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**REPUBLIC OF BOLIVIA
NATIONAL ROADS SERVICE**

PROJECT RURAL ROADS II

**FINAL REPORT
(TECHNICAL ASSISTANCE)**

LOAN USAID NO.: 511 - T - 061

GRANT NO.: 511 - 0466

DECEMBER 1986

ROY JORGENSEN ASSOCIATES, INC

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Chapter One

INTRODUCTION

In October 1985, a contract between the United States Agency for International Development (USAID) and Roy Jorgensen Associates, Inc., was signed for the provision of technical assistance to the National Roads Service (SNC) of the Republic of Bolivia in the execution of the project, "Rural Roads II" financed by USAID. The project, as designed, had two related objectives: the improvement of the capability of the SNC to carry out rural roads upgrading programs and the improvement of 260 kilometers of secondary roads in the Department of Cochabamba, specifically the Chapare region. The consultant services were initially to be provided for a twenty-four month period, but this was changed to twelve months because of financial constraints.

This Final Report documents the existing conditions that were encountered in SNC and reports the results obtained. It is organized into chapters -- Summary, Project Antecedents, Project Description, Technical Assistance, Existing Situation, and Results.

Chapter Two

SUMMARY

Introduction

Roy Jorgensen Associates provided technical assistance to the National Roads Services (SNC), through the Rural Roads Department, for execution of the Rural Roads II project. Consistent with the project objectives, the needs determined by the advisor, and the specific requirements of the contract, a work plan was structured to carry out the twelve months of technical assistance. This chapter will briefly examine the achievements attained in relation to the program.

Many factors limited the technical assistance in the execution of the upgrading activities. Climatological conditions, intensive use of project equipment on maintenance-related activities and labor problems were among these factors. The project was suspended in April 1986 to assist SNC on an emergency program to rehabilitate trunk roads damaged by heavy rains. The advisors provided technical assistance to this program up to July 1986 and then concentrated efforts on training activities.

Training provided to the upper, middle, and operational levels greatly strengthened the institutional capability of the SNC in project management, construction techniques and equipment operation. SNC requested USAID to extend the services of the advisor beyond the contractual period for training. Budget limitations did not allow for the extension.

Summary

Roads Selection

The advisor participated in the last two phases of the road selection procedure: Socioeconomic Analysis and Economic Evaluation. A total of fourteen roads with a total length of 176.5 kilometers were analyzed and the final results submitted to the SNC. Economic indicators of all the projects were above the minimum rate of return considered acceptable for this type of project.

Twenty-four kilometers are pending to complete the selection process in accordance with the project target of 200 kilometers.

A microcomputer program for the economic analysis phase was designed with the participation of the SNC Chief of the Computing Division. The program is in BASIC and can be run on an IBM-PC or similar.

All of the selection process was carried out with the active participation of the economist of the Rural Roads Department.

Planning and Programming

To effectively carry out future project planning and programming, an analysis of the Rural Roads Department was performed. It was recommended that Rural Roads Divisions be officially created at the district level to reinforce the decentralization process.

Productivity levels that take into account the construction methodologies in use and past experiences were estimated. The unit costs were revised and updated based on these productivity levels.

Even though it was not possible to develop a plan for project execution, planning and programming techniques were included in the seminars on Project Planning and Scheduling. The engineers have the capability to develop such plans using these techniques. The acquisition of a microcomputer recommended by the advisor will greatly enhance planning capabilities in the Rural Roads Department.

Execution of Works

Assistance was provided in the area of project administration, construction methodologies, supervision, equipment operation, quality control, reporting, selection of contractors, and organization of work. This was performed during the period November 1985 to March 1986 and continued in the maintenance and rehabilitation area up to June 1986. Reports and continuous communication with the Project Director served as a basis to reinforce the assistance provided.

Accumulated costs of the projects were satisfactory. For example, a projection in April of the total costs to be expended by the completion of the project Chipiriri-San Francisco would be 80 percent of the projected costs. Even though costs will increase somewhat if recommended improvements were implemented, it is expected that the final costs will approximate estimated costs. Training provided will also increase construction effectiveness.

Information Systems

The information system was reviewed. Two new formats were recommended to reinforce the system, one at the field level and another at the upper-management level. At the field level, information would facilitate control, improve accuracy and expedite monthly report preparation. At the upper level, an executive-type report will provide concise information of project execution at the national level.

The microcomputer acquired with project funds will be very helpful in maintaining updated information to assist our project management.

Training

A major achievement realized during this project was training provided to SNC personnel. Considerable efforts were expended on this activity. Two equipment operator training courses and two seminars on project planning and scheduling were carried out. A third seminar on Evaluation of Rural Roads Project could not be done because of SNC budget limitations; however a curriculum was developed and two more curriculums were developed for the operators' course and a seminar on project planning and scheduling.

A summary of the personnel trained is as follows:

- 40 engineers at the upper and middle level were trained on project planning and programming techniques. Other useful management areas were covered during the two seminars.
- 75 persons, most of them equipment operators, were trained. Classroom training was completed along with field training.

Recommendations

Organizational Recommendations

The number of rural roads programs being administered by the Rural Roads Department have increased considerably in the last four years. Among different projects, a total of \$38.9 million, from local and external funding, are being administered by the Department. Current plans indicate the work load will increase in the future.

Based on the high volume of work the Rural Roads Department is currently carrying out, and the possibility that this work load will further increase in the

future, project management can be greatly enhanced with the introduction of a cost accounting system.

Closely related to the objectives of reinforcing the organization of the Rural Roads Department is the official creation of the Rural Roads Divisions at the District Offices. The creation of these divisions is of major importance for present and future project execution. Decentralization would promote decision making to more effectively and efficiently carry out management functions.

Roads Selection Recommendations

There are only twenty-four kilometers pending to complete the road selection process. Application of the new selection procedure is an effective means to establish priorities and optimize use of resources.

The selection of the twenty-four kilometers should be made as soon as possible to establish a definitive list of the roads to be improved, indicating priorities for execution.

It is recommended that the road selection procedure be officially adopted at the national level. Priorities and resource allocation would in this may be made on a national and consistent basis.

Planning Recommendations

No plan has been developed for the project because the roads selection process has not been concluded. As described before, the procedure provides the means of developing plans optimizing project objectives and use of resources.

Based on the priorities established through the road selection procedure, a plan should be developed to properly execute the project. This plan should include a resource analysis to compare existing or available funds against requirements. The plan should consider local budgeting restrictions as well as local conditions that may affect the project. Work should be planned for the dry season, as past experience has shown project progress to be minimal during this time of the year. Equipment repair and training should be planned instead. Plans should include allocation of funds for maintenance to ensure roads are kept in good condition.

