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NICARAGUA

PROGRAM TO CONSTRUCT AND IMPROVE RURAL ROADS

(NI0033)

PROJECT REPORT

NOVEMBER 1976

NICARAGUA
LOCAL ROAD CONSTRUCTION AND MAINTENANCE PROGRAM

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I. INTRODUCTION

A. Background Information and Priority

- 1.01 On April 30, 1976 the Government of the Republic of Nicaragua submitted an application to the Bank for a loan in the equivalent of US\$18.6 million for partial financing of a program on construction and improvement of about 300 kilometers of local roads. The total cost of that program had been calculated at the equivalent of US\$23.2 million. The government has attached top priority to this program and it is part of the programs scheduled for implementation under the National Development Plan 1975-1979.
- 1.02 Between August 9 and 20, 1976, a mission from the Bank visited Nicaragua to conduct the technical, economic, financial and institutional analysis of the program. As the result of this and the subsequent analysis at headquarters, a program was defined for construction and improvement of about 390 kilometers of local roads at a total estimated cost of US\$22.5 million equivalent. The Bank would participate in the financing by means of a loan in the equivalent of US\$18 million, which would cover 80% of the total cost of the program.
- 1.03 The Government of Nicaragua submitted the application for this loan based on technical and economic feasibility studies for 605 km of local roads 1/ conducted by the firm of Baker-Wibberly International in consortium with Octavio Salinas M. y Asociados. These studies were financed mainly through the technical cooperation on a contingent recovery basis ATC/TF(SP)-1295-NI granted by the Bank to the Ministry of Public Works of the Republic of Nicaragua in June 1974 for the equivalent of US\$750,000.
- 1.04 These studies delivered in May 1976 represent the first stage of the operation. A second stage calls for the preparation of final designs, construction plans, cost estimates and bidding documents for 300 km of roads comprising the program. Of that second stage the consulting firm has delivered the work corresponding to 6 roads with a total length of 167.28 km. The consulting firm has up to May 1976 to complete the design of four of the remaining roads, which would make up the 300 km of designs contracted.

1/ The list of projects studied, together with their rates of return, is shown in Annex A.

1.05 Up to the present time, the Bank has granted two loans to the Republic of Nicaragua for highway programs. The loan contract for the first one (63/SF-NI) was signed on October 25, 1965. That loan amounted to the equivalent of US\$12 million and was used for partial financing of a program to build and improve about 458 kilometers of local roads in several parts of the country at a total estimated cost of US\$18,929,000 equivalent. The implementation was under the General Bureau of Roads (DHC) of the Ministry of Public Works (MOP). The contract for the second loan (305/SF-NI) was signed on November 23, 1971. It was in the equivalent of US\$3,500,000 and was also executed by the MOP through the DGC. The project at a total cost originally estimated at US\$5,040,000 includes the expansion and strengthening of the maintenance system on the highway network of Nicaragua through: (i) the procurement of machinery, equipment and spare parts for the maintenance of secondary roads and for the construction of maintenance camps and shops; and (ii) technical assistance for strengthening and reorganizing the financial management system of the Department of Roads. The date for last disbursement is November 25, 1976.

1.06 These operations are evaluated in Chapter VI of this report.

1.07 The conclusions presented in this report result from the studies done by the Project Committee on the site, the subsequent analysis of the program conducted at Bank headquarters, and the talks and preliminary agreements between officials of the Bank and the Government. The implementation of the proposed operation is thus considered feasible, as described in the following chapters and under the conditions recommended in this project report.

B. Frame of Reference

1. The Agriculture-Livestock Sector

1.08 Agriculture and livestock production are the economically most important activities in Nicaragua because of their share in gross domestic product, their contribution to the total value of exports and their ability to generate employment. Almost two thirds of the agriculture and livestock product come from agricultural and forestry production and almost all of the remaining one third comes from livestock production.

1.09 Most of the land devoted to agriculture and livestock activities is located in the Pacific and central regions of Nicaragua where the roads to be built under this program are located. These regions are those of smallest size of the three into which the country can be divided for geographic, topographic and climatic reasons. 1/ This situation can be seen from the following table taken from the 1971 census.

1/ The Pacific region (18,219 km²) includes the departments of Chinandega, León, Managua, Masaya, Carazo and Rivas. The Central Region (33,597 km²) includes the departments of Chontales, Bosco, Matagalpa, Jinotega, Estelí, Madris and Nueva Segovia. The Atlantic Region (66,542 km²) includes the departments of Rio San Juan and Zelaya.

	Area	No. of Farms	%	Area settled (1,000 manzanas) 1/	%
Pacific Region	18,219 km	33,942	39.1	2,133.2	36.1
Central Region	33,597 km	51,693	59.5	3,688.3	62.3
Atlantic Region	66,542 km	1,183	1.4	94.8	1.6
Totals	118,358 km ²	86,818	100.0	5,916.3	100.0
	=====	=====	=====	=====	=====

1.10 The tables on land tenure 2/ by size indicate that the rural population of Nicaragua is made up primarily of small-scale farmers:

(Number of properties)

	Less than 1 mz.		1-10 mz.		10-50 mz.		50-500 mz.		More than 500 mz.		Total	
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
Pacific Region	3,590	10.6	16,850	49.7	8,772	25.8	4,013	11.8	717	2.1	33,942	100.0
Central Region	1,389	2.7	15,692	30.4	18,378	35.6	15,321	29.6	913	1.7	51,693	100.0
Atlantic Region	185	15.6	713	60.3	165	14.0	101	8.5	19	1.6	1,183	100.0
Total	5,164	5.9	33,255	38.3	27,315	31.5	19,435	22.4	1,649	1.9	86,818	100.0
	=====		=====		=====		=====		=====		=====	

1.11 The total area pertaining to the various property sizes is as follows:

(Number of properties)

	Less than 1 mz.		1-10 mz.		10-50 mz.		50-500 mz.		More than 500 mz.		Total	
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
Pacific Region	1.9	0.1	63.4	3.0	192.9	9.0	552.1	25.9	1,322.9	62.0	2,133.2	100.0
Central Region	0.6	0.01	62.3	1.7	451.7	12.2	1,763.3	47.8	1,410.4	38.3	3,688.3	100.0
Atlantic Region	0.1	0.1	1.2	1.3	2.4	2.5	9.6	10.1	81.5	86.0	94.8	100.0
total	2.6	0.04	126.9	2.2	647.0	10.9	2,325.0	39.3	2,814.8	47.6	5,916.3	100.0
	=====		=====		=====		=====		=====		=====	

1.12 The greatest concentration of lands is in the Pacific Region, where 2% of the properties occupy 62% of the land. That region also has the highest percentage of small owners, since 60.3% of the properties are smaller than 10 manzanas in area. The Central Region is characterized by medium-size properties (10 to 500 manzanas), which with 65.2 of the properties, cover 60% (12.2 + 48.8) of the area.

1/ One manzana equals about 0.6989 hectares or 6,989 m².

2/ Based on the 1971 census.

- 1.13 From 1963 to 1974 the product of the agriculture and livestock sector grew at an average rate of 5.5%, largely owing to the increase in production of the major traditional export commodities such as cotton, coffee, sugar, tobacco and beef. ^{1/} Farm products for domestic consumption such as corn, rice, sorghum and beans barely reached a rate of growth of 3%.
- 1.14 This increase in agriculture and livestock production between 1963 and 1974 was achieved primarily through the addition of new lands to the productive process, increasing from 5.4 million manzanas ^{2/} in 1963 to 7.7 million in 1974. The increase in the productivity of land stemming from the application of more advanced technology and better culture practices affected the production to a lesser extent.
- 1.15 In 1975 the gross domestic product registered a rate of growth of only 1.8% and the agriculture and livestock product grew by less than 1%. Agricultural production, affected by the higher production costs and the drought of the first few months of winter, decreased 3.1% with a reduction in the output of cotton, corn and beans. These reductions were only somewhat offset by the increases in the production of coffee, (17%) sugar cane (13%) and livestock and the favorable level of prices for those commodities on internal markets.
- 1.16 Because of its share of GDP, its contribution to the total value of exports and its employment-generating capacity, the agriculture and livestock sector is particularly important within the National Reconstruction and Development Plan for 1975-1979. That plan calls for an average annual rate of growth of 5.5% for the agriculture-livestock sector.
- 1.17 The National Plan for Rural Development 1976-1981 is aimed at improving the standard of living of the rural population, which, as already indicated, makes up about 60% of the total population of Nicaragua. The strategy for implementing this plan consists in establishing the coordination mechanisms between the executing units and expanding and improving the planning capacity and initiation of the public agriculture and livestock sector, creating, organizing and strengthening the appropriate agencies, in order to achieve a better allocation of resources that will be channeled towards rural development. To this end, an institutional reorganization is being carried out of the public agriculture and livestock sector through the implementation of comprehensive rural development projects and the strengthening of the basic infrastructure needed to assure achievement of the goals that have been set. This program falls within these plans.
- 1.18 In 1975, based upon a study of the agriculture sector in Nicaragua carried out through financing from the Agency for International Development, the

^{1/} In 1975 the four major export products (cotton, coffee, meat and sugar) produced US\$214 million in foreign exchange.

^{2/} One manzana = 6,989 m² or 0.6989 hectares.

measures enacted by the Law on the Public Agriculture and Livestock Sector were adopted. These included the creation of four new institutions that would group and strengthen the major activities of the sector, to wit: Institute of Rural Welfare (Instituto de Bienestar Campesino INVIERNO), Institute of Renewable Resources (Instituto de Recursos Renovables), Center for Promotion and Guidance for World Markets (Centro de Promoción y Asesoramiento para los Mercados Mundiales) and the Nicaraguan Institute of Agriculture and Livestock Technology (Instituto Nicaragüense de Tecnología Agropecuaria). The Institute of Rural Welfare (INVIERNO) was created in April 1975 to provide financial and technical assistance to small-scale farmers and to coordinate the marketing and storage services. The regionalized activity of INVIERNO was focused in its initial phase on two areas of the Central Region. The Nicaraguan Institute of Agriculture and Livestock Technology (INTA), created in March 1976, has the major objectives of research, adaptation and dissemination of agriculture and livestock technology, and training of the personnel needed to promote the agriculture and livestock development of Nicaragua. In the area of influence of the various roads comprising the present program the Government of Nicaragua is undertaking the implementation of several programs for developing the rural sector. They are explained in detail in Annex P.

2. The Transportation Sector

- 1.19 Highway policy occupies a fundamentally important position within the National Reconstruction and Development Plan 1975-1979 and the balanced and comprehensive development strategy adopted by the government. The transport sector brings the centers of production and high agriculture and livestock potential together with the major market areas of the country. Effective development of this sector is considered of high priority since it is a complementary and essential element of the development efforts undertaken by the government in the rural areas and the agriculture and livestock sector.
- 1.20 Traditionally the most important means of transportation in Nicaragua have been by ocean and by land. Ocean transportation is very important to the economic development of the country since it is the major means of transportation for international commerce. About 90% of this occurs through the ports of Corinto and Somoza on the Pacific and El Bluff on the Atlantic seaboard, whose importance is gradually increasing, particularly since the improvement of the road to El Rama. The other two ports on the Atlantic, Cabezas and Isabel, are important only to local commerce owing to the absence of overland communication between that area and the rest of the country.
- 1.21 In 1974, 7.2% of the total flow of merchandise within the country went by means of inland waterways, 1.2% by rail, 3% by air, 8.1% by pipeline and 83.2% by road.
- 1.22 Inland waterways are very important in the eastern part of the country where there is no railroad and few all-weather roads. Of the 511,000 tons shipped by inland waterways in 1974, 469,000 used the Atlantic Coast

System and 42% the system of Lake Managua and Lake Nicaragua. The government is currently making investments to improve the transportation system of that region, primarily through the construction of a canal between Laguna de Perlas and El Bluff port. However, rivers, lagoons and canals of the Atlantic Region are expected to continue to be the major means of transportation for many years.

- 1.23 The Pacific Region, the most heavily populated of Nicaragua, has a railroad and an elaborate system of all-weather roads and therefore transportation by inland waterways has been declining. Even so, this means of transportation is of vital importance locally, particularly in Lake Nicaragua.
- 1.24 Nicaragua has a railroad network 318 kms. long, including the branch lines. The main national railroad line, Pacific Railroad of Nicaragua (Ferrocaril del Pacífico de Nicaragua - FPN), runs from the Port of Corinto of the Pacific to Granada (190 kms), passing through Chinandega, León, Managua and Masaya. The branch lines extend from León to Río Grande in the north (84.8) and from Masaya to Diriamba (43.5 kms). A branch line 25.3 kms long is currently being built which will connect Ceiba Mocha to Puerto Somoza. It is expected to be finished by the end of 1976.
- 1.25 Owing to its state of deterioration, railroad transportation provides an insignificant contribution to the national transportation system and automobile transportation has absorbed a large part of the annual growth in the transportation of cargo and passengers.
- 1.26 Domestic air transportation takes place primarily between the national capital and the Atlantic Region. There is regular air service from Managua, stopping at Bluefields, Corn Island, Puerto Cabeza, Waspan, Rosita, Bonanza and Siuna. This transport mode provides important connections to these isolated communities, but is relatively expensive.

3. The highway network of Nicaragua

- 1.27 Transportation by road is the most important within the domestic transport mix of Nicaragua, accounting for 83.2% of total transport of goods in the country. This importance is reflected by the growth of the highway network of Nicaragua, which now totals about 18,000 kms.
- 1.28 As can be seen from the next table, in the period 1960-1974 the highway network increased in length from a total of 6,137 kms. to 17,511 kms., equivalent to an increase of 185% and an annual average rate of growth of 7.8%.

Growth of the Highway Network by Type of Road

	1960 kms.	1974 kms.	Annual Rate of Growth %
Paved roads	669	1,584	6.3
All-weather roads	1,868	6,717	9.6
Roads passable in dry season	3,600	9,210	6.9
Total	6,137	17,511	7.8

1.30 Even so, since it lacks sufficient all-weather roads to the production areas, the highway system of Nicaragua does not satisfactorily meet the needs for shipping the products of the agriculture and livestock sector.

1.31 The shape of the major network can be seen in the map of Annex B. The major centers of the country are served by a network of paved roads, which also serves as connection to the neighboring countries of Costa Rica and Honduras. The concentration of roads in the Pacific and Central Regions can also be noted. In numerical terms and for the year 1974, this distribution is summarized in the next table:

	<u>Length of the Roads</u> (Km)	<u>Area</u> (Km ²)	<u>Density</u> (Km/1000 Km ²)
Pacific Region	9,204	18,219	505
Central Region	7,231	33,597	215
Atlantic Region	1,076	66,542	16
Total	<u>17,511</u>	<u>118,358</u>	<u>148</u>

1.32 A 38.9% increase occurred in the growth in volume of passenger and commercial vehicles in the last 5 years (1971-1975). In December 1975 the number of passenger and commercial vehicles registered totaled 59,108, broken down in the following manner:

<u>Passenger Vehicles</u>	<u>36,451</u>	61.7%
Automobiles and jeeps	33,697	57.0%
Minibuses and buses	2,754	4.7%
<u>Commercial Vehicles</u>	<u>22,657</u>	38.3%
Light trucks and pick-up trucks	15,053	25.4%
Vans	929	1.6%
Trucks	6,675	11.3%
Total	<u>59,109</u>	<u>100.0%</u>

- 1.33 The rates of growth in the stock of vehicles in Nicaragua, shown in the next table, are consistent with the economic development of that country. The fleet of vehicles in 1964 was characteristic of an economy experiencing a considerable lag in its development. The higher growth rate that occurred over the period 1964-1974 resulted from the expansion in the road network and more effective participation by Nicaragua in the Central American Common Market. The rates of growth for the period 1969-1974 correspond to a period of more balanced development.

Annual Growth Rates in Vehicles Registered

<u>Types of Vehicles</u>	<u>1964-1974</u>	<u>1969-1974</u>
Light passenger vehicles	7.8%	6.0%
Heavy passenger vehicles	6.6%	2.3%
Light cargo vehicles	18.8%	14.6%
Heavy cargo vehicles	7.7%	7.6%
Total of registrations (average)	9.1%	7.4%

- 1.34 The above table shows the large relative growth in light cargo vehicles, for which there has been a great demand in the last few years because of their versatility and suitability for medium-scale agriculture-livestock and industrial uses.
- 1.35 In the last few years the Republic of Nicaragua has intensified its programs in the transport sector, investing approximately US\$59.5 million in the period 1970-1974. Further evidence of the importance that the government has given to the development of the transport sector is the recent formulation of a national transportation plan prepared with the financial help of the United States Agency for International Development

and entrusted to the consortium of consulting firms Wilburn Smith-Conrado and Cisneros. This plan is in its final stage and should be completed in November. The study will serve as a basis for planning works within the transport sector to supplement other works of the National Development Plan intended for improving the living conditions of the Nicaraguan farmer, providing more jobs, increasing agricultural and industrial production and reducing commercialization and marketing costs. Through the National Transportation Plan it would be possible to prepare a plan for road investments for 10 and 20 years, also revealing the priority of each of the programs comprising that investment plan.

1.36 Until such time as the National Transportation Plan has been finished, the Ministry of Public Works has scheduled the construction of a number of works for the purpose not only of attending to specific transport problems but also helping the rural production sectors. Some examples are:

- (a) the construction of the Acoyapa-San Carlos and Río Blancos-Siuna-Puerto Cabezas road to provide access to the Atlantic Coast and to facilitate settlement of that area.
- (b) The construction of 498 kms of all-weather access roads to be done jointly with the Institute of Rural Welfare (Instituto de Bienestar Campesino-INVIERNO) ^{1/} and the financial support of the United States Agency for International Development, and
- (c) the present local roads program.

1.37 It was assumed as one of the initial hypotheses under the National Transport Plan study that the present local roads program would be carried out and therefore no analysis of its justification was made within the Plan. For this reason, the works under the program assume top priority within the investments recommended in the period 1976-1985.

^{1/} The INVIERNO program covers all-weather roads of smaller specifications than those of the present program and that largely represent by-passes from the network of local roads and therefore complement that network. In the period 1976-1979 INVIERNO will serve low-income farmers in the areas of influence of its Development Centers (Centros de Desarrollo - CEDES) of its Central Interior and Central Pacific regions that correspond to the Department of Estelí and the western part of the departments of Jinotega and Matagalpa. The road program of INVIERNO has a cost of approximately US\$2,400,000 and will be carried out under force account with the Ministry of Public Works through an agreement to be signed between the two institutions.

II. THE PROGRAM, ITS COST AND FINANCING

A. Purposes

- 2.01 The main purpose of this program is to provide permanent communications between various agricultural regions of Nicaragua and the centers of consumption and marketing. This would facilitate the transportation of agricultural produce at all times of the year, bring down the cost of this transportation, tie new farming areas into the country's economic development and thus boost agrolive-stock production. Besides facilitating the increasing of agrolive-stock production and thereby improving farmers' incomes, an efficient transportation system would also be propitious for the complementation and implementation of other projects connected with integrated rural development, such as education, public health, health, electrification, irrigation and agricultural and forestry development projects.

B. Description

Goals and location

- 2.02 To achieve these purposes, the program proposes the construction and/or improvement of approximately ten (10) local roads aggregating approximately 300 km located in the Central and Pacific regions of the country. ^{1/} The preliminary list of roads selected, through the technical-economic feasibility study, is given in Annexes A, B and C.
- 2.03 Various of the roads included in the preliminary list are already partly or fully in existence, which means that only improvement works would be required for them. The extent of this improvement will depend on the nature of the present road and the final engineering designs and could range from simple resurfacing and installation of drainage to virtually complete construction. In accordance with the importance of the works to be executed, the 10 roads selected in principle were classified into construction works (six roads with a total length of approximately 182 km) and improvement works (four roads with a total length of approximately 120 km).
- 2.04 According to current Bank policy, six roads were selected from the 10 comprising the preliminary list for a representative sample of the program.

Of those six roads with final designs and economic feasibility studies complete, the following five represent construction works:

^{1/} Four roads in the Pacific region and six in the Central region, according to the preliminary list.

	<u>Length in km.</u>
1. Villa Salvadorita-Malpasillo	29.54
2. Juigalpa-La Libertad	32.91
3. Abisinia-Bocaycito	26.99
4. Rivas-Veracruz	5.70
5. San Cayetano-La Trinidad	31.53

While the following represents improvement works:

6. Villanueva-El Sauce	40.61
Total	167.28

Under the construction works the five roads listed represent 59.4% of their cost and 69.5% of their length, while the Villa Nueva - El Sauce road accounts for 29.8% of cost and 38.9% of length for the improvement works.

- 2.05 Selection of the remaining 113 km would be based mainly on the other roads in the preliminary list which have already been shown to have internal rates of return over 10%. 1/

Design Standards

- 2.06 The design standards employed for these roads 2/ would be those for low-cost roads of small width and low design speed to be usable the year round. The roads were divided into two types for design purposes, in accordance with the expected traffic intensity and the topographic characteristics of the terrain. In general, the standards for these two types coincide with the current Nicaraguan design specifications for Departmental Class 1 and 2 roads.
- 2.07 Low-cost roads of modest geometric specifications such as these will be sufficient to meet the transportation requirements of the rural areas concerned and the demands of the low traffic volumes involved.

Selection criteria

- 2.08 The final selection of the roads that will make up the program 3/ will be based on the following criteria:

1/ This condition would be included in the possible loan contract. In view of the socio-economic circumstances of the beneficiaries, it is recommended that an internal rate of return of over 10% be used as selection criterion.

2/ The design standards for departmental roads I and II are set forth in detail in Annex D.

3/ The preliminary list of roads selected, giving their location and description, appears in Annexes A, B and C to this report.

- (i) They must be directly connected with the existing road system, with features similar to those of departmental roads I and II in Nicaragua. 1/
- (ii) The economic evaluation of each of them must show an internal rate of return of over 10%.
- (iii) The characteristics of each road and the degree of completion of the engineering designs must be such as to permit starting and finishing construction before the second and fifth years, respectively, of the period of the possible loan contract.
- (iv) The program will have to be consistent with the recommendations of Nicaragua's National Transportation Plan, preparation of which is now in its final phase.
- (v) The program will have to comprise substantially the roads studied with the resources of Technical Cooperation ATC/TF(SP)-1295-NI and primarily those found to be technically and economically feasible by that study and which today form the preliminary list of ten (10) roads.

C. Cost and Financing

1. Total cost

2.09 It is estimated that the total cost of the program would amount to US\$22.5 million equivalent, as follows:

1/ The design standards for departmental roads I and II are set forth in detail in Annex D.

(Equivalent in thousands of US\$)

Investment Categories	Foreign Exchange Costs			Local Currency Cost	Total	%
	Direct	Indirect	Total			
1. <u>Engineering & Administration</u>	<u>1,430</u>	-	<u>1,430</u>	<u>1,270</u>	<u>2,700</u>	<u>12.0</u>
1.1 Studies and designs	525	-	525	225	750	3.3
1.2 Supervision	615	-	615	265	880	3.9
1.3 Executing unit	-	-	-	710	710	3.2
1.4 Consulting services	140	-	140	70	210	1.0
1.5 Executing unit equipment	150	-	150	-	150	0.6
2. <u>Direct Costs</u>	<u>4,420</u>	<u>7,100</u>	<u>11,520</u>	<u>7,280</u>	<u>18,800</u>	<u>83.6</u>
2.1 Construction on contract	3,070	5,450	8,520	5,580	14,100	62.7
2.2 Improvement on force account	650	1,650	2,300	1,700	4,000	17.8
2.3 Equipment procurement	700	-	700	-	700	3.1
3. <u>Finance Charges</u>	<u>830</u>	-	<u>830</u>	-	<u>830</u>	<u>3.7</u>
3.1 Credit commission	180	-	180	-	180	0.8
3.2 Interest	470	-	470	-	470	2.1
3.3 Inspection and supervision fund	180	-	180	-	180	0.8
4. <u>Associated Costs</u>	-	-	-	<u>170</u>	<u>170</u>	<u>0.7</u>
4.1 Rights of way	-	-	-	170	170	0.7
TOTALS	<u>6,680</u>	<u>7,100</u>	<u>13,780</u>	<u>8,720</u>	<u>22,500</u>	<u>100.0</u>
Percentages	29.7	31.5	61.2	38.8	100.0	

2. Main components of the total cost

a. Engineering and Administration (US\$2,700,000)

2.10 The US\$2,700,000 under this category would be mainly for the following costs:

(i) Studies and designs: The sum assigned for recovery of the Bank's contributions through Technical Cooperation ATC/TF(SP)-1295-NI used for the partial financing of the studies and designs which were used to prepare this program (US\$750,000).

