase the level of operating costs. During the last three years, however, the roads deteriorate badly owing to neglect during the first four years, and become badly cracked and potholed, causing operating costs of vehicles to soar. The consultants have estimated that adequate and regular maintenance during the first four years will result in savings in operating costs equal to one half the difference between operating costs on paved and gravel roads during the last three years, or about 15 percent. Calculated on the basis of operating costs observed in Brazil, this benefit equals $11,226 per kilometer per year 1/. On the

1/ See Annex IV, Exhibit B.

basis of a seven year road life, it is assumed that 1/7 of the system is renewed each year. Under present conditions, it is also assumed that 4/7 of the system is in fair conditions and that 3/7 is in a deteriorated condition. Further, assuming that 1/3, 2/3, and all of the new equipment is in full operation in the years 1969, 1970, 1971 respectively, and that the first four years of maintenance will not result in significant user benefits, the first significant benefits will therefore accrue in 1973. At that time, the benefit will be calculated as 1/3 x 3/7 x $11,226 x the number of kilometers (3,664). In 1974, the benefit will be 3/3 x 3/7 x $11,226 x 3,664 1/ In 1975 (the end of the comparison period) the benefit will accrue to 3/7 of the road system. See Annex IV, Exhibit C for a flow of these benefits. The total flow of benefits through 1975 for this type is $40.6 million.

User Benefits for Gravel and Earth Roads

2.111- For user benefits on gravel and earth roads, the consultants in their B:C analysis, estimated that the present level of maintenance results in 15 percent and 10 percent higher operating costs respectively than would be the case if the roads were properly maintained. To be conservative, this analysis will assume only a 10 percent saving for both types of roads 2/. This results in a savings of $1,387/km for gravel and $2,007/km for earth roads (see Annex IV, Exhibit B for calculations). For purposes of calculating the annual benefits, it is assumed that the surfaces of the roads are improved each year, but that it will require four years to bring the roads up to a level where full 10 percent benefits can be achieved. On an average basis this means that in the second year of improved maintenance, the road is improved enough to achieve 25 percent of the user savings benefit, in the third this rises to 50 percent, and so on. On this basis, and on the assumed equipment arrival schedule, the first year of benefit would occur in 1970 and would equal 1/3 x 1/4 x benefit per km x no. of km. In 1971, the benefit would be 1/3 x 1/4 + 1/3 x 1/2 x the benefit per km x no. of km. See Annex IV, Exhibit C for computations of the benefits over the life of the project. The annual benefits in 1975 for gravel roads are $17 million and $19 million for earth roads.

1/ The jump from 1/3 to 3/3 is explained by concentration of 2/3 of the total new equipment on the 3/7th of the total system in deteriorated condition.

2/ The reasonableness of this 10% saving was previously discussed.

User Benefit from Conversion of Earth Roads to Gravel

2.112 One of the highest returns from this program will be the user benefits to be derived from the conversion of earth roads to gravel roads. As can be seen from an analysis of the operating costs (Annex IV, Exhibit B), costs of operation on gravel roads are about one-third less than on earth roads. The consultants have recommended that all roads with ADT's of more than 200 should be converted to gravel. More than 3,000km of earth roads now have ADT's in excess of 200. Normal traffic increases will of course put additional kilometers in this category before the project commences. The program will give the states the capacity to convert approximately 1,000 to 1,200km per year, or 600km a year more than they are presently converting.

2.113- In the calculation of benefits due to conversion, the consultants estimated that 75 percent of the difference in operating costs is due to surfacing and 25 percent due to alignment. The consultants therefore in their calculations estimated a 75 percent reduction in operating costs. In this analysis a more conservative reduction is used - 66 percent. On this basis user savings per km have been calculated at $3,680 per km (see Annex IV, Exhibit B for calculation).

2.114- Under the project, the states will be able to convert an additional 600km per year of earth to gravel roads. Kilometers converted in one year will not generate benefits until the next. However, benefits will be cumulative and roads converted in the first year will provide benefits throughout the life of the project. In 1970, the benefit will be 1/3 x 600 km x $3,680; in 1971 the benefit will be on 400 km converted in 1970 plus the 200 converted in 1969. See Annex IV, Exhibit D for the flow of these benefits.

Producer Benefits

2.115- In the case of paved roads, a benefit in the form of reduced surfacing costs accrues to the producer. According to information received from the various states, the normal period between reconstruction or major overhaul of asphalt roads is 7 years despite the fact that in the 5th year, as discussed later, major deterioration has already set in owing to inadequate

maintenance. Normally, at that time, the pavement is in such poor condition that it is ripped up and removed, and new aggregate is mixed into the existing base or a new layer of aggregate is placed on top of it, or both.

2.116- According to the current practice, the normal period between reconstruction of asphalt roads is seven years, During these years, the following developments normally take place:

2.117- The deterioration of the road that took 7 years with optimum maintenance now takes about 4 years. After these 4 years the road could be restored to its original condition by application of a new wearing course. For lack of appropriate equipment this is not done, and from that point on , the wearing course of the road rapidly deteriorates, and cracks and potholes occur, and permit water to saturate and weaken the base and sub-base, requiring the road to be reconstructed or given a major overhaul at the end of 7 years. At the end of these 7 years, such overhaul will include major repair of the base and placement of a plant-mix mat on top. The consultants have estimated the cost of such repair to be the same as a 5 cm layer of plant-mix and an 8 cm layer of water bound macadam. With optimum maintenance, the consultants estimate that the cost of the repair can be reduced by the cost of the 8 cm of water bound macadam, or approximately, $971 per km every 7 years.

2.118- The producer benefit to be received will, therefore, be a one-time benefit at each reconstruction period. Assuming that 1/7 of the road system is renewed every year and that three years of maintenance are required before the cost reduction can be achieved, the first benefit will occur in 1972 and will equal 1/3 x 1/7 x $971 x the number of km of paved roads (3,664). In 1973 the benefits will occur on 2/3 x 1/7 of the roads; and in 1974 the benefit will occur on 1/7 of the roads; thereafter, for the life of the project, the benefit will accrue to 1/7 of the roads each year. The annual return on 1/7 of the road is $0.5 million (See Annex IV, Exhibit E).

Other Benefits

2.119- Other benefits which will accrue to the economy and the state have been touched on briefly, earlier in the paper. However, one which has not been mentioned is a reduction in maintenance costs which will start to occur around the 4th and 5th year of operation as a result of the betterment program, the costs of which are included in the capital and operating costs of this project. Up to the 4th and 5th year, extensive maintenance will be required to keep the road surfaces at a satisfactory level. After four years, the improved roads will require less extensive maintenance operations to achieve these surfaces, and the equipment used to that point on betterment may be transferred to new roads or be used to replace worn out equipment. This benefit has not been calculated because the value will be small in the earlier years and will not become significant until later years. It will, however, contribute to a significant reduction in maintenance costs in future periods.

The Costs of the Program

2.120- The program has two costs; the capital cost of the new equipment pool, and the increased costs of maintaining roads at a higher level. The capital costs have been established at $5.3 million.

2.121- The increased costs of better maintenance have been calculated by subtracting present costs of maintenance (adjusted by estimated increased costs of maintenance due to increased traffic through 1971) from projected future costs of maintenance with the new equipment pool.

Present Costs

2.122- The consultants estimated present costs as being 60 percent of their estimated cost of optimum maintenance. This analysis has attempted, by the use of adjusted state cost data, to arrive at the true cost of maintenance under present circumstances. To establish these costs, actual cost data from the records of the states of Paraná and Santa Catarina was obtained. In the case of Paraná, data presented a much higher cost per km than was

expected; after discussions with the state, it became obvious that these costs were high because of an excessive labor force. (As a result of the proposed reorganization to be accomplished under the projects, these excess labor costs are expected to be reduced substantially; also the new projects will be able to absorb much of the excess labor). Based on the normal labor component in relation to equipment, reductions of 40 percent were made in equipment operators' costs and 50 percent in general labor costs before computation of per/km cost of maintenance. The effect of these reductions is to reduce the internal rate of return. Further, equipment depreciation was removed since equipment depreciation will be measured as a capital cost of the program. Calculations of per/km costs of maintenance in Paraná and Santa Catarina, even after labor reduction costs in the former state, resulted in adjusted actual costs which were equal to approximately 80 percent of costs projected for optimum maintenance 1/.

2.123- The analysis of the maintenance costs and operations in the Southern states indicates that the present maintenance costs are high because of inefficiencies resulting from (1) excessive wear and down time of old equipment, and (2) improper maintenance practices. The first inefficiency, which will be corrected by the replacement of equipment, is an important element of cost of the present level of maintenance. The consultants, in an earlier study to determine the economies of replacing existing worn out equipment, estimated that operating costs for the existing level of maintenance could be reduced by 10 percent to 30 percent by an equipment replacement program. This cost saving, which is in effect a producer benefit, is already included in this program; however, a lack of adequate data prevents segregation of this benefit. It is reflected, however, as part of the user benefits in the form of reduced maintenance costs of optimum maintenance. The second inefficiency, improper maintenance practices is largely correctable without new equipment and therefore should not be included in this analysis as a cost to be reduced by the equipment project. This inefficiency will in effect be corrected by technical assistance in reorganization, whether new equipment is made available or not. It is difficult, however, to quantify the costs of these inefficiencies. With

1/ This compares with the 60 percent estimate made by the consultants.

respect to improper maintenance practices, it is estimated that inefficiencies of operation caused increasing costs of 5 to 10 percent. In view of the difficulty of quantifying these costs, it was decided for purposes of this analysis to reduce present maintenance costs by 20 percent to eliminate the effect of improper maintenance practices. This also has the effect of reducing the internal rate of return. Taking the above factors into account, the adjusted cost per km of the present level of maintenance was established. These resultant costs were then multiplied by the number of kilometers in the 1970 road system. These total annual costs were then subtracted from the projected total annual costs under the project to arrive at the increased annual costs of maintenance attributable to these projects. These are as follows:

	Thousands of $		
	Paved	Gravel	Earth
Paraná	$ 698	$ 518	$ 549
Santa Catarina	434	1,002	314
Rio Grande do Sul	414	1,818	865

2.124- These annual costs or applicable parts thereof, together with the capital costs of the project, constitute the total cost to be charged against the benefits in determining the internal rate of return. See Annex IV, Exhibits E and F.

Projected Future Costs

2.125- Projected future costs were calculated as follows:

1. The average annual operating costs of equipment (less depreciation) over an economical life was multiplied by the equipment to be assigned to each highway department These annual operating costs were obtained from data developed by the consultants on the Minas Gerais project, from Brazilian manufacturers handbooks, and from U.S. manufacturers handbooks. In the opinion of the USAID/BPR engineers these are reasonable estimates of costs to be realized under the project.

2. Labor costs for operating personnel represent the total number of operators to operate the equipment at current wage levels.

3. Material costs represent engineering estimates of material costs for the program at current prices.

4. General labor was estimated at 50 percent of operating personnel costs, and works out to slightly more than one laborer for each operator.

5. Supervision was estimated at 20% of total labor.

6. Administration was estimated at 20% of total labor.

2.126- The cost figures thus developed are considered to approximate the real cost per km of maintenance which should be realized under an efficiently executed program under Brazilian conditions.

E. Financial Analysis

2.127 - The cash-flow statements located in Annex V, Exhibit 1, shows the entire financial operations of the various state highway departments. For the most part, the financial projections for future road construction and capital expenditures reflect tentative rather than final planning on the part of the borrowers; however, these will not affect the proposed projects since monies for maintenance come from special revenues. This analysis will therefore concentrate only on those sources of revenues which are directly applicable to the support of the proposed maintenance program.

1. Financial Schedule

2.128- The financial plans for the proposed projects establishes US$ 31.6 million for imported equipment and US$ 3 million for technical assistance to be financed by A.I.D. The Borrower will finance US$16.0 million (Cruzeiro equivalent) for locally manufactured equipment. In addition to this US$ 5.8 million (Cruzeiro equivalent) will be loaned to the Borrowers by the GOB from the Title IV Counterpart Wheat Fund to be also used to finance locally manufactured equipment and locally procured technical assistance. The proposed financial schedules is as follows:

(Millions of U.S. Dollars)

	1968	1969	1970	1971	Total	
Rio Grande do Sul						
A.I.D. Dollar Financing for equipment & Tech.Assistance	5.6	7.4	.2	.1	13.3	
DAER Cruzeiro Financing for equipment		3.0	3.0		6.0	
Wheat Fund for Equipment & Technical Assistance	1.0	1.0	.2		2.2	
Total Rio G. do Sul Project						21.5
Santa Catarina						
A.I.D. Dollar Financing for equipment & Technical Assist.	3.7	3.6	.1	.1	7.5	
DER/SC Cruzeiro Financing for equipment	1.8	1.9	1.7		5.4	
Wheat Fund for Equipment & technical assistance	.7	.7	.2	.2	1.8	
Total Sta. Catarina Project						14.7
Paraná						
A.I.D. Dollar Financing for equipment & Tech. Assistance	5.5	5.0	.2	.1	10.8	
DER/PR Cruzeiro Financing for equipment	2.2	2.4			4.6	
Wheat Fund for Equipment & Technical Assistance	.8	.9	.1		1.8	
Total Paraná Project						17.2
Total Project .....US$						53.4

2.129- The Borrowers will over the four-year implementation period of the project spend approximately US$16.0 million of their own resources in support of the proposed loan

2. Financial Plan

2.130- As explained in the engineering section, the projects will be implemented in two phases in order to alleviate the

financial and technical burden of absorbing the federal highway networks. In the first phase these states will only received equipment for their own state road systems. In the second phase, equipment will be delivered for the maintenance of the federal systems. Santa Catarina will probably not receive equipment for the federal network until 1969. The state of Rio Grande do Sul will need three years to implement its project and will not receive maintenance equipment for the federal system until the last quarter of 1968 and first quarter of 1969. Since Parana is already maintaining 70 percent of its federal road network, the DER/PR will most likely receive the total complement of equipment for both the federal and state systems before the other two states.

2.131- During the implementation phases of these projects the borrowers will be required to make additional investments for the purchase of locally manufactured highway maintenance equipment due to the acquisition of the maintenance responsibilities of the federal highway networks. Because of this, the financial burden for the borrowers will be at its heaviest during the implementation phase of the projects. Once the programs have been established, however, the cost of maintenance to the borrowers will be reduced and the financial expenditures will level off. (See Investment Program, p.64).

3. Title IV Counterpart Wheat Fund

2.132- NCr$ 16.0 million have been allocated from the 6th Wheat Agreement Title IV Funds for the purchase of locally manufactured maintenance equipment and to finance local technical assistance. These funds will be lent to the Southern states by the GOB with monetary correction and interest rates to be established by the Central Bank.

4. Source and Application of Funds

2.133- The financial statements (Located in annex V exhibit 1) were presented to A.I.D. by the various state highway departments and are actual thru 1966 and estimated thereafter. The future projections of revenues and expenditures are based on general planning. This is because the taxation system from which the states derive their incomes has recently been changed. Since the revenues to be derived from the new tax system have not been quantified, revenue projections for the states are exceedingly tentative. Fortunately, the State Highway Departments have certain revenues which are assured and which, as this analysis reveals, will provide funds to carry out the proposed maintenance programs. This analysis, therefore, will concentrate on the state highway departments assured sources of income, which will be, by agreement of the states and covenants of the loans, assigned to maintenance as a first priority. The sources of revenues to be examined are as follows:

a) The National Highway Fund

2.134 - As can be seen in the cash-flow statements in (Annex V exhibit 1) one of the main sources of financing for the Sourthern states highway departments is the National Highway Fund (NHF). This fund is based on a federal tax on motor fuels and lubricants created by federal Decree-Law No.26.5 of September 1960. On November 5, 1964, the National Highway Fund was changed by the adoption of a sole tax on lubricants and fuels -- Law No. 4452. This law tied the tax resources of the National Highway Fund to the price of imported crude oil and thus to the exchange rate. The new law adopted a fuel and lubricant pricing formula which eliminated the subsidized exchange rate. Together these two laws resulted in an 80 percent real increase in revenues for the National Highway Fund in 1964. The Fund is administered by the DNER and was distributed as follows.

i. 40 percent to the DNER.

ii. 48 percent to the States and Federal District.

iii. 12 percent to the municipalities.

2.135- The total expenditures of the DNER are financed by allocations from the National Highway Fund. The allocation from the National Highway Fund to the states and Federal District is distributed in accordance with area, population and consumption of petroleum products. Under this formula the DAER/RGS has over the past five years received from the National Highway Fund about 40 percent of its total budget. DER/SC and DER/PR have received during the same period about 38 percent and 37 percent, respectively.

2.136- In January 1967, with the adoption of the new constitution, the pattern of the distribution of the National Highway Fund was changed as follows:

i. 60 percent to the DNER.

ii. 32 percent to the states and Federal District.

iii. 8 percent to the municipalities.

2.137 -This fund still represents 35 to 40 percent of the income of the various state highway departments. In real terms, this fund has not in the past two years kept pace with the rate of inflation as it is affected by the cruzeiro dollar exchange rate which by and large determines the internal price of motor fuels on which the tax is based. In the long run, however, it is assumed that devaluation should keep pace with inflation, allowing the fund in real terms to grow with fuel consumption. The projections of the revenues from this fund on pages 42 and 43 are based on a growth rate of 7.5 percent. This has been the historical rate of growth of fuel consumption in these states of which this tax is a function, and is considered to be a reasonable forecast.

b) <u>ICM Tax</u>

2.138-. To make up the loss to the State Highway Departments caused by a reduction in the allocation from the National Highway Fund, a new state tax - ICM (Impôsto de Circulação de Mercadorias e Lubrificantes) - sanctioned by the Federal Government, will go into effect in January 1968.

This tax will charge 10.5 percent on all petroleum products used by highway vehicles in all the states. This tax along with the states' share in the National Highway Fund will generate approximately the same income for the state highway departments as in the past. Thus, in the projections on pages 42 and 43, the ICM on fuel and the NHF have been combined, and the growth projection is based on the assumption that the ICM will compensate for the slight reduction in the NHF income resulting from the recent change in its distribution. The base year for projections is 1966. The reduction in the 1967 NHF and ICM combined projection is caused by the fact that the ICM tax on motor fuels does not go into effect until January 1968.

c) State Contribution to the Highway Departments

2.139- Another major source of income is the state matching contribution to the respective DER's. The Mission feels that the projection of these contributions is realistic. The states have in the past made significant contributions to the highway departments, and as mentioned previously, the Loan Agreement will (1) covenant that the maintenance program will have first call on all highway departments funds, and (2) require the states to assure adequate financing of maintenance operations.

2.140- These state contributions take two forms. One is a budgetary allocation to the highway department, and the other is the earmarking of a portion of sales tax receipts for the road program. The state of Rio Grande do Sul has both forms. The revenues from the sales tax receipts shown for the state of Rio Grande do Sul are an estimate of a 10 percent allocation of the new value added tax which replaces the previous state transport tax. In Santa Catarina and Paraná, the state contribution to the operating fund are limited to the state contribution which in theory, as in most states, is equal to the revenues from the NHF; in practice it has been less. These funds have therefore been projected from the 1966 base at a growth rate of 5 percent, based on an economic growth rate of 5 percent in the southern states.

d) Contributions for the DNER

2.141- The various state highway departments have in the past received funds from the DNER for performing maintenance and construction work on Federal highways. The state highway departments will in the future receive additional funds from the DNER from the acquisition of the DNER equipment personnel and maintenance responsibilities. The projections are an estimate and appear to be reasonable. Agreements will be signed before the implementation of the project establishing exact amounts which the DNER must pay to cover the cost of having the state highway departments maintain the federal roads.

e) Other Sources of Funds

2.142- The projections of other sources of revenues, general tax funds, industrial receipts, toll bridge tax, etc., although a small share of the highway departments budgets do appear to be generally realistic and represent a secure source of income.