Execution of Works Recommendations

Execution of project works is very influenced by the Chapare local conditions. Climatological conditions and scarcity of labor are factors that have affected the project. Community participation has also been limited.

Compaction equipment is not being applied to the materials. Sheepfoot rollers procured for the project have never been used due to lack of towing equipment. Tests have not been performed to verify compaction obtained through the construction equipment. The specific recommendations are:

- Compaction equipment should be procured or rented to provide adequate compaction. Lack of adequate compaction can reduce surface life by 50 percent, greatly increasing maintenance needs.
- Work should be programmed to be performed only during the dry season.
- Concrete culverts of different sizes should be produced to decrease construction costs.
- Community participation must be actively promoted for road upgrading activities and minor maintenance.
- Bridge construction must be planned ahead in order to assure traffic flow during the entire year.
- Work by contractors must be intensified to alleviate the scarcity of local labor. Drainage activities are appropriate to execute through this method.
- Further technical assistance would be required in the future to enhance the Rural Roads Department capability for project execution.

Information System Recommendations

Formats were designed for the SNC Rural Roads Department to reinforce the information system. They were designed in response to immediate needs. Many other of the existing formats need to be modified or eliminated.

It would be convenient to put in practice the formats designed to reinforce the information system. Immediate benefits can be achieved at the upper management and field levels.

Services of an accounting specialist should be contracted to develop the accounting system for the Rural Roads Department. The specialist must also implement the system and train personnel in its use.

The accounting system can be computerized to obtain better and timely results. The microcomputer acquired for the project has the capability to use available software to classify and process the information.

Training Recommendations

Training should be continued to further improve the capabilities of the Rural Roads Department to carry out rural roads upgrading programs.

Training for equipment operators should be reinforced with productive (on-the-job) training. The SNC Training Division has the capability to carry out this type of training if reinforced with more personnel at the instructor level and the acquisition of audio/video-type courses or in-house development of slide-tape courses.

Training on microcomputer operations and programming is recommended at the engineer and administrative level. Very limited application of existing microcomputers is being made because of the lack of trained personnel.

Seminars that can be carried out to improve engineering management and technical skills are:

- Personnel Administration,
- Managerial Accounting,
- Evaluation of Rural Roads Projects,
- Equipment Management, and
- Project Execution and Control.

The training facilities exist at Cuticollo in Cochabama to develop the seminars.

Chapter Three

PROJECT ANTECEDENTS

In 1976, the Bolivian Government subscribed with the United States Agency for International Development (USAID) a \$8.5 million loan agreement (No. 511-T-056) to carry out a feeder roads improvement program (Rural Roads I) in the Departments of La Paz, Cochabamba, Santa Cruz and Chuquisaca to improve the standard of living of residents living in these areas. A specific purpose was to enhance the capacity of Bolivian implementing agencies, particularly the Rural Roads Department of the National Roads Service (SNC), to carry out rural roads upgrading programs. The program included the improvement of 1200 kilometers to be completed by the end of 1980.

In 1978, a second loan agreement (No. 511-T-061) for \$13.0 million was signed with USAID to undertake a rural roads upgrading program in the Departments of Chuquisaca (South), Potosi and Tarija. Program objectives included the upgrading of 1000 kilometers.

Due to problems in the implementation of the above programs, the Rural Roads I Project was cancelled and the Rural Roads II Project suspended in July 1980. Progress was made by the SNC after this date toward correcting some of the past deficiencies for implementation. As a result of this progress, the USAID Mission recommended that the Rural Roads II Project be reactivated, but refocused on the Rural Roads I geographic area, especially the Chapare, a tropical zone located in the Department of Cochabamba. Among the reasons in support of this change were:

- a much greater investment of time and resources were required to implement the project in Chuquisaca, Potosi and Tarija; and
- additional road improvement work was still required in the Rural Roads I Project area to upgrade existing roads to all-weather standards.

In May 1982, with the joint consent of USAID and the Government of Bolivia, the geographic focus was changed to the Rural Roads I Project area, but specifically to the Chapare. This region was selected in large because of its potential as a growth area, especially in terms of high-value agricultural and agro-industrial development considered critical to Bolivia's growth.

Chapter Four

PROJECT DESCRIPTION

Objectives

The overall objective -- to improve the standard of living of rural small farm families -- remained the same. The project, as redesigned, had two related purposes:

1. Institutional building of the Bolivian implementing agencies, particularly the Rural Roads Department of the SNC, to carry out rural road upgrading programs including planning, selection, design and execution of road improvement activities as well as maintenance of roads and equipment; and
2. to improve access to and from farms by upgrading 260 kilometers of secondary roads and the repair of bridges damaged by floods in the Chapare region.

Project elements considered which would contribute directly to improving the institutional capability of the SNC were technical assistance, training and procurement of heavy equipment.

The institutional building element of this project would continue the decentralization process begun under the Rural Roads I project. This implied increased responsibility and decision-making authority, at district level, in connection with project planning and implementation of rural roads activities.

Institutional Framework

The National Roads Service, a unit of the Ministry of Transportation, Communications and Civil Aeronautics, would be the principal counterpart organization. At the national level, the SNC Rural Roads department would be responsible for overall project coordination including preparation of documents for international procurement, scheduling of training, coordination of project accounting and implementation of the disbursement system. Below the national level, implementation responsibility would be at the SNC's district highway office. The office in Cochabamba (District No. 4) would work with the Secretariat of Development of the Bolivian Tropic and be responsible for overall coordination of Chapare development, devising yearly implementation schedules for road upgrading in the Chapare, give support to the

construction equipment and personnel assigned to the project, carry out light to moderate repairs on project-related equipment, manage contracts for road upgrading, bridge and culvert construction and undertake local procurement.

The Villa Tunari highway residence in the Chapare would be directly involved in the road upgrading activities. It would carry out light repairs on equipment, monitor the progress of contractors, and provide major maintenance to the upgraded road system. Routine maintenance would be carried out by the Chapare local community work groups.

The Rural Roads Department would furnish the personnel required to operate heavy equipment and some administrative personnel including one accountant at the district office to facilitate administration of the pari-passu system and to maintain accounting records for the project. Another accountant would be provided by the SNC for the same purpose in the Central Office in La Paz.

An organization chart of the SNC, along with descriptions of the Rural Roads Department, the District Office, the Highway Residence in Villa Tunari, is included in Appendix A.

Financing

As redesigned, the total cost of activities being financed under this project is \$13,031,000. Funding comes from the following sources:

	Cost in Thousands		
	<u>External</u>	<u>Bolivian Govt.</u>	<u>Total</u>
USAID Loan No. 511-T-061	\$9,042.0	\$ ---	\$ 9,042.0
USAID Grant No. 511-0466	300.0	---	300.0
Government of Bolivia		3,127.0	3,127.0
Chapare Local Communities		<u>562.0</u>	<u>562.0</u>
Total	\$9,342.0	\$3,689.0	\$13,031.0
Percent	72%	28%	100%

The financial plan is shown in Figure 4-1 on the following page.