(ii) Supervision: The estimated cost of the services of a consulting firm that would take care of the supervision and technical control of the works to be carried out under contract (US\$880,000).

This sum, which represents about 7.5% of the total cost of the works in question, was estimated on the basis of the most recent experience in Central America with the hiring of consulting engineering firms to supervise road projects.

(iii) Executing Unit: The cost of the Executing Unit that the DGC will have to set up and entrust with execution of the program (US\$710,000).

(iv) Consulting services: The cost of a consultant whom the DGC will have to hire to advise the Executing Unit on everything connected with execution of the program and the DGC itself regarding maintenance. (US\$210,000).

(v) Executing Unit Equipment: The cost of vehicles, business machines, laboratory equipment and other imported items needed for the Executing Unit (US\$150,000).

b. Direct Costs

2.11 The amount equivalent to US\$18.8 million included in this category consists of: i) the estimated costs of the construction works to be carried out by contract, including cost escalation and contingencies (US\$14.1 million); ii) estimated cost of the improvement works to be carried out on force account, including the corresponding escalation and contingencies (US\$4 million), and iii) the acquisition of equipment to supplement that to be used by the Dirección General de Caminos, of what it already owns, to carry out these works on force account.

i) Construction costs on contract

2.12 The costs of this subcategory include:

2.13 The construction costs estimated in September 1976 (US\$10.36 million). These costs were estimated on the basis of the final designs of five of the six roads comprising the subcategory and on the preliminary project for the remaining road which was done for the technical-economic feasibility study whereby the roads that will comprise the program were selected on a preliminary basis.

- 2.14 The budgets for the five roads with final designs available were calculated by applying unit prices current in September 1976 to the work volumes obtained from those construction plans.
- 2.15 These unit prices, which are similar to those obtained in the most recent bidding conducted by the Dirección General de Caminos, 1/ were estimated through a careful evaluation of inputs (equipment, labor and materials) required for each type of job.
- 2.16 To calculate the cost 2/ of the four roads 3/ for which final designs are not available, a comparison was made first of the final budget for the six roads 4/ with designs available with the estimated costs for those roads in the technical feasibility study, which showed the format to be an average of 7.4% higher. This figure is considered reasonable, especially considering the difference in the date of the estimates. The cost of the four roads without final design was finally estimated by increasing preliminary project cost by 7.4%.
- 2.17 As indicate above, the following costs were estimated for the six roads to be executed on contract:

<u>Roads with final design</u>	<u>Cost (US\$)</u>	<u>%</u>	<u>Length in km</u>	<u>%</u>	<u>Cost in km (US\$)</u>
1. Villa Salvadorita-Malpaisillo	1,222,504	11.8	29.54	16.2	41,400
2. Juigalpa-La Libertad	1,339,477	12.9	32.91	18.1	40,700
3. Abisinia-Bocaycito	1,756,447	16.9	26.99	14.8	65,700
4. Rivas-Veracruz	242,231	2.3	5.70	3.1	42,500
5. San Cayetano-La Trinidad	1,593,760	15.5	31.53	17.3	50,500
	<u>6,154,419</u>	<u>59.4</u>	<u>126.67</u>	<u>69.5</u>	<u>48,600</u>
<u>Roads without final design</u>					
6. San Juan del Río Coco-Wiwili	4,211,066	40.6	55.56	30.5	75,800
TOTALS	<u>10,365,475</u>	<u>100.1</u>	<u>182.23</u>	<u>100</u>	<u>56,700</u>
	<u>=====</u>	<u>=====</u>	<u>=====</u>	<u>=====</u>	<u>=====</u>

1/ Las Mercedes-San Benito (November 1975) and Acayapo-San Carlos (January 1976).

2/ Cost in the event the work is done on contract.

3/ One by contract and three on force account.

4/ Five on contract and one on force account.

- 2.18 The total cost of the five roads in the representative sample for this subcategory makes up 59.4% of subcategory cost, while they account for 69.5% of the total length.
- 2.19 The average cost per kilometer of this representative sample is similar to that for the rural road construction program in El Salvador recently financed by the Bank (Loan 472/SF-EC), whose representative sample amounted in March 1976 to an average of US\$40,000/km with a maximum of US\$59,600/km.
- 2.20 Because of their simple construction, the costs of these roads are very sensitive to variations in the excavation and earth-moving items because of the differences in topography in the regions crossed.
- 2.21 For instance, of the roads for which final designs are available, those with the highest and lowest per-km cost, respectively, are Abisinia-Bocaycito and El Sauce-Villanueva. 1/ These two involve an average of 15,300 m³ and 3,800 m² earthmoving, respectively, and just the difference for this item (US\$25,300, i.e., 11,500 m³ at US\$2.20/m³), makes up 70% of the US\$36,300 difference in cost per km between the two.
- 2.22 The cost per kilometer for the San Juan Río Coco-Quilalí-Wiwilí road, for which final designs are not yet ready, is higher than for the rest because its preliminary project called for excavation amounting to 16,000 m³/km more than any of the other roads in the sample and a larger number of bridge meters also (3.5 meters/km as compared for example to 1.2 in Abisinia-Bocaycito).
- 2.23 Cost escalation (US\$2.45 million). The escalations were calculated by taking into account the contracting procedure in Nicaragua, whereby unit prices are fixed and only differences in cost of direct inputs are paid separately. 2/ Those are expected to account for 25% of the contract value. Consequently, the escalation rate, estimated at 12% per annum, is applicable to 100% of cost in these cases only between August 1976 and the date established for delivery of the proposals. Thereafter the escalation rate is applicable to only 25% of annual investment projected.
- 2.24 Contingencies (US\$1.29 million). An item has been allocated for contingencies equivalent to 10% of estimated construction costs including cost escalation. This amount would cover the additional cost deriving from execution of larger volumes of work than expected, any differences arising between costs estimated for construction contracts and prices actually quoted by successful bidders and the cost of any additional minor works not included in the estimates but essential for completion of the program roads.

1/ Included in the roads to be done on force account.

2/ Fuel, lubricants, materials, labor.

ii) Improvement costs on force account

2.25 Cost under this category include:

Construction costs estimated in September 1976 (US\$2.73 million).

These costs were estimated on the budget for those works, if done on contract, from which was deducted:

- Amortization 1/ on these works, of machinery to be purchased with loan funds.
- A percentage corresponding to direct administration costs since it is included directly under the heading of the executing unit.
- The percentage for profit and cost of contractors bonds.

2.26 The construction costs for the four roads comprising the subcategory on a preliminary basis, in the event they were carried out on contract, were estimated, for the roads for which designs are already available, in accordance with the resulting volume of work and corresponding unit prices in September 1976. Calculations for the other roads were done as described in paragraph 2.16.

2.27 As explained, construction costs in September 1976 for these four roads would be:

1/ Estimated at 40% of their original cost.

<u>Roads with final designs</u>	<u>Cost (US\$)</u>	<u>%</u>	<u>Length in km</u>	<u>%</u>	<u>Cost in km (US\$)</u>
Villanueva-El Sauce	1,192,264	29.8	40.61	33.9	29,300
	<u>1,192,264</u>	<u>29.8</u>	<u>40.61</u>	<u>33.9</u>	<u>29,300</u>
<u>Roads without final designs</u>					
Somotillo-Cinco Pinos	787,876	19.7	30.00	25.0	26,300
Limay-Pueblo Nuevo	1,208,069	30.1	24.65	20.6	49,000
Asturias-Pantasma	819,194	20.4	24.68	20.5	33,200
	<u>4,007,403</u>	<u>100</u>	<u>119.94</u>	<u>100</u>	<u>33,400</u>

Deductions:

From that cost the following deductions were made to estimate the cost of works undertaken on force account:

Part of general costs and profit 25%	1,001,850	8,300
	<u>3,005,553</u>	<u>25,100</u>
Amortization of equipment, 40% of 700,000	280,000	2,300
	<u>2,730,000</u>	<u>22,800</u>

2.28 The cost of the only road serving as representative sample for this sub-category is 29.8% of the total cost, while its length represents 33.9%.

2.29 If those works had been done on contract their cost would have been as follows:

Deductions:

<u>Cost (US\$)</u>	<u>%</u>	<u>Length in km</u>	<u>%</u>	<u>Cost/km</u>
<u>4,007,403</u>	<u>100</u>	<u>119.94</u>	<u>100</u>	<u>33,400</u>

2.30 This average cost of US\$25,100 per kilometer following discount of amortization of equipment to be purchased with the loan is comparable to that obtained for construction of the Cudega-Yali segment with specifications similar to those of the roads in this program and done on force account by the DGC with financial support from USAID between 1972 and 1975. In that case the resulting cost was US\$18,000 km, not including the cost of maintaining equipment or administration, which amounted to approximately US\$28,000/km.

2.31 Cost escalation (US\$890,000). These were estimated in the same way as the escalation of works to be done on contract, with the difference that direct inputs were estimated as 33% of the cost because of the elimination of 25% of cost for profit and general expenses.

2.32 Contingencies (US\$380,000). These were calculated as 10% of construction cost, including price escalation. This sum would cover the additional costs deriving from execution of work volumes greater than projected, differences that might occur between estimated costs for construction contracts, the prices of the winning bids and those for additional minor works not projected but essential for complete execution of the program.

iii) Construction equipment (US\$700,000)

2.33 The amount of this equipment to be acquired by the Dirección General de Caminos to supplement that to be used in executing the works on force account ^{1/} was calculated on the basis of a preliminary evaluation of needs. Accordingly, it would be necessary to purchase:

2 medium bulldozer tractors	US\$120,000
4 construction motorgraders	200,000
3 medium front loaders	195,000
tractors and compacting rollers	35,000
	<hr/>
	US\$550,000
Escalation 15%	80,000
	<hr/>
	US\$630,000
Contingencies	70,000
	<hr/>
Total	US\$700,000
	<hr/>
	=====

c. Finance charges (US\$830,000)

(i) Credit fee (US\$180,000) and interest during construction (US\$470,000).

2.34 These items were estimated in accordance with the investment schedule given in paragraph 3.25 and the proposed conditions for the possible loan (credit commission 0.5%; interest during grace period 1% p.a.).

(ii) Inspection and supervision fund (US\$180,000)

2.35 This item represents 1% of the proposed loan.

^{1/} See justification and amount of loan allocated to works on force account in paragraph 3.33 et seq.

d. Associated costs (US\$170,000)

- 2.36 (i) Right of way. The US\$170,000 equivalent included for this subcategory represents the estimated cost of the land that the borrower will have to purchase to have the rights of way needed for construction of the program roads. This item was based on the estimates included in the technical and economic feasibility report and on the final designs for the representative sample.

3. Foreign exchange and local currency costs

- 2.37 As shown in the table in paragraph 2.09, the foreign exchange component of the program costs was calculated at the equivalent of US\$13,780,000, i.e., 61.2% of the total cost of the program (US\$22.5 million). Of this sum, US\$6,680,000 (29.7%) would be direct foreign exchange costs and US\$7.1 million (31.5%) indirect foreign exchange costs. The local currency costs are calculated at US\$8,720,000.
- 2.38 The breakdown into direct and indirect foreign exchange costs and local currency costs was based on the following criteria:

<u>Item</u>	<u>Direct Foreign Exchange</u>	<u>Indirect Foreign Exchange</u>	<u>Local Currency</u>
1. <u>Engineering and Administration</u>			
1.1 Studies and designs	70%		30%
1.2 Supervision	70%		30%
1.3 Executing unit			100%
1.4 Consultants	70%		30%
1.5 Executing unit equipment	100%		
2. <u>Direct Costs</u>			
2.1 Construction	Contractor profit and bond costs; materials to be procured abroad such as structural steel and sheet-metal drains; part of the contractor overheads.	External component of materials procured in local market, such as fuel, tools, lubricants, explosives, etc. Amortization and depreciation ^{1/} of equipment; parts.	Skilled and unskilled labor; local materials such as lumber and cement; part of overheads.
2.2 Construction equipment	100%		
3. <u>Finance Charges</u>	credit fee, interest during construction and inspection and supervision fund.		
4. <u>Associated Costs</u>			Cost of purchasing rights of way.
2.39	The profit, bond cost and part of the overhead costs of the contractors have been estimated as direct foreign exchange costs since it is likely that contracts will go to foreign firms. This assumption is based on the results of the most recent bidding competitions organized by the DGC and also the fact that the works concerned would be combined into packages large enough to be attractive to foreign firms.		
2.40	To determine the foreign exchange and local currency costs of the program roads the respective unit prices were analyzed in accordance with the pertinent Bank criteria.		

^{1/} Except on that purchased with loan funds.

4. Financing plan

(a) Financing plan

2.41 The program would be financed as follows:

(In thousands of US\$ or equivalent)

	<u>Source of funds</u>		<u>Application of funds</u>		<u>Total</u>	<u>%</u>
	<u>Foreign Exchange</u>	<u>Local</u>	<u>Foreign Exchange</u>	<u>Local</u>		
IDB Loan (FSO)	18,000 <u>1/</u>	-	13,600 <u>2/</u>	4,400	18,000	80.0
Nicaraguan Govern- ment	-	4,500	180 <u>3/</u>	4,320	4,500	20.0
Total	18,000	4,500	13,780	8,720	22,500	100.0
Percentage	80.0	20.0	61.2	38.8	100.0	

2.42 The Bank loan chargeable to the Fund for Special Operations would amount to US\$18 million (80% of the total program cost), which would be disbursed entirely in foreign exchange over a period of five years counting from the effective date of the pertinent contract. The Bank loan would cover the full amount of the external costs, except for the commitment fee, and 50.5% of the local costs.

2.43 The loan funds would be used to finance:

- The full amount to be reimbursed to the Bank by the Nicaraguan Government under the terms of technical cooperation contract. ATC/TF(SP)1295-NI.
- The full amount of the costs of the consulting firm that will supervise the works carried out under contract and of the consultant who will advise the Executing Unit.
- The full cost of vehicles, office equipment and laboratory equipment to be imported for use by the Executing Unit.
- 81% of the direct construction cost of the program roads, covering 100% of the foreign exchange cost and 52.7% of the local currency cost.

1/ It is expected that US\$4.4 million equivalent to 24.4% of the foreign exchange proceeds of the loan, would be used to finance local expenditures.

2/ Includes an estimated US\$7.1 million for indirect foreign exchange costs.

3/ The credit fee.

- The total cost of the construction equipment to be procured.
 - The full amount of the interest due during construction, and
 - The sum earmarked for the inspection and supervision fund.
- 2.44 The sum of US\$4.4 million that would be used to finance local currency costs represents 24.4% of the loan funds and 50.5% of the total program local currency costs.
- 2.45 The local contribution by the borrower to the execution of the program would amount to US\$4.5 million, 20% of the total cost of the program. This would be used to finance:
- The full amount of the Executing Unit's operating costs.
 - 19.0% of the direct construction costs, representing 47.3% of the local costs.
 - The commitment fee payable in foreign exchange, and
 - The cost of obtaining the rights of way.

The feasibility of the local contribution is shown in paragraph 4.44 ff.

Investment Categories

- 2.46 The application of the loan funds and the local contribution by program investment category would be as follows:

Financing Table

(In thousands of US\$ or equivalent)

	I D B				Nicaraguan Government			
	Foreign Exchange		National currency	Total	Direct foreign exchange	National currency	Total	Total
	Direct	Indirect						
Engineering and Administration	1,430	-	560	1,990	-	710	710	2,700
Engineering designs	525	-	225	750	-	-	-	750
Works supervision	615	-	265	880	-	-	-	880
Executing unit	-	-	-	-	-	710	710	710
Consultants	140	-	70	210	-	-	-	210
Equipment E.U.	150	-	-	150	-	-	-	150
Fixed Costs	4,420	7,100	3,840	15,360	-	3,440	3,440	18,800
Construction on Contract	3,070	5,450	2,900	11,420	-	2,680	2,680	14,100
Improvement on force account	650	1,650	940	3,240	-	760	760	4,000
Equipment procurement	700	-	-	700	-	-	-	700
Service Charges	650	-	-	650	180	-	180	830
Credit commission	-	-	-	-	180	-	180	180
Interest interpolated	470	-	-	470	-	-	-	470
Inspection and supervision fund	180	-	-	180	-	-	-	180
Unallocated costs	-	-	-	-	-	170	170	170
Rights of way	-	-	-	-	-	170	170	170
Totals	6,500	7,100	4,400	18,000	180	4,320	4,500	22,500
Percentages	(28.9)	(31.2)	(19.6)	(80.0)	(0.8)	(19.2)	(20.0)	(100.0)

III. EXECUTION OF THE PROGRAM

A. Execution of the Program

3.01 The Ministry of Public Works (MOP) would be responsible for the execution of the program and would carry out the following activities for the purpose:

- (a) Planning of the composition and execution of the program.
- (b) Coordinating, directing and supervising all the technical, administrative and financial aspects of the program.
- (c) Meeting the conditions laid down in the possible loan contract.
- (d) Forwarding to the Bank for its information and agreement: (i) the terms of reference for the hiring of the consulting firm that will supervise the program; (ii) the list of firms invited; (iii) the final designs of the other six roads; (iv) the economic evaluations; (v) the bidding conditions, and (vi) the bidding documents for the projects that will make up the program.
- (e) Arranging the call for bids and/or the corresponding public bidding competitions and suggesting who should receive the contracts.
- (f) Maintaining a system of financial records which will permit appropriate control of the project operations as regards both the loan funds and the local contribution.
- (g) Sending the disbursement applications to the Bank.
- (h) Preparing and submitting to the Bank the technical and financial reports and reports on any other matter connected with the program.

B. Planning of the Program

3.02 The MOP would carry out the first of the above-listed responsibilities through its Department of Planning and Programming, which would act in coordination with the DGC. The planning and programming work, which would have to be finished within the first year of the loan contract period, would comprise the following points:

- (a) The roads forming the program, in accordance with the criteria established.
- (b) The manner of execution of each of them (contractor or force account).

(c) The equipment to be procured to supplement that which the DGC already has for carrying out the works to be done by force account.

(d) The combining of the works into bidding packages.

3.03 It is not, of course, required that this planning be finished before any of the works are started, since those for which the designs are already available could unquestionably be started right away. However, this programming will have to be completed for all the works before the end of the first year of the loan contract period, so that taking into account the time needed for bidding on and awarding of the contracts, they can be started before the end of the second year and thus meet the Bank's requirement on this score.

C. Administration of the Program

3.04 The MOP would execute the program through its subordinate agency the DGC, which would accordingly be responsible for all the items listed in paragraph 3.01 except for the planning which, as noted in paragraph 3.02, would be done by the Department of Planning and Programming in coordination with the DGC.

Executing Unit

3.05 For the more efficient performance of this work an Executing Unit would be set up in the DGC which would be directly responsible for the execution of the program and would report to the Director of Roads.

3.06 Formation of this unit would facilitate the administrative side and decision-making and thus prevent the delays which have affected and are still affecting road projects financed by the Bank in Nicaragua.

3.07 The DGC would take care of the first steps essential to execution of the program such as invitations to prequalify, prequalification, call for bids on the first package of works, invitation to consulting firms to tender for the supervision of the works to be carried out under contract, and hiring of the individual consultant, while the program executing unit is being set up. It would be a prerequisite for the first disbursement from the possible loan that this unit be established and operational.

3.08 Annex E gives the projected composition of this Executing Unit and details of its budget. The unit will have to be fully operational before the date on which the works are physically started.

3.09 The recommendations made by the consulting firm hired with Technical Cooperation ATC/TF-(SP)-1295-NI include the suggestion that the

desirability be studied of hiring the services of an independent consultant to advise on everything connected with the bidding, the awarding of the contracts and supervision of the construction. The Study Mission looked into this matter and agreed with the recommendation, which is why it is considered desirable that the Executing Unit should have the services of an individual consultant 1/ who would advise it on all matters connected with:

- i. Awarding of the construction contracts.
 - ii. Execution of the works to be done by force account.
 - iii. Selection of the equipment to be procured.
 - iv. Compliance with the contract conditions and the execution schedule.
 - v. Maintenance.
- 3.10 The consultant whose contracting would be a condition precedent to the first disbursement of the proposed financing, would provide his services directly through the chief of the executing unit.
- 3.11 In view of his close connection with the program, once the consultant is appointed he would advise and assist the Department of Planning and Programming and the DGC in matters relating to the planning of the program even when this is not essential since these two agencies are already proceeding with this work.

D. Status of Designs and Economic Feasibility Studies

- 3.12 By means of Technical Cooperation ATC/TF-(SP)-1295-NI, the MOP hired the consulting firms Baker-Wibberley International and Octavio Salinas M. y Asociados, working as a consortium, to prepare the technical and economic feasibility study of approximately 600 km of local roads and the final design for 300 km.
- 3.13 The feasibility study for 19 roads aggregating 605 km was submitted in May 1976, thus completing the first stage of the study financed by ATC/TF-(SP)-1295-NI. Based on the return offered by each project, 12 of the most viable roads, with a original total length of 327.24 km, were selected as subjects for final designs. At the present time final engineering designs and construction plans and bidding documents are on hand for six of the roads, representing 167.28 km, which make up the representative sample.

1/ In addition to the consulting firm responsible for supervising the work to be performed under contract. The terms of reference for this consultant are given in Annex F.

- 3.14 The final designs and other documents are presently being checked by the MOP and the DGC for final approval.
- 3.15 The design of these six roads increased the length scheduled by 11 km, raising the total length of the 12 roads to 338 km. In order to keep the work within the volumes originally contracted for with the consulting firm, the DGC ordered that the firm not prepare designs for the remaining six roads, 1/ thereby reducing the designable length to 302 km and the scope of the program to 10 roads covering approximately 300 km. The consulting firm has up to May 1977 to complete the designs.
- 3.16 The study of the National Transportation Plan is in its final phase and is expected to be completed within three months. The other roads making up the program in addition to those of the representative sample will be reviewed in the light of the recommendations of this plan to see whether, when analyzed from the national rather than the regional viewpoint, any small changes may be needed in the specifications or whether it might be desirable to replace any section by another offering a higher return for the program as a whole.
- 3.17 This is because some of the roads originally studied may prove to fulfill a greater function than that of a penetration road and could form part of a secondary system. For instance, the roads considered in the initial feasibility study included El Sauce-Villanueva, Villanueva-Achuapa-Limay and Limay-Pueblo Nuevo. Of these, only El Sauce-Villanueva and Limay-Pueblo Nuevo were found to be feasible. Villanueva-Achuapa-Limay, from the viewpoint exclusively of traffic to or from its direct area of influence, proved to have an internal rate of return of only 4.9%, so it was dropped. It is probable that if the El Sauce-Pueblo Nuevo stretch were analyzed, i.e. the three sections together as one single road, the return of not only the Villanueva-Achuapa-Limay section but also that of the other two would have been greater and justified construction of the entire road. This aspect could only be assessed after the National Plan is completed. In any event, no major changes are expected in the make-up of the program, which would still consist for the greater part of the 10 projects selected on a preliminary basis.
- 3.18 Should it prove desirable to carry out some new project that is not included in this list of 10, the design work would be done by the DGC within the first year of the possible loan contract and leaving sufficient time for construction to be started within the first two years.

E. Procurement of Goods and Services

- 3.19 Several of the roads defined in principle as components of the program are already available in part or in whole and call for improvements only. The scope of such improvement depends on the nature of the

1/ El Tabaco-La Calamidad and Villa Somoza-El Zapotal.

present road and the final engineering designs. In some cases, rebedding and construction of drainage facilities may be enough, while in others almost complete construction may be required. Based on the works to be carried out, the 10 roads selected in principle were classified into construction works (six roads, five of which constitute the representative sample) and improvement works (four roads, one of which is included in the representative sample). The construction works would be carried out on contract with local or foreign construction companies, while improvements would be done on force account.

- 3.20 The contracting of the construction firms and the procurement of the construction equipment and vehicles would be done by international public bidding following the procedure set forth in Annex E and which would form an integral part of the possible loan contract. In view of the small scale and lack of experience of the local roadbuilding industry, 1/ it is considered desirable that a prequalification system be followed in the bidding procedure.
- 3.21 The five roads to be contracted which comprise the representative sample in this subcategory, would be offered for bids simultaneously, subdivided on the basis of criteria of communication and proximity into two packages so that the volume of each would make it attractive to foreign companies. Any company with the necessary capacity would also have the option of making a proposal for the two packages together. The other components in this subcategory would be contracted with a single construction firm 2/ with an invitation to bid issued at the end of the first year of the loan contract so that construction would begin after the rainy season in the second year. 3/
- 3.22 The consulting firm to be hired by the DGC for supervision and control of the works done under contract would be selected in accordance with the Bank's normal requirements.

1/ See paragraphs 3.28 and 3.29 for details.

2/ To date, the rest of the subcategory consists of a single road, but this could change, depending on program conditions.