5. Cost of the Proposed Maintenance Programs

2.143- In order to determine the cost of the present level of maintenance and the cost of maintenance required to implement the proposed projects the Mission has on the basis of maintenance cost data developed by the states, the consultants and the World Bank calculated the annual cost of maintenance of an average kilometer in the southern states for paved, gravel and earth roads. These costs, however, do not include equipment, since it is only considered a cost in the year of purchase. Adjusted to January 1967 values these annual costs for the present level of maintenance in new cruzeiros are as follows:

	Rio Grande do Sul	Km	Santa Catarina	Km	Paraná	Km.
1. Pavement	NCr$2,597 x	472	2,501 x	200	3,271 x	1,055
2. Gravel	1,467 x	4,664	1,573 x	4,129	2,202 x	1,817
3. Earth	969 x	3,604	969 x	1,024	1,064 x	4,244

2.144- By multiplying the number of kilometers of each of the three types of roads in each of the states by the average annual maintenance cost per kilometer as shown above, it is possible to arrive at an estimate of the annual maintenance costs for all the state roads at the present level of maintenance. For the southern states, these costs are as follows:

1. DAER/RGS NCr$ 11.6 million
2. DER/SC NCr$ 7.7 million
3. DER/PR NCr$ 12.0 million

2.145- The proposed projects will increase the annual costs of maintenance per km as follows:

	Rio Grande do Sul	Santa Catarina	Paraná
1. Pavement	NCr$ 3,021	4,374	3,917
2. Gravel	2,624	2,406	2,397
3. Earth	1,498	1,649	1,453

2.146- The additional cost per km reflecting implementation of the proposed projects will result in the following annual maintenance cost for the southern states highway departments.

1. DAER/RGS NCr$ 17.6 million
2. DER/SC NCr$ 12.5 million
3. DER/PR NCr$ 14.6 million

2.147- These figures reflect the projected increase in cost for the proposed maintenance program, but do not include the cost of the new equipment as it will be financed by loan funds. Future replacement of equipment will however be accomplished by budgetary allocations. The consultants will assist the borrowers in determining the correct equipment replacement cycle for the programs. A covenant of the loans will be the establishment by the borrowers for an equipment replacement program governing new purchases.

6. Highway Department Financial Capacities to Support Proposed Maintenance Program

2.148- As mentioned previously, the financial projections submitted by the borrowers are based on general planning and appear to be over optimistic. Because of this the Mission has reduced the projections as follows:

(1) Seven (7) percent has been used as a growth factor from 1967 to 1970 for the National Highway Fund and ICM tax because the fund reflects the historical growth rate of fuel consumption in Brazil.

(2) Five (5) percent has been used as growth factor for the financial contributions of the states. Although the financial projections in Annex V, Exhibit 1 show a greater growth rate for the states' financial contributions, the Mission believes that conservative projections are more realistic. A projection based on 5 percent also represents the expected economic growth for the southern states.

i) Rio Grande do Sul (Ncr$ millions)

Principal Sources of Revenues for DAER/RGS*	Actual 1964	Actual 1965	1966	Cruzeiros of 1967 1967**	1968	1969	1970
1. National Highway Fund	6.5	18.0	27.2	24.5	31.3	33.6	36.1
2. State Transport Tax	5.3	9.2	15.2				
3. New General State Tax for Transport				16.0	21.0	22.0	23.1
4. State Contribution	3.3	2.5	11.0	12.0	12.6	13.9	13.9
Total	15.1	29.7	53.4	52.5	64.9	69.5	73.

(*) 1966 figures are shown in January 1967 values and are used as a base for the projections. The National Highway Fund is projected at 7.5 percent and the state contributions are projected at 5 percent.

** The reduction in the NHF revenues for 1967 is a result of the change in the law governing the distribution of the fund. In 1968 a new tax (ICM) will compensate for this adjustment.

2.149- DAER/RGS is presently spending about NCr$11.6 million at a level of about 60 percent of satisfactory highway maintenance. In 1966 DAER disbursed approximately NCr$59.5 million to cover its operations, including road construction. NCr$11.6 million represents about 19.5 percent of the total budget and about 25.2 percent of the assured sources of revenues for that year. The proposed project will increase the cost of maintenance to NCr$17.6 million annually, which will represent about 15.7 percent of the DAER's proposed budget in 1968 and about 15.9 percent in 1969. As shown in the above table the proposed project will only represent 24.0 percent of the adjusted principal sources of Revenue in 1970, the year the State will be required to make the largest financial expenditure to implement the project.

2.150- Since the projected income from the National Highway Fund already exceeds in 1966 the cost of the proposed maintenance program for both state and federal roads and since the DNER will be required to pay DAER for the maintenance of the federal network, it is reasonable to assume that this project will not place any serious strain on the financial resources of DAER/RGS. The Loan Agreement will, however, covenant that the first call on all DAER resources will be for highway maintenance.

ii) Santa Catarina (NCr$ millions)

Principal Sources of Income for DER/SC*	Actual		Cruzeiros of 1967				
	1964	1965	1966	1967	1968	1969	1970
1. National Highway Fund & ICM	1.7	5.6	8.7	7.8	10.1	10.9	11.7
2. State Contribution	3.1	2.9	4.6	5.0	5.2	5.5	5.8
Total	4.8	8.5	13.3	12.8	15.3	16.4	17.5

(*) 1966 figures are shown in January 1967 values and are used as a base for the projections. The National Highway Fund is projected at 7.5 percent and the state contributions are projected at 5 percent.

2.151- The present level of maintenance is costing the DER/SC approximately NCr$7.7 million per year which represents about 48 percent of the total projected highway departments budget for 1967 and 60.1 percent of the principal sources of revenue shown in Table II. This percentage is high in relation to Santa Catarina's sister states because the state has a small budget for the highway department. Santa Catarina's share in the National Highway Fund is also considerably smaller leaving the state with less financial resources to adequately maintain its highway network. The proposed project will increase the cost of maintenance to the DER/SC from NCr$7.7 million to NCr$12.8 million. The full cost of this program however will not be incurred by the DER/SC until 1970. At this time, the combined income from the National Highway Fund and the projected state contribution will be NCr$17.5 million. The proposed maintenance program will then represent about 73 percent of the assured sources of income. Since the projections have been worked out on a very realistic basis and do not include other items of income, the DER of Santa Catarina, with proper guarantees and covenants should be able to support the proposed program.

iii) Paraná (NCr$ millions)

Principal Sources of Revenue for the DER/PR*	Actual		Cruzeiros of 1967				
	1964	1965	1966	1967	1968	1969	1970
1. National Highway Fund & ICM Tax	9.8	16.1	18.9	17.0	21.5	23.1	24.8
2. State Contribution	4.9	11.4	14.3	25.6	26.9	28.2	29.6
Total	14.7	27.5	33.2	42.6	48.4	51.3	54.4

2.152- The consultants calculated that the DER/PR as the other two southern states is presently maintaining the state roads at approximately 60 percent of an effective acceptable level for road maintenance. Presently,

(*) 1966 figures are shown in January 1967 values and are used as a base for the projections. The National Highway Fund is projected at 7.5 percent and the state contributions are projected at 5 percent.

the DER/PR is spending approximately NCr$12.0 million which represents about 18.3 percent of the total highway department budget for 1966. The proposed project will increase the annual cost of maintenance for all types of roads, from NCr$12.0 million to NCr$17.6 million. The income alone from the National Highway Fund is able to finance the cost of this project in 1970 - as the cost of the program only represents 70 percent of the fund. It is reasonable to assume therefore that the DER/PR has the financial capacity to effectively carry out the proposed maintenance project. The loan agreement with the DER/PR as with the other highway departments will covenant that first call on highway funds be for the highway maintenance program.

7. Repayment Capacity

2.153- The debt services of the proposed loans projected to 1972 as a percentage of the total budget of the southern states highway departments are as follows:

	1968	1969	1970	1971	1972
DAER/RGS	4.0	4.0	3.8	2.1	1.7
DER/SC	1.4	2.3	2.5	5.7	4.1
DER/PR	0.6	0.9	0.9	5.4	4.5

2.154- As these percentages of the debt services are low in relation to each state highway budget, it is reasonable to assume that the state highway departments have the financial resources to repay the interest and principal of the loans.

8. Loan Terms and Interest Rates

2.155- The repayment of the loans by the state DER's will be fifteen (15) years with a three year grace period from the date of disbursement at three and one half (3-1/2) percent interest on all funds disbursed including those during grace period.

2.156- Although 15 years is about 1-1/2 to 2 times the life of equipment, the terms are justified by the (1) institution-building of the project, (2) the large transport investment to be undertaken by the states, (3) the public nature of the borrowers and (4) the financial burdens to be incurred by the state highway departments in assuming the maintenance responsibilities of the Federal Highway networks.

2.157- Each state will be required to perform intensive maintenance in order to upgrade the highway system and absorb the additional responsibility of maintaining the federal highway network. In order to do this the states will have to make significant financial contributions of their own, in the form of (1) purchasing additional maintenance equipment and spare parts and (2) meeting increased operations costs to implement the maintenance program for both the states and federal highway systems. (See Investment Program - page 64).

2.158- The states will also have to carry out during the implementation and repayment periods of these loans an important highway construction program partially financed by the World Bank. Although this construction program will require an increase in road user taxes, the investment requirements of the southern states transport sector are so large that the recommended terms are needed to assist the programs implementation.

2.159- While the borrowers do not exactly fit into the category of public institutions eligible for low interest rates, as specified in M.O. 1052.1, the terms recommended are justified by the public nature of the borrowers. They provide a public service and are not profit earning institutions. These projects moreover will require significant additional expenditures on their part and the returns will accrue the economy of the southern states as a whole and not to borrowers accounts. The savings in interest charges will allow a better allocation of funds for maintenance operations.

2.160- In view of these considerations, the terms as recommended are considered appropriate.

9. Investment Program

2.161 - The World Bank transport master plan for the southern states recommends an investment program for (1) the construction of 7,080 Km of main roads and 910 Km of important feeder roads and (2) a major investment in highway maintenance equipment. This transport study supports the proposed projects and will serve as the basis for a large construction program to be partially financed by the IBRD. The transport master plans recommended annual investments are as follows:

Master Plan Transport Investment Recommendations in Millions of 1967 New Cruzeiros

	1965	66	67	68	69	70	71	72	73	74	75	76
Feeder Roads	79	197	18	20	19	17	15	8	26	8	1	6
Main Roads	337	899	177	206	231	249	173	121	236	289	239	78
Maintenance												
R.Grande do Sul			28.2	6.1	4.5	24.3	4.2	2.6	1.8	3.1	2.0	10.2
Santa Catarina			26.0	2.5	1.8	7.6	2.9	2.5	2.0	4.4	4.7	9.7
Paraná			25.3	4.7	4.1	12.4	3.1	3.4	5.4	4.4	4.7	7.2

2.162- Financial, technical and administrative constraints will prevent the realization of these investments. The master plan therefore recommends the immediate construction of 1,816 Km of priority roads and the proposed maintenance investment.

2.163- These investments, both construction and maintenance are obviously too large to be carried out without external financial assistance, since state resources will be stretched to a maximum to carry out both programs.

2.164- The maintenance investment program as can be seen from the recommended investment plan has a projected hump from 1967 to 1970. Under normal circumstances, the states would be able to carry out without external assistance a maintenance equipment replacement program. As shown by the investment flow, however, the states are faced with a major equipment reinvestment program. The purpose of these loans is to provide the states with financial assistance for importing equipment during the 1968 to 1970 period. After 1970 the states will be able to continue the maintenance programs with their own resources.

2.165 - In view of the large investment requirements and the increased operational costs to be financed by the states, the cost sharing programs proposed in these projects are considered to be reasonable. Accordingly the financing of the foreign exchange requirements has been recommended.

June 7, 1967

CHECK LIST OF STATUTORY CRITERIA (ALLIANCE FOR PROGRESS)

(FAA - Foreign Assistance Act of 1961, as amended by the Foreign Assistance Act of 1966)

(App.- Foreign Assistance and Related Agencies Appropriations Act, 1967)

1. FAA Section 102. Precautions that have been or are being taken to assure that loan proceeds are not diverted to short-term emergency purposes (such as budgetary, balance of payments, or military purposes) or any other purpose not essential to the country's long-range economic development.

USAID personnel will approve all borrower requests for opening letters of commitment. Since the subsequent letters of credit issued by the designated bank must conform in substance to the letter of commitment, the only funds disbursed will be those required to finance the goods and services of the project.

2. FAA Section 102. Information on measures taken to utilize United States Government excess personal property in lieu of the procurement of new items.

The borrower shall utilize, with respect to imported goods financed under the loans to which Borrowers take title at the time of procurement, such reconditioned United States Government-owned excess property as may be consistent with the requirements of the projects as may be available within a reasonable period of time. The Borrowers shall seek assistance from A.I.D. and A.I.D. will assist the Borrowers in ascertaining the availability of and in obtaining such excess property. A.I.D. will make arrangements for any necessary inspection of such property by the Borrowers or their representatives. The cost of inspection and of acquisition, and all charges incident to the transfer to the Borrowers of such excess property, may be financed under

the loans. Prior to the procurement of any goods, other than excess property, financed under the loans and other having sought such A.I.D. assistance, the Borrowers shall indicate to A.I.D. in writing, on the basis of information then available to then, either that such goods cannot be made available from reconditioned United States Government-owned excess property on a timely basis or that the goods that can be made available are not technically suitable for the use in the projects.

3. FAA Section 102. Information whether the country permits, or fails to take adequate measures to prevent, the damage or destruction by mob action of United States property.

The GOB does not permit, and takes measures to prevent, the damage or destruction by mob action of U.S. property.

4. FAA Section 201(d). Information and conclusion on legality (under laws of country and U.S.) and reasonableness of lending and relending terms of the loan.

The proposed loan is consistent with the laws of Brazil and the United States and its terms are considered reasonable by both the Borrowers and A.I.D.

5. FAA Section 251(a). Manner in which loan will promote country's economic development and contribute to the welfare of its people.

This loan will contribute significantly to the development of Brazil's transport sector and hence will promote the country's economic development.

6. FAA Section 251(b)(1). Extent to which country is adhering to the principles of the Act of Bogota and Charter of Punta del Este and is showing a responsiveness to the vital economic, political, and social concerns of its people, and extent to which country has demonstrated a clear determination to take effective self-help measures.

Account has been taken of Brazil's adherence to the principles of the Act of Bogota and the Charter of Punta del Este, and the GOB's responsiveness to the vital economic, political, and social concerns of its people. A full report of Brazil's efforts to comply with both the Act of Bogota and the Charter of Punta del Este is set forth in the 1966 Country Program Submission.

7. FAA Section 251(b)(2). Information and conclusion on activity's economic and technical soundness.

This activity has been found economically and technically sound (see the relevant sections of this paper).

8. FAA Section 251(b)(3). Information and conclusion on activity's relationship to and consistency with other development activities, and its contribution to realizable long-range objectives.

(See Section: Place of the Loan in the Program).

9. FAA Section 251(b)(4). Information and conclusion on possible effects on U.S. economy, with special reference to areas of substantial labor surplus.

The loan will finance the procurement of $31.2 million of U.S. equipment and technical assistance, and thus will have positive effects on the U.S. economy.

10. FAA Section 251(b)(5). Information and conclusion on the degree to which the country is making progress toward respect for the rule of law, freedom of expression and of the press, and recognition of the importance of individual freedom, initiative, and private enterprise.

The recent inauguration of an elected government marks a return to full constitutionality in Brazilian government. A new constitution has been adopted by the Congress and all the extra-constitutional Institutional Acts have terminated. A number of laws and programs have been instituted in recent years at all levels of government to improve the climate for private enterprise. Press and

National Security laws enacted by the previous Brazilian government are more restrictive than previous legislation; it remains to be seen how these laws will be applied by the new Government.

11. FAA Section 251(b)(6). Information and conclusion on the degree to which the country is taking steps to improve its climate for private investment.

Brazil has provided a very broad range of incentives for private investment, domestic and foreign. The national state and municipal level of government offer tax incentives, tariff concessions and low cost financing for investments in priority sectors and development regions.

12. FAA Section 251(b)(7). Information and conclusion on whether or not the activity to be financed will contribute to the achievement of self-sustaining growth.

The activity will contribute to the achievement of self-sustaining growth through its assistance in identifying exploitable natural resources.

13. FAA Section 251(b)(8). Information and conclusion on the extent to which the activity will contribute to the economic and political integration of Latin America.

The loans will have a positive effect on transportation in the Southern states of Brazil. The economies of these states are related to the economies of Paraguay, Argentina and Uruguay. The loans will have an indirect beneficial effect in intra-Latin America trade in this region.

14. FAA Section 251(b). Information and conclusion on availability of financing from other free-world sources, including private sources within the United States.

Other international lenders have been solicited and have expressed no interest in this project. Borrowers are state agencies and therefore it is unlikely that private U.S. capital would be interested or their participation encouraged.

15. FAA Section 251(b). Information and conclusion on capacity of the country to repay the loan.

The "2-Step" agreement will offer the GOB 40 years to repay the debt on concessional terms which are well within the country's debt servicing capacity.

16. FAA Section 251(b). Information and conclusion on country's efforts to repatriate capital invested in other countries by its own citizens.

Brazil's efforts to stabilize the value of the cruzeiro through measures to counter inflation should contribute to the return of capital invested in other countries by its citizens.

17. FAA Section 251(b). Information and conclusion on reasonable prospects of repayment.

The loans will be repaid by the states of Paraná, Santa Catarina and Rio Grande do Sul. Terms are within their capacity for repayment.

18. FAA Section 251(c). Information and conclusion on availability of an application together with sufficient information and assurances to indicate reasonably that funds will be used in an economically and technically sound manner.

See Engineering Section.

19. FAA Section 251(g). Information and conclusion on use of loan to assist in promoting the cooperative movement in Latin America.

The loans will have no effect on the cooperative movement in Latin America.

20. FAA Section 251(h). Information and conclusion on whether the activity is consistent with the findings and recommendations of the Inter-American Committee for the Alliance for Progress in its review of national development activities.

The loans are consistent with the findings and recommendations of the Inter-American Committee for the Alliance for Progress in its review of national development activities.

21. FAA Section 252(a). Total amount of money under loan which is going directly to private enterprise, is going to intermediate credit institutions or other borrowers for use by private enterprise, is being used to finance imports from private sources, or is otherwise being used to finance procurements from private sources.

The Borrowers are state owned agencies. The loan money, however, will finance U.S. imports and technical services from private U.S. companies.

22. FAA Section 281. Extent to which the loan will contribute to the objective of assuring maximum participation in the task of economic development on the part of the people of the developing countries, through the encouragement of democratic private and local governmental institutions.

The loans are intended to assist agencies of the Brazilian Government at the national level.

23. FAA Section 601(a). Information and conclusions whether loan will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture, and commerce; and (f) strengthen free labor unions.

These loans will effect (a) the increase of international trade because the Southern states are the major exporters of agricultural products; and (b) improve the efficiency of agriculture and commerce in the area.

24. FAA Section 601(b). Information and conclusion on how the loan will encourage U.S. private trade and investment abroad and how it will encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

All of the loans funds will be used for the procurement of goods and services from U.S. private enterprise.

25. FAA Section 601(d). Conclusion and supporting information on compliance with the Congressional policy that engineering and professional services of U.S. firms and their affiliates are to be used in connection with capital projects to the maximum extent consistent with the national interest.

It is expected that engineering and consultant services shall be provided by a joint venture of Brazilian and American firms.

26. FAA Section 602. Information and conclusions whether loan will permit American small business to participate equitably in the furnishing of goods and services financed by it.

To the extent that American small business manufactures the required equipment, it will be notified and invited to participate.

27. FAA Section 604(a); App. Section 108. Compliance with restriction of commodity procurement to U.S. except as otherwise determined by the President and subject to statutory reporting requirements.

All goods and services purchased under this loan will be of U.S. origin.

28. FAA Section 604(b). Compliance with bulk commodity procurement restriction to prices no higher than the market price prevailing in the U.S. at time of purchase.

Will comply.

29. FAA Section 604(d). Compliance with requirement that marine insurance be purchased on commodities if the host country discriminates, and that such insurance be placed in the U.S.

Will comply.

30. FAA Section 604(e). Compliance with requirement that funds not be used for procurement of any agricultural commodity or product thereof outside the United States when the domestic price of such commodity is less than parity.

Not applicable.