Figure 4-1

Financial Plan

	US Agcy. for Int'l. Develop.			Govt. of Bolivia	Community	Total
	Grant	Loan	Total			
Technical Assistance	\$ 300	\$	\$ 300	\$	\$	\$ 300
Equipment/Vehicles/Spare Parts		3,400	3,400			3,400
Training		100	100			100
Evaluation		30	30			30
Phase I Complementary Activities		1,600	1,600			1,600
Chapare		2,442	2,442			2,442
<hr/>						
<u>SNC</u>						
Personnel				2,301		2,301
Fuel/Oil				433		433
Travel/Per Diem				107		107
Operating Costs				259		259
Facilities Improvement				27		27
<hr/>						
<u>Community</u>						
Community labor					160	160
Right-of-way Access					361	361
Local Materials					41	41
<hr/>						
Inflation & Contingencies		1,470	1,470			1,470
<hr/>						
Total	\$ 300	\$9,042	\$9,342	\$3,127	\$ 562	\$13,031

Technical assistance provided to the project is financed by a grant. Project local funds cover road upgrading and bridge repair activities in the Chapare, including:

- purchase of road building,
- purchase of fuel and oil,
- culvert and bridge construction,
- materials for drainage work, and
- travel and per diem for SNC personnel to attend training sessions.

The Government of Bolivia contribution through the National Roads Service finances salaries of the Rural Roads Department staff assigned to the project in Cochabamba and the Central Office, and operating costs and facilities to support construction works. The community contribution consists of local materials, hand labor to maintain the upgraded roads, and right of way.

Chapter Five

TECHNICAL ASSISTANCE

Consistent with the project objectives in October 1985 USAID contracted the services of the consulting firm Roy Jorgensen Associates, Inc., to provide technical assistance to the USAID/Bolivia Mission and the National Roads Service and, as appropriate, the Secretariat for the Development of the Bolivian Tropic (SDTB). Technical assistance would consist of programming, planning and implementing road upgrading activities principally in the Chapare to strengthen the administrative capability of SNC's Rural Roads Department to plan and carry out rural roads improvement programs. For this purpose, the firm provided a Highway Engineer with management expertise whose activities began on October 16, 1985. As described in the contract subscribed by USAID and the firm, the scope of work consisted of the following specific activities:

- Advise SNC's personnel and, as appropriate SDTB, in improving and implementing the last two stages of the Rural Roads II Project's selection procedures regarding road improvements. These stages will include socio-economic analysis and economic justification. The selection procedure will be used in the Rural Roads II Project and other future SNC's Rural Roads Projects.
- Prepare work plans and determine work priorities, based on the conclusions of the road selection procedure during execution of the Chapare-related Rural Roads Project component.
- Advise SNC's personnel in planning, scheduling construction, deployment of field teams and supervision of construction related to secondary road upgrading in the Chapare region.
- Guide SNC's field staff in proper use and operation of equipment and appropriate mixture of machinery and hand labor.
- Advise SNC's personnel on technical specifications for the geometric design of rural roads and a methodology for planning, study and construction of rural roads at the national level, taking into account the topographic characteristics of the different Bolivian regions, and specially as it relates to the Chapare portion of the Rural Roads II Project.

- Identify problems in project administration and suggest workable solutions.
- Develop systems for evaluation of project administration and progress.
- Schedule and implement training programs for project professionals, technical personnel and equipment operators -- the latter is to be in coordination with a heavy equipment advisor who has been contracted separately with project funds.
- Plan for and execute procurement of instructional aids necessary for in-country training programs.
- Develop plans for continuing implementation of the Chapare roads program after AID loan financing terminates.

In connection with these activities and the SNC immediate needs, a work plan was prepared to carry out the technical assistance. As specified by the contract, the technical assistance was to be provided for one year. The work plan is described in detail in Chapter 7 of this report.

Technical assistance was also to be provided by an equipment advisor. His activities consisted of assisting the SNC to improve maintenance of heavy equipment. Some activities of the contract were carried out in coordination with this advisor.

Chapter Six

EXISTING SITUATION

Visits to the field, information available, and interviews with SNC, USAID and SDTB personnel involved in the project execution served as the basis in obtaining general knowledge at the beginning of the technical assistance. Some areas required further analysis during project execution to more accurately determine actual needs, set priorities, and more efficiently concentrate advisor efforts. One of these areas was training to be provided to the SNC.

Organization

Functional Organization

Under the organization shown in Appendix A, Figure A-2, the Rural Roads Department, principal responsible for executing the project, had been coordinating not only activities related to the Rural Roads II Project, but also other similar ongoing projects financed with foreign and local currency (Figures 6-1 and 6-2). These relatively new projects had become a responsibility of the Department during the 1983-1985 period. Including the Rural Roads II Project, a total of 1404 kilometers of rural roads are planned to be improved and 60 kilometers constructed by SNC force account over a period of four to five years at a total cost of \$58.8 million. Even though the Central Office organization seemed satisfactory to administer these programs, it was anticipated that new management tools and possibly more personnel would be required to more effectively and efficiently carry out construction and improvement activities. For example, there was the need of a cost accounting system in the Department to reinforce project control.

As part of the decentralization process begun under the Rural Roads I Project, increased responsibility and decision-making had been transferred to the District Office (Appendix A, Figure A-3) in Cochabamba. In this context, the District was responsible for planning and implementing all construction activities in the Chapare, including contractor supervision, execution of construction works, road maintenance and accounting. Functionally the Chief of District was in charge of managing the financial aspects of the project. Technical matters -- planning, programming and implementing project activities -- had been delegated to a Project Director responsible to

Figure 6-1

Rural Roads Department
Road Upgrading Programs

Project	Objectives (Kms)			Source of Financing	Cost (000 US \$)
	Const.	Upgrading	Maint.		
Des. Agropecuario Norte de Chuquisaca		71.4		FIDA, CORDECH	\$ 1,087.40
Plan de Emergencia Santa Cruz		500.0		BID, CAF, CORDE-CRUZ, TGN	16,000.00
Des. Rural del Alto Beni	60.0	205.0	250.0	Pending	19,925.81
Des. Agroindustrial Yungas de La Paz		250.0		PNUD, TGN	5,542.08
Des. Rural Integrado Omasuyo-Los Andes (La Paz)		24.0		IDRA (World Bank TGN) SNC	700.00
Caminos Vecinales II		260.0		AID, GOB Communities	13,031.0
Cotagaita-San Juan de Oro		90.0		FIDA, CORDEPO	2,508.0
Totals	60.0	1400.4	250.0		\$58,794.29

the Chief of District. Even though the Project Director's office was functioning as a Division (Appendix A, Figure A-3), this had not been officially approved. At the District level there was also an accountant in charge of the financial control who reported to the District and to the SNC Department of Finances.