3/ The lengthy processing of bids and awards make it virtually impossible to provide, in accordance with the termination dates for designs, for works to begin before that rainy season.

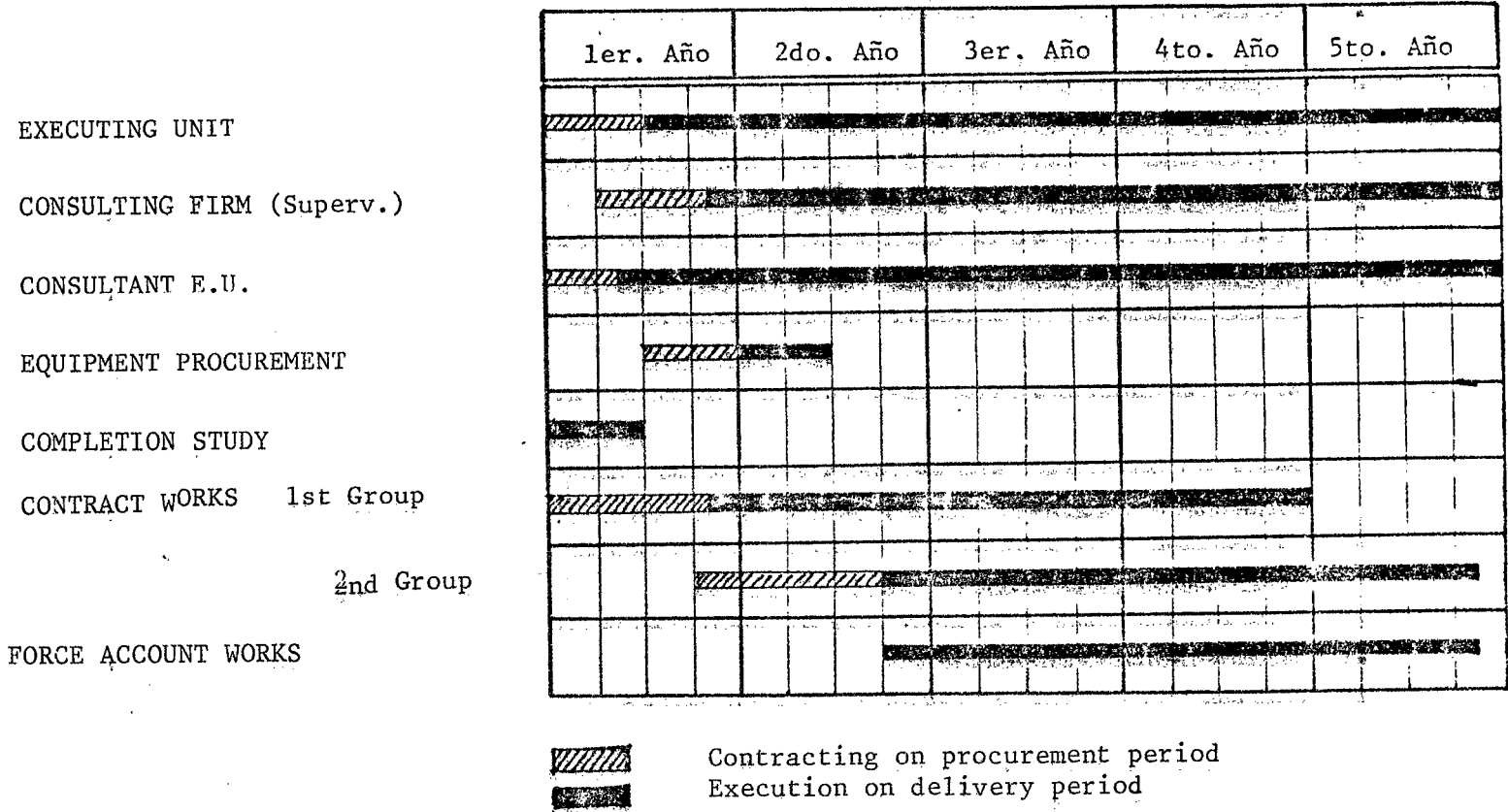
F. Execution Schedule

- 3.23 The program would be executed over a period of sixty months in accordance with the execution schedule shown on the next page. The starting date for this schedule would be the effective date of the loan contract.
- 3.24 In setting up this schedule the following factors were taken into account:
- (a) The time needed to complete the remaining final designs.
 - (b) The time that would elapse between submission to the Bank of designs, specifications, and call for bids and the starting of the work is about ten months, including the period for payment of the usual advance to the contractor.
 - (c) In the rainy season (May to October) earthmoving work is virtually impossible, so the works would have to be started in November or December.
 - (d) The construction times for the works were estimated at three years from the date of starting, mainly owing to the fact that very little could be done in the rainy season, making the real working time eighteen months.
 - (e) For the same reasons, the works to be done by force account would also take three years.
 - (f) In this type of global program involving multiple works, the Bank requires that all the works be physically started within two years of the effective date of the possible loan contract.
- 3.25 Both the activities of the Executing Unit and the services of the consulting firm that would supervise the program and those of the individual consultant would be extended for an additional two months following construction of the last group of works. During this period the final payments to the contractors would be processed and made and the final report on the execution of the program would be drafted.

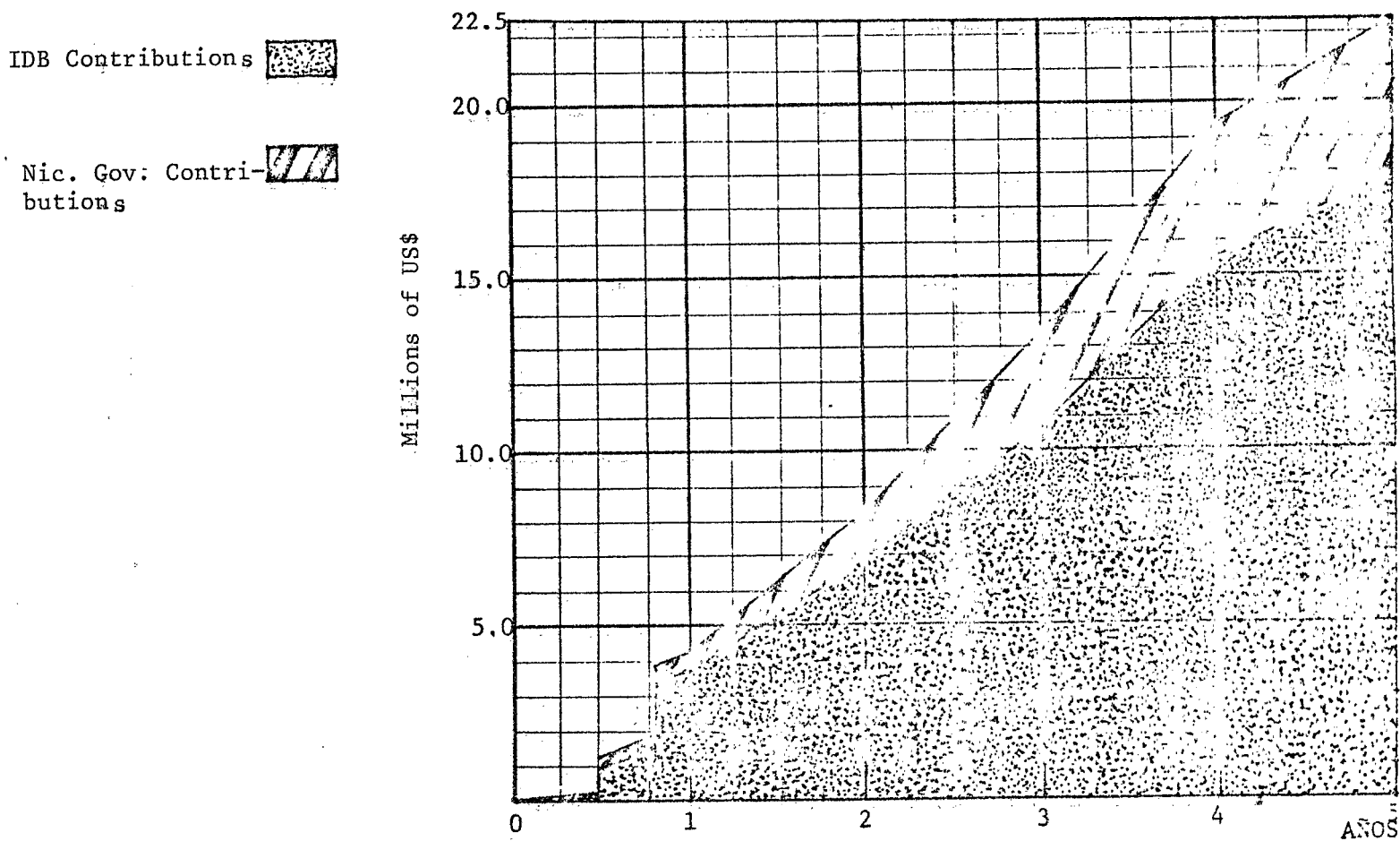
G. Investment Schedule

- 3.26 The following investment schedule was based on the above execution schedule:

EXECUTION SCHEDULE



DISBURSEMENT SCHEDULE



G. Investment Schedule

3.26 The following investment schedule has been prepared in the basis of the above execution schedule.

INVESTMENT SCHEDULE

(Equivalent in thousands of US\$)

Investment Categories	First Year		Second Year		Third Year		Fourth Year		Fifth Year	
	IDB	NIC	IDB	NIC	IDB	NIC	IDB	NIC	IDB	NIC
<u>Engineering and Administration</u>	850	110	390	150	250	150	250	150	250	150
1.1 Studies and designs	750	-	-	-	-	-	-	-	-	-
1.2 Cons. firm (superv.)	80	-	200	-	200	-	200	-	200	-
1.3 Executing Unit	-	110	-	150	-	150	-	150	-	150
1.4 Consultants	20	-	40	-	50	-	50	-	50	-
1.5 Executing Unit equipment	-	-	150	-	-	-	-	-	-	-
<u>Direct Costs</u>	1,250	290	2,290	540	4,010	940	4,900	1,150	2,210	520
2.1 Loan on contract	1,250	290	2,290	540	3,210	750	3,450	810	1,220	290
2.2 Improv. on force account	-	-	-	-	800	190	1,450	340	990	230
2.3 Equipment	-	-	700	-	-	-	-	-	-	-
<u>Finance Charges</u>	25	32	79	62	111	47	148	29	287	10
3.1 Credit commission	-	32	-	62	-	47	-	29	-	10
3.2 Interest interpolated	7	-	43	-	75	-	112	-	233	-
3.3 Inspection and Sup. Fund	18	-	36	-	36	-	36	-	54	-
<u>Associated Costs</u>	-	90	-	80	-	-	-	-	-	-
4.1 Right of way	-	90	-	80	-	-	-	-	-	-
 TOTAL	 2,165	 522	 3,459	 832	 4,371	 1,137	 5,298	 1,329	 2,747	 680
	2,647		4,291		5,508		6,627		3,427	
	(11.8%)		(19.1%)		(24.5%)		(29.5%)		(15.1%)	

II. Disbursement Schedule

- 3.27 The following disbursement schedule was based on the above investment schedule and differs from it only in the formation, in the first year, of a revolving fund using the resources from the possible loan and the result discounting of the payments after formation of this fund.

	<u>First Year</u>	<u>Second Year</u>	<u>Third Year</u>	<u>Fourth Year</u>	<u>Fifth Year</u>	<u>Total</u>
IDB	3,777	3,106	3,905	4,735	2,477	18,000
NICARAGUA	<u>522</u>	<u>832</u>	<u>1,137</u>	<u>1,329</u>	<u>680</u>	<u>4,500</u>
TOTAL	<u>4,299</u>	<u>3,938</u>	<u>5,042</u>	<u>6,064</u>	<u>3,157</u>	<u>22,500</u>

I. Availability of Construction Firms

- 3.28 The Nicaraguan roadbuilding industry has never had any opportunity to develop. Up until about twenty years ago, all roads in the country were built by the DGC by the force account system. When international financing began to be obtained, which meant that the works had to be carried out under contract, the lack of financial support, the high guarantees required and the fact that contracts were not regularly forthcoming were obstacles in the way of the industry's development, to the extent that many times the few local companies were unable to compete with foreign firms.
- 3.29 The Study Mission paid special attention to this matter and drew up an inventory of the local firms having the equipment and basic personnel for carrying out roadbuilding works such as that making up the proposed program. This inventory is given as Annex H. On the basis of this analysis the Project Committee believes that there are four firms or consortia that should be able to handle contracts of the size proposed in the project under study.
- 3.30 As regards foreign firms, the main projects carried out in Nicaragua in recent years have usually been done by foreign contractors, either by themselves or in partnership with local firms. The last two such contracts let, Las Mercedes-San Benito and Acoyapa-San Carlos, were awarded to a U.S. firm, Albert Ellis. There are three U.S. companies that generally bid on contracts offered by the DGC, while others that operate in the Central American area do so occasionally. Costa Rican firms have also shown an interest in taking part in road contracts in Nicaragua.

- 3.31 On the basis of the foregoing, it is believed that there would be enough qualified firms to handle the program even if the contracts concerned, on account of their nature and the amounts involved, failed to attract foreign firms.

J. Works on Force Account

- 3.32 On the other hand, if the job offer were extended to a weak construction industry or work or equipment performance was low, this could signify: i) that if no foreign companies bid, execution of the works on contract would be endangered, and ii) market capacity would be exceeded, with a logical resulting increase in prices.
- 3.33 In the case of the four roads involving improvements, the work should be done on force account, since the typical low productivity of the equipment and the little interest that would be shown by contractors, because of the amount and features involved, indicate that bid prices would be high.
- 3.34 A study is being conducted on capacity of the local road industry, under the national transportation plan, concluding 1/ that the Dirección General de Caminos has a greater construction capacity than local private industries. The plan would propose general measures for development of the industry, indicating that, until it does develop, the construction of roads like those comprising the program should be done on force account.
- 3.35 As outlined, it is recommended that the road improvement works covered by the program, for a total cost of US\$4 million, be executed by the Dirección General de Caminos on force account. It is believed that the Dirección General de Caminos has sufficient capacity to execute them within the terms provided.
- 3.36 The following performances were achieved in the works performed by force account in the program financed with Loan 63/SF-NI:

1/ Announcement to the Project Committee; the plan has not yet been finished.

	<u>Km</u>	<u>Time Taken</u>
El Viejo-Consiguina	35.8	4 years 11 months
III Cambocho Plan (1st stage)	104.7 <u>1/</u>	1 year 8 months
III Cambocho Plan (2nd stage)	124.4 <u>2/</u>	2 years 8 months

- 3.37 It can be seen that for the Cambocho Plan the work was diligently performed and in reasonable times. As regards the El Viejo-Consiguina section, the actual road work was in fact done in two years and seven months (between October 1965 and May 1968) but the building of the two bridges (El Viejo and El Congo) was not started until February 1970 and took until September of that year, thus making the total time four years and eleven months. In all three of the above, compliance with the technical specifications was excellent.
- 3.38 With USAID financing, the DGC built the Condega-Yalí section by force account, to specifications similar to those for the roads under consideration in this program and totaling 43 km, in approximately three years between 1972 and 1975. Considering that the Managua earthquake occurred in that period, with all the consequent delays, this can be considered a good performance.
- 3.39 The MOP is currently proceeding with the procurement of about US\$15 million worth of equipment. US\$8 million of that amount would be financed by EXIMBANK. According to the present schedule this equipment would be used mainly for maintenance and construction by force account of roads to the Atlantic region, an area where contractors will not work because of its inaccessibility and its nine-month rainy season. This work in the Atlantic region and the lack of maintenance equipment already noted has meant that the DGC does not have sufficient equipment for the work to be done by force account under the present program. It is accordingly proposed that a total of US\$700,000 from the possible loan be used to purchase additional equipment. As noted under Maintenance, the DGC has the capacity needed for the proper operation and maintenance of the equipment.

K. Right of Way

- 3.40 The design of the roads included in the preliminary list follows the present routes in practically every case. In most instances, therefore, the construction work could go ahead without any rights of way having to be obtained. The ones that would have to be acquired would be for widening the presently rather narrow roadway to the specifications, and in the few cases where the design departs from the existing route. As noted, the cost of the rights of way needed would be US\$170,000 equivalent.

1/ 77 km construction plus 27.7 km improvement.

2/ 80.9 km construction and 43.5 km improvement.

- 3.41 The Ministry informed the Study Mission that it would initiate negotiations for obtaining the rights of way as soon as the possible loan contract was signed. Although no difficulties are expected before the physical starting of the works in each case, the borrower will be required to demonstrate to the Bank that it has sufficient rights to the land concerned. 1/

L. Supervision and Technical Control of the Works

- 3.42 The Executing Unit would be responsible for the supervision, inspection and technical control of the works. In the works to be done under contract, the consulting firm to be hired for the purpose would take care of this, while in those done by force account the Unit's own staff would handle the matter directly with advice from the individual consultant.

M. IDB Inspection and Supervision

- 3.43 The inspection and supervision of the execution of the program would be taken care of by the Field Office of the Bank in Nicaragua.

N. Accounting and Audit of the Program

- 3.44 During execution of the program the DGC would set up a system of separate accounts for recording all investments made in the program, both those chargeable to the possible loan funds and those funded from the local contribution.
- 3.45 From the fiscal year in which execution of the program is started and throughout its execution, the DGC would submit to the Bank within 120 days of the ending of each fiscal year the financial statements of the program duly audited by an independent firm of public accountants proposed by the National Accounting Office and acceptable to the Bank, using audit procedures satisfactory to the Bank.

O. Betterment Tax

- 3.46 The Real Estate Tax Law promulgated in the Official Gazette (Diario Oficial) of November 26, 1974 specifies that there shall be an annual tax on real estate. Article 1 of the Law empowers the General Bureau of Revenue to apply and collect this tax on the basis of the assessment of the land according to the Law on Real Estate Records and Inventory of Natural Resources.

The General Bureau of Natural Resources is required to pay this tax on real estate by applying the rate of 1% on the valuation assessed on the preceding June 30. This tax is a charge on the property which has preference over any other lien on it, recorded or noted after the institution of the tax liability, and is therefore a privileged claim.

1/ This condition would be included in the loan contract.

This charge may be met by payment of the liability or through any other recognized form of settlement of tax liabilities.

- 3.47 The Real Estate Tax Law allows taxpayers the right to a credit against the tax, which may also be 1% on mortgage balances due on the date on which the tax is payable. This credit can be granted in the following cases: (i) when the taxpayer has received financing from the national financing system for permanent investment in or improvements to the property and the value of these is included in the assessed value; (ii) when the taxpayers have received mortgages to purchase or build their homes in the same property, or (iii) when the balance of the mortgage debt is part of the price of the property.
- 3.48 Pursuant to the Regulations to the Real Estate Tax Law, the assessed value shall be considered the estimated market value determined according to an Assessment Manual and the findings of a property survey. These Regulations further specify that the market value shall be the largest sum in money or its equivalent which the purchaser would pay or for which the owner would sell if the property were on the market for a reasonable time, provided both were aware of the uses and purposes for which the property could be employed right now or in the near future, and any restrictions on same.

P. Road Maintenance

- 3.49 The expansion of Nicaragua's road system from 6,200 km in 1965 to 11,200 km in 1969 led to certain maintenance problems. In an attempt to resolve these, the Bank granted Nicaragua Loan 305/SF-NI designed to help strengthen the maintenance system for unpaved roads by means of:
- (a) Construction of machinery and equipment.
 - (b) Construction of repair shops in four main camps and ten auxiliary ones.
 - (c) Provision of technical assistance regarding maintenance procedures and the practice of equipment repair.
 - (d) Strengthening and reorganization of the financial administration of the DGC.
- 3.50 Execution of this loan has almost been completed, with satisfactory results (see loan evaluation, Chapter VI). The technical cooperation granted simultaneously with this loan for road maintenance has achieved all of its purposes except for implementation, 1/ which has not been

1/ The equipment purchased with the loan was not sufficient to fill all the needs; the continuing expansion of the system, which increased from 11,200 km in 1969 to 17,500 km in 1974, and the aging of much of the existing equipment, have further aggravated this deficiency.

completed owing to lack of sufficient maintenance equipment. The technical cooperation for maintenance of the equipment had to be canceled because the expert hired withdrew.

- 3.51 To solve these problems of implementation and maintenance, the DGC plans to procure the US\$15 million worth of maintenance equipment already referred to, which would begin to arrive in the country in the course of 1977. To solve the equipment maintenance problems, the Boswell Engineering Co. has been awarded a contract totaling US\$2,400,000, of which US\$320,000 would be used for training mechanics and operators, US\$320,000 for construction of a lecture room, purchase of audiovisual equipment and supplementary items to be built into existing facilities, and US\$1,760,000 for purchase of shop equipment and tools.
- 3.52 This would leave implementation of the maintenance plan prepared with Loan 305/SF-NI to be done. To this end it is proposed that the same consultant who would be hired to advise the Executing Unit during execution of the program should extend his activities to include advising the DGC on maintenance, pursuant to the terms of reference set forth in Annex H. This would all serve to considerably improve the maintenance done by the DGC, so that there would be grounds for assuming that the roads to be built under this program would be properly maintained.
- 3.53 No problems would, therefore, be expected with the maintaining of the roads to be built under the program. In any event, the borrower would undertake to have this maintenance work done to the Bank's satisfaction.

Ex-post evaluation

- 3.54 The Bank will in due course consider granting technical assistance to the Republic of Nicaragua to establish the bases for compilation of the information needed for ex-post evaluation of the project. 1/

1/ See Annex P.

IV. THE BORROWER AND THE EXECUTING AGENCY

A. Institutional Analysis

1. The borrower and the executing agency

- 4.01 The borrower would be the Republic of Nicaragua and the executing agency would be the Ministry of Public Works (MOP) through its General Bureau of Roads (DGC). The latter would have under it a Local Road Program Executing Unit that will be established primarily for execution of the program under study.

2. Basic functions

The legal basis for the MOP resides in the Law Establishing the Ministries of State (Decree No. 106 of October 29, 1948) as amended, plus the Constitution of April 3, 1974. The basic functions of the MOP are: (1) technical direction and construction of the national road system; (2) encouragement of commercial and other navigation on rivers, lakes and seas; (3) improvement of environmental and traffic conditions in the municipalities; (4) public works in general; (5) operation of the National Geographic Institute; (6) construction and maintenance of public buildings and (7) promotion of development of Nicaragua's Atlantic Coast region.

3. Organizational structure and personnel

(a) Ministry of Public Works

The present formal organizational structure of the Ministry of Public Works as given in Annex I hereto, is the outcome of the administrative reform carried out by extending to the MOP the recommendations deriving from the studies made by the consultants Peat, Marwick, Mitchell & Co. under Technical Cooperation Agreement ATP/SF-1135-NI, for the administrative, financial and accounting reorganization of the DGC. This firm was hired to remedy deficiencies brought to light during application of the financing granted through Loan 305/SF-NI and its work is presently in the evaluation of results stage. ^{1/}

- 4.02 The organization chart of the DGC after implementation of the administrative reform is given in Annex J.

The DGC has the following main purposes: (a) to promote expansion of the country's road system and take care of its improvement and maintenance; (b) to assure availability of all-weather roads to agricultural areas and rural population centers, and (c) to make economic feasibility and engineering studies for the future development of the road system.

^{1/} The evaluation of the progress of this Technical Cooperation is considered in paragraph 4.11.

- 4.03 Following the Managua earthquake of December 1972, the following additional short-term purposes relating to the transportation sector were formulated for the DGC: (a) to meet the demand for transportation generated by productive, social and urban activities; (b) to create employment; (c) to reduce congestion on the roads into Managua, and (d) to improve access to nearby cities, especially Masaya, Granada and Jinotepe.
- 4.04 To achieve these purposes, the DGC has three departments (Engineering, Administration and Operations) and a staff of 3,532 distributed as follows:

	<u>Department 1/</u>			
	<u>Engineering</u>	<u>Administration</u>	<u>Operations</u>	<u>Total</u>
Professionals	25	12	45	82
Office staff	32	124	241	397
Technicians	4	5	195	204
Other	103	92	2,654	2,849
Totals	<u>164</u>	<u>233</u>	<u>3,135</u>	<u>3,532</u>

- 4.05 The Operations Department, through its Roads Division, would be responsible for the carrying out of the physical works included in the local roads project.
- 4.06 The chief functions of the Roads Division include: (a) executing projects by force account; (b) analyzing the maintenance requirements of the national road system and construction of production roads; (c) installing road signs, and (d) protecting the highways through application of a system of control over loads.
- 4.07 The Division has a Production Roads Section and a Maintenance Section. The Production Roads Section is responsible for the building, widening and improving of secondary and production roads by force account. The Maintenance Section handles the maintaining of dirt roads, load control and signing.