31. FAA Section 611(a)(1). Information and conclusion on availability of engineering, financial, and other plans necessary to carry out the assistance and of a reasonably firm estimate of the cost of the assistance to the United States.

See Engineering Section.

32. FAA Section 611(a)(2). Necessary legislative action required within recipient country and basis for reasonable anticipation such action will be completed in time to permit orderly accomplishment of purposes of loan.

All necessary legislation exists.

33. FAA Section 611(b); App. Section 101. If water or water-related land resource construction project or program, information and conclusion on benefit-cost computation.

Not applicable.

34. FAA Section 611(c). Compliance with requirement that contracts for construction be let on competitive basis to maximum extent practicable.

Will comply.

35. FAA Section 612(b) and 636(h). Appropriate steps that have been taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.

There is no excess currency owned by the United States that could be used in this project. The Borrowers will be financing all local cost requirement, including local technical services.

36. FAA Section 619. Compliance with requirement that assistance to newly independent countries be furnished through multilateral organizations or plans to maximum extent appropriate.

Not applicable.

37. FAA Section 620; App. Section 107(a) and (b). Compliance with prohibitions against assistance to Cuba and any country (a) which furnishes assistance to Cuba or failed to take appropriate steps by February 14, 1964, to prevent ships or aircraft under its registry from carrying equipment, materials, or supplies from or to Cuba; or (b) which sells, furnishes, or permits any ships under its registry from carrying items of primary strategic significance, or items of economic assistance to Cuba.

No assistance will be furnished under this loan to the present Government of Cuba, nor does Brazil furnishe assistance to the present Government of Cuba. Brazil has taken appropriate steps to prevent ships or aircrafts under its registry from engaging in any Cuban trade.

38. FAA Section 620(b). If assistance to the government of a country, existence of determination it is not controlled by the International Communist movement.

The Secretary of State has determined that Brazil is not controlled by the international communist movement.

39. FAA Section 620(c). If assistance to the government of a country, assistance of indebtedness to a U.S. citizen for goods and services furnished or ordered where such citizen has exhausted available legal remedies or where the debt is not denied or contested by such government or the indebtedness arises under an unconditional guaranty given by such government.

Brazil is not known to be indebted to any U.S. citizen on goods or services furnished or ordered where such a citizen has exhausted available legal remedies or where the debt is not denied or contested by the Borrowers or the indebtedness arises under an unconditional guarantee of payment by the Borrowers.

40. FAA Section 620(d). If assistance for any productive enterprise which will compete in the U.S. with U.S. enterprise, existence of agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan.

Not applicable.

41. FAA Section 620(e)(1). If assistance to the government of a country, extent to which it (including government agencies or subdivisions) has, after January 1, 1962, taken steps to repudiate or nulify contracts or taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking appropriate steps to discharge its obligations.

Neither the Government of Brazil nor any governmental agency or subdivision thereof has, on or after January 1, 1962, nationalized expropriated, or seized, ownership or control of property of any U.S. citizen or firm, taken steps to repudiate or nullify contracts with such citizens or firms or imposed or enforced discriminatory taxation or other exactions or restrictive conditions

or taken other actions having the effect of nationalizing expropriating or otherwise seizing ownership or control of property owned by U.S. citizen or firms, as specified in this Section of the Act without taking appropriate steps to discharge its obligations as specified in this Section of the Act.

42. FAA Section 620(f); App. Section 109. Compliance with prohibitions against assistance to any Communist country.

Assistance under these loans will not be furnished to any Communist country.

43. FAA Section 620(g). Compliance with prohibition against use of assistance to compensate owners for expropriated or nationalized property.

Assistance under these loans will not be used to compensate for expropriated or nationalized property.

44. FAA Section 620(h). Compliance with regulations and procedures adopted to insure against use of assistance in a manner which, contrary to the best interests of the U.S., promotes or assists the foreign aid projects or activities of the Communist-bloc countries.

Assistance provided by these loans will not be used in a manner which, contrary to the best interests of the U.S., promotes or assists the foreign A.I.D. projects or activities of the Communist-bloc countries.

45. FAA Section 620(i). Existence of determination that the country is engaging in or preparing for aggressive military efforts.

The President has not determined that Brazil is engaging in or preparing for aggressive military efforts.

46. FAA Section 620(i). Information on representation of the country at any international conference when that representation includes the planning of activities involving insurrection or subversion against the U.S. or countries receiving U.S. assistance.

There has been no Brazilian Government representation nor any private Brazilian representation with Brazilian Government sanction at any international conference in which that representation includes the planning of activities involving insurrection or subversion against the U.S. or countries receiving U.S. assistance.

47. FAA Section 620(k). If construction of productive enterprise where aggregate value of assitance to be furnished by U.S. will exceed $100 million, identification of statutory authority.

Not applicable.

48. FAA Section 620(l). Consideration which has been given to denying assistance to the government of a country which after December 31, 1966, has failed to institute the investment guaranty program for the specific risks of inconvertibility and expropriation or confiscation.

Brazil has signed and instituted such an agreement.

49. FAA Section 620(n); App. 107(b) and 116. Compliance with prohibition against assistance to countries which traffic or permit trafficking with North Viet-Nam.

Brazil does not traffic nor knowingly permit trafficking with North Viet-Nam.

50. FAA Section 620(o) If country has seized, or imposed any penalty or sanction against, any U.S. fishing vessel on account of its fishing activities in international waters, information on the consideration which has been given to excluding the country from assistance.

Brazil has not seized or imposed any penalty or sanction against any U.S. fishing vessel in International water.

51. FAA Section 620(q). Existence of default under any Foreign Assistance Act loan to the country.

No loans to Brazil under the Foreign Assistance Act are in default.

52. FAA Section 621. Information and conclusion on how the loans in providing technical assistance will utilize to the fullest extent practicable goods and professional and other services from private enterprise on a contract basis. If the facilities of other Federal agencies will be utilized, information and conclusion on whether they are particularly suitable, are not competitive with private enterprise, and can be made available without undue interference with domestic programs.

An American engineering/consultant firm or firms shall contract probably in joint venture with a Brazilian firm to perform the required technical supervision and design work.

53. App. Section 102. Compliance with requirement that payments in excess of $25,000 for architectural and engineering services on any one project be reported to Congress.

Will comply.

54. App. Section 104. Compliance with bar against funds to pay pensions, etc., for military personnel.

Funds obligated by the loan will not be used to pay pensions, annuities, etc.

55. App. Section 106. If country attempts to create distinctions because of their race or religion among Americans in granting personal or commercial access or other rights otherwise available to U.S. citizens generally application which will be made in negotiations of contrary principles as expressed by Congress.

No attempts by Brazil to create distinctions because of race or religion among Americans in granting personal

/...

or commercial access or other rights otherwise available to U.S. citizens generally are known. If the Host Government attempts to create such distinctions, application will be made in negotiations of contrary principles as expressed by Congress.

56. App. Section 111. Compliance with existing requirements for security clearance of personnel.

Existing requirements for security clearance of personnel will be observed.

57. App. Section 112. Compliance with requirements for approval of contractors and contract terms for capital projects.

The loan agreements will so stipulate.

58. App. Section 114. Compliance with bar against use of funds to pay assessments, etc., of U.N. member.

Loan funds will not be used to make payment to any U.N. member.

59. App. Section 115. Compliance with regulations on employment of U.S. and local personnel for funds obligated after April 30, 1964. (Regulation 7)

Not applicable.

60. App. Section 401. Compliance with bar against use of funds for publicity or propaganda purposes within U.S. not heretofore authorized by Congress.

Loan funds will not be used for publicity or propaganda purpose within the U.S.

June 7, 1967

SUDENE Highway Maintenance Equipment Loan
(512-L-019)

1. Loan Authorizations

a) On February 11, 1964 A.I.D. authorized a Highway Maintenance Equipment Loan to SUDENE of US$9 million for four Northeast Brazil states, i.e., Alagoas, Bahia, Rio Grande do Norte and Sergipe.

b) On June 30, 1964 A.I.D. issued an amendment loan authorization in an amount not to exceed US$20 million "to assist in financing the cost of acquisition by the state highway departments of Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piaui, Rio Grande do Norte and Sergipe in Northeast Brazil ("Executing Agencies") equipment, retention of qualified highway maintenance advisors, and training mechanics and equipment operators..."

The loan authorization stipulated that "not to exceed eleven million two hundred thousand ($11,200,000) may be utilized to finance procurement of equipment of Brazilian manufacture and related services on terms and conditions acceptable to A.I.D. provided, however, that in the event Borrower procures any item of equipment in Brazil, A.I.D. shall make available funds to finance said item in an amount not to exceed the United States list price of said item plus twenty (20) percent."

Note: It was estimated that U.S. List Price plus 20% would approximately correspond to CIF Brazilian port price of equipment imported from the U.S.

2. The Loan

a) Loan Agreement signed November 18, 1964 between SUDENE and A.I.D.

b) Loan Amount: U.S. $20,000,000
Cr$ 4,500,000,000 (PL-480 funds generated under Agricultural Commodities Agreement of September 11, 1963)

c) Purpose: to finance the costs of (1) acquiring highway maintenance equipment and accessories to be used in the project states (2) retaining qualified highway maintenance

technicians for each of the project states, and (3) training of mechanics, equipment operators, and other maintenance personnel. Not less than nine hundred and fifty thousand dollars of the loan funds were to be set aside to be used exclusively for items (2) and (3) above.

d) The Projects: The specific purpose of the loan is to assist in the establishment of effective state highway maintenance departments which will maintain the road systems in the states of Alagoas, Bahia, Rio Grande do Norte, Sergipe, Maranhüo, Paraíba, Ceará, Piauí, and Pernambuco (Project States).

3. Terms: duration: 40 years
grace period: 10 years
credit fee: during grace period 3/4 of 1% per annum and 2% thereafter.

4. SUDENE - State Agreements

On March 5, 1965, SUDENE entered into identical agreements with each of the nine project states, handing over "the equipment for maintenance of highways to DER for use, in accordance with the loan agreement and during the term of its useful life." (SUDENE retains title to the equipment and has the right to repossess it if the State or the DER violate any of the dispositions of the agreement).

5. BPR Services

The BPR, under a PASA with AID, acts as purchasing agent for U.S. equipment and furnishes technical assistance to GOB in Brazilian procurement, training of highway maintenance personnel and utilization of equipment. BPR monitors the implementation of the loan agreement in the nine states of Northeast Brazil. With regard to Brazilian procurement the BPR assists in the preparation of specifications for, and selection of equipment, and in the inspection of equipment on delivery prior to acceptance.

6. Problems Encountered

a) Slowness of SUDENE in advertising for bids;
b) Unwieldy bidding procedures of SUDENE causing the need for readvertising in a number of instances;

/...

c) Most serious problem is failure on part of GOB to issue blanket import permit for all U.S. procured equipment. The need for obtaining separate import permit for each procurement has protracted processing of import licenses for over one year.

d) State financing of operations is being restricted by the fact that the states are receiving less funds (actually less cruzeiros) from National Highway Fund than they received two years ago.

e) frequent diversion of loan equipment for emergency uses.

7. Status of Expenditures as of May 1967

U.S. Procurement:	app. $4.5 million
Braz. Procurement and other: local cost	app.$10.5 million plus Cr$ 4.5 billion

MINAS GERAIS Highway Maintenance Equipment Loans
(512-L-043, 512-L-047)

1. Loan Authorization

On May 28, 1965, AID authorized two highway maintenance equipment loans to the State Highway Department of Minas Gerais. One loan was for US$ 15 million and the other Cr$ 9 billion old cruzeiros. These loans were to finance the purchase of highway maintenance equipment and technical assistance.

2. Terms

Twenty (20) years at 3½% with a three-year grace period.

3. Status of Loans

All the Cr$ 9 billion loan has been disbursed. Of the US$ 15 million, one half, US$ 7.5 million, was designed for local

purchases. This is now approximately 50% disbursed. The other $7.5 million to be used for United States procurement is now approximately 65% disbursed.

4. Problems Encountered

The DER-MG is presently experiencing financial problems because of the recent changes in the apportionment of the Federal Highway Fund. At a recent meeting with the Governor USAID was reassured that the necessary funds would be provided to support the maintenance program. A new State Fuel Tax of 10½% will be levied beginning January 1968 and should be adequate to overcome the current deficit in revenues.

SAO PAULO Highway Maintenance Loan
(512-L-059)

1. This project was authorized on June 29, 1966 and the loan agreement was signed August 18, 1966. The loan provides US$ 20 million for the purchase of highway maintenance equipment and technical assistance for the highway department of the State of Sao Paulo. All conditions precedent have been met in Section 301 of the loan agreement except the hiring of a consultant to implement the project. This has been delayed because of negotiations with the World Bank and the GOB relating to master planning for the state beltway studies for Sao Paulo and reorganization of the highway maintenance department. All engineering service proposals for the implementation of this project were submitted to the DER-SP on May 15, 1967 and a consultant is expected to be hired by the middle of June.

DECREE-LAW No. 122 of January 31, 1967

Provides for Reorganization of the National Department of Highways and otherwise enacting.

The President of the Republic, by virtue of the powers vested upon him by Institutional Act No. 4, article 9, paragraph 2 of December 7, 1966, hereby decrees:

Art. 1 - The National Department of Highways, an administrative agency, financially independent, given the status of a corporate body by Decree-Law No. 8463 of December 27, 1945, is restructed in its competence and organization, pursuant to the provisions of this Decree-Law and the rules and regulations that may be issued by the Executive Power.

Art. 2 - DNER is charged with planning, projecting, financing, control and supervision of the services of execution, paving, upkeep and restoration of the highways integrated in the National Highway Plan, as well as with the transit policy on those highways and that for interstate traffic, including those matters connected with granting of concessions for passenger transportation services.

Sole Paragraph - DNER may exercise any other activities which be of interest to highway development.

Art. 3 - In order to develop highway practices and improve the methods of control and supervision, as well as to provide training for its personnel, DNER will fix an annual program of works under its direct supervision or execution.

Art. 4 - DNER, in order to attain the objectives indicated in Art. 29, is hereby authorized to sign agreements with the States, military organizations or other federal entities.

Sole Paragraph - The agreements provided for in this article may include permanent or temporary assignment of personnel, materials, equipment, buildings and facilities.

Art. 5 - The Agency's personnel will be reviewed pursuant to the rules established by Decree-Law No. 5 of April 4, 1966, in order to meet the requirements provided for in Art. 2 and 3 hereof.

Sole Paragraph - The assignment referred to in sole paragraph of Article 4 will preferably apply to the personnel considered as surplus pursuant to the provisions of this article, and it may be established that the payment of salaries and benefits to such personnel, will be for the account of the State, under the terms of the Federal Legislation applicable.

Art. 6 - Within 180 (a hundred and eighty days), starting from the date of publication of this Decree-Law, the Executive Power will dispose, through regulations, on the jurisdiction, organization and structure of DNER.

Art. 7 - This Decree-Law will become effective on the date of publication of the regulations referred to in the previous article hereof.

Art. 8 - Provisions to the contrary are hereby revoked.

Brasilia, January 31, 1967;
the Independence 146th, the
Republic 78th.

(s) H. Castello Branco
(President)

(s) Juarez Távora
(Minister of Transport)

Legal Description of the Borrowers

1. Highway Council

The basic organization is as follows: Each DER and DAER of Rio Grande do Sul has a Highway Council, composed of four members. This Council is headed by an independent engineer of recognized competence and integrity, appointed by the State Government outside of its civil service. The other members of the Council are usually a representative of the state engineering association, a representative of the state department of public works; and the director-general of the state highway department.

The Council is responsible for establishing the policies and programs and approves the annual budgets.

2. Executive Council

Another part of the State Highway Departments' organization is the Executive Council, also composed of four members: the director-general of the highway department; the chief of the technical division; the legal counsel; and the chief of the division of administration. This Council is responsible for supervising and coordinating the operations of the highway department, including the review and approval of bids.

3. Board of Audit

A Board of Audit is responsible for controlling the highway departments' finances. This board has three members, but its composition is different in each state. In Paraná, it is composed of an engineer representing the state department of public works, who is the chairman; an accountant representing the general accounting office of the state and another accountant from the state court of accounts.

In Santa Catarina, the members are: a representative of the department of public works, a representative of the accounting office and a representative of the state department of statistics. In Rio Grande do Sul all economic and financial control is performed by the control bureau which derives its authority from the state's control commission.

The Highway Department Board of Audit has control over all the financial aspects of the DER's and Control Bureau of DAER operations, including the review and approval of all contracts.

4. Executive

The executive elements of the DER's and DAER's administration are as follows: a director-general, appointed by the Governor of the State; a technical division; a division of administration; and a legal counsel. The head of all of these units are appointed by the director-general of the DER or DAER in the case of Rio Grande do Sul.

Rio de Janeiro,
July 27, 1965.

Dr. José Lafayette S. do Prado
Director General
Departamento Nacional de Estradas de Rodagem
Av. Presidente Vargas, 522

Dear Dr. Lafayette:

In discussions at your office on 22 July we agreed to pursue the concept of a large USAID loan or a group of related loans to assist in financing the purchase of highway maintenance equipment for the DNER and the many States which have requested such assistance from us. The concept includes a systemized delegation of authority to several of the more prominent States for maintenance of federal highways within their boundaries as an opening step in a long range institutional change in the highway maintenance responsibilities of the DNER.

The prosecution of such a plan will obviously require an immense amount of groundwork and coordination between your staff, the highway staffs of the various States involved and the USAID staff. In anticipation of this effort we also agreed to appoint a planning group to meet for the purpose of laying out a work plan for this project. USAID has appointed Messrs. C. L. Bower, L. J. Brilsford, and M.M.Vogel as our members of the planning group. We await the appointment of your members, and are ready to commence work immediately.

The proposed project, as we envision it, will be a keystone in our development loan program for the next few years, and

we believe will be of tremendous assistance in the systematic and economical maintenance of Brazil's far-flung highway system. We look forward with enthusiasm to working with you in this important endeavor.

Sincerely,

(signed)
Merten M. Vogel
Chief, Engineering and
Natural Resources Office

MVOP - DEPARTAMENTO NACIONAL DE ESTRADAS DE RODAGEM

Rio de Janeiro, September 28, 1965.

Representative of the State Government

In attention to loan requests for acquisition of equipment for highway maintenance, received from DNER and from various states, AID suggested the elaboration of an ample and integrated plan for highway maintenance. The effectiveness of this plan would constitute in a significative contribution to the improvement of the state highways and the federal system.