Even though the District Residence at Villa Tunari was supposed to oversee road upgrading activities, carry out minor repairs on equipment and monitor the progress of contractors, a change in the organization had been introduced and two temporary camps functioning independently had been established at Isinuta and Villa 14 de Septiembre to support the construction activities of the two roads being executed. Each camp had a resident engineer in charge of the road upgrading activities.

Support was also received from the Bridge Department that was in charge of some bridge repairs included in the Rural Roads II project. Repair works were to be supervised by the District Office at Cochabamba.

In general, the SNC functional organization to carry out the Rural Roads II project activities was found adequate. One problem that had considerably affected the SNC organization in the past had been labor problems out of control of this institution. Even though these were less frequent, they were still affecting SNC and project activities.

At the District level, there were problems with project supervision due to lack of transportation. The Project Director did not have vehicle assigned and residents were using very old vehicles. To solve this problem, trucks were being procured by USAID.

As detailed in other sections of this report, the information system needed to be reinforced to provide more useful information -- especially at the upper level of the Rural Roads Department. There was a need to introduce an executive-type report that concisely summarized project execution results and provided information to facilitate decision-making. Some field information also needed adjustments.

Equipment

A list of the existing equipment in December 1985 is shown in Figure 6-3. Equipment acquired through the Rural Roads I Project between 1978-1980 was to be rehabilitated with spare parts being procured by USAID under the Rural Roads II Project. A rehabilitation program had been prepared by the equipment advisor based on the spare parts arrival schedule.

Figure 6-3

Equipment
(to December 1985)

Equipment	Rural Roads I	Rural Roads II	Total
<u>Construction Equipment</u>			
Tractor D7G	4	6	10
Tractor D6D	2	--	2
Pay Loader	3	1	4
Motorgrader	2	1	3
Dump Truck	12	9	21
Excavator	--	1	1
Sheepsfoot Roller	2	--	2
Truck (water)	1	1	2
Subtotal, Construction Eqpt.			45
<u>Supporting Equipment</u>			
Workshop Truck	1	--	1
Cistern Truck	1		1
Small Truck	3		3
Trailer	1		1
Truck	1		1
Compressor	2		2
Lubrication Truck	--	1	1
Subtotal, Supporting Eqpt.			10
<u>Other</u>			
Crusher	1	--	1
Agricultural Tractor	2	--	2
Generator 30 KVA	1	--	1
Culvert Plant	1	1	2
Subtotal, Other			6
TOTAL			61

Rural Roads II equipment arrived in 1985.

An analysis of the operating equipment that would be available after rehabilitation indicated some imbalance between tractors and dump trucks. The tractor capacity exceeded that of the dump trucks for surfacing.

The agricultural tractors procured under Rural Roads I did not have the required capacity to tow the sheepfoot rollers. As a consequence, materials were not being compacted.

Workshops

Repairs were being carried out at the District workshop in Cochabamba and at the camps of Isinuta and Villa 14 de Septiembre. A workshop truck had been acquired to facilitate equipment periodic maintenance and minor repairs.

The personnel required to assist on equipment maintenance and repairs were insufficient. Equipment advisor reports indicated that only 50 percent of the personnel had been assigned by September 1985. By December, the construction equipment fleet had been increased to fifty-three units.

Warehouses

The main project warehouse was located in Cochabamba. A field warehouse was to be functioning at the District Residence of Villa Tunari in the Chapare. Materials and spare parts storage were very limited at the camp facilities.

Project Execution

The Rural Roads II Project was reactivated on October 14, 1983 through USAID Implementation Letter No. 14. This letter contained the details according to which the original Rural Roads II Agreement had been modified. Although construction works had been carried out with the Rural Roads I equipment in 1984, practically all works were initiated in July 1985 when the new equipment (tractors) arrived at the project site. Upgrading was begun on the roads Chipiriri-San Miguel-San Francisco (26.6 kilometers) and Central Sucre-Mariscal (20.0 kilometers).

Project Location

The project area, located in the subtropical region of the Chapare Province, has an approximate extension of 147,000 Has. dedicated to agricultural development by small farm families which had settled the zone. El Chapare with a topography predominately flat, clay-based soils and an average elevation of 300 meters above sea level

is a region subject to a high precipitation. Based on factors such as population distribution, soil characteristics, hydrological conditions, and the existing road network, the project area was divided into nine micro-regions (Figure 6-4) for the implementation of rural infrastructure programs. Road upgrading would follow this strategy but concentrate in micro-regions 3 to 9.

Project Upgrading Activities

Road Selection

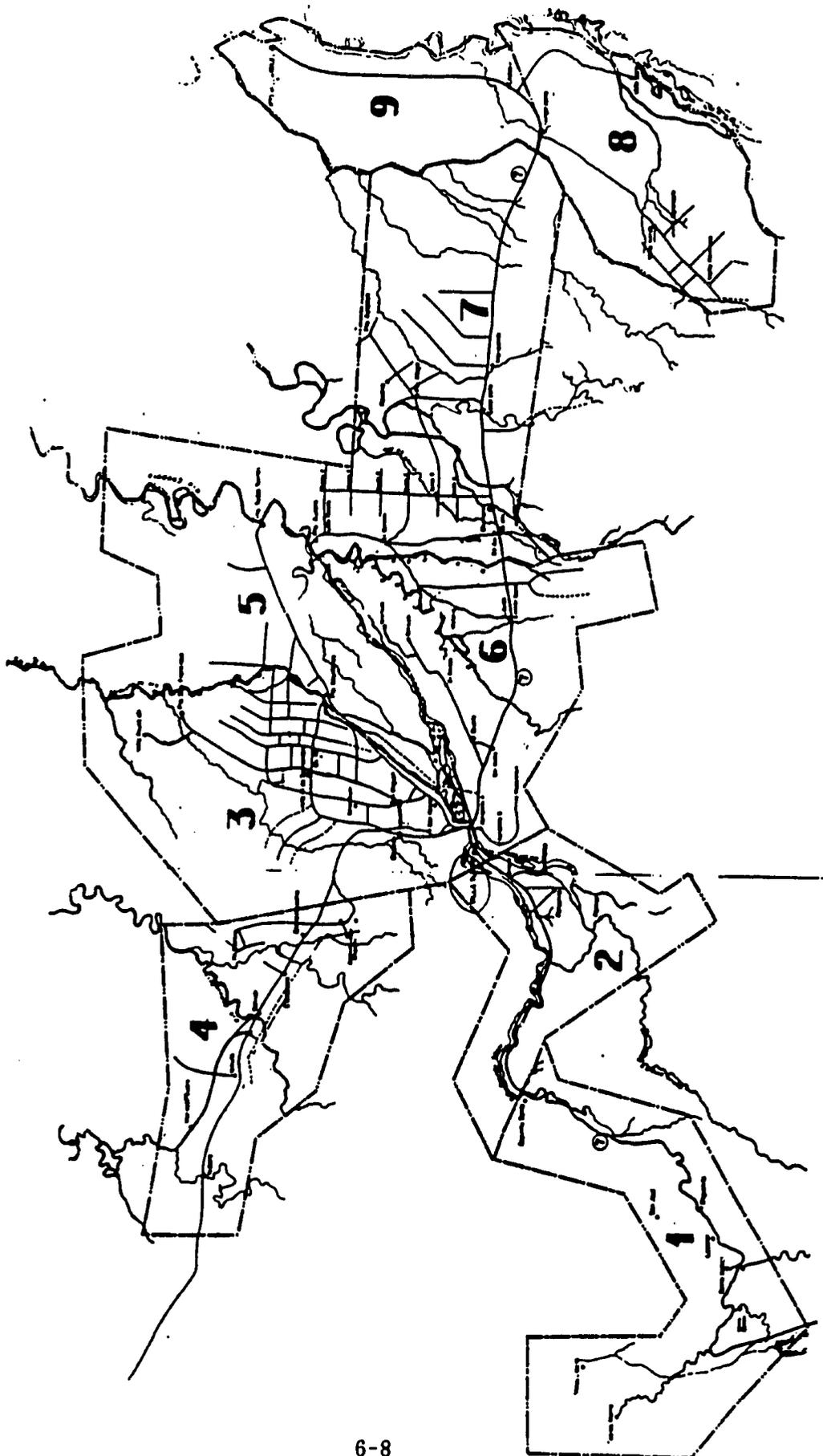
A procedure for the selection of roads to be improved had been recommended by USAID and approved by SNC. The procedure based on the most recent techniques developed for rural roads evaluation involved three levels of analysis for every candidate road consistent with:

- a preselection or screening step based on factors closely associated to rural development objectives,
- socio-economic analysis to quantitatively reflect social and economical benefits due to upgrading, and
- economic analysis to evaluate project return on investment derived from road improvement.

By December 1985, two phases had been completed and the economic evaluation begun for a total of 175 kilometers. No updated information was available for the economic evaluation. A field survey was scheduled and carried out with participation of SNC and SDTB personnel to update this information.

The selection of the remaining 75 kilometers was to be started in January 1986.

Figure 6-4
El Chapare Micro-Regions



Planning and Scheduling

A work plan including the roads to be improved had been developed, yet the road selection process had not been completed. At a general level, there existed an Implementation Plan and a Budget for the total duration of the Program estimated in three years with expected date of conclusion on December 31, 1986. The Implementation Plan contained a detail of the activities to be carried out and scheduled expenditures. The Plan was submitted by SNC to USAID in 1984 as one of the loan disbursement conditions.

Annual plans were also prepared in accordance with USAID procedures. They contained more detailed information of the annual expected accomplishments and expenses. For 1986, roads to be improved were scheduled based on priorities established through the results of the first two phases of the road selection procedure.

Road Improvement Works

Road improvement activities on the Rural Roads II Project were practically started in July 1985 when part of the new equipment arrived to the project. Works were initiated in the sub-projects Chipiriri-San Miguel-San Francisco (26.6 kilometers) and Central Sucre-Mariscal (20.0 kilometers) located in micro-regions 3 and 4, respectively.

Physical execution was delayed due to almost continuous SNC labor problems which were also affecting other governmental institutions. Progress obtained by October 1985 is shown in Figure 6-5. Activities behind schedule were surfacing and drainage.

Geometric Design

Upgrading activities were being carried out on a fast-track system. Design and construction activities were being executed at the same time. Geometric design was following the standards established by the SNC Rural Roads Department.

Earthworks Construction Methodology

Progress achieved on this activity in spite of delays was satisfactory. Tractors were the first new equipment received at the project in numbers more than adequate for the two projects under execution.

Figure 6-5

Rural Roads II Project
Progress As Of October 1985

Item	Unit	Central Mariscal-Sucre	Chipiriri-San Miquel-San Fran.
Top Soil Removal	m ³	24,080 (34%)	54,390 (92%)
Clearing & Grubbing	Ha		
Borrow	m ³	13,940 (48%)	18,983 (41%)
Embankment	m ³	16,728 (48%)	22,780 (41%)
Surfacing	m ³		5,554 (27%)
Hauling	m ³ -km		4,910 (10%)
Foundations	m ³	88.6 (33%)	157 (26%)
CMP Culverts 36"	m ¹		173 (34%)
CMP Culverts 60"	m ¹	74.40 (35%)	
Masonry (Bridges)	m ³		
Masonry (Culverts)	m ³		
Concrete	m ³		

Borrow methodology which was being used for subgrade construction was adequate for local conditions where topography was predominantly flat and adjacent materials satisfactory. However, materials were not being compacted and no control was being executed on density which was dependent on local traffic and construction equipment. The degree of compaction that was being achieved was adequate but not satisfactory. Compaction was not being provided due to lack of suitable equipment to tow the sheepfoot rollers.

Surfacing

This activity had been substantially delayed because new dump trucks had not been received at the project until December 1985. Progress achieved to October 1985 was 27 percent for Chipiriri-San Miguel-San Francisco and none for Central Sucre-Mariscal.

Surfacing materials were also not being compacted. An early recommendation to the SNC highlighted the need to provide the project with at least two vibratory rollers and compactors for this purpose. Compaction was highly recommended in the Chapare, a region subject to heavy rainfall activity.

Bridges

No bridges had been built. The bridge superstructure designed to be used had not been defined. Bidding documents including bidding specifications needed to be written after defining the type of superstructure.

Bridge repairs included in the Rural Roads II Project were about to start.

Culverts

Only 60-inch and 36-inch corrugated metal pipe culverts had been installed due to lack of other sizes. The culvert plant acquired with project funds had not been installed. New sizes would decrease costs and accelerate culvert construction activities.

Culvert headwall construction had not been initiated. Recommendations to start this activity as soon as possible were made to avoid damage by rain.

Information Systems and Control

The Rural Roads Department had an information system for project progress control. Information was prepared on a monthly basis by the resident engineers (Figures 6-6 and 6-7). No cost accounting system was in existence to provide actual unit costs that were being obtained to compare with existing standard unit costs.

Reports were revised by the Project Director and generally sent the tenth of every month to the Rural Roads Department. The information received by the Department was used to prepare quarterly reports for the SNC Executive Director. There was no executive-type report, upper-management oriented, that concisely summarized project execution results, and facilitated analysis and corresponding corrective actions in case of deviations.