4. Accounting and financial management

- 4.08 The MOP maintains budget accounts in accordance with the Budget Law. Implementation of the budget is the responsibility of two Budget Delegates, one for the entire Ministry except for the DGC and the other for the DGC alone.

1/ Source: Organization and Methods Section, MOP.

- 4.09 Technical Cooperation ATP/SF-1135-NI (Accounting and administrative reorganization of the DGC) has enabled the DGC to overcome to a large extent the shortcomings of its administrative and accounting procedures. This technical cooperation took the form of hiring of the consulting firm Peat, Marwick, Mitchell & Co. to study the administrative and accounting procedures, diagnose deficiencies, design and implement new systems, and finally evaluate and verify the results obtained.
- 4.10 On the organizational side, the consultants prepared various manuals, chief among which are those on organization, administrative procedures and accounting (general and cost accounting, with its schedules of accounts, and budget accounting in line with the pertinent legal provisions).
- 4.11 As already noted, the DGC has an accounting system that is independent of the rest of the Ministry and covers the aspects relating to performance of its budget, general accounting and cost accounting for works in progress.
- 4.12 Under Technical Cooperation ATP/SF-1135-NI the consultants designed the consolidation of the accounting system into a computerized information system. This system is now being implemented.
- 4.13 The Minister of Public Works' decision to extend the administrative and accounting reorganization of the DGC to the entire Ministry has entailed the transfer of major DGC units to the MOP itself. This decision has led to criticism from the consultants, who maintain that it unbalances the organization set up in the DGC and that this could render the manuals prepared obsolete, so that the effort spent on them would have been wasted and the results achieved so far to no effect.
- 4.14 At the same time, there are also differences of opinion between the MOP and the consultants regarding the effectiveness of the implementation of the computerized information system, which the MOP asserts has not produced the desired results owing to design and implementation shortcomings attributable to the consultants. The consultants are now in the process of evaluating the results.
- 4.15 Since the favorable results of the Bank-sponsored technical cooperation could be compromised if the consultants are right in their assertions, the condition would be stipulated that the borrower must produce evidence to the Bank, within one year of the signing of the possible loan contract, to the effect that the computerized information system and all the administrative and accounting procedures recommended as a result of Technical Cooperation ATP/SF-1135-NI, or alternatives producing equivalent results acceptable to the Bank, have been put into effect by the DGC. (See Recommendations)

Audit

- 4.16 The financial management of the MOP and its subordinate agencies is subject to the following audit and control procedures:
- (a) Advance supervision is exercised through the Budget Officials Bureau of the National Budget of the Finance Ministry, who verify the existence of budget appropriations for disbursements and compliance with applicable legal requirements.
- 4.17 As already noted, the internal audit unit which used to be part of the DGC now reports direct to the Minister of Public Works.
- 4.18 The consultants Peat, Marwick, Mitchell & Co. prepared a manual of audit procedures for the DGC, but this has not been put into effect yet. There are no audit work programs for the rest of the Ministry's subordinate agencies, basically because the audit staff (1 auditor plus 2 assistants) have been limited to working permanently with the Government Audit Office and have been unable to attend to specific functions.
- 4.19 For the program under study, the borrower would be required to produce evidence to the Bank within one year of the signing of the possible loan contract, that the MOP: (1) has assigned sufficient, properly qualified staff to its internal audit units, and (2) has implemented the work programs pertaining to the DGC.

Outside Audit

- 4.20 The outside audit setup for the MOP and its subordinate agencies is as follows:
- (a) For the MOP, there is a permanent Audit Office unit to approve and forward for action, after verification and registration, all payment requests to be met by the General Treasury of the Republic. Another such unit is assigned exclusively to the DGC.
 - (b) The Government Audit Office handles the consolidated annual balancing of the Revenue and Expenditure Budget of the Republic.

B. Financial Analysis

1. Resources

- 4.21 The DGC has no resources of its own, neither does it receive the proceeds of any special taxes to finance its operating and capital expenditure programs. Its sole source of funds is the national budget.

2. Budget performance of the DGC

4.22 The DGC is responsible for execution of programs connected with road projects that involve highway and road construction, whether by private contractors or force account, and the maintenance of the road system.

4.23 On average, the funds actually allocated to the DGC over the period 1973-75 have represented 78% of the MOP's budget in that period. Budget performance by DGC program is summarized below: 1/

(Thousands of US\$) 2/

	1973			1974			1975		
	Budget	Performance	%	Budget	Performance	%	Budget	Performance	%
Operation	3,816	3,793	99	4,865	5,680	117	8,874	8,210	93
Investment									
Highway									
Project	12,877	7,469	58	15,236	12,295	81	20,125	13,238	66
National									
Emer-									
gency &									
Demoli-									
tion	1,678	423	25	1,768	3,808	115	530	503	95
TOTALS	18,371	11,685	64	21,869	21,783	99	29,529	21,951	73
% MOP Budget		70			87			76	

4.24 The above table shows a recovery in the percentage performance in 1974 compared with 1973, followed by deterioration again in 1975. Operating expenditures show the highest percentages, averaging 101% of the original budget figures. Investment expenditures, on the other hand, only averaged 72% of budget over the period. This was due mainly to the cutbacks in the highway construction programs.

4.25 It should nevertheless be noted that, as the following table shows, the investments made in road construction have shown a steady although moderate growth, especially between 1973 and 1974, despite the fact that funds had to be diverted to demolition and cleanup work in Managua after the December 1972 earthquake:

1/ Detailed DGC budget performance figures are given in Appendix L.

2/ Exchange rate: C\$7 = US\$1.

<u>Year</u>	<u>Investments in roads (thousands of US\$)</u>	<u>% increase compared with previous year</u>
1973	7,469	-
1974	12,295	65
1975	13,238	8

Road Maintenance Budget

4.26 Performance of the road maintenance budget over the period has been very satisfactory, averaging 103% of the original appropriations.

4.27 The actual maintenance expenditure figures can be summarized as follows:

<u>Year</u>	<u>Expenditures (thousands of US\$)</u>	<u>% increase compared with previous year</u>
1973	1959	-
1974	3790	93
1975	5672	50

As is evident, there has been an appreciable increase in absolute terms of 190% between the 1973 and 1975 figures.

The sums actually spent on road maintenance represented the following percentages of total MOP and DGC expenditures in the three years considered:

<u>Year</u>	<u>Performance</u>	
	<u>MOP</u>	<u>DGC</u>
	<u>%</u>	<u>%</u>
1973	12	17
1974	15	17
1975	20	26

It is therefore apparent that there has also been a considerable increase in relative as well as absolute terms, when compared with total MOP and DGC expenditures.

4.28 The DGC budget estimates for 1976 show an appropriation of US\$5,391,000 equivalent for maintenance which, while slightly lower than the actual US\$5,672,000 spent in 1975, still maintains its relative significance in the DGC's total expenditure, estimated at US\$21,332,000 for 1976, since if actual expenditure proves to be as estimated, maintenance will account for one fourth of the DGC's expenditure this year.

C. External Loans Granted to Nicaragua for Road Works

4.29 Various international financing agencies have contributed toward the implementation of road infrastructure projects in Nicaragua. The share of these agencies in the financing of road and highway construction programs over the past fifteen years is shown in Annex J.

- 4.30 Of the total of US\$62 million granted to Nicaragua by international financing institutions as of the end of 1975, 81% (i.e. US\$50 million) had been disbursed while the other 19% was for completing projects in progress. The list of international institutions assisting Nicaragua on roads is headed by the Central American Bank for Economic Integration, which has provided 50% of the total financing made available to Nicaragua for road projects.
- 4.31 The IDB, for its part, contributed 26% of the total, followed by AID with 13%, EXIMBANK with 8% and the Canadian International Development Agency with 3%.
- 4.32 The status of the execution of the IDB loans is given in Chapter VI.

D. Financial Projections

- 4.33 In preparing the financial projections it was borne in mind that the DGC has no income of its own and that there are no taxes for financing the works involved in the proposed program. The sole source of financing would therefore be the national budget. 1/

1. DGC Budget Projections

- 4.34 The DGC budget projections for the period 1976-81 are as follows:

1/ The bases adopted for these projections are given in Annex K.

GENERAL BUREAU OF ROADS
FORECAST OF NATIONAL FUNDS REQUIRED

1976-79
(Thousands of US\$)

	Actual 1975	Budget 1976	1977	1978	Estimate 1979	1980	1981	TOTAL 1976-81
REQUIREMENTS								
Operating Expenditures								
Management & Administration	954	969	1,017	1,068	1,121	1,177	1,236	6,588
Supervision Highways & Roads	227	258	271	285	299	314	330	1,757
Planning & Design	439	474	498	523	549	576	605	3,225
Road Maintenance	5,672	5,391	5,768	6,172	6,604	7,066	7,561	38,562
Mechanical Maintenance	918	477	518	562	610	662	718	3,547
Total Operations Expenditures	8,210	7,569	8,072	8,610	9,183	9,795	10,450	53,679
Capital Expenditures								
I. Projects under execution								
1. Paved highways	5,340	8,297	3,349	-	-	-	-	11,646
2. Secondary roads	5,347	4,752	734	-	-	-	-	5,486
3. Local roads	3,054	714	171	-	-	-	-	885
	13,741	13,763	4,254	-	-	-	-	18,017
II. Projects to be executed								
1. Paved highways	-	-	3,057	12,229	20,970	8,396	-	44,652
2. Secondary roads	-	-	7,574	7,574	7,574	7,574	-	30,296
3. Local roads	-	-	3,107	5,211	6,428	6,627	3,427	24,800
a. Project under study	-	-	2,647	4,291	5,508	6,627	3,427	22,500
b. Other	-	-	460	920	920	-	-	2,300
	-	-	13,738	25,014	34,972	22,597	3,427	99,748
Total Capital Expenditure	13,741	13,763	17,992	25,014	34,972	22,597	3,427	117,765
Total Funds Requirement	21,951	21,332	26,064	33,624	44,155	32,392	13,877	171,444
FUNDS AVAILABLE								
Operating Expenditures	8,210	7,569	7,569	7,569	7,569	7,569	7,569	45,414
Investment Costs								
I. Financed entirely out of national funds								
Roads built under contract	3,889	4,302	734	-	-	-	-	5,036
II. Financed partly with external funds								
a. Loan negotiated	8,080	7,000	9,092	6,059	6,059	6,059	-	34,269
b. Loans to be negotiated								
Rural Roads Program	-	-	2,125	3,459	4,371	5,298	2,747	18,000
(Project under study)	-	-	3,166	12,146	18,424	6,346	-	40,082
Other	-	-	5,291	15,605	22,795	11,644	2,747	58,082
	11,969	11,302	15,117	21,664	28,854	17,703	2,747	97,387
Total funds available	20,179	18,871	22,686	29,233	36,423	25,272	10,316	142,801
National funds to be provided								
Annual	1,172	2,461	3,378	4,391	7,732	7,120	3,561	28,643
Cumulative	-	2,461	5,839	10,230	17,962	25,082	28,643	

2. National funds requirements

4.35 Based on the budget forecasts for 1976 and the estimates of operating and capital expenditures for 1977-81, the above Forecast of National Funds Required was prepared.

4.36 The DGC budget for the forecast period would be financed to a large extent (about 54%) from external resources. The programs which need international financing agency assistance for their realization, and which include the Local Road Program under study, show the following picture:

(In thousands of US\$ or equivalent)

	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Investment costs	9,461	17,258	25,014	34,972	22,597	3,427
External financing <u>1/</u>	<u>7,000</u>	<u>14,383</u>	<u>21,664</u>	<u>28,854</u>	<u>17,703</u>	<u>2,747</u>
National funds requirement	<u>2,461</u>	<u>2,875</u>	<u>3,350</u>	<u>6,118</u>	<u>4,894</u>	<u>680</u>
% increase over 1976 budget	-	17	36	149	99	(72)

4.37 As is apparent, except in the last year, the local counterpart funds called for exceed the forecast requirements for 1976 throughout the program execution period, owing to the higher number of highway investment programs financed partially with external funds.

4.38 The forecast national funds requirements, in comparison with the 1976 budget, are as follows:

1/ Includes both loans negotiated and loans to be negotiated.

(Thousands of US\$ or equivalent)

	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Operating expenditures	<u>7,569</u>	<u>8,072</u>	<u>8,610</u>	<u>9,183</u>	<u>9,795</u>	<u>10,450</u>
% increase over 1976 budget	-	7	14	21	29	38
Capital expenditure						
- Financed out of local resources	4,302	734	-	-	-	-
- counterpart to external financing	<u>2,461</u>	<u>2,875</u>	<u>3,350</u>	<u>6,118</u>	<u>4,894</u>	<u>680</u>
	<u>6,763</u>	<u>3,609</u>	<u>3,350</u>	<u>6,118</u>	<u>4,894</u>	<u>680</u>
% increase over 1976 budget	-	(47)	(50)	(10)	(28)	(90)
Total national funds required	<u>14,332</u>	<u>11,681</u>	<u>11,960</u>	<u>15,301</u>	<u>14,689</u>	<u>11,130</u>
% increase over 1976 budget	-	(18)	(17)	7	2	(18)

4.39 As can be seen the national funds needed during the first two years of construction of the program roads are less than the expenditures in 1976, only reaching somewhat higher figures in the third and fourth years before dropping again as the works are completed. On average, the funds required by the DGC during the program execution period will be about 10% less than the sums budgeted for 1976.

4.40 If the assumptions made prove correct, the projects under execution and to be executed by the DGC up to the completion of the program under study would require additional national resources over and above those projected as available for that period by US\$3,378,000, US\$4,391,000, US\$7,732,000, US\$7,120,000 and US\$3,561,000 in 1977, 1978, 1979, 1980 and 1981, respectively. These additional requirements would be met by stepped-up national budget appropriations for the MOP.

3. Feasibility of the local contribution to the program

4.41 The funds needed for the local counterpart to the program would be obtained from appropriations from the national budget for the MOP.

4.42 The local contribution to the program would be US\$4.5 million and would be made available as follows, according to the investment schedule given in paragraph 3.26.

<u>YEAR</u>	<u>US\$ THOUSANDS</u>
First (1977)	522
Second (1978)	832
Third (1979)	1,137
Fourth (1980)	1,329
Fifth (1981)	680
Total	<u>4,500</u>

4.43 This shows that the largest local contributions will be called for in the third and fourth years, at US\$1.3 million and US\$1.3 million, respectively. These figures represent 8% and 10% of the sum invested in execution of road works in 1975.

4.44 The relative significance of the local counterpart as compared with the national funds that would be required by the DGC during the execution period would be as follows:

(Thousands of US\$ or equivalent)

	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Local contribution to program	<u>522</u>	<u>832</u>	<u>1,137</u>	<u>1,329</u>	<u>680</u>
Total national funds required	<u>11,681</u>	<u>11,960</u>	<u>15,301</u>	<u>14,689</u>	<u>11,130</u>
Local contribution as % of total requirements	4	7	7	9	6

4.45 It is concluded from the above that the Nicaraguan Government would not have to make any excessive effort to produce the national funds needed for execution of the program. Similarly, assuming that the balance of the public debt remains substantially the same as at the close of the 1975 fiscal year (i.e. about US\$644 million equivalent) the program, with Bank financing of US\$18 million equivalent, would upon completion of its execution raise this debt by approximately 3%. This increase would be of minor significance as regards the conditions on which the loan would be granted.

V. JUSTIFICATION FOR THE PROGRAM

A. Legal Power

- 5.01 The Republic of Nicaragua is legally empowered to contract the eventual loan. The Ministry of Public Works, as part of the centralized administration of the Republic, also has legal capacity to implement the program through the General Bureau of Roads.

B. Technical Feasibility

- 5.02 From the technical standpoint the program is feasible based on the following reasons:
1. The program is well conceived technically and will contribute to solve to a certain extent the lack of adequate access roads to the rural areas of the country.
 2. The selection criteria used, particularly the perception of the program from the national standpoint and not merely the regional standpoint, in keeping with the recommendations of the National Transportation Plant, assure adequate planning of the works to be executed.
 3. The design standards used are in accordance with the size of the roads and the volume of the expected traffic.
 4. The six projects were designed following methods consistent with good engineering practices.
 5. The calculated cost of the program is reasonable and was prepared:
 - i. For the six roads with designs available representing 53% of the program on the works deriving from those designs and current unit prices.
 - ii. For the other four roads on the preproject costs prepared for the technico-economic evaluation, corrected by the ratio of project cost to cost of preprojects for the previous six.
 6. The unit prices used to calculate the predictions of this sample are reasonable and in line with experience in road construction in the Central American region.
 7. The General Bureau of Roads would have the necessary technical capacity to implement the program within scheduled deadlines. These deadlines include sufficient time for each of the implementation stages, including completion of studies, bidding and contracting, construction and final completion of works.

8. The work to be done under contract would be awarded to private contractors following international bidding procedures consistent with the Bank's requirements for programs financed out of the Fund for Special Operations.
9. Nicaragua has contracting firms with the necessary construction capacity to perform the work to be done under contract, and furthermore foreign companies may also participate in the bidding.
10. The General Bureau of Roads has the necessary technical staff and capacity to perform the jobs proposed to be done under force account.
11. The creation of an executing unit would provide the necessary administrative flexibility to implement the program within scheduled deadlines. The technical capacity of this unit would be augmented through the contracting of a consulting firm to supervise the work done under contract and a consultant who would provide supervision and guidance to it during the implementation of the program in general and the work under force account in particular.
12. With the contracting of Boswell Engineering Co., the procurement of equipment and the implementation of the maintenance plans prepared within loan 305/SF-NI, the General Bureau of Roads would have sufficient capacity to handle proper maintenance of the roads to be built under the program, pursuant to the Bank's requirements in this regard.

C. Financial Feasibility

5.03 The program is also considered feasible financially and institutionally for the following reasons:

1. At the time that work is begun on the program, the recommendations of the consultants would have been completely implemented on the administrative and accounting reorganization of the General Bureau of Roads. The executing unit for the program will also be ready, and therefore no problems are anticipated in administrative and accounting control of the program.
2. Although the General Bureau of Roads does not have its own resources, the local contribution to the program would be feasible, since during its execution it would represent as an average only 8% of the resource needs of the General Bureau of Roads coming from domestic sources.

D. Economic Justification

5.04 The economic evaluation of the program was done by examining a sample composed of six roads unassumed to be representative of the total program. This sample, which covers 53.7% of the cost and 55.7% of the length of the program, is composed of the following roads:

Villa Salvadorita-Malpaisillo	29.5 Kms.
Juigalpa-La Libertad	32.9 Kms.
Abisinia-Bocaycito	26.99 Kms.
Rivas-Veracruz	5.70 Kms.
San Cayetano-La Trinidad	31.53 Kms.
Villanueva-El Sauce	40.61 Kms.
	<u>167.28 Kms.</u>

Methodology for the Economic Analysis

- 5.05 Generally speaking, the methodology employed in analyzing access roads to areas without population or production is based on computing the total net value of the production in the area of influence of each project.
- 5.06 In the present case, since the areas are currently producing and since the construction or improvement of the roads would increase production only marginally, the benefits were calculated primarily as road user savings. For the incremental production the only benefit assigned, per ton, was half of the savings in the cost of transporting existing production.
- 5.07 In the case of most of the roads a large part of the benefits will stem from savings by shifting transport by pack animal (mule) to transport by vehicles (trucks, jeeps and minibuses) on a gravel road passable throughout the year. At present the use of mules to transport cargo is confined chiefly to the products of small landowners who would, in terms of freight, be the major beneficiaries of the modal change to trucks. The switch to minibuses to transport passengers would also benefit primarily the neediest persons, who now travel by mule.
- 5.08 In cases where there is already a road to accommodate vehicular traffic, ^{1/} not easily but almost throughout the year, the hypothesis was also accepted that the benefits would be the cost differential between the two transport modes of mule and automotive vehicle. This hypothesis was reached under the assumption that, if the improvement work under the present program is not performed, the current road would soon become unpassable and transport would revert to the original system of using mules. ^{2/}
- 5.09 The entire methodology is based on traffic coming from or going to the direct area of influence of each project. There are some projects, however, which in the event that some supplementary works are constructed will also have crossover traffic, that is to say they will accomplish a greater connection function in addition to what could be ascribed to

^{1/} Existing roads are of very low cost, built without any technical standards and kept open based on reconstruction practically every year. Given the current size of the network it is impossible to assume that such work can be done permanently.

^{2/} Annex 0 describes the calculations performed to estimate the cost of transporting by mule.

primarily to the fact that no knowledge would be available as to the time in which this would occur or as to the crossover traffic. This consideration, which is not precise in itself, would have resulted in increasing the estimated internal rates of return, which are already acceptable.

- 5.10 This methodology, although apparently free from value judgments, has an implicit value judgment in actual practice, since it assumes that the marginal utility of income is the same regardless of the beneficiary. Nevertheless, it is generally accepted that this marginal utility is greater for the poor income levels and therefore weights should be used to account for this fact. In the evaluation of this program in accepting the traditional calculation of benefits no weights were attached, even though weighting coefficients greater than one should be applied since the beneficiaries are at income levels below the national average. The economic rate of return on the roads from the standpoint of social welfare is therefore greater than indicated in this report.
- 5.11 Since the ratio between using mules and vehicles as the mode of transport is 10 to 1, the benefits and therefore the economic rate of return are very sensitive to a change in the factors determining the cost of using mules as the mode of transport. 1/
- 5.12 Conservative assumptions have been used in this analysis, even though the existence of nonquantifiable benefits (for example access to schools, medical services, etc.) would make it permissible to use more generous criteria.

Economic Evaluation of the Representative Sample

Area of Influence

- 5.13 The total area of influence of the roads comprising the representative sample of the program is 3,063 km² with a population estimated in 1974 at 85,700 inhabitants. Of that population 72,8% is considered rural.

1/ See Annex O.

Area and Population in Project Zones of Influence
in the Representative Sample
(1974)

<u>Project</u>	<u>Area Km2</u>	<u>Total Population</u>	<u>Rural Population</u>	<u>Available Rural Labor Force</u>	<u>Gainfully Employed Rural Population</u>
Villa Salvadorita-Malpaisillo	513	20,100	12,650	10,800	3,800
Juigalpa-La Libertad	238	9,100	6,200	4,250	1,900
Abisinia-Bocaycito	430	13,500	11,400	6,250	2,750
Rivas-Veracruz	43	3,200	1,750	950	350
San Cayetano-La Trinidad	361	29,000	20,100	11,000	3,800
El Sauce-Villanueva	478	10,800	8,300	4,500	1,800
Total	<u>2,063</u>	<u>85,700</u>	<u>62,400</u>	<u>37,750</u>	<u>14,400</u>
	=====	=====	=====	=====	=====

5.14 Per capita income in Nicaragua was estimated at about C\$4,400 in 1973, equivalent to US\$629. 1/ The study entitled "Summary of the Situation and Diagnosis of the Agriculture-Livestock Sector in Nicaragua" done by the Sectoral Analysis Unit of National Agriculture-Livestock Committee in 1973 gives the average income per rural family in the 10 regions into which the country was divided for such purposes 2/ as C\$6,317 equivalent to US\$902. The study assumes that the average rural family is composed of 6.1 members; therefore, per capita rural income in the country has been calculated at C\$1,036,00 US\$148. This information is summarized on the following page:

1/ The analysis is based on 1973 figures, the last year for which such figures are available.

2/ The 10 regions appear in the table in paragraph 5.15. Each region covers one to three departments with similar features.

Average Rural Income

(córdobas for 1973)

Departments	Average annual rural family income 1/		Per capita rural income	
	C\$	US\$	C\$	US\$
León and Chinandega	9,607	1,372	1,575	225
Managua, Carazo	4,813	688	789	113
Mazaya, Granada Rivas	7,763	1,109	1,273	182
Nueva Segovia, Madriz	5,601	800	918	131
Matagalpa, Estelí, Jinotega	3,837	548	629	90
Boaco, Chontales, Río San Juan	9,516	1,359	1,560	223
	6,317	902	1,036	148

1/ It has been assumed that the average family is statistically composed of 6.1 members.

5.15 The roads of the representative samples are included in the departments for which rural income is itemized in the preceding table, as follows:

<u>Project</u>	<u>Department</u>
1. Villa Salvadorita-Malpaisillo	Chinandega, León
2. Juigalpa-La Libertad	Chontales
3. Abisinia-Bocaycito	Jinotega
4. Rivas-Veracruz	Rivas
5. San Cayetano-La Trinidad	Carazo, Managua
6. Villanueva-El Sauce	Chinandega, León

5.16 According to available information on the size of farms in 12 of the 14 municipalities where the zones of influence of roads in the representative samples are located, approximately 47.8% of the farms are less than 10 manzanas in size, 1/ 38.8% are from 10 to 100 manzanas and the remaining 13.4% over 100 manzanas. A breakdown of this information is presented in the following table:

1/ Un manzana = 0.6898 hectares.