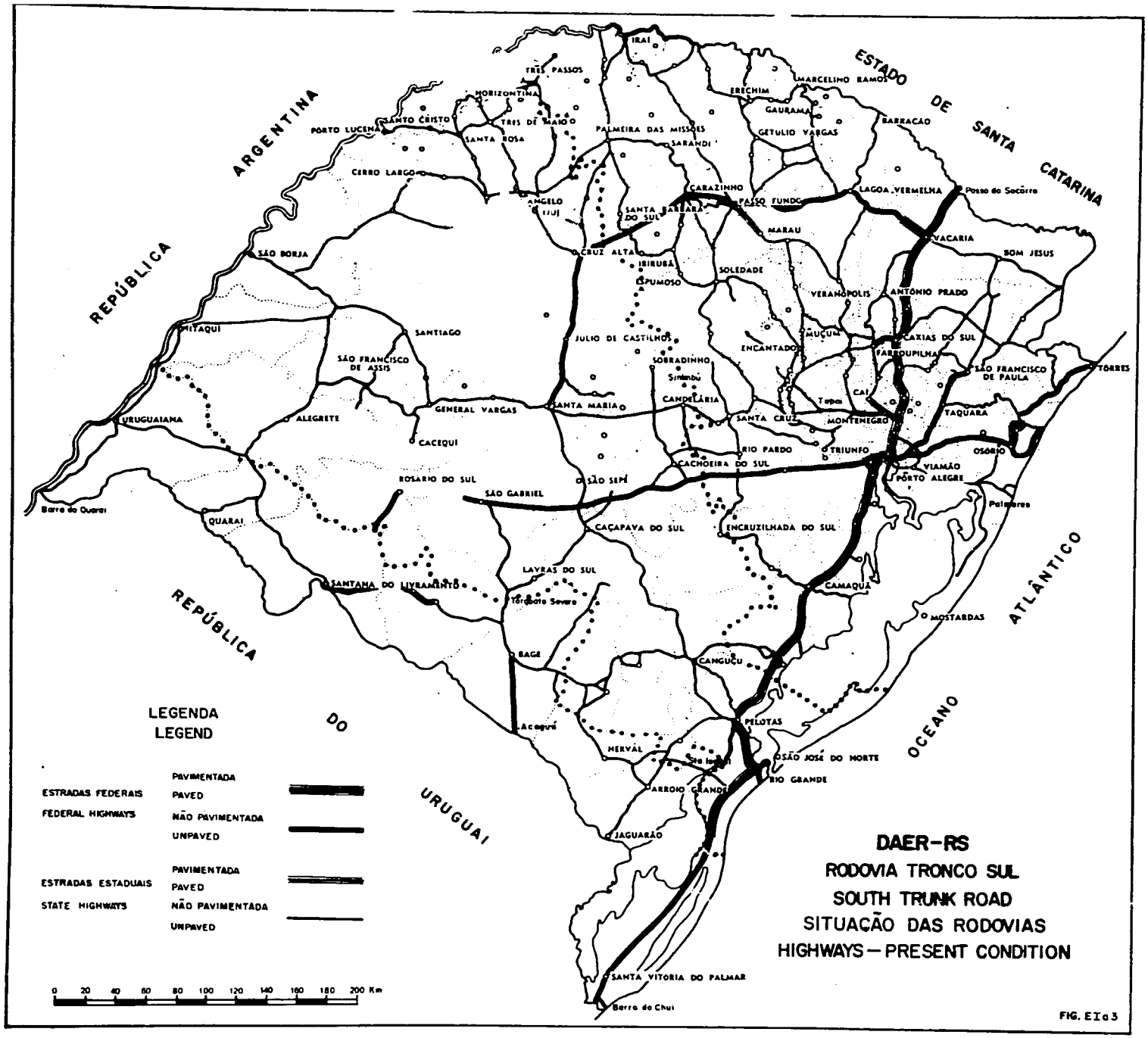
A mixed commission AID-DNER studied this plan, and is now submitting a general description to you for your appreciation.

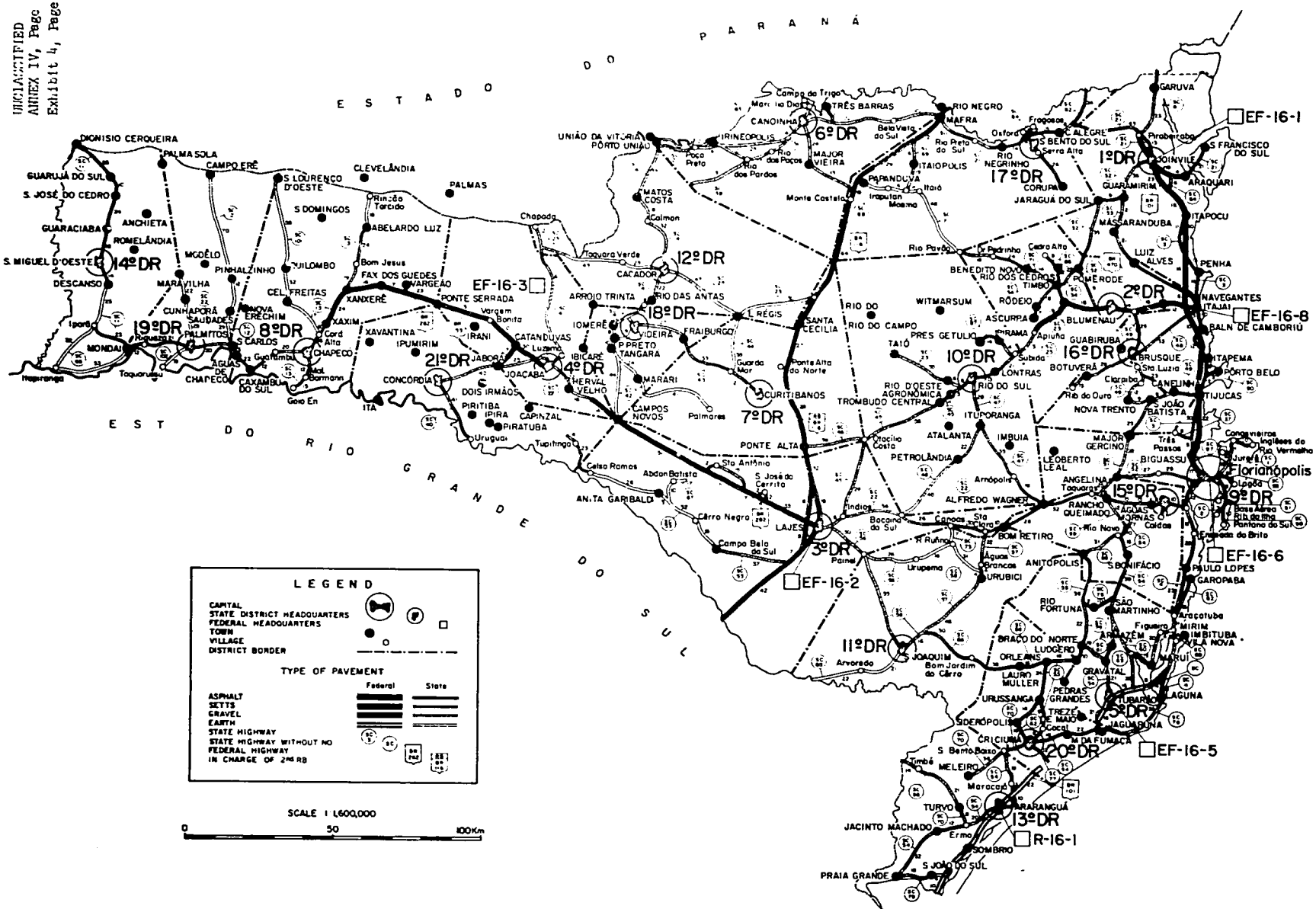
AID and this Department are at your disposal for any additional information you may require.

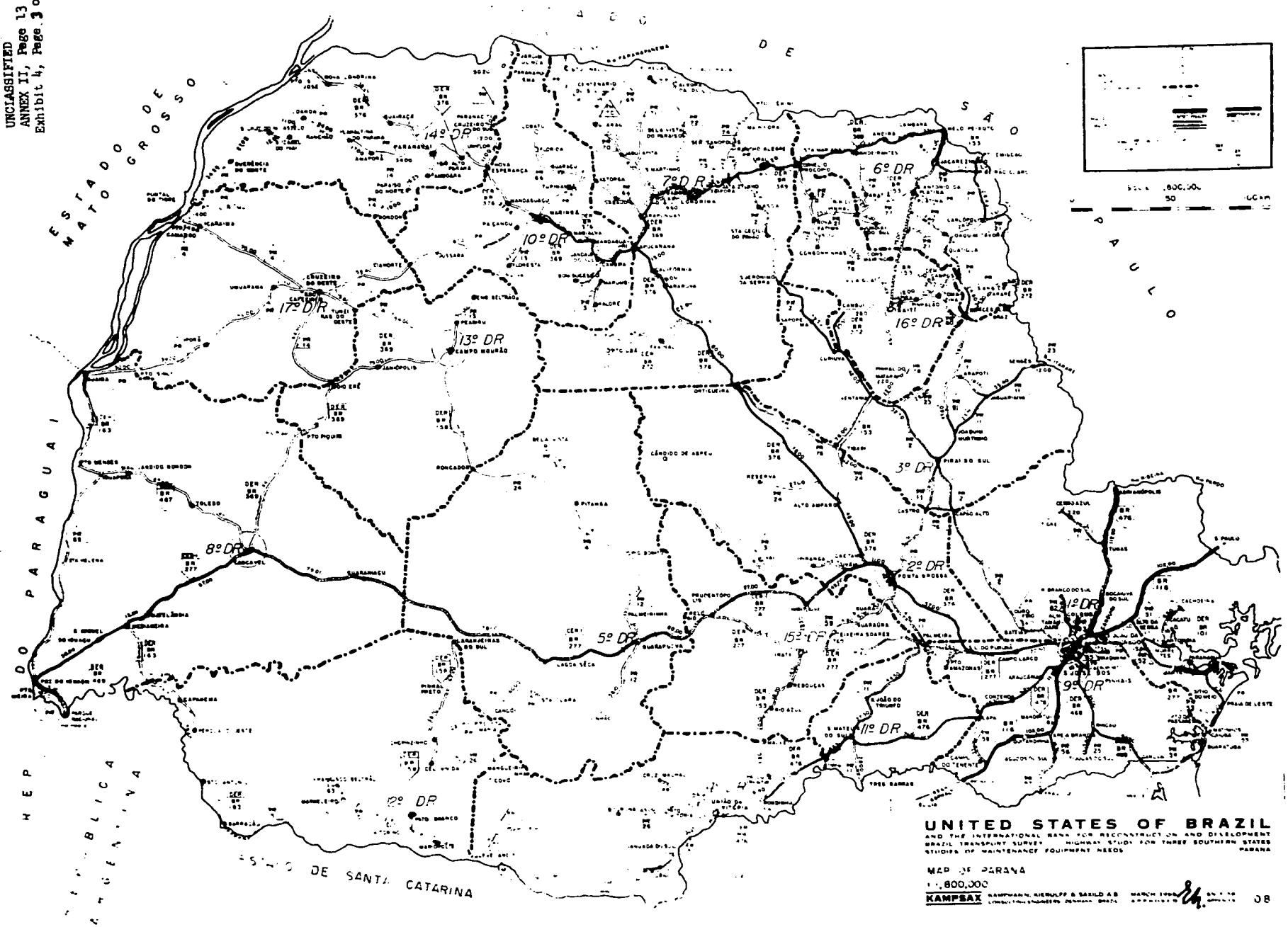
We hereby request that the State expresses in writing its interest in participating in the mentioned plan, accepting the responsibility assigned to it of the proportional part of the execution cost of the feasibility study.

Due to the urgency in proceeding with the work, we request that the answer be delivered to us as of October 8 of this year.

Sincerely,
(signed)
Eng. José Lafayette S. do Prado
Director General - DNER


ESTADO DE SANTA CATARINA
ARGENTINA
REPÚBLICA
REPÚBLICA DO URUGUAI
OCEANO ATLÂNTICO
IRAI
TRES PASSOS
HORIZONTINA
TRES DE MAIO
SANTA ROSA
SANTO CRISTO
PORTO LUCENA
CERRO LARGO
ERECHIM
MARCELINO RAMOS
GAURAMA
BARRACÃO
GETULIO VARGAS
PALMEIRA DAS MISSÕES
SARANDI
CARAZINHO
PASSO FUNDO
LAGOA VERMELHA
Passo do Socorro
ANGELO IJUI
SANTA BARBARA DO SUL
CRUZ ALTA
MARAU
VACARIA
BOM JESUS
SÃO BORJA
IBIRUBÁ
SOLEDADE
PUMOSO
VERANÓPOLIS
ANTÔNIO PRADO
ITAQUI
SANTIAGO
JULIO DE CASTILHOS
MUÇUM
CAXIAS DO SUL
ENCANTADO
FARROUPILHA
SÃO FRANCISCO DE ASSIS
SOBRADINHO
Sinimbú
SÃO FRANCISCO DE PAULA
TORRES
CAI
Tapes
CANDELÁRIA
URUGUAIANA
ALEGRETE
GENERAL VARGAS
SANTA MARIA
SANTA CRUZ
MONTENEGRO
TAQUARA
CACEQUI
RIO PARDO
TRIUNFO
OSÓRIO
CACHOEIRA DO SUL
VIAMÃO
PORTO ALEGRE
ROSARIO DO SUL
SÃO SEPÉ
SÃO GABRIEL
Barra do Quaraí
QUARAÍ
CAÇAPAVA DO SUL
ENCRUZILHADA DO SUL
Palmares
LAVRAS DO SUL
SANTANA DO LIVRAMENTO
Tenente Severo
CAMAQUÃ
MOSTARDAS
BAGÉ
CANGUÇU
PELOTAS
Acegua
MERVAL
SÃO JOSÉ DO NORTE
RIO GRANDE
ARROIO GRANDE
JAGUARÃO
SANTA VITORIA DO PALMAR
Barra do Chuí
LEGENDA
LEGEND
ESTRADAS FEDERAIS
FEDERAL HIGHWAYS
PAVIMENTADA
PAVED
NÃO PAVIMENTADA
UNPAVED
ESTRADAS ESTADUAIS
STATE HIGHWAYS
PAVIMENTADA
PAVED
NÃO PAVIMENTADA
UNPAVED
0 20 40 60 80 100 120 140 160 180 200 Km
DAER-RS
RODOVIA TRONCO SUL
SOUTH TRUNK ROAD
SITUAÇÃO DAS RODOVIAS
HIGHWAYS — PRESENT CONDITION
FIG. EIa3


ESTADO DO PARANÁ
ESTADO DO RIO GRANDE DO SUL
LEGEND
CAPITAL
STATE DISTRICT HEADQUARTERS
FEDERAL HEADQUARTERS
TOWN
VILLAGE
DISTRICT BORDER
TYPE OF PAVEMENT
Federal
State
ASPHALT
SETTS
GRAVEL
EARTH
STATE HIGHWAY
STATE HIGHWAY WITHOUT NO
FEDERAL HIGHWAY
IN CHARGE OF 2ND RB
SCALE 1 1,600,000
0
50
100Km
1ºDR
2ºDR
3ºDR
4ºDR
5ºDR
6ºDR
7ºDR
8ºDR
9ºDR
10ºDR
11ºDR
12ºDR
13ºDR
14ºDR
15ºDR
16ºDR
17ºDR
18ºDR
19ºDR
20ºDR
EF-16-1
EF-16-2
EF-16-3
EF-16-5
EF-16-6
EF-16-8
R-16-1
Florianópolis
UNITED STATES OF BRAZIL
AND THE INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
BRAZIL TRANSPORT SURVEY — HIGHWAY STUDY FOR THREE SOUTHERN STATES
STUDIES OF MAINTENANCE EQUIPMENT NEEDS
SANTA CATARINA
MAP OF SANTA CATARINA
1 1,600,000
MT-SC
KAMPSAX
0.03


ESTADO DE MATO GROSSO
DO PARAGUAI
REPUBLICA ARGENTINA
ESTADO DE SANTA CATARINA
14º DR
7º DR
6º DR
10º DR
17º DR
13º DR
16º DR
3º DR
8º DR
2º DR
1º DR
5º DR
15º DR
9º DR
11º DR
12º DR
UNITED STATES OF BRAZIL
MAP OF PARANA
1:1,800,000
KAMPSAX

M E M O R A N D U M

UNCLASSIFIED

TO: Mr. Stuart H. Van Dyke, DCM DATE: May 22, 1967

FROM: L. V. Moran, ADCD

SUBJECT: Southern States Highway Maintenance Equipment Loan

The subject Capital Assistance Paper has been revised in accordance with the suggestions of the Executive Review Committee, and is forwarded herewith for your approval. The following major revisions and changes have been made:

1. The engineering analysis has been expanded to include the discussion of the criteria and standards used in establishing (1) the equipment requirements list, and (2) the amount of the existing equipment inventory which can be used in the project.

2. All front end loaders (which are a national similar) have been transferred from the dollar equipment list to the local cost equipment list and will be financed by the States. It is now our judgement that there will be no national similars problem.

3. The recommended interest rate has been changed to 3-1/2 percent, and a section has been added to justify this rate. This is an issue in the paper. I doubt that we can get AID/W to approve this in the light of our experience with the Sao Paulo loan, but we will try.

4. The economic analysis has been revised to show the internal rate of return of the project. The internal rate of return is 27 percent.

5. The amount of the local contribution has been made an issue.

6. Editorial changes and changes in presentation have been made in accordance with the suggestions of members of the Committee.

UNCLASSIFIED

We are simultaneously distributing copies of the revised paper to the DERC for any final comments - subject to your approval. Mr. Prindiville would hand carry the paper to Washington on Thursday night, May 25. I would expect to go myself on Thursday or Friday.

Drafted by
ADCD-DEJohnson:vhl
May 23, 1967

cc.: DERC Members

EQUIPMENT NEEDS AND COST ESTIMATE CHARTS FOR Rio Grande do Sul, Santa Catarina and Paraná

Equipment needs and cost estimate charts were prepared utilizing information from KAMRSAX reports, discussions with Highway officials, field trips over different representative types of system highways, and visits to several residency and central maintenance facilities. Estimates for equipment needs were primarily based on mileages to be maintained and average traffic density in the States.

Two methods of equipment distribution were considered for cost analysis and management purposes:

1. Proportioning the equipment between the National Highway System (DNER) and the State Highway System (DER or DAER) for separate maintenance operations.

2. All equipment be designated for the State Highway Department who would assume the total maintenance responsibility for both agencies.

Some saving in equipment cost can be realized through combining all equipment under the State maintenance organization but the major saving would be through reduction in operating costs.

Examples of these savings would be through the reduction in the number of residencies where duplicate facilities are maintained in the same area and the utilization of only one central shop for component and major equipment overhaul, one central warehouse, one central procurement section, one sign shop and etc.

Maintenance Units (or crews)

The number of specialized work units (or crews) were based on the number of Kms of asphalt, macadam, gravel surfaced and earth roads in each of the three southern states (Paraná, Santa Catarina and Rio Grande do Sul). Each of the specialized work units were equipped as dictated by the different highway surfaces and maintenance conditions. (See attached lists).

I. Earth Road Maintenance - Average 235 Kms per unit (or crew).

	Units (or crews)	
Paraná	- DER -	21
Santa Catarina	- DER -	6
Rio Grande do Sul	- DAER -	20

II. Maintenance and betterments of roadside ditches, shoulders, cuts and embankments, slopes, culverts and drainage pipe on asphalt roads - Average 120 Kms per unit (or crew)

	Units (or crews)	
Paraná	- DER -	10
Santa Catarina	- DER -	4
Rio Grande do Sul	- DAER -	12

III. Asphalt Sealing - Average 615 Kms per unit (or crew)

Units (or crews)

Paraná	- DER -	2
Santa Catarina	- DER	2
Rio Grande do Sul	- DAER -	3

IV. Re-surfacing and upgrading gravel roads
Average 400 Kms per unit (or crew)

Units (or crews)

Paraná	- DER -	6
Santa Catarina	- DER -	10
Rio Grande do Sul	- DAER -	12

V. Surface Maintenance Asphalt Highways
Average 120 Kms per unit (or crew)

Units (or crews)

Paraná	- DER -	10
Santa Catarina	- DER -	3
Rio Grande do Sul	- DAER -	12

VI. Maintenance Asphalt Plants - Average 335 Kms per unit (or crew)

		Units(or crews)
Paraná	- DER -	5
Santa Catarina	- DER -	2
Rio Grande do Sul	- DAER -	4

VII. Rock Crushers and Quarry Plants - (State Wide)

		Units (or crews)
Paraná	- DER -	5
Santa Catarina	- DER -	3
Rio Grande do Sul	- DAER -	5

VIII. Maintenance of Gravel and Macadam Roads
Average 210 Kms per unit (or crew)

		Units (or crews)
Paraná	- DER -	12
Santa Catarina	- DER -	23
Rio Grande do Sul	- DAER -	26

I. Earth Road Maintenance

For the maintenance and improvement of the earth roads, it is recommended that the crews be equipped with the following equipment: (Average 235 Kms. per crew)

3 eac. Motor graders
1 ea. Tractor dozer (angle) with rear mounted ripper, D6 class
1 ea. Front end loader, track type 1 3/4 cu.yd. capacity
5 ea. Dump trucks, heavy duty, 5 cu.yd. capacity
1 ea. Cargo or service truck 5 ton capacity
1 ea. Air compressor with two jack hammers
1 ea. Water tank truck 8,000 liter capacity
1 ea. Pickup 3/4 ton
1 ea. Vibratory compactor
1 ea. 75 HP Tractor wheel
1 ea. Lubrication unit, heavy duty, trailer mounted
1 ea. Fuel tank 1,000 gal. Trailer mounted

II. The units of equipment listed below are recommended to be worked as a unit for the maintenance and betterments of road side ditches, shoulders, cut and embankment slopes, bridges, culverts and drainage pipe on asphalt surfacedroads. (Average 120 Kms. per crew)

2 ea. Motor graders
1 ea. Front end loaders wheel type 2 cu.yd. capacity
1 ea. Roller self propelled, pneumatic tires
1 ea. Water truck 8,000 liter capacity with 3" water pump mounted
5 ea. Dump trucks, heavy duty, 5 cu.yd. capacity
1 ea. Air compressor with two jack hammers
1 ea. Wheel tractor equipped with rear mounted hydraulic back-how attachment
1 ea. Cargo or service truck 5 ton capacity
1 ea. Tractor dozer (angle) with rear mounted ripper
1 ea. Fuel tank, 1,000 gal. trailer mounted
1 ea. Pickup truck 3/4 ton pickup
1 ea. Concrete mixer (to be furnished when needed)
1 ea. Lubrication unit, heavy duty, trailer

/...