Information related to personnel, equipment repairs and material consumption were also being prepared at the field office. Information sources used for the general report were payroll, equipment operator daily reports and warehouse reports.

In general, the information which was being produced was reliable. Work quantity computations were carried out by the resident engineers and equipment operator reports revised and, if necessary, adjusted by the camp clerk. Information on resources used were sent to the District Project Accountant for review and processing.

Project Accounting

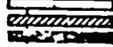
Two accountants, one at the District Office in Cochabamba and another at the Central Office in La Paz, had been assigned to carry out project accounting to facilitate financial control and to expedite USAID disbursement requirements. All information processing was oriented to provide the accounting information required by USAID in the Project Implementation Procedures.

The information was being classified by the District Accountant according to the SNC Accounting Manual for the preparation of consolidated financial statements.

The Rural Roads Department did not have a cost accounting system. As a consequence, unit cost deviations with respect to unit standard costs and their causes could not be established. In a similar manner, a compatibility between progress and actual costs could not be determined on a consistent basis.

Figure 6-6
Project Progress

SERVICIO NACIONAL DE CAMINOS		DEPARTAMENTO CAMINOS VECINALES		CRONOGRAMA DE AVANCE DE OBRA												FECHA DE INICIO: ___/___/___						
DISTRITO: _____		SUB PROYECTO: _____						CÓDIGO: _____												LONG. TOTAL: _____		
CLAS	ITEMS	UNID	CANTIDADES PROGRAMADAS	COSTO UNITARIO	COSTO TOTAL	%	AVANCE EN PERIODO	%	1	2	3	4	5	6	7	8	9	10	11	12	%	
11	Descape	m ²																				
12	Desbroce y Desboque	Hs.																				
13	Excavación Común	m ³																				
14	Excavación Roca	m ³																				
15	Excavación Zanjas	m ³																				
16	Préstamo	m ³																				
17	Terraplén	m ³																				
18	Ripiado	m ³																				
34	Transporte	m ³ /Km																				
42	Excav. Fundaciones	m ³																				
43	Construcción Bodegas	m ³																				
44	Colocación Tubos Ø 600	ml.																				
45	Colocación Tubos Ø 1000	ml.																				
50	Mampostería con mortero	m ³																				
51	H ^o C ^o Fundaciones	m ³																				
52	H ^o C ^o Elevaciones	m ³																				
53	Hormigón Simple	m ³																				
54	Hormigón Armado	m ³																				
							Σ =															

REFERENCIAS :  AVANCE PROGRAMADO
ITEM EN CONSTRUCCION
ITEM CONCLUIDO

Financing

Economic problems had not permitted the Government during the fiscal year 1985 to meet the counterpart financial requirements in the amount anticipated. Counterpart funds corresponding to the First Quarter 1985 were only 45 percent (US\$31,975) of the total budgeted. USAID participation for this period was US\$146,188 which corresponded to the first disbursement.

Due to the above situation, USAID suspended disbursements in the Second Quarter of 1985. Nevertheless, work continued with District financial support. By December 1985 a second disbursement had been requested by the SNC covering the last three quarters of 1985 and USAID had been made an advance of US\$30,385 in recognition of the funds that had been provided by the District.

One aspect that required special attention by the SNC was the establishment of a procedure for using a revolving fund of US\$10,000 that USAID had approved for local (district) procurement. This fund would serve to expedite repairs through local spare parts acquisition. Regular disbursements would feed the fund.

Chapter Seven

WORK PLAN AND RESULTS

Based on the program objectives, the needs determined by the advisor in the diagnostic phase, and the specific requirements of the contract a work plan was structured (Figure 7-1) to carry out the twelve months of technical assistance. Areas where special efforts were to be concentrated were those identified as immediate needs such as road selection, planning and scheduling; those related to construction works where technical assistance was to be provided on a daily basis; and those oriented to reinforce the SNC organization such as training and system information improvements. Other activities included were supplementary to the major activities just mentioned.

The work plan as designed was flexible. Adjustments could be made within the scope of the contract of technical assistance to respond to the actual needs and priorities of the SNC to more effectively carry out the services to be undertaken.

General coordinating functions among the USAID Mission, the SNC and the SDTB and other institutions related to project execution were also to be carried out by the advisor as needed.

Activity 1 -- Analysis of the Existing Situation

The analysis of the existing situation served as a basis to program the activities of the technical assistance.

Results

An Inception Report containing an analysis of the existing situation at the beginning of the technical assistance: a work plan including the activities to be performed and the strategy to be followed, and recommendations on potential areas for reinforcing the organization of the Rural Roads Department, was submitted to SNC and USAID for consideration. This report would not only serve as a guide to carry out the different activities, but also as a means to coordinate efforts on some areas with the SNC. Some activities were to be performed with the active participation of the SNC personnel.

Activity 2 -- Road Selection

Under this activity, two sub-activities were to be performed -- (1) selection of the 260 kilometers of roads to be improved, and (2) adaptation of the procedure recommended by USAID at the national level.

Project Road Selection

This activity would provide assistance in the selection of roads to be upgraded. This would follow the procedure approved by the SNC and described below. Three phases were involved in the analysis:

1. preselection phase,
2. socio-economic analysis, and
3. economic analysis.

The activity would be a joint effort of the SNC and SDTB personnel and the advisor. The preliminary tasks involved collection, verification and analysis of the data required by the selection procedure. Final recommendations were to be made about the data to be used and the final results.

Results

The advisor participated actively in the last two phases of the road selection procedure. A total of fifteen projects with a total length of 191.5 kilometers were analyzed and the final results and recommendations included in the Quarterly Report April-June 1986. Some particular aspects about the results and priorities established are:

<u># of Projects</u>	<u>Micro-region</u>	<u>Benefit/Cost Range</u>	<u>IRR * Range (%)</u>	<u>Length (Km)</u>
6	4	11-14	25-26	47.0
3	7	7-10	21-24	58.0
1	6	7	21	20.0
1	8	6	19	8.0
3	3	4-5	16-17	<u>43.5</u>
			Total	176.5

Notes: One project was discarded (length = 15 km).

*IRR: + Internal Rate of Return

+ Minimum Attractive Rate of Return for public investments -12%
(Source: SNC Planning Department).

Project Central Sucre-Mariscal (20.0 km), one of the two projects being upgraded, obtained the highest ratio: B/C = 14% and IRR = 26%. Project 14 de Septiembre-San Francisco (14.5) was among the lowest rated, but still within acceptable values: B/C = 5% and IRR = 17%.

The list developed would serve as the basis to program future undertakings. One project that was discarded from the list was Valle Hermoso-Villanueva. A field inspection revealed it was new construction. Details about this action are contained in Act of December 9, 1985 signed by SNC, SDTB personnel and the advisor.