Distribution of farms by size in Municipalities where zones of influence of roads in the representative samples are located 1/

<u>Project</u>	<u>Municipalities in zone of influence</u>	<u>Number of farms</u>	<u>% of farms 1 m - 9 m</u>	<u>% of farms 10 m - 99 m</u>	<u>% of f over 1</u>
Malpaisillo-Villa Salvadorita	Chinandega Posaltega Villa Nueva Larreynaga Teleca	1,071 157 456 771 491	68.3 40.8 22.4 54.9 59.9	23.9 41.4 68.2 33.7 35.4	7.7 17.8 9.4 11.4 4.7
Juigalpa-La Libertad	Juigalpa La Libertad	890 294	56.9 6.5	22.6 55.4	10.5 38.1
Abisinia-Bocaycito	Jinotega	-	-	-	-
Rivas-Veracruz	Rivas Tola	495 280	64.6 46.0	22.6 37.9	12.7 16.1
San Cayetano-La Trinidad	Diriamba El Carmen San Rafael del Sur	879 - 264	64.1 - 54.2	28.6 - 34.5	7.4 - 11.4
Villa Nueva-El Sauce	Villanueva El Sauce	456 487	22.4 35.3	68.2 52.8	9.4 11.9

1/ Data available only for 12 of the 14 municipalities involved in the sample roads; calculation data from the 1971 census.

- 5.17 The zones of influence of the sample roads, as described in the preceding table, now have poorly constructed trails or paths serving only a few farms mainly producing sugar, cotton and cattle that have the vehicles needed for this type of roads. Small producers in the zone transport their goods by rudimentary means, which signifies limited accessibility during the rainy season and difficult conditions during most of the year. This results in high transportation costs and a heavy disadvantage in marketing their products, a situation that would be improved through construction or improvement of program roads.
- 5.18 Agricultural production in the areas of influence of the representative sample roads have the following features.

Malpaisillo-Villa Salvadorita

Cotton and sugar cane account for about 80% of marketable production in the zone, with livestock and livestock products making up much of the rest.

Juigalpa-La Libertad

Cattle, milk and other dairy products are important in the zone of influence of this project. Also comparatively significant is the production of grains, bananas, and sugar cane.

Abisinia- Bocaycito

In the area of influence of this road both food crops and industrial crops, as well as livestock and dairy products, make a substantial contribution to total output. Rating the products by marketable weight in 1974 in order of importance they are: milk, vegetables and truck gardening, bananas, coffee, sugar cane, cattle and corn.

Rivas-Veracruz

This road has a small area of influence but agricultural production is fairly diversified. In 1974 food crops represented about 22% of the total surplus available for marketing, industrial crops about 50% and livestock and livestock products the remaining 28%. The major products were: sugar cane, bananas, milk and cattle.

San Cayetano-La Libertad

Agricultural output in this zone is the largest of the six projects comprising the representative sample. This zone is also the most diversified of them all, although cotton is the predominant crop. Sugar cane, ^{1/} milk, rice, cattle and bananas also make a significant contribution to the zone production.

Villa Nueva-El Sauce

The major marketable product in this area is cotton, accounting for nearly 80% of total tonnage. Milk is the second most important item, representing around 13% of total tonnage.

^{1/} This is the major crop in terms of tonnage.

Analysis of Benefits

- 5.19 The internal rate of return on the roads in the representative sample varies from a minimum of 10.5% to a maximum of 18.5%. The utilization of a minimum discount rate of 10% is based on recent experience by the Bank in rural road construction, ^{1/} prior agreements between the Bank and the applicant, and the desire to recognize the social objectives and benefits of the program that are not easily quantifiable in monetary terms, one of the most important of which was being able to serve low-income populations in areas of low productivity.

The next table gives a summary of the economic evaluation of the projects comprising the representative sample of the program.

<u>Projects</u>	<u>Internal rate of return</u> <u>%</u>
Villa Salvadorita - Malpaisillo	17.6
Juigalpa - La Libertad	18.5
Rivas - Veracruz	10.5
Abisinia-Bocaycito	11.5
San Cayetano- La Trinidad	14.3
Villanueva-El Sauce	13.3

- 5.20 By virtue of the results summarized here and given in greater detail in Annex N and the other considerations given before, the program turns out to be economically justified.

Justification of Financing

- 5.21 Use of the Fund for Special Operations for partial financing of the program is considered justified because of:

1. The classification of Nicaragua as a less developed country.
2. The program's fulfillment of the aim of integrating new areas of agricultural production into the country's economic development and improving existing areas.
3. The extension of program benefits to needy and marginal sectors of the Nicaraguan population. The population in the areas of influence of the roads is primarily rural (70%)

- 5.22 A characteristic of developing countries is the income differentials, with a marked decline in the income of the rural population in comparison to that of the urban population. Nicaragua is no exception to this rule. The analysis shows that in 1973 per capita income of the rural

^{1/} Loan 427/SF-PN to the Republic of Panama and more recently loan 427/SF-ES to El Salvador.

population varied, depending on the department between US\$90 and US\$225 per annum. 1/ These figures represent 14% and 36% of the national per capita which was estimated at US\$629 in 1973. 1/

As concerns the social services offered, the picture turns out to be more or less similar to that of income. The literacy rates of the rural population ranged from 20% to 37.5%, whereas the national rate is 53%. The situation of access to health services also does not seem to be better, even though no data are available to illustrate this. 2/

Environmental Impact of Project

In view of the rural nature of the roads comprising this project, with no major ansolary works, the impact on the environment is expected to be negligible.

1/ 1973 dollars.

2/ Annexes M and N provides details on the per capita income and literacy rates at the level of each project in the sample.

VI. EVALUATION OF PREVIOUS LOANS IN THE TRANSPORTATION SECTOR

Loan 63/SF-NI

- 6.01 On September 27, 1975 the Bank approved this loan for the Republic of Nicaragua in the equivalent of US\$12 million for partial financing of a program to build and improve about 658 kilometers of local roads in various parts of Nicaragua at a total cost originally estimated in the equivalent of US\$18,152,125. 1/ Its execution was under the DGC (General Bureau of Roads) of the MOP (Ministry of Public Works).
- 6.02 The contract was signed on October 25, 1965 and the deadline for the last disbursement was established at October 25, 1968. The final disbursement was extended on three occasions by the Bank owing to the slow rate of progress in the construction work and problems relating to the construction of the Paso Real Bridge. When the last deadline of May 25, 1974 expired, the construction of 386 kilometers had been completed and the improvement of 72 kilometers of roads. Thus, 98% of the program was completed and it only remained to finish the bridge. At that time a balance in the equivalent of US\$19,360 of the original amount of the loan was canceled and the borrower had to complete the Paso Real Bridge over the Río Grande de Matagalpa from its own funds. The bridge has already been finished and thus the works called for have been implemented.

Loan 305/SF-NI

- 6.03 On September 2, 1971 the Bank approved this loan for the Republic of Nicaragua for the equivalent of US\$3,500,000 to help expand and improve the maintenance system on the highway network of Nicaragua by means of:
- i. The procurement of machinery, equipment and spare parts for the maintenance of secondary roads and the construction of maintenance camps and fields for that purpose.
 - ii. Technical assistance to strengthen and reorganize the financial management system of the Department of Roads.
- 6.04 The total cost of the loan was originally estimated at the equivalent of US\$5,040,000. The MOP, through the DGC, was designated as executing agency.
- 6.05 The contract was signed on November 23, 1971. The deadline for the last disbursement was set at November 23, 1974. That last deadline was extended three times. The last extension was for November 23, 1976. The extensions

1/ In April 1976 the physical goals of the project were changed to 459.3 kilometers by means of Amendatory Contract No. 1.

were primarily the result of delays in the construction of the repair camps and shops originally called for in the project. Nevertheless, all of the works are expected to be completed by the date of the last disbursement.

- 6.06 The portion of the project intended for the procurement of machinery and equipment has been completely finished. At September 30, 1976 the equivalent of US\$3,376,163 had been disbursed, 97.5% of the total amount of the loan and the total progress of the project is calculated at approximately 98%.
- 6.07 Included within this loan was technical cooperation ATP/SF-1135-NI in the equivalent of US\$258,000 for the purpose of providing technical guidance to the executing agency (DGC) concerning:
- i. Maintenance of roads;
 - ii. Conservation and repair of machinery and equipment;
 - iii. Strengthening and reorganizing of the financial management of the DGC.
- 6.08 To accomplish those objectives, the DGC contracted individual consultants for each of the three consulting tasks.
- 6.09 As of now, the work on road maintenance and strengthening and reorganization of the DGC has been finished. Concerning administrative aspects, the consultants prepared various manuals on organization, administrative procedures and accounting. They also designed a comprehensive computer information system for consolidation of the accounting system. As indicated in paragraphs 4.15 and 4.17, there are discrepancies between the MOP and the consultants concerning the effectiveness of the system's implementation. Therefore the condition has been laid down that within one year from the signing of the eventual loan contract the borrower will have to prove that the computerized accounting information system and all of the administrative and accounting procedures have been implemented by the DGC.
- 6.10 The work on the conservation and repair of machinery and equipment was canceled, since the consultant contracted to do the work decided to withdraw from the task. The DGC made two attempts to find a replacement for him, but no bidders took part. The DGC then decided against contracting such an expert and the pertinent sum of US\$75,000 equivalent was canceled.

Technical cooperation ATC/TF(SP)-1295-NI

- 6.11 In June 1974 the Bank provided the Ministry of Public Works with this contingent-recovery technical cooperation for the equivalent of US\$750,000 for partial financing of technical and economic feasibility studies on about

600 kilometers of local roads, of which approximately 300 kilometers would be selected having the greatest feasibility, according to selection criteria established by common agreement with the Bank. These studies and plans served as a basis for the application by the Government of Nicaragua for the present loan.

- 6.12 The consulting firms Baker-Wibberley and Octavio M. Salinas y Asociados, contracted as a consortium to carry out the feasibility studies, delivered them in May 1976. Based on the rate of return of each project, from the approximately 600 kilometers studied 12 roads were selected with a total original length of 327.24 kilometers to be covered by the final designs. The design of six (6) of these roads has already been submitted, and must now be reviewed by the Ministry of Public Works and the General Bureau of Roads.
- 6.13 The consulting firm has up to May 1977 to complete the design of four of the remaining roads, which would thus complete the 300 kilometers of designs contracted. The designs of the remaining 40 kilometers would be made directly by the General Bureau of Roads with its own staff and would be finished before the effective year of the eventual loan contract is completed.

To date, the status of the investments of the technical cooperation resources is as follows:

Amount:	US\$750,000.00	100.0%
Disbursed:	571,095.09 -	76.1%
Balance:	178,904.91 -	23.9%

In turn, the borrower has disbursed the equivalent of US\$188,465.66 chargeable to the local contribution, which represents 56.2% of the borrower's contribution to the program.

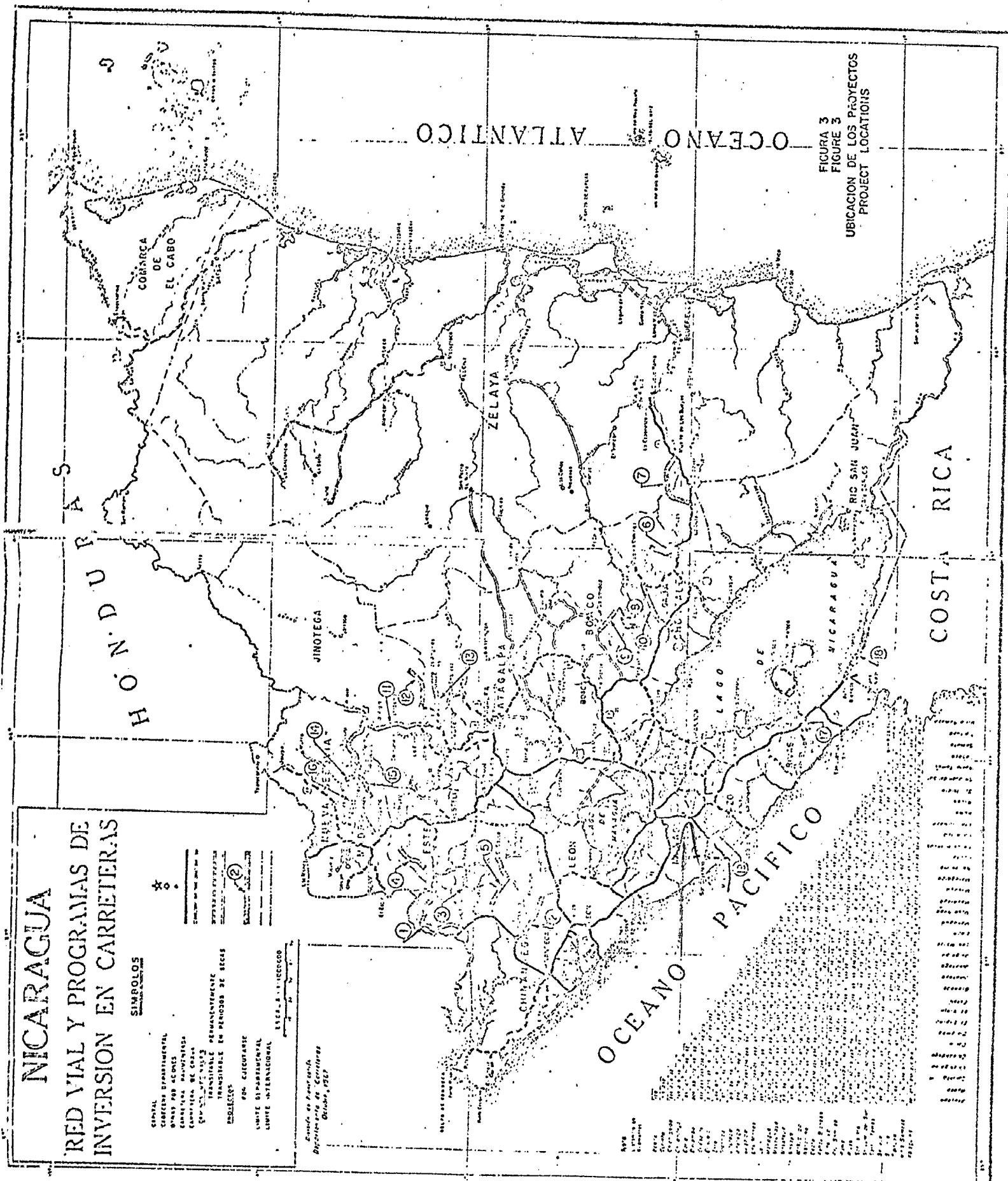
Camino estudiados mediante la Cooperación Técnica ATC/TP(SF)1295-NI

<u>Número</u>	<u>Camino</u>	<u>Long. 1/</u> <u>(Km.)</u>	<u>Costo 1/</u> <u>US\$1.000</u>	<u>Tasa de</u> <u>Retorno 1/</u>
1 A *	Somotillo-Cinco Pinos	30,0	734	14,8
1 B	Cinco Pinos-Limay	34,8	2.506	Neg
2 **	Villa Salvadorita-Malpaisillo	29,5	1.223	17,6
3	Villanueva-Achuapa-Limay	47,0	2.313	4,9
4 *	Limay-Pueblo Nuevo	24,7	1.125	12,4
5 **	El Sauce-Villanueva	40,6	1.192	13,3
6	Villa Somoza-El Zapotal	16,7	1.323	9,9
7 A	La Gateada-Río Mico	14,9	1.222	5,8
7 B	Río Mico-Muelle de los Bueyes	21,6	1.657	-
8	Cuapa-El Tabaco	12,1	1.909	6,7
9	El Tabaco-La Calamidad	19,3	1.056	22,2
10 **	Juigalpa-La Libertad	33,0	1.340	18,5
11 A *	Asturias-Pantasma	24,7	763	12,8
11 B	Pantasma-Buena Esperanza	19,8	1.924	4,9
12 **	Abisinia-Bocaycito	27,0	1.757	11,5
13	La Colonia-La Concha	20,9	1.629	4,4
14	Las Vueltas-S.J. del Río Coco	15,1	1.420	Neg.
15 A	Palacaguina-S.J. del Río Coco	43,2	2.235	4,5
15 B *	S.J. del Río Coco-Wiwilí	55,6	3.921	11,1
16	Ciudad Antigua-Telpaneca	19,1	1.789	0,8
17 **	Rivas-Veracruz	5,7	242	10,5
18	Sapoá-Orosi	35,5	1.485	7,0
19 **	San Cayetano-La Trinidad	31,5	1.594	14,3

* Caminos seleccionados preliminarmente.

** De los caminos seleccionados preliminarmente los que integran la muestra representativa.

1/ En el caso de los caminos que forman la muestra representativa los datos han sido ajustados para reflejar los resultados del análisis posterior en la Sede.



DESCRIPCION INDIVIDUAL DE LOS PROYECTOSSOMOTILLO-CINCO PINOS

El Proyecto designado comienza en el Departamento de Chinandega y termina en el Departamento de Estelí, más específicamente comienza en Somotillo; procede a través de Santo Tomás de Nace y termina en Cinco Pinos. La distancia total del proyecto propuesto es de 30.0 kilómetros.

Ruta Existente

Abandonando la Ruta 24 cerca de Somotillo, la Ruta sigue un camino existente calificable como substandard, hacia Santo Tomás del Nace. La superficie de rodamiento es regular en esta Sección, pero la ruta debe ser considerada como de estación seca debido a los diferentes vados encontrados. El terreno varía de plano a ondulado con suelos variados generalmente buenos para la construcción de carreteras. Existen algunos puentes pequeños, pero no hay instalaciones de drenaje menor a lo largo de la ruta. No se cruzan ríos grandes en esta Sección.

En Santo Tomás del Nace una circunvalación relativamente nueva para alrededor del pueblo. El alineamiento de este camino primitivo es aceptable para este tipo de proyecto bajo consideración, pero tiene una superficie pobre y drenaje inadecuado.

De Santo Tomás del Nace a Cinco Pinos la ruta sigue un camino primitivo. La superficie es generalmente pobre ya que la ruta va a través de terrenos ondulados o montañosos y es común encontrar gradientes empinadas. Los suelos son variados pero adecuados para la construcción de carreteras.

Normas de Diseño

Corrientemente con un TPD indicado de menos de 150, estandares Clase 2 fueron adoptados resultando en un ancho de corona de cinco metros.

Fuentes de Materiales

A lo largo del proyecto existen numerosas colinas de donde es posible obtener material adecuado para la superficie. En los cortes tipo A-2-4 a A-2-7 los materiales fueron observados. Cerca del kilómetro 7 existe un banco de préstamo el cual parece de excelente calidad para la capa de la base. Esta fuente ha sido usada por la Dirección General de Caminos.

En Río Los Quesos cerca de San Juan de Lima hay cantidades considerables de material de grava arenosa el cual debe de ser adecuada para efectos de construcción.

Proyecto Propuesto

Del Km. 0,5 al Km. 30, el proyecto propuesto sigue la alineación actual, haciendo uso máximo de la plataforma del camino y de esas pocas estructuras que se encuentran ya emplazadas. No hay cruces mayores de ríos ni tampoco se anticipan problemas inusitados en la construcción.

Trazados Alternativos

Del Km. 1 al Km. 15 una línea alterna fué estudiada tomando una alineación directa a través de un terreno generalmente plano. Aunque bastante más corto que el Proyecto propuesto, esta alterna fué abandonada debido a que ésta omite la utilización completa de las facilidades existentes.

Del Km. 20 al Km. 28, una alineación más directa fué estudiada, pero fué abandonada en orden de hacer uso al máximo de la alineación existente y para servir mejor a la población a lo largo de la ruta.

MALPAISILLO-VILLA SALVADORITA

El Proyecto ha sido asignado como la ruta Villa Salvadorita a través de Las Grietas, El Higueral, Ocotón y El Pinadillar a Malpaisillo con una distancia aproximada de 42 kilómetros. Esta pasa a través de los Departamentos de Chiriquí y León, sin embargo, la ruta ha sido truncada en El Pinadillar para usar plenamente los 8 kilómetros del camino existente a la Mina El Limón, y para utilizar aproximadamente 6 kilómetros de la carretera Telica-San Isidro cerca de Malpaisillo. La distancia actual acortada del proyecto es de 26.65 kilómetros.

Ruta Existente

De la Ruta 24 cerca de Villa Salvadorita, una trocha carrozable procede a través de plantaciones de algodón y banano hacia El Higueral. El camino carece de superficie y el alineamiento en ciertas áreas no es direccional. El terreno es extremadamente plano y los suelos varían desde limosos (o depósitos fluviales) a arcilla y son muy propensos a erosión.

De El Higueral a Ocotón, no existen caminos que puedan ser usados aunque es posible atravesar el área usando los caminos privados de las haciendas. El terreno es plano y cultivado de algodón. Los suelos generalmente son depósitos fluviales o barro y son apropiados para la construcción de carreteras aunque medidas especiales para la prevención de la erosión deben ser tomadas.

De El Ocotón a El Pinadillar, existe una trocha carrozable con una superficie extremadamente pobre. Aunque ciertos puentes pequeños existen en este camino, no hay drenajes menores. Los suelos son generalmente variados y son apropiados para la construcción de carreteras.

Normas de Diseño

Con un tráfico indicado en exceso de 150 vehículos por día, estándares Clase 2 fueron adoptados resultando en un ancho de corona de seis metros.

Fuentes de Materiales

La topografía de este segmento es muy plana y la mayor parte de los bancos de préstamo estarán localizados en áreas planas.

En el Km. 1,2 hay un lecho de río fluvial limo-arenoso. Y a 1.500 metros hacia la derecha hay una colina llamada El Obraje la cual contiene grandes cantidades de materiales. En el Km. 15 en la finca La Queserita hay varias colinas para una posible extracción de material selecto.

Proyecto Propuesto

El Proyecto sigue enteramente caminos existentes para poder hacer una completa utilización de las facilidades de derechos de vía, nivelación y drenajes. En varias áreas donde la ruta existente no es direccional, una alineación directa ha sido suministrada, generalmente a través de terreno plano. En varias áreas donde las rutas existentes sirven simultáneamente como cauce y camino, una alineación elevada será suministrada paralela a la que es corrientemente usada.

Ninguna alternativa ha sido estudiada para este proyecto ya que la alineación es muy directa.

LIMAY-PUEBLO NUEVO

El Proyecto designado está ubicado en el departamento de Estelí comenzando en San Juan de Limay y procediendo a través de Los Llanos, El Limón y Pueblo Nuevo hasta aproximadamente el kilómetro 22, Los Llanos, y después procede a lo largo de un alineamiento deficiente con gradientes inclinadas hasta El Limón. El camino existente es seguido desde El Limón hasta Pueblo Nuevo con revestimiento muy deficiente y con muchos vados en riachuelos locales. Desde Pueblo Nuevo hasta Placaguina, el proyecto es un camino adecuado de todo tiempo y con estructuras de drenajes emplazadas. La carretera Panamericana cruza casi a 2 kms. de Placaguina.

Normas de Diseño

Con un TPD corrientemente indicado de menos de 150 vehículos por día, estándares Clase 2 fueron adoptados resultando un ancho de corona de cinco metros. Las gradientes serán basadas en terreno montañoso, y de acuerdo con los diseños estándares propuestos. El máximo de las gradientes será aumentado 3% para poder obtener una máxima utilización de las facilidades existentes.

Fuentes de Materiales

En este Proyecto no se anticipa ningún problema, ya que existen suficientes fuentes a lo largo de la ruta. Tipo A-2-7 y A-2-6 fueron observados en varias ubicaciones y en los cortes existentes.

Proyecto Propuesto

Hasta el Km. 12 no se anticipa ningún trabajo. Del Km. 12 hasta el Km. 22, el proyecto propuesto sigue el camino existente en un alineamiento empinado a la ladera de colinas. Los suelos en esta área son rocosos pero apropiados para construcción y los materiales no son problema. No se encuentran estructuras mayores de drenajes.

Del Km.22, el Proyecto propuesto entra en reubicación hasta el Km.27, para poder así eliminar varias áreas de alineamiento tortuosos y gradientes extremadamente empinadas. El camino existente es generalmente seguido desde el Km.27 hasta Pueblo Nuevo (Km.37). Los suelos son adecuados a lo largo del Proyecto. No hay que cruzar ríos, pero muchos vados pequeños van a requerir puentes en el área Sur de Pueblo Nuevo.