III. Asphalt Sealing (Average 615 Kms. per crew)

Units or crews equipped as listed below are recommended for placing asphalt seal coats on the existing asphalt highways and for asphalt penetration surfaces.

1 ea. Asphalt distributor, minimum capacity 1,500 gallons
1 ea. Self propelled chip spreader
2 ea. Self propelled road broom with extra broom
1 ea. Drag broom (shopmade)
1 ea. Asphalt transfer tanker, trailer type, with heaters and asphalt pump minimum 3,000 gallons
1 ea. Truck tractor (for towing transfer tanker)
1 ea. Pneumatic roller, self propelled
1 ea. Water tank truck, 8,000 liter capacity with 3" water pump mounted
1 ea. Wheel type front end loader, 2 cu-yd. capacity
8 ea. Dump truck, heavy duty, 5 cu.yd. capacity
1 ea. Fuel truck, two compartments, 8,000 liter capacity
2 ea. Pickup truck 3/4 ton
1 ea. Cargo or service truck 5 ton capacity
1 ea. Lubrication unit, heavy duty, trailer mounted
1 ea. Rewinding machine for road brooms to be used on State-wide bases
1 ea. 75 HP Wheel tractor

Units or crews with the above equipment should be highly mobile, work State-wide and be equipped with new equipment.

IV. For resurfacing and upgrading the existing gravel roads and assist in upkeep of the earth roads surface the following equipment is recommended: (Average 400 Kms. per crew)

1 ea. Tractor dozer (angle) with rear mounted ripper D6 class
1 ea. Front end loader, track type, 1 3/4 cu.yd. capacity
2 ea. Motor grader
8 ea. Dump trucks, heavy duty, 5 cu.yd.
1 ea. Water tank truck, 8,000 liter capacity with 3" water pump mounted
1 ea. Vibratory compactor, towed type minimum 36 diameter roller
1 ea. Wheel type tractor 75 HP
1 ea. Tilt bed trailer 15 ton capacity
1 ea. Fuel tank, 1,000 gallon capacity trailer mounted
1 ea. Lubrication unit, heavy duty, trailer mounted
2 ea. Pickup truck 3/4 ton
1 ea. Cargo or service truck 5 ton capacity

The above units or crews to be highly mobile.

V. Surface Maintenance of Asphalt Highways (Average 120 Kms. per crew)

The equipment listed below is recommended for use as a unit for each crew doing asphalt surface maintenance.

2 ea. Dump truck, heavy duty, 5 cu-yd. capacity
1 ea. Cargo or service truck 5 ton capacity
1 ea. Asphalt kettle, trailer mounted, equipped with heater, gasoline engine powered asphalt pump, attachments for spraying and 300 gallon capacity
1 ea. Air compressor with two pavement breakers equipped with spade tools
1 ea. Asphalt storage tank 1,000 gallon capacity equipped with heater
1 ea. Wheel type tractor of 75 HP
1 ea. Wheel type tractor with front end loader attachment
1 ea. Roller, tandem, 3-5 tons with trailer
1 ea. Pickup 3/4 ton

VI. Maintenance Asphalt Plants (Average 335 Kms. per crew)

The following portable asphalt plants with supporting equipment using strategically located sites throughout the asphalt road system will be capable of mixing and stockpiling the material necessary for the surface maintenance of asphalt roads.

1 ea. Portable plant complete, 15 T.P.H.
Capacity with feeder hoppers and conveyor for stockpiling the finished product

1 ea. Asphalt storage tanks, 1,000 gallon capacity. Equipped with asphalt pumps and heaters

1 ea. Wheel type front end loader 2 cu.yd. capacity

1 ea. Cargo or service truck 5 ton capacity
1 ea. Dump truck, heavy duty, 5 cu.yd capacity
1 ea. Fuel storage tank, 1,000 gallon capacity, trailer mounted
1 ea. Pickup truck or jeep

VII. Rock Crushers and Quarry Plants (State Wide)

It is recommended that all small rock crushers shown in the KAMPSAX reports as in working condition be located throughout the States' gravel surfaced road systems. These units to produce and stockpile material for resurfacing the sections that are not accessible to gravel pits or river deposits, thereby cutting the haul distance for the resurfacing crews.

It is also suggested that any of the large crushers that are not equipped with classifier units (or screen decks) be included as stated above.

Any of the large crushers listed having classifier units (or screen decks) that can be adjusted to produce aggregate suitable for asphalt seal coat and patch mix for surface maintenance be used on the asphalt road systems. A careful study should be made of these sites to minimize the hauling distance of the finished material.

In addition to the present number of rock crushers in the States there appears to be a need for the following listed equipment per unit. This equipment will assure the correct gradation of aggregate for use in asphalt seal coats and concrete work.

1 ea. Portable quarry plant, with classifier unit or screen deck capable of producing two controlled sizes of aggregate simultaneously. Capacity minimum 90 T.P.H. of 1" aggregate. Diesel engine driven
1 ea. Portable feeder conveyor and mechanical feeder
2 ea. Portable stacker conveyors with 24" belt, 50' long
1 ea. Air compressors 600 CFM or 2 ea. 365 CFM
2 ea. Wagon drills 220 lb. class
2 ea. Jack hammer 45 lb. class
3 ea. Dump trucks, heavy duty, 6-8 cu.yd. capacity
1 ea. Tractor dozer (angle) D6 class
1 ea. Front end loader, truck type, 1 3/4 cu.yd. capacity

4 ea. Hose for wagon drill 50' long
6 ea. Hose for jack hammer 50' long
4 ea. Length of wagon drill steel for screw type bits 6' - 12' - 18'
6 ea. Length of jack hammer steel for screw type bits 2' - 4' - 6' - 8'
12 ea. Size of wagon drill steel bits, screw type with carbine inserts - 1-2-3 (or three different sizes)
18 ea. Size of jack hammer steel bits, screw type with carbine inserts - 1-2-3-4 (or four different sizes)
2 ea. Line oilers for jack hammer hose
1 ea. Fuel tank trailer mounted 1,000 gallon capacity
1 ea. Pickup 3/4 ton
1 ea. Cargo service truck 5 ton
1 ea. Lubrication unit, heavy duty, trailer mounted

Maintenance of Gravel and Macadam Roads
(Average 210 Kms. per crew)

VIII. For the maintenance of the road surface, shoulders, ditches, cross drainage (pipe, culvert, bridges) cut and embankment slopes and base failures of gravel surfaced and macadam roads, work crews with the following equipment are recommended:

1 ea. Tractor dozer (angle) with rear mounted ripper D6 Type
2 ea. Motor Graders
1 ea. Wheel type front end loader 2 cu-yd. capacity
1 ea. Tilt top trailer 15 ton capacity.
5 ea. Dump truck heavy duty 5 cu.yd. capacity
1 ea. Cargo or service truck 5 ton capacity
1 ea. Water tank truck 8,000 liter capacity with 3" water pump mounted.
1 ea. Steel Wheel roller from existing inventory
1 ea. Vibratory compactor roller combination
1 ea. Air compressor with two jack hammers
1 ea. 75 HP Wheel tractor
1 ea. Pickup truck 3/4 ton capacity
1 ea. Lubrication unit, heavy duty, trailer mounted
1 ea. Wheel tractor with hydraulic back hoe
1 ea. Fuel tank 1,000 gal. trailer mounted.

Equipment Repair Shop Facilities

Rio Grande do Sul has fifteen (15) Maintenance Divisions. Santa Catarina has twenty-one (21) and Paraná seventeen (17). Each of these Maintenance Divisions has a spare parts warehouse and equipment repair shops. Much equipment time is lost due to delays of equipment repair due in part to the lack of spare parts and shop tools and equipment. No attempt was made in the recommended equipment chart to show the specific equipment and tools needed, since this would require a detailed study.

The cost of stocking spare parts for the maintenance and repairs in each Maintenance Division would be prohibitive. And to equip this number of work shops with modern equipment necessary for repairing maintenance equipment would be in excess to the needs.

It is recommended for each State to have one Central Shop (or garage) for the repair of Components and Equipment Rebuilt. This shop (or garage) be equipped for making any repairs needed on components and equipment rebuild. Rebuilt components be shipped to the Maintenance Divisions as needed instead of spare parts. The Maintenance Divisions shops be equipped for maintenance, minor repairs and installations of components.

One Central Warehouse located near the Central Shops to support the Central Shops and to control the movements of components and fast moving spare parts to the Divisions. Maintenance Divisions warehouses to stock only fast moving spare parts (fan belts, filters, spark plugs, and etc.)

The State of Minas Gerais has made a very successful change to the above recommendation. The State of São Paulo has plans in the new program for the same type of operation.

/...

Maintenance Organization of the State Highway Departments

Rio Grande do Sul (DAER/RGS)

DAER/RGS is directed by a Director-General, assisted by a Technical Director and administrative Director. Each of the two sub-directors heads up several divisions. The maintenance and improvement division is headed by a state maintenance engineer under the technical director.

The maintenance division is responsible for the maintenance of 8,740 km of state highways, comprising of:

Asphalt:	421 km
Macaban:	51 km
Gravel:	4,664 km
Earth:	3,604 km

The addition of the federal highway system will increase the kilometrage to be maintained by DAER by 2,152 km comprising of:

Asphalt:	1,160 km
Gravel:	591 km
Earth:	401 km

This will bring the total kilometrage of roads to be maintained by the DAER to 10,892 km.

DAER Maintenance Residencies

The state highway network is divided into 15 residencies, each managed by a residency engineer. These highway residencies are the organizational units responsible for the highway maintenance of the state roads.

Each residency has its own office, warehouse, shop, concrete pipe plant and commissary. Generally only minor repairs of equipment are made at the residency shops.

DAER has a large central work shop in Pôrto Alegre where major repairs and equipment overhauls are performed. Plans have been made to construct a new shop and warehouse since the present ones are inadequate.

Santa Catarina (DER/SC)

DER/SC is headed up by a Director-General and assisted by a Technical Director and Administrative Director. Under the Technical Director is a Maintenance and Construction Division. The DER/SC maintains a total of 5,353 km consisting of:

Asphalt:	132 km
Macaban:	68 km
Gravel:	4,129 km
Earth	124 km

The addition of the federal highway system will increase the kilometrage of the state by 955 km consisting of:

Pavement:	352 km
Gravel:	471 km
Earth:	401 km

This will bring the total kilometrage to be maintained by DER/SC to 6,380 km.

In Santa Catarina all road planning and construction work used to be controlled by a state agency called Plano de Metas do Govêrno (PLAMEG). PLAMEG used to accept and implement new highway construction and then turn the roads of the DER/SC for maintenance. The State Highway Department was therefore almost exclusively a highway maintenance department. In January 1967 a new director general was appointed by the Governor. The new director prevailed upon the Governor to return to the DER/SC the responsibilities that were formerly handled by PLAMEG. This now gives the DER/SC an organizational structure similar to DAER in Rio Grande do Sul and the

DER of Paraná. This was accomplished partly in anticipation of the USAID maintenance project and also by the realization that DER/SC must modernize and reorganize in order to absorb the maintenance responsibilities of the federal highway network in the State.

DER/SC Maintenance Residencies

The Director General controls the 21 residencies. Each residency is responsible for 161 to 368 km and is directed by a residency engineer.

Because of the shortage of engineers, however, some engineers handle two residencies. These residencies perform all normal highway maintenance work and when possible betterment. This betterment work is done with the same equipment, personnel and funds that is also used for maintenance work.

The central repair shop and warehouse is located in Florianópolis, where all major repairs and equipment overhauls are performed.

As in Rio Grande do Sul, the residencies are adequate for servicing only minor repairs. All major repairs must be done at the central workshop or private repair shops. Additional space, facilities and improved managerial operations are urgently needed.

Paraná (DER/PR)

The State Highway Department in Paraná like the ones in Santa Catarina and Rio Grande do Sul has a Director General assisted by a Technical Director and Administrative Director. As in the other two states, each Sub-Director has several divisions one of which is the Highway Maintenance Division which in the case of Paraná is under the Technical Director. The Technical Director is responsible for coordinating the activities of the "Residencies".

DER/PR Maintenance Residencies

Each of the 17 districts is headed by a District Engineer who is responsible for both construction and maintenance within his district. The District Engineer normally has two assistants, one being occupied only with maintenance. Each residency maintains approximately 198 to 275 kms of highways. There are at present 7,116 km of highways in the state system comprising of:

Asphalt:	752 km
Macadan:	303 km
Gravel:	1,817 km
Earth:	4,244 km

The addition of the federal highway system will increase the kilometrage by 973 km consisting of:

Pavement:	303 km
Gravel:	594 km
Earth:	76 km

This will bring to 7,157 km the total kilometrage to be maintained by the DER/PR.

HIGHWAY MAINTENANCE TRAINING IN THE UNITED STATES

A Highway Maintenance Program to be completely successful should have engineers from the Maintenance Sections trained in the practical knowledge of (1) maintenance programming, (2) cost control and (3) good field practices. In the judgement of USAID engineers staff this training is more effective when these operations can be observed practically applied in one of the State Highway Departments in the United States.

The Mission proposes, therefore, that at least 20 Highway engineers from each of the three southern states be sent to the U.S. for this training as soon as possible and return to assist in development of the maintenance programs in their respective states.

These engineers are to be treated as students rather than visiting dignataries from Brazil. Their training will be limited to 2 lane primary, secondary and gravel roads and will definitely not include the beautiful U.S. highway system such as the U.S. interstate systems.

Some of the classroom subjects will be on developing a maintenance manual, highway maintenance organization, programming, drainage, compaction, road surface, etc.

Field training will be the observation of a U.S. state Highway Maintenance Department, performing the following maintenance operation: seal coating, patching of asphalt pavement, grading gravel and earth roads, pulling ditches, culvert installation, signing, striping, and many more operations.

The major objective of the program is to stress a working and practical knowledge in highway maintenance.

With the knowledge and prestige gained from this course, these engineers will be able to become the leaders and teachers in the formation of modern maintenance organizations in their respective states. Cost for this training covering transportation to and from the United States is $100,000 per State.

LABOR INTENSITY

Two examples of routine highway maintenance operations comparing the cost and production of using intensive labor methods versus maintenance equipment.

Example I

Loading of a five yard truck by hand compared with loading the same truck with a front end 2 cubic yard loader.

(a) It takes five (5) men one (1) hour and forty five minutes to load a 5 cubic yard truck.

8 3/4 man hours x the minimum wage of $.224 per hour = $1.96

(b) A two cubic front end loader is able to load a 5 cubic yard truck in 1 1/2 minutes.

$\frac{1.5}{60}$ x $5.37 per hour - (the equipment cost per hour) = $0.13.

The front end loader is able to load 10 times faster and is 15 times less expensive.

Example II

To clear 22 kilometers of road ditches, it takes two months using 20 men working 10 hours per day, six days per week.

(a) 20 men x 54 days x 10 hours per day = 10,800 man hours.

10,800 man hours x $.224 hours (minimum wage) = $2,420.00

(b) One (1) grader, one (1) two cubic yard loaders and one (1) truck can clean 9.6 kilometers per day (6 miles).

$\frac{22 \text{ km}}{9.6 \text{ km/day}}$ = 2.3 days or 18 1/2 man hours, costing the Highway Department as follows:

I. The grader = $4.35 per hour x 18 1/2 = $80.50

II. The loader = $5.37 per hour x 18 1/2 = $99.40

III. The truck (5 cubic yards) = 3.09 per hour x 18 1/2 = 57.20

Total for equipment - $237.10

IV. The labor = 18 1/2 hour x 3 men = 55 1/2 man hours
55 1/2 x $.347 per hour = $19.20

Total for operation - $256.30

Using maintenance equipment for cleaning ditches is 29 times faster and 6.8 times less expensive.

Four-Year Technical Assistance Program

It is essential that a program of technical assistance and training be given the State Highway Department by a consultant firm. This program will be improved for the ones now in operation based upon present USAID experience.

Based on experience gained to date in Brazil it is evident that two years of assistance in the procurement and initial training is not enough for a highway maintenance program. There must also be included a 2-year period of guidance; assisting in putting the program and training into practical application.

This technical assistance by a consultant will be divided into the following two phases:

1. Procurement and Training

2. Operations.

Phase I - 2 years: Will basically consist of but not be limited to the following: procurement of equipment, training in the use and maintenance of new equipment, reorganization of highway department, instruction on modern highway maintenance programming and operations.

Phase II - 2 years: Assist the State to mobilize its forces into an effective maintenance operation making sure they utilize their training and incorporate the modern highway maintenance methods throughout.

The consultant should furnish the following men to support the above program for each state:

1st year

Cost

Man Power

1 Project Manager (project administrator)
1 Maintenance Engineer
1 Equipment Specialist
1 Shop Equipment Specialist
1 Warehouse man
1 Equipment Instructor
1 Accountant

84 man months at
$4,500/man month +

= $378,000 First Year

Local Help (Brazilian)

NCr$58,200

1	Office Manager	NCr$12,000/yr
2	Engineers	25,400/yr
2	Secretaries	12,000/yr
1	Translator	6,000/yr
1	Office boy	1,800/yr
		NCr$58,200

2nd Year

= $378,000

1 Project Manager
1 Maintenance Engineer
1 Equipment Specialist
1 Shop Equipment Specialist
2 Equipment Instructors
1 Warehouse man

No change in local help

= CNr$ 77,600
(including inflation)

3rd Year		Cost
1 Project Manager		36 man months at $4,500/man month
1 Maintenance Engineer		= $150,000
1 Accountant (1/2 year)		
1 Equipment Specialist (1/2 year)		
Reduce Local Help to:		
1 Engineer	= 21,000	
1 Secretary	= 11,500	
	32,500	NCr$32,500

4th Year	
1 Project Manager	24 man months at $4,500/man month
1 Maintenance Engineer	=$108,000
Local Help same as 3rd year.	NCr$43,000

Cost for Technical Assistance for 4 Years

= $1,004,000

NCr$ 211,300 (from Wheet Fund)

The man month figure of US$4,500 is based on the maintenance consulting contract between Brown and Root and the state of Minas Gerais made in 1965 and where the cost, including salary, over-head and fee and direct expenses averaged $4,500 per man month.

ENRH Item	Equipment	PARANÁ Est. Unit Cost	PARANÁ Nº of Units for Total Implementation	US$ DOLLARS Cost
3	Tractor, Dozer (Angle) w/Rear mtd. Ripper, D6 Class	23.000	42	966.000
47	Track Type Loader, 1 3/4 cu.yd. capacity	21.000	34	714.000
26	Pneumatic Roller, Self Propelled	16.000	5	80.000
19	Spreader, Aggregate, Self Propelled	25.000	2	50.000
38	Dump Truck, Heavy Duty, 5 cu.yd. capacity	8.000	290	2.320.000
25	Portable Scales	1.500	12	18.000
23	Field Laboratories	2.500	Contingent Cost	10.000
69	Hydraulic Excavator (Gradall or equal)	45.000	6	270.000
9	Mech. Sweeper (Self Propelled Broom)	7.000	2	14.000
32	Quarry Plant, Portable - 90 TPH	130.000	5	650.000
60	Feeder Conveyor, Portable for quarry Plants	12.000	5	60.000
61	Conveyor, Stacker, 24" Belt Portable	9.000	10	90.000
67	Air Compressor, 600 CFM, Portable	14.000	5	70.000
45	Painter, Stripe, Self Propelled	3.000	2	6.000
48	Pan Type, Vibrator Compactor, 135 lb Class	500	34	17.000
53	Re-winding Machine for Road Brooms	1.400	1	1.400
68	Wagon Drill w/Hose, Drill, Steel, Bits	4.000	10	40.000
75	Radio Equipment - Fixed and Mobile	1.500	108	162.000
76	Core Drill w/Accessories, skid. mtd.	4.000	-	-
77	Cutting edges for Motor Graders	28.000	9,000 sets	252.000
70	1620 IBM Computer	140.000		140.000
72	Est. for components to up grade existing equip.	200.000		200.000

Paraná will procure all their equipment for both State and Federal roads at the same time as they are presently maintaining 70% of the Federal system.