A microcomputer program was devised with participation of the SNC Chief of the Data Processing Division for the economic analysis phase. The program is in BASIC language and can be run on an IBM-PC (256 K) or similar. Sensitivity analyses can also be carried easily out through this program.

On May 28, 1986, through USAID Implementation Letter No. 28, the original target of 260.0 kilometers of roads was reduced to 200.0 kilometers in agreement with the National Roads Service. The cause for reductions, were based on past experiences in project implementation. According to the new goal of 200.0 kilometers, only 24.0 kilometers of roads are yet to be selected to complete the selection process. Some delays in obtaining the final results were registered due to internal priorities established by the Rural Roads Department on the activities of the economist in the Department. All of the selection process was carried out with active participation of the economist of the Rural Roads Department and the Rural Roads II Project Director.

Adaption of the Road Selection Procedure at the National Level

This activity required visits to different regions in the country where other rural roads programs were being carried out. The purpose of the visits would be to get acquainted with every program objective, the areas where projects were to be executed, type of work, institutional framework for project implementation, information available and other elements that should be considered under the selection procedure.

The road selection procedure in use for the Rural Roads II Project would be revised in the light of the collected information and the experiences derived from its application to the Chapare roads. Adjustments would be made, if necessary, to develop future rural roads upgrading programs. Past experiences of the SNC Planning Department would also be taken into account.

The proposed strategy was to integrate an analysis committee, formed from personnel of the Rural Roads and Planning Departments, whose activities would be coordinated by the advisor.

Results

Even though this activity was not carried since the last three months of the technical assistance was devoted exclusively to training in accordance with USAID Letter PRD-ME-130/86 of July 23, 1986, some recommendations are included below to extend the use of the road selection procedure to other rural road programs, based on the experiences at the Rural Roads II Project:

- Phase 1: Preselection -- Since most of the screening factors used are directly associated to conditions which generally must be met for regional rural development, this phase is also applicable to other programs. Current condition of the program under study can be added as new factors. These should be established with the consensus of the institutions involved in the program.
- Phase 2: Socio-Economic Analysis -- Weights of the factors must be established by a committee integrated by the institutions involved in the program. The weights will reflect the relative importance of each factor in relation to the specific objectives of the program. The factors considered in the USAID procedure are the most commonly used for rural roads projects.
- Phase 3: Economic Analysis -- The only difference in every case would be the establishment of the costs and benefits for the particular program. A lengthy description of how to determine these elements and the different methods of economic evaluation for rural roads programs were included in the text prepared by the advisor for the Seminar on Evaluation of Rural Roads. Sensitivity analysis is strongly recommended for the evaluation of results. In general, this phase is also applicable to other rural roads programs.

Activity 3 -- Planning and Programming

Roads planning and programming were scheduled after the road selection process was completed and roads and their priorities for improvements defined. This activity would be carried out with participation of the District and the SDTB. This task embraced the following tasks:

- Task 1: Project Organization Analysis -- An analysis of the project organization would be conducted. Critical elements of the organization that might be affecting project administration would be identified.
- Task 2: Unit Costs Updating -- Productivities would be estimated based on project experiences. Existing unit costs would be revised and updated based

on these productivities. An analysis of indirect costs to be applied to the unit costs would also be carried out.

- Task 3: Work Quantities -- Work quantities would be developed once the roads to be improved were defined.
- Task 4: Work Programming -- Planning and programming would be based on the Critical Path Method (CPM) technique. An integrated road upgrading program would be prepared following priorities established through the road selection process. Critical activities would be identified.

The global program would serve as the basis for the preparation of annual operating programs.

Results

- Organization -- An analysis of the Rural Roads Department organization was carried out. Considering the nature of rural road programs which are often subject to local regulations and controls; the increasing trend of new programs, and the need to expedite decision-making in order to more effectively and efficiently develop project management functions, the official creation of the Rural Roads Division in every district where rural roads programs are executed is of major importance. Details of this recommendation were included in the Quarterly Report January-March 1986. Other organizational aspects that should be mentioned in connection with the project are:
 - + The equipment rehabilitation program prepared by the mechanical advisor has not been implemented as expected. Late arrival of spare parts has been the major reason.
 - + To reinforce the Rural Roads Department organization, a justification to acquire a microcomputer was prepared by the advisor. This equipment -- an IBM-PC-XT -- was procured by USAID and received by the SNC in October 1986.
 - + Three light trucks for the project were received in June. These trucks alleviated the problem of mobilization for project supervision.
- Unit Costs -- Unit costs were reviewed and updated. An indirect cost analysis was performed. The calculated indirect costs were 23 percent and

the figure adopted for project units costs were 20 percent. SNC had been applying only 10 percent.

- Work Quantities -- Suspension of project activities in April 1986, and as a consequence change in priorities of the activities of the technical assistance, did not permit continuing with this activity. Approximate quantities have been in use for the two projects that were being executed.
- Work Programming -- Even though a program could not be developed due to delay of the road selection process until July 1986, an estimate of the global progress that can be achieved on the project per month was estimated based on the project's past experiences. These figures were included in the Quarterly Report January-March 1986. According to this, if project activities were reinitiated in May 1987, project completion would be at the end of 1989. The current project completion date established for December 1987 (Implementation Letter 28) should be reviewed and updated.

Planning and programming techniques were included in the seminars on Planning and Scheduling. The CPM techniques were discussed with enough detail at the seminar. They are useful tools that can be used for future project planning and programming.

Activity 4 -- Execution of Works

The technical assistance and work execution would be provided on a daily basis. A major portion (20 percent) of the assistance was assigned to this task. This activity would include advising in the areas of organization, construction, supervision and control of work. Problems that might affect the project would be identified and the necessary actions to be taken to solve these problems recommended.

This activity would also include coordination among SNC, USAID, SDTB and other agencies necessary to ensure that work would be efficiently carried out.

Activities scheduled under this item were the following:

- Geometric-Design Standards Review -- Existing geometric design standards would be reviewed and adjustments would be recommended if potential benefits could be derived from their use at the national level. The revision would take into account the topographic characteristics of the different regions of the country. As a guide, specifications which have been adopted by other countries with similar topography would be used.

- Construction Specifications -- Construction specifications guidelines would be written for work to be undertaken by force account and recommendations made for work to be performed by contractors.
- Construction Technical Assistance -- The technical assistance to be provided would include:
 - + scheduling of construction activities including resource analysis,
 - + recommendations on deployment of field teams considering the appropriate mixture of machinery and hand labor,
 - + analysis of construction methodologies,
 - + advising on equipment operation,
 - + identification of problems in project administration and recommendations for their solution,
 - + construction quality control,
 - + cost control, and
 - + identification of training needs.