Trazados Alternativos

Una ruta alterna fué estudiada del Km. 12 hasta el Km. 22 la cual involucra una larga reubicación hasta la parte alta de las montañas en esta área. Aunque la alterna hubiese acortado algo, y no tuviera gradientes tan adversas, fué abandonada porque no se lograba utilización completa de las facilidades existentes.

EL SAUCE-VILLANUEVA

El Proyecto está ubicado en los Departamento de Chihuahua y León. El Proyecto definido comienza en Villanueva y procede a través de Mina de Agua Llano El Rodeo, y Santa Bárbara hasta El Sauce como punto terminal. El Proyecto tiene aproximadamente 37 kilómetros de largo. Para poder eliminar el cruce del río Villanueva cerca del comienzo del Proyecto, el punto de inicio se movió a una ubicación sobre la Ruta 24 cerca de 2 kilómetros del puente existente sobre el Río Villa Nueva.

Ruta Existente

Dejando la Ruta 24 en la ubicación arriba mencionada, el corredor sigue un derecho de vía ya abierto por aproximadamente 6 kilómetros hasta un punto cerca de Mina de Agua donde esta encuentra el camino entre Mina de Agua y Mina El Limón. Este camino es entonces seguido hacia el Sur hasta el Llano El Rodeo donde el camino existente voltea hacia El Sauce en el Km. 39. Todos los caminos arriba mencionados son caminos primitivos con revestimientos deficientes y drenajes inadecuados. Varios vados existen a lo largo del Proyecto. El terreno es generalmente plano a ondulado y los suelos son adecuados

para construcción de carreteras en este proyecto no hay más ríos grandes que el Río Villanueva.

Normas de Diseño

El TPD actual de menos de 150 vehículos por día indica estadares Clase 2 con 5 metros de ancho de corona. Las gradientes serán basadas en terrenos planos a ondulados.

Fuentes de Materiales

Seiscientos metros a la derecha del comienzo del Proyecto en la carretera Villa Salvadorita-Somotillo, hay un banco de préstamo el cual ha sido ya usado por la Dirección General de Caminos. En el río Villanueva, también cerca del comienzo del proyecto, hay grandes cantidades de material de grava arenosa. Existen suficientes fuentes a lo largo del proyecto de tal modo que este no tendrá problemas relacionados con materiales.

Proyecto Propuesto

El Proyecto propuesto hará uso pleno de los caminos primitivos existentes para todo el proyecto excepto para una corta reubicación cerca del Km.27 para eliminar gradientes empinadas y otra reubicación en el Km.36 para cruzar Quebrada Seca. Esta ubicación del proyecto fué seleccionada para hacer un mejor uso de los derechos de vía y las gradientes tal como están. Los suelos son adecuados para la construcción de carreteras.

Trazados Alternativos

Varias líneas alternas fueron estudiadas para el proyecto. La primera de estas fué una conexión directa a Villanueva, la cual fué descartada porque ésta necesitaba un cruce muy grande sobre el Río Villanueva, lo cual no se considera justificable por el pequeño incremento en distancia requerido para usar el puente existente.

Otros alineamientos alteros involucraban un cruce directo de Villanueva a El Sauce a través de un área de montañas bajas. Aunque esta ruta sería algo más corta, costos más altos y la imposibilidad de usar las facilidades existentes fué causa suficiente para descartarlo.

Rutas Existentes

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Desde Juigalpa en dirección Norte, prosigue un camino primitivo dentro del área montañosa entre Juigalpa y La Libertad, después sobre las montañas hacia la comarca de Cusmatillo y, finalmente a través de terreno llano a ondulado hacia La Libertad. El camino existente es empinado en sectores y con ciertos vados y muy pobre enchape. Aunque existen varios puentes, no hay drenaje local en su sitio. Los suelos son generalmente rocosos y apropiados para construcción de carreteras y se notan fuentes de material a lo largo de la ruta. El proyecto no está cruzado por ríos grandes.

Normas de Diseño

Al tener indicación de TPD menor de 150 se adoptó la Norma de Clase 2 resultando un ancho de corona de 5 metros.

Fuentes de Materiales

Desde el comienzo del proyecto hasta el Km. 18 existen muchas fuentes de material selecto A-2-7. Desde el Km. 18 hasta el final el material predominante es la arcilla fina. También se encuentra roca dura.

Proyecto Propuesto

Comenzando en la Carretera a Rama al lado Oeste de Juigalpa, el proyecto propuesto pasa justo al Oeste del pueblo hacia el cruce existente del Río Mayales, después sigue el camino existente a través de las montañas, con ligeras relocalizaciones donde se necesita para obtener alineación o gradiente adecuada. Desde el Km. 23 hasta el Km. 31, el proyecto esencialmente sigue el camino existente, con una ligera relocalización en el Km. 31 el cual conecta el proyecto directamente con el camino de La Libertad-Santo Tomás.

Trazados Alternativos

Se estudiaron varios alineamientos alternativos en el comienzo del proyecto, pero fueron descartados en favor de la ruta propuesta.

ASTURIAS - PANTASMA

El proyecto designado comienza en Asturias en el Departamento de Jinotega y procede La Sta. Pantasma. La longitud total del proyecto es alrededor de 24.7 kilómetros.

Ruta Existente

Desde la Presa El Mancotal cerca de Asturias, pasa un camino primitivo hacia el norte a través de terreno ondulado hasta la orilla montañosa de la Sierra Los Cedros, en donde entonces descende hacia el valle de Pantasma.

Normas de Diseño

Las normas de Clase 2 fueron adoptadas con una corona de cinco metros de ancho.

Fuentes de Materiales

Este proyecto atraviesa terreno muy agreste, excepto un segmento dentro del Valle de Pantasma. Aproximadamente en el Km. 8.5, existe un foso con material arcilloso-arenoso, A.2-7.

Al comienzo del proyecto, cerca de la Presa El Mancota, hay una fuente de material selecto muy grande. Existe mucho material arenoso-gravoso en el

lecho del Río Pantasma, muy poco del cual tiene tamaño grande. Se obtiene grava también del Río Coco, cerca de La Vigía. Además de estas fuentes, existen otras a lo largo de todo el proyecto para mayor investigación.

Ruta Propuesta

Desde el final del desarrollo carretero en la Presa El Mancotal, la ruta propuesta prosigue hacia el norte generalmente siguiendo el camino existente a través de Los Pedernales, Km. 5, hacia la comunidad de Las Cruces en aproximadamente el Km. 8. Desde este sitio, se comienza un descenso espiral de la Sierra de Los Cedros la cual continúa dentro del valle de Pantasma en aproximadamente el Km. 22.

Trazados Alternativos

Se estudiaron varias otras alternativas, la principal de las cuales fué un alineamiento un poco hacia el Este del propuesto proyecto entre Asturias y La Vigía. El corredor originalmente seguía ese alineamiento pero fué modificado a requerimiento del Consultor. El motivo para esta modificación fué que el corredor original no sirve al valle de Pantasma y no utilizaba la construcción existente en su máxima extensión posible. Somos del sentir que la selección de la ruta propuesta ha satisfecho ambas de estas necesidades importantes.

ABISINIA - BOCAYCITO

El Proyecto 12 está ubicado en el Departamento de Jinotega, empezando en Abisinia y prosiguiendo a través del Valle del Cuá hasta Bocaycito. La longitud del proyecto según se propone es 21.72 kilómetros.

Ruta Existente

A la salida de Asturias, se extiende un camino primitivo hasta el valle de la Quebrada La Pavona por espacio de 3 o 4 kilómetros como acceso para operaciones agrícolas. Después de este sitio, solo existen senderos que no son apropiados para transporte de vehículos automotrices. El terreno es ondulado a montañoso con suelos rocosos apropiados para construcción de caminos. No existen en esta área ríos grandes.

Normas de Diseño

Debido a una indicación de TPD tipo bajo, se adoptó la Norma de Clase 2 resultando en una corona de cinco metros de ancho. Las gradientes serán determinadas por el terreno montañoso.

Fuentes de Materiales

Este proyecto atraviesa una zona de topografía agreste, la cual deberá proveer fuentes de material adecuadas. En el Km. 3, se han iniciado dos sitios de fuentes de material, de los cuales la Dirección General de Caminos anteriormente ha obtenido material de base. A lo largo de la longitud del

proyecto existen muchas colinas las cuales tienen material adecuado.

Ruta Propuesta

Partiendo de Abisinia, Km. 0, la ruta propuesta prosigue hacia el Este hasta a través del valle de la Quebrada La Pavona en un alineamiento de mantenido ascenso hasta llegar a un sitio cerca de Peñas Blancas en el Km. 10. La ruta propuesta cruza entonces sobre del complejo de montañas Macizos de Peñas Blancas hasta la comunidad de El Cairo en el Km. 11. Desde El Cairo, la ruta es de mantenido descenso dentro del Valle del Cuá y llega al punto terminal de Bocaycito.

Trazados Alternativos

Fueron estudiadas diversas alternativas para la ruta en su ascenso en el complejo montañoso, pero todas fueron descartadas en favor del alineamiento propuesto.

SAN JUAN DEL RIO COCO - WIWILI

Este proyecto está ubicado en los Departamentos de Matriz y Nueva Segovia. El Proyecto comienza en San. Juan del Río Coco, y se extiende hasta su punto terminal en Wiwilí. El proyecto tiene una longitud de 55.6 kilómetros.

Ruta Existente

Desde San Juan del Río Coco se atraviesa una cordillera hacia Quilalí, donde se cruza el Río Júcaro, terreno plano a ondulado generalmente atraviesa pequeños cerros hacia el punto terminal en Wiwilí.

Las características del camino existente varían a través del recorrido, con caminos revestidos en la sección occidental hasta Telpaneca, y caminos sin revestimiento para el resto. Gradientes severas se encuentran frecuentemente en toda la longitud del proyecto y también carece de drenaje local. Cruces de ríos mayores se encuentran en el Río Coco, Río Júcaro y Quebrada de Agua. Los suelos son extremadamente variables, pero se opina que son adecuados para la construcción de carreteras.

Normas de Diseño

Especificaciones de diseño clase 2 fueron adoptadas para este proyecto, con un ancho de corona de 5 metros.

Fuentes de Materiales

No se anticipan problemas en relación a los bancos de préstamo, tanto en capacidad, como en calidad. Los materiales predominantes en la zona son del tipo A-2-7, A-2-4 y A-1-b. Este último material abunda en los varios ríos que atraviesa el proyecto.

Proyecto Propuesto

Desde San Juan del Río Coco, el proyecto de nuevo sigue el camino existente, atravesando terreno montañoso, hasta La Reforma y Quilalí (Km. 63); pero muchas cortas relocalizaciones son requeridas en esta área para mantener los deseados estándares geométricos.

En Quilalí se encuentra un cruce mayor para el Río Júcaro.

Desde el Río Júcaro a Wiwilí, el proyecto sigue un alineamiento plano a ondulado atravesando Panalí y San Bartolo (Fin del Proyecto 11), y continúa con un alineamiento ondulado a montañoso hasta Wiwilí, en el Km. 98. Un cruce mayor de la Quebrada de Agua se encuentra poco antes de Wiwilí (Km. 97).

RIVAS - VERACRUZ

Este proyecto se extiende desde Veracruz hasta Rivas, en el Departamento de Rivas. Su longitud de 5.8 kilómetros, lo denomina como el proyecto más corto de todos los proyectos estudiados.

Ruta Existente

Resultante de su proximidad con la ciudad de Rivas, el segmento de 5 Km. entre Rivas y Veracruz es relativamente densamente poblado. La topografía entre los dos poblados es plana-ondulada, y contiene muchas trochas. La mayoría de las cuales no son adecuadas para transporte automotriz, especialmente durante la estación lluviosa. Estas trochas carecen de recubrimiento superficial, y sus trazados atraviesan normalmente pequeños pueblos y caseríos, lo cual no facilitaría el flujo del tránsito. No se encuentran cruces mayores de ríos en esta zona.

Normas de Diseño

Con un presente bajo TPD indicado, la Clase 2 de las Especificaciones de diseño, son adecuadas para este proyecto, con un ancho de rodamiento de 5 metros.

Fuentes de Materiales

Este proyecto no presenta ninguna dificultad en este respecto, debido a su longitud de solamente 5 kilómetros. Cerca del punto medio del proyecto, se encuentran materiales del tipo cascajo-arcillos que pueden usarse.

Proyecto Propuesto

Partiendo de Veracruz en el Km. 0, la ruta propuesta gira en dirección Sureste, para circunvalar el pie de un cerro bajo cruzar el caserío de Las Piedras en el Km. 4, y conectarse con los caminos existentes en el área Noroeste de Rivas en el Km. 5. Desde este punto terminal, existe un camino adecuado de un Km. hasta la Carretera Panamericana.

Trazados Alternativos

Varias otras alternativas fueron disponibles para este proyecto, debido a lo varios caminos existentes. Sin embargo, el trazado propuesto fué seleccionado por ser el que mejor serviría las necesidades de las comunidades, suministrando acceso no sólo al poblado de Rivas, sino también a la Carretera Panamericana.

SAN CAYETANO - LA TRINIDAD

El Proyecto designado comienza en San Cayetano en el Departamento de Managua y prosigue a través de El Salto hacia La Trinidad en el Departamento de Carazo. El alineamiento pasa a través de o cerca de Santo Domingo y de San Pablo y tiene una longitud de 30,77 kilómetros.

Ruta Existente

Abandonando la Ruta 10 en San Cayetano, la ruta existente sigue caminos y senderos primitivos a través de Santo Domingo, Los Sanchez, y San Pablo, hasta el punto terminal de La Trinidad. Con pequeñas excepciones, la ruta existente no es utilizable para vehículos a motor durante la mayoría del año. En la ruta existen muchos taludes cortos. El terreno es generalmente plano hasta ondulado con suelos de arcilla. No existen puentes ni drenaje local.

Una excepción de lo arriba indicado es la sección entre el Km. 12 y el Km. 18, o desde la Ruta 8 hasta un punto al Sur de San Pablo. En esta área, una compañía de cemento ha realizado operaciones de mantenimiento en la carretera y la superficie de rodamiento, y la carretera pudiera clasificarse como carretera de todo tiempo. Sin embargo, el alineamiento en ésta área es deficiente ya que prosigue directamente a través del centro del pueblo de San Pablo.

Normas de Diseño

El tráfico de este proyecto indica camino Clase 1 con una corona de 6 metros.

Fuentes de Materiales

A lo largo del proyecto existen muchas fuentes de materiales en las laderas de las colinas. En las afueras del pueblo de Santo Domingo y cerca del río que pasa el pueblo, hay fuentes de arena. Entre Santo Domingo y San Pablo, predominan materiales de piedra caliza. En las cercanías de Santa Lucía y La Trinidad se observó piedra arenisca volcánica la cual debe ser excelente para revestimiento.

Proyecto Propuesto

Abandonando la Ruta 10 cerca de San Cayetano, (Km. 0), la ruta sigue los senderos existentes hasta un enlace de Santo Domingo (Km. 7), y otro enlace de Los Sanchez (Km. 10). Entonces prosigue hasta un punto medio de conexión con la Ruta 8 aproximadamente a medio camino entre El Salto y San Rafael del Sur. En este sitio, el alineamiento se desvía algo para hacer uso completo del medio existente.

Desde Ruta 8, el proyecto prosigue hacia el Sur hasta un enlace de San Pablo en el Km. 14 y después prosigue para continuar a lo largo de caminos y senderos primitivos existentes y se dirige hacia el Sureste hasta el punto terminal en La Trinidad, Km. 31, directamente adyacente a la Ruta. 15.

Trazados Alternativos

Se estudiaron diversos alineamientos alternos para este proyecto, la mayoría de los cuales pasaban directamente a través de las comunidades involucradas. Los alineamientos de enlace fueron seleccionados después de observaciones de campo de las condiciones cerca de estos pueblos.

NORMAS DE DISEÑO DE LOS PROYECTOS

Item	Clase 1	Clase 2
1. Paveda de Vía	25.00 m.	20.00 m.
2. Ancho de Carrera Mínimo	6.00 m.	5.00 m.
3. Ancho Superficie de Rodamiento	6.00 m.	5.00 m.
4. Pendiente Máxima*		
a. Terreno Plano	5% to 6% for 700 m.	5% to 6% for 500 m.
b. Terreno de Lomerío	7% to 10% for 300 m.	8% to 10% for 300 m.
c. Terreno montañoso	9% to 12% for 200 m.	10% to 12% for 200 m.
* Tolerancia 3% adicional para alineamiento existente.		
5. Velocidad de Diseño		
a. Terreno plano	60 Km/h.	50 Km/h.
b. Terreno de Lomerío	45 Km/h.	40 Km/h.
c. Terreno montañoso	30 Km/h.	30 Km/h.
6. Visibilidad de Parada		
a. Terreno plano	75 m.	60 m.
b. Terreno de Lomerío	55 m.	45 m.
c. Terreno montañoso	30 m.	30 m.
7. Grados Máximos		
a. Terreno plano	10°-00' (R=114.59 m.)	15°-00' (R=76.32 m.)
b. Terreno de Lomerío	18°-30' (R=61.94 m.)	24°-30' (R=46.77 m.)
c. Terreno montañoso	48°-30' (R=26.34 m.)	43°-30' (R=26.34 m.)
8. Taludes de Terraplen		
a. Menor de 1.20 m.	3:1	3:1
b. Mayor de 1.20 m. pero menor 2.00	2:1	2:1
c. Mayor de 2.00 m.	1.5:1	1.5:1
9. Taludes de Corte		
a. En roca sana	0.0 to 0.5:1	0.0 to 0.5:1
b. Tierra compacta	1.0:1	1.0:1
c. Tierra malos compacta	1.25 to 2.0:1	1.25 to 2.0:1
10. Sobre Anchos en Curva	Variable	Variable
11. Peralte Máximo	10%	10%
12. Longitud de Transición	Variable	Variable
13. Bombeo Normal	4%	4%
14. Ancho de Puente	3.5 m.	3.5 m.
15. Carga de Diseño	HS-15-44	HS-15-44
16. Mater. Superf. de Rodamiento	Granular Compactado	Granular Compactado

UNIDAD EJECUTORAPERSONAL Y PRESUPUESTO PROPUESTO

1 Jefe de Proyecto	a	¢	12.000/mes	12.000
3 Ingenieros Clase A	a	¢	7.000/mes	21.000
2 Ingenieros Asistentes	a	¢	5.500/mes	11.000
1 Administrador	a	¢	5.000/mes	5.000
1 Contador	a	¢	3.500/mes	3.500
1 Auxiliar	a	¢	2.500/mes	2.500
1 Office boy	a	¢	900/mes	900
1 Secretaria	a	¢	1.800/mes	1.800
1 Mecanógrafa	a	¢	1.200/mes	1.200
8 Choferes	a	¢	1.200/mes	<u>1.200</u>
				68.500
			Gastos 30%	<u>20.600</u>
				<u>89.100</u>

56 meses a ¢\$89.100 a ¢\$7/US\$ = US\$710.000.

Consultor de la Unidad EjecutoraTérminos de Referencia

El consultor individual que contrate la Dirección de Caminos para supervisar y asesorar en los aspectos técnicos relacionados con la ejecución del programa, deberá hacerlos en referencia a las siguientes tareas:

1. Planificación del programa. Selección de caminos que integren el programa, costos, diseños, modalidad de construcción, plazos de ejecución, paquetes de licitación, etc.
2. Adquisición de equipos. Elección del tipo de equipos a adquirir, especificaciones de licitación, selección de ofertas y propuestas de adjudicación.
3. Obras por administración. Selección de las obras, selección del equipo a usar, supervisión de la construcción, selección de materiales, etc.
4. Obras por contrato. Llamado a licitación, selección de ofertas, propuestas de adjudicación, problemas específicos que se presentaren.
5. Informes. Informes inicial, semestral y final que la Unidad Ejecutora debe presentar al Banco.

El Consultor deberá además prestar servicios generales de asesoramiento a la Dirección de Caminos en todo lo que se refiera al mantenimiento vial, y en especial a la implantación de las recomendaciones al respecto surgidas de la cooperación técnica incluida en el Préstamo 305./SF-NI.

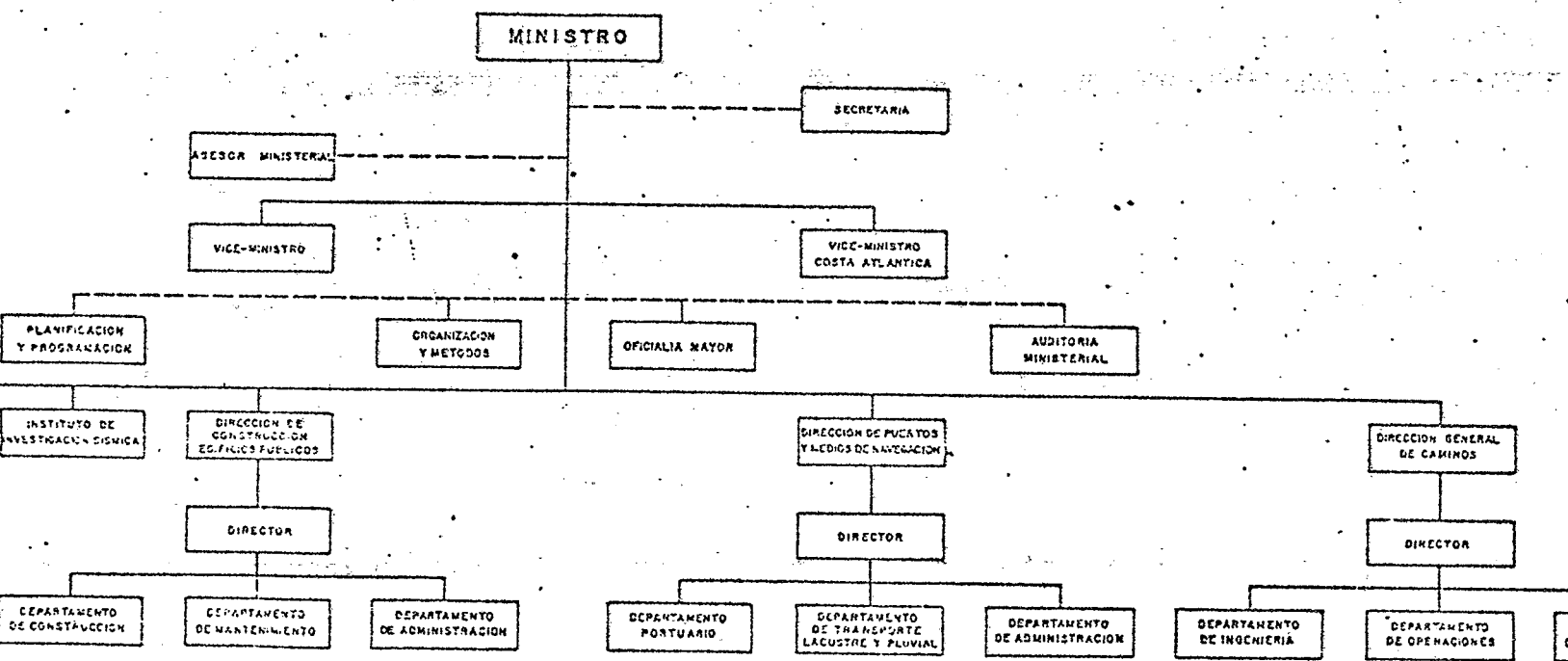
El Consultor deberá presentar un informe inicial cubriendo la situación en el momento de su contratación, con planificación de sus actividades, informes semestrales y un informe final, que reseñe el desarrollo y cumplimiento de su contrato.

Las actividades del Consultor se entiende que se extenderán hasta el término de la ejecución del programa.