Sub total:	6.430.400
Minus items 70, 71, 72 and 77 for calculating spare parts:	5.538.400
15% for spare parts:	830.760
Items 70, 71 and 72	892.000
20% for shipping and insurance	1.452.232
Est. total if procurement is made in 1967:	8.713.392
Est. total plus 5% increase in equipment and spare parts cost if procured in '68:	9.149.062
Est. total plus 5% increase in equipment and spare parts cost if procured in '69	9.606.515

ERRH item	Equipment	PARANÁ Est. Unit Cost	NEW CRUZEIROS Nº of Units for total implementation	Cost
1	Motor Graders	59.000	60	3.540.000
33	Air Compressor w/3 Jack Hammers	13.500	20	270.000
63	Dump Truck, Heavy Duty, 6-8 cu. yd. capacity	25.000	20	500.000
39	Cargo Truck, 5 ton capacity	12.000	55	660.000
75	Front Loader Wheel Type, 1 1/2 cu. yd. cap.	65.000	34	2.210.000
1	Tanker, Water Truck, w/3" Pump, 8,000 lt cap.	27.700	40	1.108.000
40	Tanker, Truck Fuel, 2 comp. 1,000 gal. cap.	28.000	19	532.000
50	Asphalt Trans. Tanker, Trailer mtd. w/Heater	18.000	2	36.000
43	Asphalt Distr. min. 1,500 gal. capacity	28.000	2	56,000
42	Trailer Tilt Bed, 15 ton capacity	6.500	20	130.000
27	Tractor (Wheel) 75 HP	10.500	30	315.000
58	Air Compressor w/2 Pavement Breakers and Spade Tools	15.000	10	150.000
14	Pick up, Truck, Heavy Duty, 3/4 ton capacity	8.800	100	880.000
44	Roller Tandem w/Trailer, 3-5 ton	10.000	20	200.000
46	Vibrating Compactor w/Smooth and Sheepsfoot Drum w/Trailer	15.000	30	450.000
55	Asphalt Plant, Portable 15 TPH	25.000	5	125.000
1	Truck Tractor for Asphalt Transfer Tanker	18.000	2	36.000
52	Lubrication Unit, Trailer mtd. Heavy Duty	8.000	60	480.000
54	Wheel Tractor w/Hydraulic Backhoe	14.000	18	252.000
56	Asphalt Tank Trailer mtd. 1,000 gal w/Heater	14.000	15	210.000
57	Asphalt Kettle, 300 gal. cap. Trailer mtd. w/Heater & Spray Equipment	15.000	10	150.000
62	Fuel Tank, Trailer mtd. 1,000 gal. capacity	12.000	41	492.000
74	Jack Hammers w/Drill Steel, Hose, Bits and Line Oilers	1.400	10	140.000
73	Concrete Pipe Plant w/Mixer	14.000	13	182.000
66	Lubrication Unit for Truck Mounting	9.000	-	-
65	Wheel Tractor w/Front Loader	14.000	-	-
71	Est. cost of Needed Shop Tools and Equipment	660.000		660.000

Paraná will procure all their equipment for both State and Federal roads at the same time as they are presently maintaining 70% of the Federal system.

Sub total:	12.774.000
Total minus item 71 for calculating spare parts:	12.114.000
10% for spare parts:	1.211.400
Plus item 71 and spare parts:	13.985.400
Est. total if procured in 1967:	13.985.400
Est. total plus 25% increase in equipment and spare parts assuming a two year disbursement period with inflation rate of 25% per annum	16.646.725

SANTA CATARINA

US$ DOLLARS

	Equipment	Nº of Units Imp. Nº 1	Est. Unit Cost	Est. Total Cost	Nº of Units Imp. Nº 2	Total Cost	Nº of Units for total Implement.	Cost
3	Tractor, Dozer (Angle) w/rear mtd. Ripper, D6 Class	33	23.000	759.000	3	69.000	36	828.000
47	Track Type Loader, 1 3/4 cu. yd. cap	17	21.000	357.000	3	63.000	20	420.000
26	Pneumatic Roller, Self Propelled	2	16.000	32.000	4	64.000	6	96.000
19	Spreader, Aggregate, Self Propelled.	1	25.000	25.000	1	25.000	2	50.000
38	Dump, Truck Heavy Duty, 5 cu.yd.cap.	105	8.000	840.000	21	168.000	126	1.008.000
25	Portable Scales	8	1.500	12.000	4	6.000	12	18.000
23	Field Laboratories	10	2.500	25.000	-	-	10	25.000
69	Hydraulic Excavator (Gradall or Equal)	3	45.000	135.000	2	90.000	5	225.000
9	Mech.Sweeper (self propelled broom)	2	7.000	14.000	-	-	2	14.000
32	Quarry Plant, Portable - 90 TPH	3	130.000	390.000	-	-	3	390.000
60	Feeder Conveyor, Portable for Quarry Plants	3	12.000	36.000	-	-	3	36.000
61	Conveyor, stacker, 24" Belt, port.	6	9.000	54.000	-	-	6	54.000
67	Air Compressor, 600 CFM, Portable	3	14.000	42.000	-	-	3	42.000
45	Painter Stripe, self propelled	1	3.000	3.000	1	3.000	2	6.000
48	Pan Type, Vibrator Compactor, 135 lb Class	20	500	10.000	4	2.000	24	12.000
53	Re-winding Mach. for Road Brooms	1	1.400	1.400	-	-	1	1.400
68	Wagon Drill w/Hose, Drill Steel,Bits	6	4.000	24.000	-	-	6	24.000
75	Radio Equipment - Fixed and Mobile	60 sets	1.500	90.000	-	-	60 sets	90.000
77	Cutting Edge for motor graders	11,500 sets	28.	323.400	-	-	-	323.400
70	1620 IBM Computer	1	140.000	140.000	-	-	1	140.000
71	Est. Cost of Needed Shop Tools and Equipment		300.000	300.000				300.000
72	Est. cof Components to up grade existing equipment		200.000	200.000				200.000
				3.489.400		562.000		

Sub total:	4.315.400
Minus items 70,71, 72 and 77 for calculating spare parts:	3.352.000
15% for spare parts:	501.700
Plus item 70, 71, 72 and 77:	963.400
Plus 20% for shipping and insurance:	982.992
Est. total if procurement is made in 1967:	5.735.410
Est. total plus 5% increase in equipment and spare parts cost if procured in 1968:	5.751.580
Est. total plus 5% increase in equipment and spare parts cost if procured in 1969:	6.039.159

	Equipment	SANTA CATARINA: No of Units Imp. No 1	Est. Unit Cost	Est. Total Cost	No of Units Imp. No 2	Total Cost	NEW CRUZEIROS: No of Units for total Implement.	Cost
1	Motor Graders	61	59.000	3,599,000	16	944.000	77	4,543,000
33	Air Compressor w/3 Jack Hammers	15	13.500	202,500	3	40.500	18	243,000
63	Dump Truck, Heavy Duty, 6-8 cu.yd. capacity	9	25.000	225.000	-	-	9	225,000
75	Front Loader, Wheel type, 1 1/2 cu.yd.	22	65.000	1,430,000	8	520,000	30	1,950,000
49	Cargo Truck, 5 ton capacity	37	12.000	444.000	8	96.000	45	540,000
41	Tanker, Water Truck, w/3" Pump 8,000 liter capacity	36	27.700	997.200	9	249.300	45	1,246,500
40	Tanker, Truck Fuel, 2 comp., 1,000 gal capacity	16	28.000	448.000	5	140.000	21	588,000
50	Asphalt Transfer, Tanker, Trailer mounted w/Heater	1	18.000	18,000	1	18.000	2	36,000
43	Asphalt Distributor min.1,500 gal.	1	28.000	28,000	1	28,000	2	56,000
42	Trailer Tilt Bed, 15 ton capacity	29	6.500	188.500	4	26.000	33	214,500
27	Tractor (Wheel) 70 HP	37	10.500	388.500	7	73.500	44	462,000
58	Air Compressor w/2 Pavement Breakers and Spade Tools	2	25.000	50,000	1	25.000	3	75,000
14	Pick up truck, Heavy Duty, 3/4 ton capacity	52	8.800	457.600	14	123.200	66	580,800
44	Roller Tandem, w/Trailer, 3-5 ton	10	10.000	100,000	2	20.000	12	120,000
46	Vibrating Compactor w/Smooth and Sheepsfoot Drum w/Trailer	34	15.000	510,000	5	75.000	39	585,000
55	Asphalt Plant, portable, 45 TPH	1	25.000	25,000	1	25,000	2	50,000
51	Truck Tractor for Asphalt Transfer Tanker	1	18.000	18,000	1	18.000	2	36,000
52	Lubrication Unit, Trailer mtd. heavy duty	38	8.000	304.000	10	80.000	48	384,000
54	Wheel Tractor w/Hydraulic Backhoe	20	14.000	280,000	6	84.000	26	364,000
56	Asphalt Tank Trailer mounted, 1,000 gal w/Heater	3	14.000	42,000	3	42,000	6	84,000
57	Asphalt Kettle, 300 gal cap. trailer mtd. w/Heater & Spray equipment	2	15.000	30,000	2	30,000	4	60,000
62	Fuel Tank, Trailer Mounted, 1,000 gal capacity	38	12.000	456,000	10	120,000	48	576,000
74	Jack Hammers w/Drill Steel, Hose, Bits and line oilers	6	1.400	8,400	-	-	6	8,400
73	Concrete Pipe Plant w/Mixer	10	14.000	140,000	-	-	10	140,000
66	Lubrication Unit for Truck Mounting	10	9.000	90,000	-	-	10	90,000
65	Wheel Tractor w/Front Loader	2	14.000	28,000	1	14.000	3	42,000
71	Est. cost of needed shop tools & equipment		660,000	660,000		-	-	660,000
				11,167,700		2,791,500		

Sub total:	14,259,200
Total minus Item 71 for calculating spare parts:	13,599,200
10% for spare parts:	1,359,920
Plus Item 71 and spare parts:	15,619,120
Est. total if procurement is made in 1967:	15,619,120
Est. total plus 25% increase in equipment and spare parts: assuming a two year disbursement period with inflation rate of 25% per annum	19,523,900

RIO GRANDE DO SUL

US$ Dollars

	Equipment	Nº of Units Imp. Nº 1	Est. Unit Cost	Est. Total Cost	Nº of Units Imp. Nº 2	Total Cost	Nº of Units for total implement.	Cost
3	Tractor, Dozer (Angle) w/rear mtd. Ripper, D6 Class	58	23.000	1.334.000	8	184.000	66	1.518.000
47	Tractor, Type Loader, 1 3/4 cu.yd. capacity	41	21.000	861.000	6	126.000	47	987.000
26	Pneumatic Roller, Self Propelled	15	16.000	240.000	9	144.000	24	384.000
19	Spreader, Aggregate, Self Propelled	1	25.000	25.000	1	25.000	2	50.000
38	Dump Truck, Heavy Duty, 5 cu.yd. capacity	278	8.000	2.224.000	42	336.000	320	2.560.000
25	Portable Scales	8	1.500	12.000	8	12.000	16	24.000
24	Field Laboratories	15	2.500	37.500	0	-	15	37.500
69	Hydraulic Excavator (Gradall or Equal)	4	45.000	180.000	3	135.000	7	315.000
9	Mech. Sweeper (Self Propelled Broom)	2	7.000	14.000	1	7.000	3	21.000
32	Quarry Plant, Portable - 90 TPH	5	130.000	650.000	-	-	5	650.000
60	Feeder Conveyor, Portable for Quarry Plants	5	12.000	60.000	-	-	5	60.000
61	Conveyor, Stacker, 24" Belt, Portable	10	9.000	90.000	-	-	10	90.000
67	Air Compressor, 600 CFM Portable	5	14.000	70.000	-	-	5	70.000
45	Painter Stripe Self Propelled	2	3.000	6.000	1	3.000	3	9.000
48	Pan Type, Vibrator Compactor 135 lb Class	15	500	7.500	10	5.000	25	12.500
53	Re-winding Machine for Road Brooms	1	1.400	1.400	-	-	1	1.400
68	Wagon Drill w/Hose, Drill Steel, Bits	10	4.000	40.000	-	-	10	40.000
75	Radio Equipment - Fixed & Mobile	180 sets		327.000	-	-	180	327.000
76	Core Drill w/Accessories, skid mtd.	1	4.000	4.000	-	-	1	4.000
77	Cutting Edges for Motor Graders	11,550 sets	28.	323.400	-	-	-	323.400
70	1620 IBM Computer or Equal	1	140.000	140.000	-	-	1	140.000
71	Est. cost of needed shop tools and equipment		300.000	300.000	-	-	-	300.000
72	Est. for components to up grade existing equipment		200.000	200.000	-	-	-	200.000
			Sub total:	7.146.800	Sub total:	977.000		

List Sub Total:	8.123.800
Minus items 70, 71, 72 and 77 due to no spare parts needed:	963.400
Equipment Sub Total:	7.160.400
15% Equipment Spare Parts:	1.074.060
Total equipment and spare parts:	9.197.860
20% of List Sub Total for shipping and insurance:	1.839.572
Est. total cost delivered plus items 70, 71, 72, 77:	11.037.432
Est. total if procurement is made in 1967:	11.037.432
Est. total plus 5% increase in equipment and spare parts cost if procured in 1968:	11.092.619
Est. total plus 5% increase in equipment and spare parts cost if procured in 1969:	11.148.082

		RIO GRANDE DO SUL					NEW GROWTHS	
Item	Equipment	Nº of Units Imp. Nº 1	Est. Unit Cost	Est. Total Cost	Nº of Units Imp. Nº 2	Total Cost	Nº of Units for total implement.	Cost
1	Motor Graders	61	59.000	3.599.000	16	944.000	77	4.543.000
33	Air Compressor, w/3 Jack Hammers	40	13.500	540.000	6	81.000	46	621.000
63	Dump Truck, Heavy Duty, 6-9 cu.yd. capacity	20	25.000	500.000	0	-	20	500.000
75	Front Loader, Wheel Type, 1 1/2 cu.yd. capacity	31	65.000	2.015.000	14	910.000	45	2.925.000
39	Cargo Truck, 5 ton capacity	68	12.000	816.000	13	156.000	81	972.000
41	Tanker, Water Truck, w/3" Pump, 8,000 lt capacity	30	27.700	831.000	8	221.600	38	1.052.600
40	Tanker, Truck Fuel, 2 comp. 1,000 gal. capacity	16	28.000	448.000	7	196.000	23	644.000
50	Asphalt Trans. Tanker, Trailer mtd. w/Heater	4	18.000	72.000	1	18.000	5	90.000
43	Asphalt Distr. Min. 1,000 gal.cap.	2	28.000	56.000	1	28.000	3	84.000
42	Trailer, Tilt Bed, 15 ton capacity	15	6.500	97.500	5	32.500	20	130.000
58	Air Compressor w/2 Pavement Breakers and Spade Tools	*30	1.400	42.000	-	-	*30	42.000
27	Tractor (Wheel) 75 HP	30	10.500	315.000	16	168.000	46	483.000
14	Pick up Truck, Heavy Duty, 3/4 ton capacity	70	8.800	616.000	32	281.600	102	897.600
44	Roller Tandem w/Trailer, 3-5 ton	15	10.000	150.000	8	80.000	23	230.000
46	Vibrating Compactor w/Smooth & Sheepsfoot Drum w/Trailer	30	15.000	450.000	8	120.000	38	570.000
55	Asphalt Plant, Portable, 15 TPH	2	25.000	50.000	2	50.000	4	100.000
51	Truck Tractor for Asphalt Transfer Tanker	4	18.000	72.000	1	18.000	5	90.000
52	Lubrication Unit, Trailer mtd. Heavy Duty	25	8.000	200.000	17	136.000	42	336.000
54	Wheel Tractor w/Hydraulic Backhoe	26	14.000	364.000	12	168.000	38	532.000
56	Asphalt Tank Trailer mtd. 1,000 gal w/Heater	10	14.000	140.000	10	140.000	20	280.000
57	Asphalt Kettle, 300 gal. cap. w/ Heater and Spray Equip.Trailer mtd.	15	15.000	225.000	8	120.000	23	345.000
62	Fuel Tank, Trailer mtd. 1,000 gal capacity	75	12.000	900.000	19	228.000	94	1.128.000
74	Jack Hammers w/Drill Steel, Hose, Bits and Line Oilers	40	1.400	56.000	-	-	40	56.000
73	Concrete Pipe Plant w/Mixer	2	14.000	28.000	-	-	2	28.000
66	Lubrication Unit for Truck Mounting	15	9.000	135.000	6	54.000	21	189.000
71	Est. cost of needed shop tools & Equipment		660.000	660.000	-	-	-	660.000
			Sub total:	13.377.500		4.150.700		

Sub total:	17.500.200
Minus item 71 due to no spare parts needed:	660.000
Equipment Sub total:	16.840.200
10% Equipment Spare Parts:	1.684.020
Total equipment and spare parts:	17.132.700
Plus item 71:	660.000
Est. total if procurement is made in 1967:	17.792.700
Est. total plus 25% increase in equipment and spare parts assuming a two year disbursement period with inflation rate of 25% per annum:	22.240.875

Cost of Vehicle Operation

Optimum Cost of Vehicle Operations per Km in Brazil on flat, smooth surfaced roads Compared to U.S. Costs

	Paved	Gravel	Earth
Heavy Truck (HT)	NCr$ .383	NCr$ .531	[illegible]
In U.S. Dollars	$ .170	$ .197	$ .282
* Comparative U.S. Costs	$ .082	$ .127	$ .216
Medium Truck (MT)	NCr$ .216	NCr$ .322	NCr$ .443
In U.S. Dollars	$ .080	$ .119	$ .164
Interpolated US cost	$ .060	$ .090	$ .140
Passenger Cars (PC)	NCr$ .091	NCr$ .119	NCr$ .146
In U.S. Dollars	$ .034	$ .044	$ .054
	$ .025	$ .032	$ .041

* World Bank Staff Paper Sept. 23, 1965

Operating costs are less taxes and administration. Truck operating costs were obtained by interview of truck companies and passenger car costs are based on observation of cars used by the consultants and their Brazilian counterparts during the course of the transport studies. These costs were then adjusted by the consultants to compensate for road conditions in order to arrive at the cost of operations on a level, smooth surfaced road. While costs appear to be on high side for heavy trucks, when compared to U.S. costs, it should be noted that Brazilian trucks are slightly larger than comparable U.S. trucks; further, Brazilian trucks operate with substantial overloads. Inasmuch as the costs are a result of a study of actual costs for vehicle operations in the Southern states, they are considered appropriate for use in this analysis.

Operating Costs and User Benefit Calculation

By multiplying the traffic distribution by vehicle costs per km by the number of days in the year, the following annual per km cost of vehicle operating costs are calculated:

Paved

	No. of Vehicles	Cost per Km.		
Heavy Trucks	120	x $.142 x 365	=	$ 6,205
Medium Trucks	1083	x .082 x 365	=	32,485
Passenger Cars	1303	x .034 x 365	=	16,060
	Operating Costs per Km			$54,690

Operating cost savings equal 1/2 the difference between costs on gravel roads and paved roads.