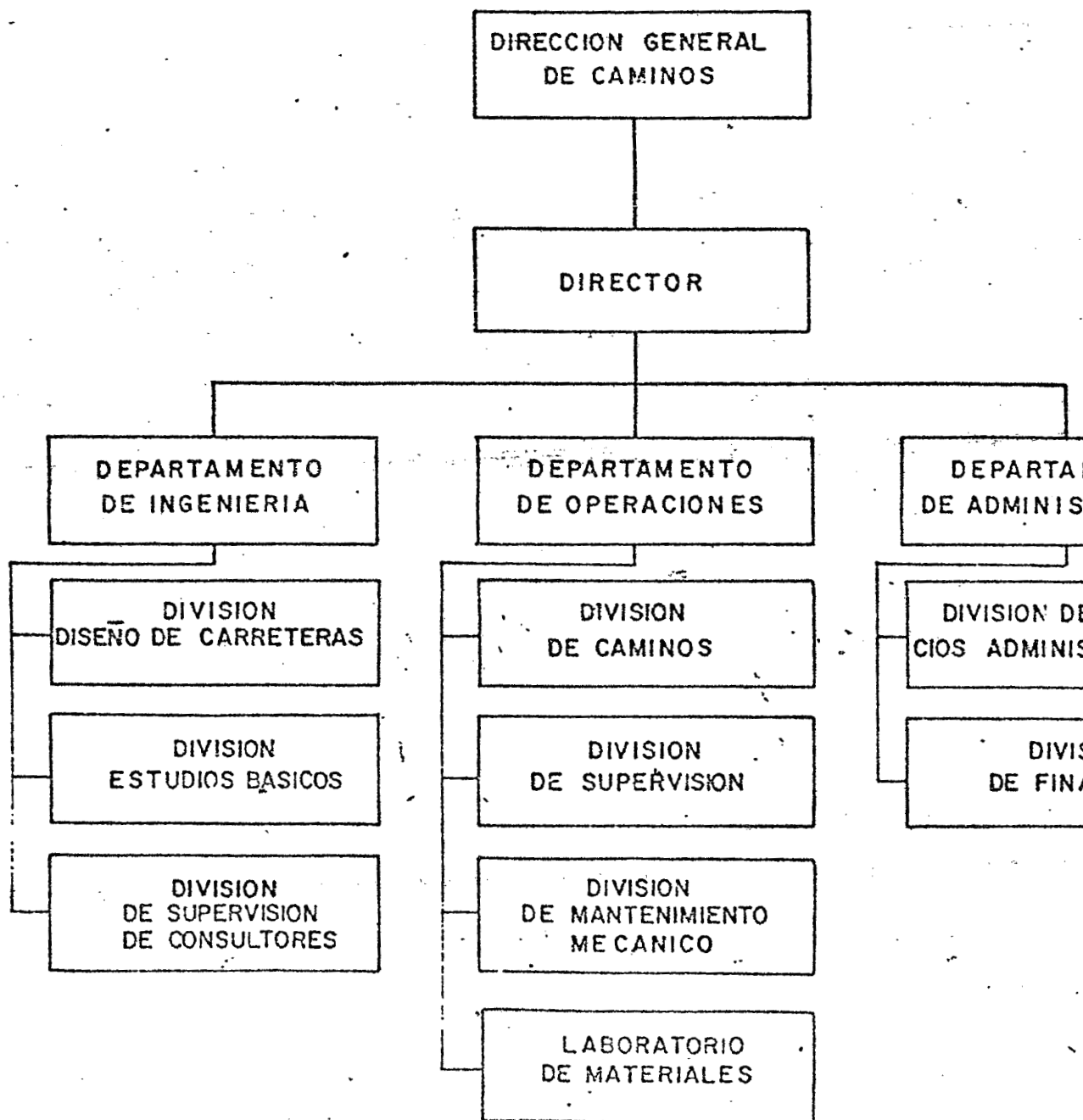
INVENTARIO EQUIPO FIRMAS CONSTRUCTIVAS NACIONALES

TIPO EQUIPO	Llansa-Dacal	CIESA	CIPSA	Wheelock & Cia.	Charroto & Cuadra	P. C. Equipos	E. Morales	U. A.
Planadoras	4	3	6	1		1		
Compres. neumáticas	2	3				4		
Compres. vibratorias	1					4		
Excavadoras	4	2	4			1		
Empujadores frontales	2	2	3	1	3	1		
Gratificadoras	2	1		2		2	1	
Camiones agua	13	6	4	2	3			
Desniveladoras	5	4	6	1	3	2	1	
Ruinas	2	1						
Camiones engrase	2							
Camiones volquete	27	8	22	5	15	5		
Camiones plataforma	2	5						
Excavadoras hormigón	18	3						
Empresores	6	3	10					
Empresores	1	1						
Empresores	1	1			1		3	
Empresores					5		2	

ORGANIGRAMA DEL MINISTERIO DE OBRAS PUBLICAS



ORGANIGRAMA DE LA DIRECCION GENERAL DE CAMINOS



PRESTAMOS EXTERNOS AL SECTOR CAMINOSAL 31 DE DICIEMBRE DE 1975

(En Miles de US\$)

<u>Organismo</u>	<u>Contratado</u>		<u>Utilizado</u>		<u>Disponible</u>	
	<u>Monto</u>	<u>%</u>	<u>Monto</u>	<u>%</u>	<u>Monto</u>	<u>%</u>
Banco Interamericano de Desarrollo	16.250	26	15.790	97	460	3
Banco Centroamericano de Integración Económica	31.035	50	19.825	64	11.210	36
Agencia Internacional para el Desarrollo	8.000	13	7.635	95	365	5
Canadian International Development Agency	1.900	3	1.900	100	-	-
Banco de Exportación e Importación (EE.UU.)	<u>4.850</u>	<u>8</u>	<u>4.850</u>	<u>100</u>	<u>-</u>	<u>-</u>
	<u>62.035</u>	<u>100</u>	<u>50.000</u>	<u>81</u>	<u>12.035</u>	<u>19</u>

Dirección Nacional de Caminos

Bases para la proyección del Pronóstico de Requerimientos de Fondos Nacionales.

El Pronóstico de Requerimientos de Fondos Nacionales que se muestra en el cuerpo del documento, se formuló con base a los siguientes supuestos:

1. Los requerimientos de fondos para los Gastos de Funcionamiento, se estimaron con base a un crecimiento esperado anual acumulativo, en el nivel general de precios del 5% para gastos en personal y del 10% para gastos en materiales.
2. Los requerimientos de fondos para los Gastos de Inversión, son los que surgen del programa de inversiones, para el período de construcción del Proyecto bajo estudio, formulado por la Dirección General de Caminos y revisado por el Banco.

Adicionalmente, se ha incluido el Programa de Caminos Vecinales bajo estudio, según surge del Calendario de Inversiones preparado por la Misión del Banco.
3. Las disponibilidades de fondos para los Gastos de Funcionamiento fueron estimadas con base a las asignaciones presupuestarias para el año 1976, las que se consideraron constantes, para los fines del análisis, durante el período de construcción de las obras.
4. Los programas parcialmente financiados con recursos externos, incluyendo el Programa bajo estudio, reflejan los calendarios tentativos de

inversiones aún cuando sólo para el componente externo de los préstamos obtenidos y en negociación a la fecha, como medio de determinar el monto total de los fondos locales de contrapartida.

5. La situación reflejada en el Pronóstico de Fondos Nacionales, supone que el Gobierno de Nicaragua habrá de gestionar y obtener oportunamente, recursos por US\$40 millones de entidades internacionales de financiamiento, adicionalmente a los ~~US\$18~~ millones correspondientes a la operación bajo estudio. En la medida que estos créditos no se obtuvieran sería ajustado el programa de inversiones.
6. Finalmente, las condiciones supuestas para el eventual préstamo BID al Gobierno de Nicaragua, son las que siguen:

Conceptos

Monto de los recursos FOE	US\$18 millones
Intereses (financiados con recursos del préstamo)	
- en período de gracia	1%
- en período de amortización	2%
Plazo	40 años
Período de gracia	10 años
Comisión de crédito (a financiar con recursos locales)	1/2%
Plazo de desembolso	5 años

La contrapartida local al Proyecto, por ~~US\$4.5~~ millones, sería suministrada por el Gobierno en forma de asignaciones presupuestarias anuales al Ministerio de Obras Públicas.

REPUBLICA DE NICARAGUA
DIRECCION GENERAL DE CAMINOS
EJECUCION PRESUPUESTARIA 1973 - 1975

(en miles de US\$)

Programa	Año 1973			Año 1974			Año 1975			Total tres años		
	Presup.	Ejecuc.	%	Presup.	Ejecuc.	%	Presup.	Ejecuc.	%	Presup.	Ejecuc.	%
Dirección y Administración	848	833	98	840	917	109	979	954	97	2.667	2.704	101
Supervisión carreteras y caminos	180	176	98	211	200	95	278	227	82	669	603	90
Planificación y diseño	173	172	99	386	395	102	486	439	90	1.645	1.006	61
Mantenimiento de caminos	1.959	1.959	100	3.020	3.790	125	6.115	5.672	93	11.094	11.421	103
Mantenimiento mecánico	656	653	99	408	378	93	1.016	918	90	2.080	1.949	93
Proyectos de inversión	12.877	7.469	58	15.236	12.295	81	20.125	13.238	66	48.238	33.002	68
Emergencia nacional	1.678	423	25	1.528	2.353	154	-	-	-	3.206	2.776	86
Demolición y limpieza	-	-	-	240	1.455	506	530	503	95	770	1.958	154
TOTALES	<u>18.371</u>	<u>11.685</u>	64	<u>21.869</u>	<u>21.783</u>	99	<u>29.529</u>	<u>21.951</u>	73	<u>69.769</u>	<u>55.419</u>	79

Evaluación Económica de los Proyectos que Componen la
Muestra Representativa

1. Malpaisillo - Villa Salvadorita 1/

El camino tiene una longitud actual de 31,8 Kms. y proyectada de 29,5 Kms. y un área de influencia de 513 Kms. con una población de aproximadamente 20.100 habitantes, de la cual un 67% se considera rural. El área de influencia está incluida en los departamentos de Chinandega y León donde, de acuerdo a los cálculos realizados sobre la base del "Resumen de la Situación y Diagnóstico del Sector Agropecuario en Nicaragua" 2/ el ingreso rural per cápita promedio es de C\$1.575 el equivalente de US\$225, 35,8% del ingreso per cápita promedio del país.

El tamaño medio de las fincas en esta área que abarca los siguientes cinco municipios es:

<u>Municipio</u>	<u>Mz. Promedio en el Municipio</u>
Chinandega	60
Posoltega	57
Villanueva	143
Larreynaga	70
Telica	50

En 1974 se transportaron fuera del área respectiva 58.377 Ton. de los excedentes agrícolas comerciables más importantes de la región, algodón y caña. De los otros productos comerciables se transportaron 13.970 toneladas. Las proyecciones de estos excedentes indican lo siguiente:

1/ El análisis de este camino se presentará en detalle. Las evaluaciones de los cuatro proyectos restantes serán resumidos ya que se utilizó el mismo método y las mismas fuentes de información. Ver Capítulo V.

2/ Ver párrafo 5.14 de este informe.

Tonelaje

	<u>1974</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>		
			<u>Sin</u> <u>Proyecto</u>	<u>Con</u> <u>Proyecto</u>	<u>Sin</u> <u>Proyecto</u>	<u>Con</u> <u>Proyecto</u>
Algodón y Caña	58.377	72.982	111.017	127.273	180.681	232.351
Otros	13.990	19.023	32.527	39.658	50.467	88.124

Suponiendo que el tonelaje de la carga se distribuya aproximadamente por mitades entre lo que ^{va} a Malpaisillo y lo que va a Villa-Salvadorita y que el centro de gravedad de la distribución se halla a dos tercios de la distancia de cada mitad de la carretera se pueden calcular las siguientes distancias medias de transporte:

$$\text{Actual : } \frac{31,8}{2} \times \frac{2}{3} = 10,6 \text{ Kms}$$

$$\text{Proyectada: } \frac{29,5}{2} \times \frac{2}{3} = 9,8 \text{ Kms}$$

Aún con el camino en las condiciones existentes el algodón y la caña se transportan por camiones.

Suponiendo que cada camión carga 2 T en una dirección la comparación de los costos actuales y proyectados de transportar estos productos muestra un ahorro de C\$5,75 por tonelada.

$$\begin{aligned} \text{Actual : } & \text{C\$ } \frac{1,3858}{2} \text{ veh.} - \text{Km} \times \frac{10,6}{2} \times 2 = \text{C\$14,69} \\ \text{Proyectado: } & \text{C\$ } \frac{0,9123}{2} \text{ veh.} - \text{Km} \times \frac{9,8}{2} = \text{C\$8,94} \end{aligned}$$

$$\text{C\$ 14,69} - \text{C\$ 8,94} = 5,75$$

1/ Estas cifras y todas las que se emplean de manera similar en esta parte del informe están basadas en las tablas de costos de usuarios utilizadas por el consultor en el estudio de factibilidad técnico-económica.

Para el año 1980 cuando se espera transportar 72.982 T. de algodón y caña el ahorro total sería del orden de C\$419.647.

Los otros productos agrícolas que se transportan fuera del área respectiva se sacan principalmente por mula. La disponibilidad de un camino de grava, transitable todo el año permitiría el uso de camiones que redundaría en ahorros sustanciales. Suponiendo que la mula haría un viaje por día en un camino de esta longitud el costo por tonelada viaje será de C\$47,06.^{1/} El ahorro por tonelada sería la diferencia entre este costo y el costo de transportar una tonelada en el camino proyectado (C\$8,94), es decir, C\$38,12 lo que representaría un ahorro de C\$725.157 en 1980 según las proyecciones.

El costo del transporte de pasajeros por mula se calcula en C\$2,14 por viaje^{1/} ya que un viaje de ida y vuelta requeriría una mula/día que como se explica en el Anexo 0 tiene un costo de C\$4,28. Suponiendo una velocidad de 5 Kph. para el transporte en mula y C\$5,20 como el valor del tiempo para los futuros usuarios de jeeps en un viaje de 10,6 Kms. (la distancia proyectada del camino) el costo del tiempo se calcula de la siguiente manera:

$$\frac{\text{C\$ } 5,20/\text{hr} \times 10,6}{5} = \text{C\$ } 11,02$$

Agregándole a esta cifra el costo por viaje en mula se llega a la suma de C\$13,16 como el costo del transporte de estos pasajeros en mula.

Las economías en el costo de transporte de pasajeros al construirse el camino sería para 1980:

$$\text{Jeeps: } \frac{\text{C\$ } 0,8936 / \text{veh.Km.} \times 9,8}{2,7 \text{ pasajeros}} = \text{C\$ } 3,24 / \text{pasajero}$$

$$\text{Microbus: } \frac{\text{C\$ } 0,6658 / \text{veh.Km.} \times 9,8}{11 \text{ pasajeros}} = \text{C\$ } 0,59 / \text{pasajero}$$

^{1/} Ver Anexo 0 .

Las economías en el costo de transporte de pasajeros se han calculado de la siguiente manera para 1980:

1) Proyección de población (1980)		23.574
2) Generación de viajes anuales per cápita		15
3) Total de viajes en 1980		353.610
4) De los que 10% serán en Jeep		35.361
5) Ahorro por viajero (Jeep): 13,16-3,24	C\$	9,92
6) Total economías en Jeep	C\$	350.781
7) 50% de los viajes, en Microbus		176.805
8) Ahorro por viajero <u>1/</u> (2,14-0,59)	C\$	1,53
9) Total economías en Microbus	C\$	270.512
10) Total ahorro pasajeros	C\$	621.293

Resumiendo, los beneficios para el año 1980 serían:

Caña y algodón	miles	C\$	419,6
Otros			725,2
Pasajeros			<u>621,3</u>
	Total	C\$	1.766,1

Los Beneficios totales en el período 1981 - 2000 serían los siguientes:

<u>Año</u>	<u>Ahorros de Transporte</u> (miles de C\$)	<u>Diferencia costos mantenimiento</u>
1981	1.855,6	-100,0
1982	1.950,0	-100,0
1983	2.048,7	-100,0
1984	2.153,6	-100,0
1985	2.264,9	-100,0
1986	2.381,7	-100,0

1/ Excluido el valor del tiempo del usuario de la mula.

<u>Año</u>	<u>Ahorros de Transporte</u> (en miles de C\$)	<u>Diferencia cos- tos mantenimiento</u>
1987	2.506,0	-100,0
1988	2.637,2	-100,0
1989	2.774,9	-100,0
1990	2.921,6	-100,0
1991	3.084,6	-100,0
1992	3.257,8	-100,0
1993	3.442,1	-100,0
1994	3.637,4	-100,0
1995	3.845,1	-100,0
1996	4.066,8	-100,0
1997	4.301,7	-100,0
1998	4.551,9	-100,0
1999	4.817,9	-100,0
2000	5.101,7	-100,0

El valor presente de los beneficios netos anuales sería de C\$22.974.000.
descontados al 10% (en 1980).

El costo del proyecto se ha estimado en C\$ 10.996.000 con un programa de
y de C\$3.298.800 en 1980.
inversión de C\$ 2.749.000 para 1978, de C\$ 4.948.200 para 1979. / El valor
presente de los costos en 1980 descontados al 10% sería de C\$12.068.00. La
tasa interna de retorno se estima en 17,6%.

2. Juigalpa-La Libertad

El camino tiene una longitud actual de 32 Kms. y proyectada de 32,9 Kms con
un área de influencia de 238 Km². La población de esta área en 1974 era de

9.064 habitantes con el 68% rural. El área de influencia está incluida en el departamento de Chontales donde el ingreso rural per cápita promedio es de C\$1.560, 1/ el equivalente de US\$223, lo que representa un 35,4% del ingreso per cápita promedio del país.

El tamaño medio de las fincas de esta área es:

<u>Municipio</u>	<u>Mz.Promedio</u>
Juigalpa	88
La Libertad	103

La estimación de los excedentes agrícolas comerciables de esta zona y las proyecciones indican lo siguiente:

		<u>Tonelaje</u>			
<u>1974</u>	<u>1980</u>	<u>1990</u>		<u>2000</u>	
		<u>Sin Proyecto</u>	<u>Con Proyecto</u>	<u>Sin Proyecto</u>	<u>Con Proyecto</u>
24.737	35.285	72.337	91.364	134.030	215.842

Las distancias medias de transporte se han calculado en 20,7 Kms. para el camino actual y 21,1 Kms para el camino proyectado.

El costo de transporte en mula sería de C\$47,06 por tonelada comparado a un costo de C\$18,90 en camión. La transición / ^{de mula a} camión resultaría en un ahorro de C\$28,10 por tonelada. Para el año 1980 cuando se espera transportar excedentes comerciablende 35.285 toneladas la economía en el costo de transporte alcanzaría la suma de C\$993.626.

El costo del transporte de pasajeros por mula (que usarán jeep una vez terminado el proyecto) en el camino actual se ha calculado en C\$23,67.

1/ Ver párrafo 5.16 del informe.

$$\text{C\$ } \frac{5.20/\text{hora} \times 20.7}{5 \text{ Kms/h}} = 21.53$$

$$\text{costo por viaje de mula} = \frac{2.14}{23.67}$$

El costo del transporte de pasajeros en jeep y en microbus en el camino proyectado sería el siguiente:

$$\text{Jeep} \quad \text{C\$ } \frac{0.9016/\text{Kmx}21.1}{2.7 \text{ personas}} = \text{C\$}7.05/\text{persona}$$

$$\text{Microbus} \quad \text{C\$ } \frac{0.6606/\text{Km} \times 21.1}{11 \text{ personas}} = \text{C\$}1.27/\text{persona}$$

Las economías en el costo de transporte de pasajeros se han calculado de la siguiente manera para 1980:

1) Proyección de población		10.981
2) Generación de viajes anuales per cápita		10
3) Total de viajes en 1980		109.810
4) De las que 10% serán en Jeep		10.981
5) Ahorro por viajero (Jeeps)	C\$	16.62
6) Total economías en Jeep	C\$	182.504
7) 50% de los viajes, en Bus		54.905
8) Ahorro por viajero <u>1/</u>	C\$	0.87
9) Total economía en bus	C\$	47.767
10) Total ahorro pasajeros	C\$	230.271

Resumiendo, los beneficios para el año 1980 serían:

Carga	C\$ 993.626
Pasajeros	230.271
Total	<u>C\$1.223.897</u>

1/ Excluido el valor del tiempo de usuario de la mula.

Sumando los beneficios provenientes del tránsito atraído 1/ que serían de C\$ 305.974 y el beneficio total en 1980 se alcanzaría la suma de C\$1.529.871

Los beneficios totales en el período 1981-2000 se estima que sean los siguientes:

(Miles de US\$)

<u>Año</u>	<u>Ahorros de Transporte</u>	<u>Ahorros costos de Mantenimiento</u>
1981	1.659,7	54,0
1982	1.805,3	54,0
1983	1.963,8	54,0
1984	2.137,8	54,0
1985	2.328,3	54,0
1986	2.537,2	54,0
1987	2.766,3	54,0
1988	3.017,4	54,0
1989	3.295,5	54,0
1990	3.597,6	54,0
1991	3.886,3	54,0
1992	4.199,6	54,0
1993	4.539,2	54,0
1994	4.908,0	54,0
1995	5.308,4	54,0
1996	5.743,2	54,0
1997	6.215,9	54,0
1998	6.729,3	54,0
1999	7.287,1	54,0
2000	7.880,5	54,0

El valor presente de estos beneficios descontados al 10% sería de C\$27.517 miles (a 1980)."

1/ Estimado para ese año en 50% del tránsito normal produciendo 25 por ciento de beneficio adicional.

El costo del proyecto se ha estimado en C\$ 12.049.000 con un programa de inversión de C\$3.012.250 en 1978, C\$5.422.050 en 1979 y C\$3.614.700 en 1980. El valor presente de los costos descontados (a 1980) al 10% sería de C\$ 13.224.000. La tasa interna de retorno se estima en un 18,5%.

3. Abisinia - Bocaycito

Este proyecto ubicado en el departamento de Jinotega tiene una longitud proyectada de 27 Kms y un área de influencia de aproximadamente 430 Kms². La población de esta área en 1974 era de 13.500 habitantes de los cuales el 84% es rural.

El ingreso rural per cápita promedio es de C\$629 el equivalente de US\$90 lo que representa solo un 14,3% del ingreso per cápita promedio del país.

El tamaño medio de las fincas de esta área es de 49 manzanas.. Se estima que los excedentes comerciables de esta zona y sus proyecciones serían las siguientes:

<u>1974</u>	<u>1980</u>	<u>1990</u>		<u>2000</u>	
		<u>Sin Proyecto</u>	<u>Con Proyecto</u>	<u>Sin Proyecto</u>	<u>Con Proyecto</u>
25.946	33.364	50.141	62.682	74.906	122.328

La inexistencia de un camino transitable por vehículos hace que toda la carga y las personas sean transportadas a lomo de mula. De nuevo, se supone que el centro de gravedad de la carga y pasajeros es de 2/3 de la longitud total, es decir, 18 Kms.

El costo de transporte por mula de la carga se estima que ascienda a C\$ 47,06 por tonelada suponiendo un viaje por día. El costo de transporte por tonelada en camiones cargados con un promedio de 2 toneladas se calcula

en C\$ 8,34:

$$\frac{0,9271 \times 18}{2} = \text{C\$ } 8,34$$

Para 1980, cuando se espera transportar 33.364 toneladas de carga el ahorro total de transporte sería el siguiente:

$$33.364 \times (47,06 - 8,34) = \text{C\$ } 1.292.521$$

El costo del transporte de pasajeros por mula sería de C\$ 20,86 ya que el costo por viaje de mula se calcula en C\$2,14^{2/} y a esto habría que agregar el costo del tiempo que se ha calculado en C\$ 18,72 de la siguiente manera:

$$\frac{5,20/\text{hora} \times 18}{5\text{Km/h}} = \text{C\$ } 18,72$$

Esto sería para aquellos pasajeros que usarían jeeps una vez terminado el proyecto. El costo del transporte de pasajeros en jeep y en microbus para 1980 se ha calculado como sigue:

Jeep	$\frac{\text{C\$ } 0,9164/\text{Km} \times 18}{2,7 \text{ personas}}$	= C\$6,11
Microbus	$\frac{\text{C\$ } 0,6617/\text{Km} \times 18}{11 \text{ personas}}$	= C\$1,08

Las economías en el costo de transporte de pasajeros se han calculado de la siguiente manera para 1980:

1) Proyección de población (1980)		16.166
2) Generación de viajes anuales per cápita		10
3) Total de viajes en 1980		161.660
4) De las que 10% serán en jeep		16.166
5) Ahorro por viajero (jeep): (C\$ 18,72-6,11)	C\$	12,61
6) Total economías en jeep		203.853
7) 50% de los viajes en microbus		80.830
8) Ahorros por viajero (C\$ 2,14 - 1,08) <u>1/</u>	C\$	1,06
9) Total economías en microbus	C\$	18.680
10) Total ahorro pasajeros	C\$	289.533

Resumiendo, los beneficios en 1980 alcanzarían, en lo que a carga se refiere, aproximadamente C\$ 1.292.521, y para pasajeros C\$ 289.533 por un total C\$1.582.054. Los beneficios totales en el período 1981-2000 se estima que sean los siguientes:

1/ Excluido el valor del tiempo del usuario de la mula.

2/ Ver Anexo O.

(Miles de US\$)

Año	Ahorros Costos de Transporte
1981	1663.2
1982	1741.2
1983	1837.0
1984	1931.3
1985	2029.5
1986	2134.8
1987	2244.9
1988	2362.0
1989	2484.8
1990	2613.3
1991	2753.1
1992	2900.1
1993	3056.7
1994	3221.8
1995	3396.6
1996	3580.9
1997	3776.6
1998	3982.9
1999	4198.3
2000	4434.7

El valor presente de estos beneficios descontados al 10% serían de C\$20.460.