	1/2 Cost Diff.	No. of Vehicles		
Heavy Trucks	.0275	x 120 x 365	=	$ 1,204
Medium Trucks	.0195	x 1083 x 365	=	7,650
Passenger Cars	.005	x 1303 x 365	=	2,372
	Savings per Km			$11,226

Gravel

	No. of Vehicles	Cost per Km.		
Heavy Trucks	27	x $.197 x 365	=	$ 1,825
Medium Trucks	241	x .119 x 365	=	10,220
Passenger Cars	115	x .044 x 365	=	1,825
	Operating Costs per Km			$13,870
	10% Operating Cost Savings			$ 1,387

Earth

	No. of Vehicles	Cost per Km.		
Heavy Trucks	29	x $.282 x 365	=	$ 2,920
Medium Trucks	264	x .164 x 365	=	15,695
Passenger Cars	73	x .054 x 365	=	1,460
	Operating Costs per Km			$20,075
	10% Operating Cost Savings			$ 2,007

User savings for conversion of earth roads to gravel = 2/3
The difference of operating costs between earth and gravel roads:

	ADT		2/3 Cost Diff.				
Heavy Trucks	29	x	.057	x	365	=	$ 621
Medium Trucks	264	x	.0299	x	365	=	2,884
Passenger Cars	73	x	.0067	x	365	=	175
			Benefit per Km.				$3,680

User Benefit Flows

Gravel Road

Year	Proportion of Benefit Received		Savings/ Km		No. of Km		Benefit
1970	.0833	x	$1,387	x	12,266	=	$ 1,417,478
1971	.25	x	"	x	"	=	4,253,236
1972	.5	x	"	x	"	=	8,506,471
1973	.75	x	"	x	"	=	12,759,707
1974	.917	x	"	x	"	=	15,600,868
1975	1.0	x	"	x	"	=	17,012,942

Earth Road

1970	.0833	x	$2,007	x	9,481	=	$ 1,585,063
1971	.25	x	"	x	"	=	4,757,092
1972	.5	x	"	x	"	=	9,514,184
1973	.75	x	"	x	"	=	14,271,275
1974	.917	x	"	x	"	=	17,449,013
1975	1.0	x	"	x	"	=	19,028,367

Paved Road

		Benefit/ KM					
1968							
1969							
1970							
1971							
1972							
1973	1/3 x 3/7 =	.3333x	11,226	x	3,620	=	13,544,685
1974	2/3 x " =	.4286x	"	x	"	=	17,417,498
1975	" x " =	" x	"	x	"	=	"

User Benefit from Conversion
of Earth Roads to Gravel Roads

Year	Accumulative Km Converted		User Benefit Per Km	Total Benefit
1970	200	x	$3,680	= 736,000
1971	600	x	"	= 2,208,000
1972	1,200	x	"	= 4,416,000
1973	1,800	x	"	= 6,624,000
1974	2,400	x	"	= 8,832,000
1975	3,000	x	"	=11,040,000

PAVED ROADS

Extra Cost/Km of Maintenance Resulting from the Project

PARANÁ

Year	Equip. on Hand		Extra Cost/Km		No. of Km		Benefit
1969	1/3	x	486	x	1,436	=	230,306
1970	2/3	x	"	x	"	=	467,590
1971	1	x	"	x	"	=	697,896
1972	1	x	"	x	"	=	"
1973	1	x	"	x	"	=	"
1974	1	x	"	x	"	=	"
1975	1	x	"	x	"	=	"

SANTA CATARINA

1969	1/3	x	787	x	552	=	143,360
1970	2/2	x	"	x	"	=	291,064
1971	1	x	"	x	"	=	434,424
1972	1	x	"	x	"	=	"
1973	1	x	"	x	"	=	"
1974	1	x	"	x	"	=	"
1975	1	x	"	x	"	=	"

RIO GRANDE DO SUL

1969	1/3	x	254	x	1,632	=	136,794
1970	2/3	x	"	x	"	=	277,734
1971	1	x	"	x	"	=	414,528
1972	1	x	"	x	"	=	"
1973	1	x	"	x	"	=	"
1974	1	x	"	x	"	=	"
1975	1	x	"	x	"	=	"

GRAVEL ROADS

Extra Cost/Km of Maintenance Resulting from the Project

PARANÁ

Year	Equip. on Hand		Extra Cost/Km		No. of Km		Benefit
1969	1/3	x	215	x	2,411	=	171,060
1970	2/3	x	"	x	"	=	347,305
1971	1	x	"	x	"	=	518,365
1972	1	x	"	x	"	=	"
1973	1	x	"	x	"	=	"
1974	1	x	"	x	"	=	"
1975	1	x	"	x	"	=	"

SANTA CATARINA

1969	1/3	x	218	x	4,600	=	330,924
1970	2/3	x	"	x	"	=	671,876
1971	1	x	"	x	"	=	1,002,800
1972	1	x	"	x	"	=	"
1973	1	x	"	x	"	=	"
1974	1	x	"	x	"	=	"
1975	1	x	"	x	"	=	"

RIO GRANDE DO SUL

1969	1/3	x	346	x	5,255	=	600,016
1970	2/3	x	"	x	"	=	1,218,214
1971	1	x	"	x	"	=	1,818,230
1972	1	x	"	x	"	=	"
1973	1	x	"	x	"	=	"
1974	1	x	"	x	"	=	"
1975	1	x	"	x	"	=	"

EARTH ROADS

Extra Cost/Km of Maintenance Resulting from the Project

PARANÁ

Year	Equip. on Hand		Extra Cost/Km		No. of Km		Benefit
1969	1/3	x	127	x	4,320	=	181,051
1970	2/3	x	"	x	"	=	367,589
1971	1	x	"	x	"	=	548,640
1972	1	x	"	x	"	=	"
1973	1	x	"	x	"	=	"
1974	1	x	"	x	"	=	"
1975	1	x	"	x	"	=	"

SANTA CATARINA

1969	1/3	x	272	x	1,156	=	103,763
1970	2/3	x	"	x	"	=	210,669
1971	1	x	"	x	"	=	314,432
1972	1	x	"	x	"	=	"
1973	1	x	"	x	"	=	"
1974	1	x	"	x	"	=	"
1975	1	x	"	x	"	=	"

RIO GRANDE DO SUL

1969	1/3	x	216	x	4,005	=	285,476
1970	2/3	x	"	x	"	=	579,604
1971	1	x	"	x	"	=	865,080
1972	1	x	"	x	"	=	"
1973	1	x	"	x	"	=	"
1974	1	x	"	x	"	=	"
1975	1	x	"	x	"	=	"

Producer Benefit-Based

1972	1/7	x	971	x	3,620	=	502,146
1973	"	x	"	x	"	=	"
1974	"	x	"	x	"	=	"
1975	"	x	"	x	"	=	"

Cost of Maintenance

In order to arrive at costs of maintenance, the USAID requested the various states to submit cost data on maintenance. Both Santa Catarina and Paraná maintained sufficiently detailed records to allow a computation of costs per KM. The state of Rio Grande do Sul was unable to submit such information; therefore in the final analysis, the RGS costs were established by adjusting Santa Catarina costs for RGS ADT.

Paraná

Table II shows the historical 1966 costs in the state of Paraná. The actual costs computed from these records were high because of an oversupply of labor. Therefore arbitrary reductions of from 40 percent to 60 percent were made in labor in attempt to arrive at the "real" or effective cost of maintenance. This resulted in the following costs per KM:

Paved.	Gravel	Earth
(*) $1067	$1266	$436

Gravel road maintenance costs, even after these reductions, were high. An analysis of the cost data indicated extremely heavy costs for maintenance and repair of equipment. This led to a line of questioning with the highway department which resulted in the tentative conclusion that a worn out equipment pool was resulting in large inefficiencies of operation which were substantially increasing maintenance costs. The consultants in an earlier study to determine the economies of replacing existing worn out equipment, indicated, in their report, that operating costs for the existing level of maintenance could be reduced by 10% to 30% through an equipment replacement program. This is a producer benefit included in this program including cost of equipment; however lack of adequate data prevents segregation of this benefit, which will

(*) These and all costs are Feb. 67 costs converted to dollars at US$1,00 = NCr$2,70.

be reflected in the other benefits. This producer benefit is the reason why the difference between (1) the cost of present level of maintenance, and (2) the cost of the future level of maintenance is less than the 40% estimated by the consultants.

However, while present inefficiencies, which will mainly affect motor grader operations, are undoubtedly highest for gravel roads, the calculated costs for Paraná are much too high. Therefore for purposes of this analysis, the Santa Catarina cost for gravel road maintenance will therefore be used. In summary, the costs per Km to be used for Paraná are:

Paved	Gravel	Earth
$1067	$583	$436

Santa Catarina

The state of Santa Catarina submitted the following breakdown of costs:

	(1966 Cruzeiros) Millions of Cr$
60% of Total Admin. Exp.	0.548
50% of Consumption of residency & Headquarter materials	.212
50% of third person services	.043
Labor social overhead charges for maintenance personnel	.815
Direct maintenance expenses	5.408
Equipment depreciation	1.130
Total	8.173

On the basis of the total KM of roads in SC, the above cost results in the following costs of maintenance per KM in Feb. 1967 cruzeiros.

Paved	NCr$ 2,921
Gravel	NCr$ 1,816
Earth	NCr$ 1,111

These costs appear to be more or less in line with the consultants estimates, adjusted to the same date:

Paved	NCr$ 2,847
Gravel	NCr$ 2,018
Earth	Ncr$ 1,436

Equipment & depreciation were then removed from the unit costs to arrive at the following per/KM costs:

Paved	Gravel	Earth
NCr$ 2,501	NCr$ 1,573	NCr$ 969
$ 926	$ 583	$ 359

These figures appeared reasonable in relation to available information and were accepted for use in the analysis.

Rio Grande do Sul

As this state was unable to present cost data, the Santa Catarina costs were extrapolated by increases due to difference in ADT to arrive at the following:

Paved	Gravel	Earth
$ 961	$ 543	$ 359

US$ Per/KM Cost of Present Maintenance - TABLE A

	Paved	Gravel	Earth
Paraná			
(1) Adjusted for labor	$ 1,067	$ 583	$ 436
(2) 20% reduction	858	466	348
(3) Adjust.for 1970 ADT	965	673	411
Santa Catarina			
(1) Adjusted for labor	$ 926	$ 583	$ 359
(2) 20% reduction	740	466	287
(3) Adjust.for 1970 ADT	833	673	339
Rio Grande do Sul			
(1) Adjusted for labor	$ 961	$ 543	$ 359
(2) 20% reduction	769	423	287
(3) Adjust.for 1970 ADT	865	626	339

Projected Costs - TABLE B

Paraná			
(1) Adjusted for labor	$ 1,290	$ 615	$ 455
(2) Adjust.for 1970 ADT	1,451	888	538
Santa Catarina			
(1) Adjusted for labor	$ 1,440	$ 617	$ 517
(2) Adjust.for 1970 ADT	1,620	891	611
Rio Grande do Sul			
(1) Adjusted for labor	$ 995	$ 673	$ 490
(2) Adjust.for 1970 ADT	1,119	972	555

A comparison of the present and future costs (line (1) in tables A & B) showed that with the exception of paved roads in RGS and earth roads in Paraná (the present costs for which appear to be approximately equal to projected future costs), projected

future costs are approximately 20% higher than present costs. The consultants in their evaluation of maintenance estimated that present costs were approximately 60% of the cost of a satisfactory maintenance level. The USAID review of maintenance costs and operations in the southern states indicates that in the present maintenance costs are certain inefficiencies. These include (1) inefficiencies resulting from worn out and therefore inefficient equipment, and (2) inefficiencies as a result of inefficient maintenance practices. The first inefficiencies (which will be corrected by the procurement project) are real costs of the present level of maintenance. The second, however, are correctible without new equipment and should not, in a comparison of the two costs, be included as a cost to be reduced by the equipment project. (They would in fact be reduced by technical assistance whether new equipment is made available or not).

It is impossible, however, to quantify these inefficiencies. The consultants in an earlier study, estimated that operating costs of maintenance could be reduced by 10% to 30% by a program to replace older equipment which hold outlived an economically useful life. With respect to uneconomic practices, its is estimated that inefficiencies of operation cause as increase in cost of 5% to 10%. In view of the impossibility of quantifying these two costs, it was decided, for purposes of this analysis, to (1) arbitrarily reduce present costs by 20% to eliminate the "inefficient practices" costs which will be removed by TA rather than equipment, and (2) not attempt to segregate the producer efficiency benefits which will result from new equipment, but rather to let these be reflected in the overall benefits. The present costs, reduced by 20% are listed in column 2 of the above table.

The difference between the present costs and future costs are as follows:

	Paved	Gravel	Earth
Paraná	$ 486	$ 215	$ 127
Santa Catarina	$ 787	$ 218	$ 272
Rio Grande do Sul	$ 254	$ 346	$ 216

INTERNAL RATE OF RETURN CALCULATION

	1968	1969	1970	1971	1972	1973	1974	1975
INVESTMENT (US$000)	17,700	17,700	17,700	-	-	-	-	-
RIO GRANDE DO SUL								
Earth	-	285	580	865	865	865	865	865
Gravel	-	600	1,218	1,818	1,818	1,818	1,818	1,818
Paved	-	137	278	415	415	415	415	415
Total - RGS	17,700	18,722	19,776	3,098	3,098	3,098	3,098	3,098
SANTA CATARINA								
Earth	-	104	211	314	314	314	314	314
Gravel	-	331	672	1,003	1,003	1,003	1,003	1,003
Paved	-	143	291	434	434	434	434	434
Total - SC	-	578	1,174	1,751	1,751	1,751	1,751	1,751
PARANA								
Earth	-	181	368	549	549	549	549	549
Gravel	-	171	347	518	518	518	518	518
Paved	-	230	468	698	698	698	698	698
Total - PR	-	582	1,183	1,765	1,765	1,765	1,765	1,765
TOTAL INVESTMENT	17,700	19,882	22,133	6,614	6,614	6,614	6,614	6,614
DISCOUNTED VALUE AT 15%	16,519	16,134	15,619	4,058	3,529	3,069	2,669	2,320
USER BENEFIT FLOWS								
Earth	-	-	1,585	4,757	9,514	14,271	17,449	19,028
Gravel	-	-	1,417	4,253	8,506	12,760	15,601	17,013
Paved	-	-	-	-	-	13,545	17,417	17,417
Earth-Gravel Conver.	-	-	736	2,208	4,416	6,624	8,832	11,040
Sub-Total	-	-	3,738	11,218	22,436	47,200	59,299	64,498
PRODUCER BENEFIT FLOW-PAVED	-	-	-	-	502	502	502	502
Total - BENEFIT FLOW	-	-	3,738	11,218	22,938	47,702	59,801	65,000
DISCOUNTED BENEFIT FLOW AT 15%	-	-	2,638	6,883	12,240	23,134	24,130	22,802
Total - INVESTMENT	17,700	19,882	22,133	6,614	6,614	6,614	6,614	6,614
Total - BENEFITS	-	-	3,738	11,218	22,938	47,702	59,801	65,000
Net BENEFIT FLOW	(17,700)	(19,882)	(18,395)	4,604	16,324	41,088	53,187	58,386
PRESENT VALUE FACTOR 25%	.8963	.7170	.5736	.4589	.3671	.2937	.2350	.1880
PRESENT VALUE AT 25%	(15,865)	(14,255)	(10,551)	2,113	5,993	12,068	12,499	10,977

$$\text{RATE OF RETURN} = 25 + \frac{2,979}{2,979 + 4,114} \times 5.0$$

RATE OF RETURN = 27.1%

Average Daily Traffic

The ADT information provided by the consultant were stated in Motor Truck Units (MTU).

In determining the averages of MTU, see Table I, the medium traffic was taken as the average traffic for the range and multiplied by the number of kilometers of traffic in the column. For example, (See Table I); in the ADT column, 0 to 100, 50 vehicles were used as the average traffic count and multiplied by the number of km's in the column to get a traffic weighted km figure. The sum of the traffic weighted km's for each type of road was then divided by the total km's to get the average ADT. For the final category (over 1000 and over 750) the average traffic was considered to be 1,500 and 1,000 respectively for paved roads, and 1,000 and 750 respectively for other classes of roads. These assumptions are considered to be extremely conservative for traffic counts of 2,500 and above are common on a substantial number of paved roads in these states. The averages thus developed are as follows:

Motor Truck Units

Type of Road	ADT Average 1965		Projected 1969 ADT
paved	$953 \times (1.06)^4$	=	1203
gravel	$212 \times (1.06)^4$	=	268
earth	$232 \times (1.06)^4$	=	293

These motor Truck Units are then converted to what the consultants call, the average traffic distribution for each type of road, using the following formula:

A. Paved

Heavy Trucks = 1203 x 10% = 120
Medium Trucks = 1203 - 120 = 1083
Passenger Cars = $\frac{1203 \times .52}{.48}$ = 1303

B. Gravel

Heavy Trucks	=	268 x 10% = 27
Medium Trucks	=	268 - 27 = 241
Passenger Cars	=	$\frac{268 \times .30}{.70}$ = 115

C. Earth

Heavy Trucks	=	293 x 10% = 29
Medium Trucks	=	293 - 29 = 264
Passenger Cars	=	$\frac{293 \times .20}{.80}$ = 73

1965 TRAFFIC COUNTS - SOUTHERN STATES
(in motor truck units)

Paraná	0 - 100	100 - 200	200 - 350	350 - 500	500 - 1000	Over 1000
Macadam		21	144	30	108	
Asphalt			16	15	78	643
Gravel	151	349	501	427	362	27
Earth	770	1059	1288	430	512	185

Santa Catarina	0 - 50	50 - 250	250 - 400	400 - 750	Over 750
Macadam		6	8	3	51
Asphalt		53	4	15	269
Gravel		2915	833	617	219
Earth		974	66	53	62

Rio Grande do Sul	0 - 100	100 - 200	200 - 350	350 - 500	500 - 1000	Over 1000
Macadam	20	15			16	
Asphalt	8		154	542	240	637
Gravel	1132	1748	1496	488	357	34
Earth	1286	1942	577	94	89	17

ADT in passenger car units may be obtained by multiplying by 2.5.