El costo del proyecto se ha estimado en C\$15.800.000 con un programa de inversión que de C\$3.950.000 en 1978, de C\$7.110.000 en 1979 y de C\$4.740.000 en 1980. Suponiendo/los costos anuales de mantenimiento son del orden de C\$75.000 el valor presente de los costos en 1980 descontados al 10% sería de C\$17.979. La tasa interna de retorno se estima en un 11,5%.

4. Rivas-Veracruz

Este proyecto ubicado en el departamento de Rivas tiene una longitud actual de 5,6 Kms. y proyectada de 5,7 Kms. El área de influencia abarca ² 43 Kms. con una población de 3.208 habitantes de la cual 54% se considera rural.

El ingreso rural per cápita promedio de esta zona es de C\$1.273, el equivalente de US\$182, 29% del ingreso per cápita promedio del país. El tamaño medio de las fincas en esta zona es el siguiente:

<u>Municipio</u>	<u>Mz. Promedio</u>
Rivas	66
Tola	70

En 1974 se transportaron fuera del área respectiva 3.899 toneladas de excedentes agrícolas comerciables. Las proyecciones de estos excedentes indican lo siguiente:

<u>1980</u>	<u>Tonelaje</u>			
	<u>1990</u>		<u>2000</u>	
	<u>Sin Proyecto</u>	<u>Con Proyecto</u>	<u>Sin Proyecto</u>	<u>Con Proyecto</u>
5.608	10.409	11.753	19.323	26.123

Las distancias medias de transporte en el camino actual y el proyectado son 3,7 Kms. y 3,5 Kms. respectivamente. Basado en estas distancias se calcula que el costo de transportar la carga por mula en este caso sería de C\$23,54 ^{1/} por tonelada Km. Comparando esto con el costo de transportar la misma carga por camión lo que se calcula en C\$3,20 ^{2/} el ahorro que se obtendría con la transición sería de C\$20,34 por tonelada Km.

1/ Dada la corta distancia media de transporte se calcula que una mula podría hacer dos viajes por día.

2/ $C\$0,915 \times 7,6 \text{Kms.} = C\$3,48.$

2 T.

Para el año 1980, cuando se espera transportar excedentes comerciables por un total de 5.608 toneladas, la disponibilidad de un camino de grava transitable todo el año y que permitiera el uso de vehículos redundaría en economías en el costo del transporte de carga del orden de C\$112.496.

Las economías que se alcanzarían en el transporte de pasajeros al construirse el camino serían de C\$60,093.

Las economías en el costo de transporte de pasajeros se han calculado de la siguiente manera para 1980:

Costo de transporte en mula: $\frac{C\$5,20/hr \times 3,7}{5 \text{ Km.p.h.}} = C\$3,85 + C\$2,14$
(futuros usuarios de jeep)

Costo de transporte en jeep: $\frac{C\$ 0,9016/Kmx3,5}{2,7 \text{ personas}} = C\$1,17/persona$

Costo de transporte en microbus: $\frac{C\$0,6606/Kmx3,5}{11 \text{ personas}} = C\$0,21/persona$

1. Proyección de población		4.153
2. Generación de viajes anuales per cápita		10
3. Total de viajes en 1980		41.530
4. De las que 10% serán en Jeep		4.153
5. Ahorro por viajero (Jeeps)	C\$	4,82
6. Total economías en Jeep		20.017
7. 50% de los viajes en Bus		20.765
8. Ahorro por viajes <u>1/</u>	C\$	1,92
9. Total economías en Bus	C\$	40.076
10. Total ahorro pasajeros	C\$	60.093

Resumiendo, los beneficios en el año 1980 serían:

Carga	112,496
Pasajeros	60,093
Total	<u>172,589</u>

Los beneficios totales en el período 1981 - 2000 serían los siguientes:

1/ Excluido el valor del tiempo del usuario.

(Miles C\$)

Año	Carga	Pasajeros	Total
1981	120,4	62,1	182,5
1982	128,9	64,2	193,1
1983	138,1	66,5	204,6
1984	146,9	68,7	215,6
1985	158,2	71,0	229,2
1986	169,4	73,4	242,8
1987	181,4	76,1	257,5
1988	194,3	78,6	272,9
1989	208,0	81,3	289,3
1990	222,7	84,0	306,7
1991	239,3	86,9	326,2
1992	257,0	89,5	346,5
1993	276,0	92,5	368,5
1994	296,6	95,5	392,1
1995	318,7	98,6	417,3
1996	338,0	101,8	439,8
1997	367,9	105,2	473,1
1998	395,4	108,6	504,0
1999	425,0	112,0	537,0
2000	456,7	115,8	572,5

El valor presente de estos beneficios netos anuales descontados al 10% sería de C\$2.394.700.

El costo del proyecto se ha estimado en C\$2.179.000 con un programa de inversión de C\$435.800 para 1979 y C\$1.743.200 para 1980. El valor presente de estos costos en 1980 descontados al 10% sería de C\$2.223.000. La tasa interna de retorno se estima en un 10,9%.

5. San Cayetano - La Trinidad

Este camino tiene una longitud actual de 35,5 Kms. y proyectada de 31,5 Kms. con una área de influencia de 361 Kms.² La población en esta área alcanza 29.000 habitantes de la cual un 69% se considera rural. El área de influencia cae dentro de los departamentos de Carazo y Managua donde el ingreso rural per cápita promedio es de C\$789, el equivalente de US\$113, lo que representa solo un 18% del ingreso per cápita promedio para el país.

El tamaño medio de las fincas de esta zona por municipios es el siguiente:

<u>Municipio</u>	<u>Mz. promedio</u>
Diriamba	32
El Carmen	103
San Rafael del Sur	18

El excedente agrícola comerciable más importante de la zona es la caña de azúcar. Esta, a pesar del mal estado de la mayor parte de la ruta, se saca actualmente en camiones que transportan un promedio de 2 toneladas métricas en una dirección.

Las proyecciones de los excedentes comerciables de la zona son las siguientes:

		<u>Tonelaje</u>				
		<u>1990</u>		<u>2000</u>		
	<u>1974</u>	<u>1980</u>	<u>Sin proyecto</u>	<u>Con proyecto</u>	<u>Sin proyecto</u>	<u>Con proyecto</u>
Caña	65.963	82.984	121.659	137.036	178.362	234.076
Otros	11.964	16.182	25.322	29.203	40.460	57.680

Se estima que en el tramo San Cayetano - El Salto ^{1/} la distancia media recorrida es 1/3 de su longitud lo que significa 4,5 Kms en el tramo actual y 4,2 Kms en el proyectado. El costo actual del transporte de la caña en

1/ Actual: 13,6 Kms. Proyectado: 12,6 Kms.

este tramo es de C\$6,40^{1/} y el proyectado es de C\$3,84^{2/}. El ahorro por tonelada sería de C\$2,56.

En el tramo El Salto - La Trinidad la distancia media recorrida se calcula que sea la mitad de su longitud.^{3/}

En el tramo actual esto representaría 10,95 Kms. y en el proyectado 9,3 Kms. El costo actual del transporte de la caña en este tramo es de:

$$\text{C\$ } \frac{1,4217/\text{veh.} - \text{Km.} \times 10,95 \times 2}{2 \text{ T.}} = \text{C\$15,60}$$

y el proyectado es de:

$$\text{C\$ } \frac{0,9132/\text{veh.} - \text{Km.} \times 9,45 \times 2}{2 \text{ T.}} = \text{C\$ 8,63}$$

El ahorro por tonelada sería de C\$6.97.

Las economías en costo de transporte, en 1980 cuando se estima habrán 82,984 toneladas de caña exportables ascendería a C\$432,015 suponiendo, como hemos hecho, que el 40% de la producción se saca por San Cayetano y el 60% por la Trinidad.

Los otros productos comerciales de la región se sacan a lomo de mula y se sacarían en camión al construirse el camino. El costo de transportar la carga por camión en cada uno de los dos tramos sería el siguiente:

$$\text{San Cayetano - El Salto} \quad \frac{4/}{\text{C\$0,9132/veh.Km.x 12,6 x 2/3x2}} = \text{C\$7,67}$$

2 T.

$$\text{El Salto - La Trinidad} \quad \frac{5/}{\text{C\$0,9132/veh.Km.x 18,9 x 1/3x2}} = \text{C\$5,75}$$

2 T.

$$\frac{1/}{\text{C\$1,4217/veh.} - \text{Km} \times 4,5 \times 2} = \text{C\$6,40}$$

2 T.

$$\frac{2/}{\text{C\$0,9132/veh.} - \text{Km} \times 4,2 \times 2} = \text{C\$3,84}$$

2 T.

^{3/} Actual: 21,9 Kms y Proyectada 18,9 Kms.

^{4/} Longitud proyectada = 12,3 Kms

^{5/} Longitud proyectada = 13,7 Kms.

El costo de transporte por mula para una tonelada, independiente de la distancia, es de C\$47,06. Los ahorros en cada tramo serían entonces de C\$39,39/T en San Cayetano - El Salto y C\$41,37 en El Salto - La Trinidad. Los ahorros que se preveen para 1980 en el transporte de carga ^{1/} en otros productos que sea la caña son del orden de C\$656,051, de nuevo suponiendo que el 40% de la producción saldría por San Cayetano y el 60% por La Trinidad.

El transporte de personas se supone se efectúa actualmente por medio de mulas. Una vez construido el camino el costo por pasajero en jeep sería de C\$2,80 ^{2/} para el tramo de San Cayetano a El Salto y de C\$2,10 ^{3/} para El Salto - Trinidad. Si la generación de viajes esta en una proporción de 40/60 entre los dos tramos, el costo por viaje en jeep con la ponderación del caso resulta en C\$2,38.

El costo del transporte de personas en microbus sería de C\$0,51 ^{4/} en el tramo de San Cayetano - El Salto y de C\$0,38 ^{5/} de El Salto a la Trinidad. El promedio ponderado por pasajero - viaje es de C\$0,43.

El promedio ponderado del costo de transporte en mula alcanza C\$10,66, (para futuros usuarios de Jeep)

Las economías en el costo de transporte de pasajeros para 1980 se han calculado de la siguiente manera:

1/ Se estima que esta cifra ascendería a 16.182 T.

2/ C\$0,8994/veh - Km x 12,6 x 2/3 = C\$2,80
2,7 persona/veh.

3/ C\$0,9016 x 18,9 x 1/3 = C\$2,10
2,7 personas/veh.

4/ C\$0,6619/veh.Km. x 12,6 x 2/3 = C\$0,51
11 personas/veh,

5/ C\$0,6606x18,9 x 1/3 = C\$0,38
11 personas/veh.

1)	Proyección de población		34,319
2)	Generación de viajes anuales per cápita		15
3)	Total de viajes en 1980		514,785
4)	De los que 10% en Jeep		51,479
5)	Ahorro por viajero (Jeeps)	C\$	8,28
6)	Total economías en Jeep	C\$	426,246
7)	50% de los viajes, en bus		257.393
8)	Ahorro por viajero <u>1/</u> (2.14 - 0,	C\$	1,71
9)	Total economías en bus	C\$	440,142
10)	Total ahorro pasajeros	C\$	866,388

Resumidos los beneficios en 1980 serían:

Caña	C\$ 432,015
Otros	C\$ 656,051
Pasajeros	<u>C\$ 866,388</u>
	1,954,454

Los beneficios totales en el período 1981 - 2000 serían los siguientes:

<u>Año</u>	<u>Ahorros de Transporte</u> (miles C\$)
1981	2039.2
1982	2123.9
1983	2211.8
1984	2304.1
1985	2401.1
1986	2501.9
1987	2606.9
1988	2717.3
1989	2832.1
1990	2952.6
1991	3086.3
1992	3226.9
1993	3375.4
1994	3530.2
1995	3793.1
1996	3865.2
1997	4046.0
1998	4236.1
1999	4403.3
2000	4646.3

1/ Excluido el valor del tiempo del usuario.

El valor presente de beneficios netos anuales en 1980 sería de C\$: 23.432 descontando al 10%.

El costo del proyecto se ha calculado en C\$14.336.000 con un programa de

inversión de C\$ 3.584.000 en 1978, C\$6.551.200 en 1979 y C\$4.300.800 en 1980.

El valor presente de los costos descontados al 10% sería de C\$15.844.000

y de C\$ 17.323.000 descontados al 20%. La tasa interna de retorno se estima en un 16%.

6. El Sauce-Villanueva

El camino tiene una longitud actual de 39,4 Km. y proyectada de 40,6 Km. con un área de influencia de aproximadamente 478 Km². La población de esta área en 1974 era de 10.791 habitantes de los que un 75% se considera rural. El área de influencia de este camino incluye parte del Municipio de Villanueva (Depto. de Chinandega) y parte del Municipio de El Sauce (Depto. de León). El ingreso rural per cápita en los departamentos de Chinandega y León es de C\$1.575, el equivalente de US\$225, lo que representa el 35,8% del ingreso per cápita promedio del país.

El tamaño medio de las fincas en esta área es:

<u>Municipio</u>	<u>Mz. Promedio</u>
El Sauce	143
Villanueva	37

La estimación de los excedentes agrícolas comerciables de esta zona y las proyecciones indican lo siguiente:

	<u>Toneladas</u>					
	1974	1980	<u>1990</u>		<u>2000</u>	
			S.Proy.	C.Proy.	S.Proy.	C.Proy.
Algodón	27.286	34.171	49.555	53.796	71.956	85.973
Otros	11.087	13.410	18.731	22.993	25.652	42.427

El algodón se transporta por camión a El Sauce o a Villanueva según la distancia del punto de recolección.

$$\text{Distancia media actual} \quad \frac{2/3 \times 39.4}{2} = 13,1 \text{ Km.}$$

$$\text{Distancia media proyectada} \quad \frac{2/3 \times 40.6}{2} = 13,5 \text{ Km.}$$

Costo de transporte en camión (suponiendo carga media de 2.Ton. en una dirección) (C\$/Ton.)

$$\text{Costo actual (Sierra)} = \frac{\text{C}\$1.4217/\text{veh.Km.} \times 26.2}{2} = 18,62$$

$$\begin{array}{l} \text{Costo con proyecto} \\ \text{(grava)} \end{array} \quad \frac{\text{C}\$0.912/\text{veh.Km.} \times 27}{2} = 12,31$$

Economía en el transporte de algodón en 1980:

$$34.171 \text{ Ton.} \times (18,62 - 12,31) = \text{C}\$215.619$$

Los otros productos se sacan actualmente en mula a un costo de C\$47,06 por tonelada. El ahorro por tonelada al usar camión en el camino proyectado sería de $\text{C}\$47,06 - 12,31 = \text{C}\$34,75/\text{Ton.}$

En 1980, el ahorro por este concepto sería

$$\text{C}\$34,75 \times 13.410 \text{ Ton.} = \text{C}\$465.997$$

Las economías en el costo de transporte de pasajeros se han calculado de la siguiente manera para 1980:

Costo actual (en mula)

Futuros usuarios de ómnibus: C\$2,14

$$\text{Futuros usuarios de jeep: } \text{C}\$2,14 + \frac{5,20 \times 13,1}{5} = 15,76$$

Costo con el proyecto

$$\text{Ómnibus: } \frac{\text{C}\$0,6658 \times 13,1}{11} = \text{C}\$0,79$$

$$\text{Jeep: } \frac{\text{C}\$0,8934 \times 13,1}{2,7} = \text{C}\$4,33$$

1. Proyección de Población	13.112
2. Generación de viajes anuales per cápita	1.515
3. Total de viajes en 1980	196.680
4. De los que 10% serán en jeep	19.668
5. Ahorro por viajero (jeep)	C\$11,43
6. Total economías en jeep	C\$224.805
7. 50% de los viajes en bus	98.340
8. Ahorro por viajero (bus)	C\$1,35
9. Total economías en bus	C\$132.759
10. Total ahorro pasajeros	C\$357.664

Resumiendo los beneficios en 1980 serían:

Algodón	C\$215.619
Otros	465.997
Pasajeros	<u>357.664</u>
Total	1.039.280

Resumiendo los beneficios totales en el período 1981-2000 serían los siguientes:

Ahorro en Coste de Transporte

<u>Año</u>	<u>(Miles de C\$)</u>
1981	1.043
1982	1.087
1983	1.133
1984	1.182
1985	1.232
1986	1.284
1987	1.339
1988	1.397
1989	1.455
1990	1.518
1991	1.585
1992	1.654
1993	1.728
1994	1.804
1995	1.885
1996	1.969
1997	2.058
1998	2.150
1999	2.247
2000	2.349

El valor presente de los beneficios anuales en 1980 es de C\$11.984.000 descontado al 10%.

El costo del proyecto se ha calculado en C\$8.346.000, con un programa de inversión de C\$2.086.500 en 1978, C\$3.755.700 en 1979 y C\$2.503.800 en 1980.

El valor presente de los costos a 1980 con tasa de descuento de 10% por año alcanza a C\$9.159.700.

La tasa interna de retorno es de 13,3%.

ANEXO M (b)

Tasas de alfabetización de la población rural en el
área de influencia de los proyectos
de la muestra

<u>Proyecto No.</u>	<u>Tasa (%)</u>
1	36.1
2	20.0
3	23.6
4	48.7
5	37.5
6	25.5

ANEXO N

COSTO DE TRANSPORTE POR MULA

La capacidad de transporte de una mula se estima en dos quintales (200 lbs.) de carga neta. Los muestreos indican sin embargo que en promedio las mulas transportan la mitad de la capacidad antes indicada. Dado que en un viaje de ida y vuelta la mula regresa en general sin carga, el coeficiente de utilización se estima entre 25 y 40%. La velocidad media de una mula es de 5 Kph. lo que significa que un día una mula puede hacer un viaje de ida y vuelta en un camino de unos 20 Km.

El costo por día-mula ha sido calculado de la siguiente manera:

Precio promedio de una mula: 1,750 C\$

Una mula trabaja desde los 3 a los 10 años, es decir 7 años.

Días útiles por año ^{1/}: 240

Utilización del tiempo anual disponible: 60%

Costo por día-mula:

$$\frac{1.750 \text{ C\$}}{7 \text{ años} \times 240 \text{ días} \times ,60} = 1.74 \text{ C\$}$$

Interés sobre el capital (al 13%)

$$\frac{1.750/2 \times 13}{240 \text{ días} \times ,60} = ,79 \text{ C\$}$$

Costo promedio de alimentación: 12,50 C\$/mes

Alimentación por día-mula (útil)

$$\frac{12,50}{30 \times 2/3 \times} = 1,04 \text{ C\$}$$

1/ Se supone que una mula necesita un día de descanso por cada dos de trabajo.

Agregando ,71 C\$ como utilidad del propietario, se llega a un total de 4,28 C\$ como costo por día-mula.

Para transportar una tonelada se requieren 11 mulas plenamente cargadas lo que costaría C\$47,06 por día-mula.

Para tramos de unos 20 Km. en un sentido se ha estimado un costo de C\$2,35 por tonelada/Km. Esto implica que la mula viaja plenamente cargada en una dirección y sin carga de regreso, o, parcialmente cargada en ambas direcciones.

Cuando los tramos a recorrer son menores que 20 Kms., se supone que las mulas, dependiendo de la distancia, pueden en algunos casos hacer más de un viaje por día. Naturalmente cada viaje incluye tiempos de carga y descarga. En estas condiciones cuando los caminos analizados tienen longitudes menores de 20 Kms., el costo de transporte por mula resulta superior a C\$2,35 /Ton.Km.

Con respecto al transporte de pasajeros, se supone que cada viajero ocupa una mula en cada viaje de ida y regreso. Para efectos de comparación con modos alternativos (Jeep o Microbus) se usa como costo de cada viaje, la mitad del costo de mula-día, es decir 2,14 C\$.

Programas para el Desarrollo del Sector Rural
en el Area de Influencia del Programa

Los proyectos en el sector agropecuario que se desarrollarán en la zona de influencia de los caminos que integrarán el Programa bajo análisis son:

A. Ministerio de Agricultura y Ganadería

1. Dirección de Planificación Sectorial Agropecuaria (DIPSA).

Entre los proyectos de riego a ser estudiados a corto plazo en Nicaragua hay tres que se encuentran dentro del área de influencia del mismo número de caminos del presente programa.

<u>Obras</u>	<u>Area a regar en Ha.</u>	<u>Estudio requerido</u>	<u>Camino vecinal</u>
Pantasma-La Vigía	1.700	Prefactibilidad	Asturias-Pantasma
Mata de Palo	9.500	Prefactibilidad	Villanueva-El Sauce
Villa Salvadorita	2.450	Factibilidad	Villa Salvadorita-Malpaisillo

Los proyectos agropecuarios cubren grandes área y afectarán aproximadamente 2.000 fincas en un plazo de 10 años. Parte de las mismas están localizadas en el área de influencia de los siguientes caminos:

i) Granos básicos

Asturias-Pantasma
Somotillo-Cinco Pinos

ii) Ganado

Juigalpa-La Libertad
La Calamidad-El Tabaco
Villa Somoza-El Zapotal

2. Instituto Nacional de Tecnología Agropecuaria (INTA).

- a) Se construirá una estación regional de investigación agrícola que estará situada en Santo Tomás (carretera al Rama). La zona de influencia abarca una franja de 60 Kms. en el sector intermedio entre la zona del Atlántico y la zona del Pacífico, con alturas que varían entre 500 y 1.000 m. sobre el nivel del mar. Su objetivo será el estudio de suelos, clima y potencial de diversificación agrícola.

Los caminos localizados en la zona de influencia de este proyecto son:

- La Calamidad-El Tabaco
- Juigalpa-La Libertad
- Villa Somoza-El Zapotal

- b) La finca modelo San Jorge en el Departamento de Rivas servirá para la demostración del uso de riego. Además es una granja reproductiva orientada hacia la diversificación de la producción. Se dará gran importancia a la ganadería y al cultivo de la caña de azúcar.

El camino localizado en su zona de influencia es Rivas-Veracruz.

B. Empresa Nacional de Luz y Fuerza (ENALUF)

El Programa de Electrificación Rural financiado parcialmente con el Préstamo 436/SF-NI, incluye, dentro de su zona de influencia, los siguientes caminos:

Villa Somoza-El Zapotal
Juigalpa-La Libertad
La Calamidad-El Tabaco
Abisinia-Valle del Cuá-Bocaycito

C. Ministerio de Salud Pública

Se han iniciado en abril de este año, los siguientes programas:

1. Programa de Salud Rural. Está financiado con fondos de AID (US\$5.0 millones) y del Banco Mundial, y comprende:
 - Puestos de salud, a nivel comunidad
 - Organización comunal, a través de adiestramiento en salud, de los líderes comunales
 - Instalación de mini-acueductos, que son bombas de succión accionadas a mano, molinos de viento, etc.
 - Instalación de letrinas sanitarias
 - Mejoramiento de las viviendas
2. Programa de control de contaminación del medio. Probable fuente de financiamiento: CIDA
 - Control de contaminación de cuerpos de agua (lagunas, lagos, ríos, etc.)
3. Programa de Centros y Puestos rurales de Salud. Probable fuente de financiamiento: BID

- Mejoramiento de hospitales regionales
- Comunicación rápida por ambulancias, radios, etc.
- Servicio de mantenimiento de equipo de hospitales.

Los anteriores programas del Ministerio de Salud, abarcan áreas en donde están localizados los siguientes caminos:

- San Juan del Río Coco-Quilalí-Wiwilí
- Asturias-Pantasma
- Abisinia-Valle del Cuá-Bocaycito

DATOS MINIMOS PARA UNA EVALUACION EX-POST DEL PROGRAMA DE
CAMINOS VECINALES

La información a ser recolectada deberá incluir como mínimo lo siguiente:

- (a) Conteo de tráfico de duración mínima de 24 horas, adecuadamente ajustado para considerar el día de la semana, mes y época (lluviosa, seca, cosecha, etc.)
- (b) Clasificación de tipo de tránsito por clase de vehículo y peso de los ejes.
- (c) Inventario de la condición de la superficie del camino, drenaje, señalización, obras de arte y actividades de mantenimiento.
- (d) Nivel de crédito y asistencia técnica que se ofrece en el área de influencia de los caminos por parte de instituciones de crédito privado y/o públicas.
- (e) Producción agrícola (comerciable) por tipo de cultivo y área.
- (f) Fletes de productos típicos.
- (g) Inventario y costo de inversiones social-económicas adicionales (tales como facilidades de almacenamiento, escuelas, agua potable y acueducto, electricidad, etc.).