PARA[illegible]
Cash Fl[illegible] Statement
(NCR$ 000)

EXPENDITURES	1964	1965	1966	1967	1968	1969	1970	1971	1972
1. Current Expenditures									
Personnel, material, miscellaneous	13.7	18.7	19.9	31.1	32.6	34.2	35.9	37.7	39.6
2. Current Transfers									
Subsidies & Contributions	1.1	2.2	2.0	2.6	2.7	2.8	3.0	3.1	3.2
Interest on public debt	-	0.5	-	-	-	-	-	-	-
Interest on A.I.D. equipt. loan *	-	-	-	-	0.2	0.3	0.3	1.3	1.6
Interest on A.I.D. Coffee Road Loan	-	-	0.1	0.1	0.1	0.2	0.2	0.2	0.2
Interest on Reg. Devlpt. Bank Loan	-	-	-	0.1	0.1	0.1	0.1	-	-
Interest on other eventual loans	-	-	-	0.2	0.2	0.2	0.2	0.3	0.3
3. Capital Expenditures									
Public Works	29.7	43.77	37.71	143.1	166.0	176.05	186.7	198.5	210.7
Equipment & Installations	5.5	1.8	5.6	-	-	-	-	-	-
A.I.D. Equipment Loan									
Imported equipment	-	-	-	-	12.2	12.2	-	-	-
Domestic equipment	-	-	-	-	2.5	2.5	-	-	-
State contribution for equipment									
Tied to A.I.D. loan	-	-	-	-	3.0	3.0	-	-	-
General	-	-	-	2.0	-	-	2.0	2.4	3.0
Permanent supplies	0.3	0.3	0.2	0.6	0.6	0.6	0.7	0.7	0.7
4. Financial Investments									
Expropriation of real estate	0.1	0.1	0.2	0.3	0.3	0.3	0.4	0.4	0.4
5. Capital Transfers									
Amortization of public debt	-	2.7	-	-	-	-	-	-	-
Amortization A.I.D. loan									
Imported equipment	-	-	-	-	-	-	-	2.1	2.1
Domestic equipment	-	-	-	-	-	-	-	0.5	0.5
Amortization Coffee Road loan	-	-	-	0.2	0.2	0.2	0.2	0.2	0.2
Amortization Reg. Devlpt. Bank loan	-	-	-	0.3	0.3	-	0.7	0.3	-
Amortization other eventual loans	-	-	-	0.4	0.5	0.8	0.2	0.6	1.0
TOTAL	50.4	70.07	65.71	181.0	221.5	233.45	230.6	248.8	264.5
* Interest Equip. loan									
USAID	-	-	-	-	0.15	0.225	0.225	1.35	1.20
Wheat Fund	-	-	-	-	0.05	0.075	0.075	0.45	0.40
Total	-	-	-	-	0.20	0.300	0.300	1.80	1.60

PARANÁ - D.E.R.
Cash Flow Statement
(NCR$ 000)

	1964	1965	1966	1967	1968	1969	1970	1971	1972
REVENUES									
A. Budget									
1. Revenues from Taxes									
Highway tax	1.7	2.6	2.3	2.5	2.6	2.8	2.9	3.0	3.2
2. Revenues from Assets									
Dividends	-	-	0.04	0.2	0.2	0.2	0.2	0.3	0.3
3. Industrial Revenues									
Own revenues	0.3	0.4	0.07	0.6	0.6	0.6	0.6	0.7	0.7
4. Current Transfers									
National Highway Fund	9.8	16.1	16.5	12.5	13.9	15.4	17.1	19.0	21.1
Tax on Circulation of Goods	-	-	-	-	15.0	16.6	18.4	20.4	23.4
State contributions	4.9	11.4	14.3	25.6	26.9	28.2	29.6	31.1	32.7
5. Capital Revenues									
Credit Operations:									
CODEPAR	20.1	16.2	12.6	-	-	-	-	-	-
Regional Devlpt. Bank	0.7	0.07	1.[illegible]	-	-	-	-	-	-
Paraná State Bank	3.0	0.7	[illegible]	-	-	-	-	-	-
A.I.D., Coffee Road	-	13.4	-	-	-	-	-	-	-
IBRD	-	-	-	-	11.	11.0	-	-	-
Other	-	-	-	30.0	20.5	22.1	34.7	36.4	38.2
A.I.D. Equipment Loan									
Imported equipt.	-	-	-	-	12.15	12.15	-	-	-
Domestic equipt.	-	-	-	-	2.5	2.5	-	-	-
6. Capital Transfers									
State contribution for construction	4.4	1.3	4.0	97.4	102.3	107.4	113.0	118.7	124.6
State contrib. for equipment	-	3.3	7.5	2.0	-	-	2.0	2.4	3.0
State contrib. A.I.D. equip. loan	-	-	-	-	3.0	3.0	-	-	-
State contrib. interest A.I.D. loan	-	-	-	-	0.15	0.3	0.3	1.3	1.6
State contrib. amortization A.I.D. loan									
Imported equipment	-	-	-	-	-	-	-	2.1	2.1
Domestic equipment	-	-	-	-	-	-	-	0.5	0.5
7. Miscellaneous Revenues									
Fines	0.2	0.1	0.3	0.2	0.2	0.2	0.2	0.2	0.3
Agreements with D.N.E.R.	3.2	2.7	3.0	10.0	10.5	11.0	11.6	12.2	12.9
Other	-	-	1.6	-	-	-	-	-	-
B. NON-BUDGET REVENUES	2.1	1.8	2.4	-	-	-	-	-	-
TOTAL	50.4	70.07	65.71	181.0	221.50	233.45	230.6	248.8	264.5

SANTA CATARINA - D.E.R.

Cash Flow Statement
(NCr$ 000)

	Actual					Projection						
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	Total
Revenues												
Budget												
Assets	2.4	1.4	3.5	11.2	1.4	0.5	1.0	2.0	4.0	8.0	16.0	51.4
Current Transfers	76.9	-	309.7		-	-	-	-	-	-	-	386.6
Other	157.8	20.0	27.7	31.9	297.2	18.0	27.0	35.0	40.0	49.0	65.1	768.7
USAID Loan	-	-	-	-	-	-	8,100.0	6,100.0	3,510.0	-	-	19,710.0
PL-480 Loan	-	-	-	-	-	-	2,500.0	2,500.0	-	-	-	5,000.0
Sale of Real Estate	0.5	0.4	0.8	-	-	1.2	2.1	3.3	4.6	6.5	8.0	27.3
Federal Government:												
Sale Tax	644.8	1,323.0	1,664.0	5,655.6	7,656.1	6,000.0	6,000.0	8,000.0	10,000.0	12,500.0	15,000.0	74,443.5
D.N.E.R.	-	-	-	-	-	-	2,400.0	4,300.0	5,000.0	5,500.0	6,000.0	23,200.0
I.C.M.	-	-	-	-	-	-	3,600.0	5,000.0	7,500.0	9,000.0	10,000.0	35,100.0
State Government	600.0	1,581.5	3,102.9	2,933.8	4,086.0	9,942.9	10,590.0	13,310.1	20,012.5	22,107.9	34,468.5	123,236.1
Non-Budget												
Agreements:												
S.V.O.P	-	17.0	-	-	-	-	-	-	-	-	-	17.0
PLAMEG	304.0	557.4	924.6	1,550.2	1,528.1	-	-	-	-	-	-	4,865.1
Total	1,786.4	3,500.7	6,033.2	10,182.7	13,569.6	15,962.6	33,220.1	41,750.4	46,071.0	49,171.4	65,557.6	266,005.7
Expenditures												
Budget												
Current	318.5	477.8	1,554.5	1,142.4	1,608.0	2,486.7	3,332.3	4,577.6	6,404.0	9,073.5	12,969.9	43,945.2
Current Transfers	74.4	136.8	225.8	428.7	459.8	1,034.6	1,546.7	2,312.7	3,458.7	5,173.7	7,740.4	22,592.3
Services under Special Programs (maintenance and new construction)	1,213.9	3,550.4	2,767.7	4,720.7	6,071.3	10,390.2	14,546.0	20,364.4	28,510.2	30,000.0	40,000.0	162,134.8
Equipment and Installations with Resources from:												
USAID	-	-	-	-	-	-	8,100.0	6,100.0	3,510.0	-	-	19,710.0
PL-480	-	-	-	-	-	-	2,500.0	2,500.0	-	-	-	5,000.0
State	160.7	601.8	15.2	963.7	3,166.1	1,945.0	2,400.0	2,400.0	2,400.0	1,000.0	900.0	15,952.5
Office Supplies	42.2	598.1	4.4	22.3	18.4	46.1	69.1	103.7	155.5	233.3	350.0	1,643.1
Amortization and Interest:												
USAID	-	-	-	-	-	-	486.0	972.0	1,182.6	2,600.5	2,701.9	6,143.0
PL-480	-	-	-	-	-	-	150.0	300.0	300.0	710.4	685.4	2,145.8
Assistance to Municipios	-	-	0.3	32.1	17.0	60.0	90.0	120.0	150.0	180.0	210.0	859.4
Non-Budget												
Agreements - PLAMEG	-	-	921.1	1,550.2	1,528.9	-	-	-	-	-	-	4,000.2
Total	1,809.7	5,364.9	5,489.0	8,860.1	12,869.5	15,962.6	33,220.1	41,750.4	46,061.0	49,171.4	65,557.6	266,126.3

PROSPECTIVE REVENUES, DNER

In Thousands of New Cruzeiros

	1962	1963	1964	1965	1966
National Highway Fund	2,011	3,481	6,542	18,003	23.835
Transport Tax	1,200	2,375	5,367	9,250	13,320
State Contribution	2,158	1,587	3,256	2,500	11,000
Highway Tax	85	100	100	394	1,019
Miscellaneous	183	339	115	836	215
Credit Operations (a) Rio Grande do Sul North Road	-	-	-	4,911	10,089
T O T A L S	5,617	7,882	15,380	35,894	59,477

DAER - EFFECTIVE EXPENSES

housands of New Cruzeiros)

	1962	1963	1964	1965	1966
Current Expenditures					
Personnel, Consumption Materials, Outside Services, General	1,440	1,548	4,116	7,933	15,200
Capital Expenditures					
Tractors and Road Equipment, Vehicles	727	209	1,091	1,566	1,880
Office Machines, Furniture, Appliances and Tools	138	50	343	310	438
Road Construction	2,519	3,874	3,905	14,450	28,301
Road Maintenance	792	2,185	5,724	11,341	13,057
Buildings	-	18	200	500	600
(a) New Buildings for DAER and 5 new Residencies.					
Total:	5,617	7,883	15,380	36,095	59,477

Note: The expenditures with road maintenance include expenditures with personnel, repair of road maintenance equipment and vehicles, and materials used in road maintenance.

DAER - REVENUE PROJECTION

(New Cruzeiros)

	1967	1968	1969	1970	1971	1972
National Highway Fund	27,000,000	33,750,000	42,187,500	52,734,375	65,917,968	82,397,460
Share Investment Fund	20,063,259	25,079,075	31,348,841	39,186,051	48,982,563	61,228,204
State Contribution	12,000,000	15,000,000	18,750,000	23,437,500	29,296,875	36,621,094
Highway Tax	1,700,000	2,125,000	2,656,250	3,206,562	4,008,202	5,010,252
Miscellaneous	215,000	268,750	335,937	419,921	524,901	656,126
Credit Operations						
USAID - PS/13 T.N.	25,000,000	20,000,000	-	-	-	-
USAID - Equipment	-	15,217,500	15,217,500	-	-	-
T O T A L S	85,978,259	111,440,325	110,496,028	118,984,409	148,750,509	185,913,136

DAER - EXPENSES PROJECTION

(In Thousands of New Crudeiros)

	1967	1968	1969	1970	1971	1972
Current Expenditures						
Personnel, Consumption Materials, Outside Services, General	17,952	21,342	26,678	33,316	41,644	52,056
Capital Expenditures						
Tractors and Road Equipment, Vehicles	1,143	20,646	21,000	2,231	2,790	3,487
Aircraft	250	-	-	-	-	-
Office Machines, Furniture, Appliances and Tools	430	537	672	840	1,050	1,310
Road Construction	46,058	45,005	32,179	45,281	53,088	65,124
Road Maintenance	18,513	22,867	28,583	35,695	44,619	55,774
Buildings	1,550	762	953	1,190	1,487	1,859
Amortization Foreign debt						
Loan USAID - T.N.	82	235	386	386	836	3,084
Loan USAID - Equipment	-	45	45	45	3,219	3,219
Totals	85,378	111,440	110,486	118,948	148,730	185,913

Note: The amortization of the foreign debt includes principal and interest.

Factors based on the General Wholesale Price Index (Conjuntura Econômica, Vargas Foundation) to convert current cruzeiros into cruzeiros of January, 1967:

Year	Factor
1961	11.965
1962	7.807
1963	4,499
1964	2.348
1965	1.553
1966	1.141
1967 (Jan.)	1.000
1967	0.800

State Revenues and Expenditures, in millions of new Cruzeiros of January, 1967

	Year	Revenues	Expenditures	Surplus or (Deficit)	% of Revenues
Rio Grande do Sul	1963	357.2	408.0	(50.8)	14
	1964	384.4	382.4	2.0	.5
	1965	367.3	403.9	(36.6)	10
	1966	448.4	492.9	(44.5)	10
	1967	425.4	442.0	(16.6)	4
Santa Catarina	1963	100.8	98.1	2.7	.3
	1964	100.0	82.4	17.6	18
	1965	110.4	117.9	(7.5)	7
	1966	102.7	102.7	-	-
	1967	92.7	98.4	(5.7)	6
Paraná	1963	169.4	169.1	.3	-
	1964	182.3	170.0	12.3	7
	1965	297.7	286.4	11.3	4
	1966	434.7	368.7	66.0	15
	1967	443.2	443.1	.1	-

Source: 1963/65, State Financial Reports; 1966-67, State Budgets.

Expenditures by Major Functions (in Thousands new Cruzeiros of January, 1967)

	1961	1962	1963	1964
Rio Grande do Sul				
Health & Education	119,650	107,737	115,174	70,205
Public Services	47,860	47,623	51,738	15,262
Social Assistance	37,091	33,570	41,841	40,151
Development	25,126	25,763	22,495	14,088
Total	229,728	214,692	241,249	139,706
Total Expenditures	408,000	369,271	408,059	382,254
Percent 4 Functions	56%	58%	57%	37%
Santa Catarina				
Health & Education	17,947	20,298	19,796	15,966
Public Services	10,768	29,667	36,892	30,054
Social Assistance	5,982	5,465	5,849	8,453
Development	2,393	2,342	3,599	3,522
Total	37,091	57,772	66,135	57,996
Total Expenditures	80,165	85,096	98,078	82,415
Percent 4 Functions	46%	68%	67%	70%
Parana				
Health & Education	45,467	41,377	44,090	44,847
Public Services	50,253	64,017	91,780	50,247
Social Assistance	22.733	23,421	22,045	16,906
Development	7,179	32,009	11,697	8,453
Total	125,632	153,017	169,612	120,452
Total Expenditures	181,868	255,289	246,995	184,788
Percent 4 Functions	69%	60%	69%	65%

Source: Statistical Yearbooks, IBGE

Planned Expenditures in 1967, by Major Budget Categories (in thousand new Cruzeiros of January, 1967)

Rio Grande do Sul	Current	Capital	Total	%
1. General Administration	93,590	4,208	97,798	22
2. Public Debt and Other Obligations	11,994	6.126	18,120	4
3. Natural Resources & Agriculture	13,128	2,202	15,330	3
4. Power	71	30,412	30,483	7
5. Transport & Communications	17,790	25,464	43,254	9
6. Industry & Commerce	1,578	11,486	13,064	3
7. Health & Education	139,300	1,420	140,720	32
8. Labor & Social Assistance	77,898	1,070	78,968	18
9. Housing & Urban Development	1,241	3,000	4,241	1
Total	356,590	86,388	441,978	100
Percent	80%	20%	100%	

Santa Catarina				
1. General Administration	20,313	27,146	47,459	48
2. Public Debt & Other Obligations	729	475	1,204	1
3. Natural Resources & Agriculture	1,419	1,246	2,665	3
4. Power	309	647	956	1
5. Transport & Communications	-	32	32	-
6. Health & Education	24,983	473	25,456	26
7. Labor & Social Assistance	9,811	5	9,816	10
8. Housing & Urban Development	1,708	9,134	10,842	11
Total	59,272	39,158	98,430	100
Percent	60%	40%	100%	

Paraná				
1. General Administration	62,180	24,000	86,180	19
2. Public Debt & Other Obligations	13,129	78,192	91,321	21
3. Natural Resources & Agriculture	9,378	1,786	11,164	2
4. Power	2,203	16,281	18,484	4
5. Transport & Communications	22,613	85,833	108,446	24
6. Industry & Commerce	129	440	569	1
7. Health & Education	83,998	4,248	88,246	20
8. Labor & Social Assistance	29,200	169	29,369	7
9. Housing & Urban Development	2,404	6,975	9,379	2
Total	225,234	217,924	443,158	100
Percent	51%	49%	100%	

Source: State Budgets

SUMMARY REVIEW OF THE STATES' FINANCES

In reviewing the conditions of the states' finances, it is useful to note the significant changes which were introduced by recent legislation in two major aspects of the state financial administration. The first important piece of legislation is federal law 4320 of March 17, 1964 which changed the format and made uniform the contents of public budgets and annual financial reports at the federal, state and municipal levels. A great improvement was the basic separation of current and capital revenues and expenditures. Previously, the budgets were divided into budgetary and extra-budgetary revenues and expenditures by broad categories of activities, and the disparities in the classification of specific items in the budgets among different states made analyses and comparisons of investments, for example, practically impossible. Now the budgets at the three levels of administration (federal, state, and municipal) represent in fact a government action program in detail and reflect the economic and financial policies to be followed. Each year's budget proposal shall contain a specific statement of sources and application of funds for investment projects covering a period of no less than three years in the future. This statement is to be up-dated every year, so that the investment program always covers three years. The significance of this innovation can best be appreciated if we note that the states and municipalities will be responsible for approximately one-third of the total investment in the public sector, called for by the present GOB five-year investment program (as part of the Ten-Year Development Plan). Given the relative confusion and the obscurities in the state budgets in the past, the new budget legislation signifies a true revolution in state administration. Although most of the states have not been able as yet to prepare their budgets fully in accordance with the new rules, there is evidence that for fiscal year 1968 they will all do so. The 1967 budgets of the three Southern states, Rio Grande do Sul, Santa Catarina and Paraná, already follow the new classification (Exhibits

The other important pieces of legislation affecting the states' finances was the 18th Amendment to the Constitution, December 1st, 1965, which restructured Brazil's tax system effective January 1, 1967. Previously, the states had the following taxes: (1) stamp tax, (2) tax on documents, (3) tax on minerals, (4) inheritance tax, (5) transactions tax, (6) tax on tobacco and its by-products, and (7) liquor tax. By far the most important tax was the transaction (or sales) tax, which generated, on the average, about 85 percent of the states' own revenues and over one-half of their total revenues, including the states' shares of various federal taxes (e.g., 10% of the income tax collected in each particular state; transfers for special purposes such as the states' share of the tax on electric power, of the tax on fuels and lubricants, etc.)

With the tax reform, the states may now levy only three types of taxes: (1) tax on the circulation of goods (ICM) which replaces the former sales tax, (2) tax on transfer of real property and related rights; and (3) tax on valorization of real estate as a result of public works. Of the proceeds of the ICM, the states retain 80% and transfer 20 percent to municipalities. The states may also retain that part of the federal income tax which they withhold as payers. There is no state income tax. An innovation of the new tax system is that the states may now collect the ICM also on petroleum products used by road transport vehicles only. The tax rate is 10.5 percent on the lowest cost, to dealers, of petroleum products consumed by road vehicles. It is to be paid monthly by the petroleum distributors directly to the state treasury where the products are consumed, and its proceeds may be used only for road construction and maintenance programs. This is an innovation in that for more than 20 years only one federal tax was imposed on petroleum products. The state ICM on these products was originally to become effective beginning April 1, 1967, but the new Federal Administration which took office March 15,

postponed its application until January 1st, 1968 for fear it might have unduly high repercussions on prices, particularly in view of the fact that in the period of transition from the old system to the new ICM system there is considerable uncertainty as to the effects of the new tax. The states will continue to share in the proceeds from the federal tax on petroleum products which is now divided up 60 percent for the Federal Government, 32 percent for the states and 8 percent for the municipalities. Formerly, the state sales tax varied in the different states between 4 and 7 percent of the gross value of each sales or transaction. Under the new system, the tax is applied on the value of the sale minus the tax paid in the preceeding stages of the production process, including the taxes on raw materials, which are all deducted. A trial rate of 12 percent was established for all states during the first half of 1967. The tax yields during these six months will indicate the potential of the tax and permit an assessment of the level at which the tax rate should be set as appropriate for each state. Subsequently, the Congress will establish the maximum rate which may be charged by all states. While the former transactions tax represented about one-half of the states' total revenues, as estimated in the 1967 budgets for the three southern states it will represent considerably more, as shown below:

(Current Cruzeiros)

	Rio Grande do Sul	Santa Catarina	Paraná
		(NCr$ 1,000)	
ICM	455,000	98,000	458,040
Total Revenues	552,475	123,038	553,963
% ICM	82%	80%	83%

As to the expenditures, in the past, with the traditional type of budget, it was impossible to know from the published documents precisely the kinds of expenditures that were made. In the last few years, Rio Grande do Sul spent an average of 52% of its total expenditures on health and education, public services, social assistance, and development; Santa Catarina,

an average of 62%, and Parana 65%. The budgets for 1967 already follow the new standard classification and thus provide more meaningful details (Exhibits), but the three-year investment program was not incorporated yet in the budget. This probably depends on each states' working out its overall economic development plan. The ICM will fluctuate, of course, with the level of economic activity, and the fact that this tax constitutes such a great portion of the states' resources will mean occasional shortfalls in the execution of the budgets. The states usually meet these shortfalls by borrowing from the Bank of Brazil against tax collections and also, infrequently, by issuing short-term state bonds. But the deficits have not been large. In the past few years they have averaged about 7 percent of revenues for the three southern states.