Results

The technical assistance on execution was limited by many factors -- climatological conditions, labor problems and intensive use of the equipment on maintenance-related activities. The SNC through Letter No. 821 of March 17, 1986 requested USAID emergency assistance to rehabilitate trunk roads in the Department of Cochabamba damaged by heavy rains. The assistance, approved by USAID through Implementation Letter No. 26 of April 7, 1986 included support with equipment, spare parts and operating expenses to be funded from the Rural Roads II Project. As per the same USAID Implementation Letter, the services of the advisor were reoriented to provide technical assistance to the SNC on this works and specifically to advise on construction procedures and supervise work quality. Several extensions to this emergency program had been approved by USAID at the termination of the technical assistance.

As a consequence of the above, the technical assistance was concentrated on the training activities. Training needs were identified at different levels and seminars and training courses carried out in coordination with the Rural Roads Chief of Department. Details about the training results are provided in other sections of this report.

A summary of the results of the assistance provided under Activity 4 is described below:

- Geometric Design Standards Review/Construction Specifications --

These activities were not concluded. On July 23, 1986 USAID through Letter PRD-ME-130/86 sent to the SNC, efforts of the technical assistance were exclusively concentrated to the implementation of seminars for the SNC personnel. Most of the above activities had been programmed for the period July-September 1986.

- Construction Technical Assistance --

Under the limitations mentioned above, assistance was provided on a regular basis in the construction activities during the period November 1985-March 1986. Assistance was also provided in the maintenance activities in the period April-July 1986 and as required in the following months in the selection of contractors for drainage works to be undertaken at the projects.

A balance of the progress registered during the period of technical assistance is shown in Figure 7-2. It can be observed that surfacing and drainage activities are the most delayed of all activities. The late arrival of dump trucks and the severe climatological conditions during the period did not permit the expected progress. Poor community support for drainage works was part of the cause for the slow progress of this item. In addition, government regulations did not allow contract works for more than \$1,000. This law was amended in August 1986.

One aspect that must be given attention in the future is the compaction of materials. Although efforts are made to compact with the construction equipment, this is insufficient to obtain the degree of compaction required. This is particularly important in the Chapare region subject to severe climatological conditions.

Accumulated total costs achieved were satisfactory. These will increase somewhat, if compaction is provided. Some additional costs will be repairs that must be carried out where subgrade has been exposed to rain and traffic. Actual unit costs are not being obtained because of the lack of a cost accounting system.

In the future, the equipment should be withdrawn from the project during the rainy season to repair or use on maintenance activities.

Figure 7-2

RURAL ROADS II PROJECT

Project Progress at the Conclusion of the Technical Assistance

No.	Activity	Units	Percent			
			Central Sucre Mariscal (L=20 km)		Chipiriri - San Miguel San Francisco (L=26.6 km)	
			During Tech. Assist.	Cum. to Mar. 86	During Tech. Assist.	Cum. to Mar. 86
11	Top Soil Removal	M ³	22	34	10	100
16	Borrow	M ³	35	65	30	59
17	Embankment	M ³	35	65	30	59
31	Surfacing	M ³	31	31	64	80
34	Hauling	M ³ - KM	26	26	34	42
42	Excavation	M ³	53	70	20	34
44	Culverts	M.l	61	78	18	46
51	Masonry Found.	M ³	--	--	1	1
52	Masonry Elevation	M ³	--	--	1	1
Estimated Total Cost US\$			318,364		454,044	
Accumulated Costs US\$			158,100 (50%)		253,600 (50%)	

NOTE: Works were suspended in April 1986.

Activity 5 -- Information System and Control

The information system in use by the Rural Road Department for evaluation and control would be revised. Forms would be designed if necessary. An immediate need was identified to design an executive type report for the upper management level.

The information system was revised and a report was submitted in April 1986 to the Rural Roads Chief of Department containing recommendations to reinforce the system. Immediate needs were considered for the use of two new forms -- one to be used at field level and the other at the upper management level. A brief description of these is given below.

A weekly report was proposed to organize and standardize the information that was being prepared by foremen for execution of works. This report would summarize the work accomplished and resources used by activity. Standardized information would facilitate control, improve accuracy, and expedite monthly report preparation. It would also constitute the basic report for an accounting system that could be structured to control costs by activity.

For the upper management, an executive-type report was proposed. This would concisely summarize, on a monthly basis, project execution results at the national level. Work and costs programmed would also be included. In this way, deviations from programs can be determined and the appropriate corrective actions taken.

An additional recommendation included in the report submitted to the Rural Roads Department was the need to introduce a cost accounting system to better control execution of works. This system would be centralized in the Department for the majority of the projects, subject generally to special regulations and controls. Trends indicate that rural roads programs will increase in the future.

Activity 6 -- Training

Specific training needs would be defined for the Rural Roads Department personnel. They would be determined in close coordination with SNC personnel to ensure they meet SNC training priorities. A tentative training program was included in the work plan based on the needs determined by the advisor based on the analysis of the existing situation.

Training would be provided to the upper, middle and operational levels. At the operational level were scheduled two equipment operator courses, and at the upper and middle levels two seminars. The operators training course would be jointly carried out with the mechanical advisor.

Specific training programs would be developed for each course and seminar. They would include a general description of their objectives and contents, estimated number of personnel to be trained, resources needed and a cost estimate. The program would be designed to make an optimum use of existing training resources in the SNC. In the training courses the SNC Training Division would have active roles especially in the field training that would be scheduled with every course.

Results of training would be evaluated to identify areas of potential improvements. Questionnaires, tests and field observations would be used for this purpose. Recommendations would be made based on the above results.

The tentative outlines of courses and seminars scheduled were:

- Equipment Operators Training Courses
 - + Course 1 Construction Equipment Operation
 Construction Safety
 Factors Influencing Production
 Reports
 Others (by the mechanical advisor)
 - + Course 2 Construction Methods
 Productivity
 Others (by the mechanical advisor)
- Seminars
 - + Seminar 1: Project Planning and Scheduling
 - Critical Path Method in Construction
 - Gantt Diagrams
 - Practical Applications
 - Value Engineering Applied to Construction
 - + Seminar 2: Project Execution and Control
 - Earthwork Volume Computation Methods
 - Productivity
 - Unit Costs
 - Specifications
 - Learning Curve
 - Use of CPM
 - Linear Programming Applied to Construction
 - Statistic Quality Control
 - Information Systems

Results

Much of the efforts of the advisor were concentrated on training. On July 23, 1986, through Letter PRD-ME-130/86 sent to SNC, USAID authorized the services of the advisor to be dedicated exclusively to training until the end of the contract. This decision was taken since an extension of the technical assistance beyond the contractual period requested by SNC was not possible due to budget limitations.

Training needs at the operational level were determined through a personnel inventory and interviews with foremen and resident engineers. The results were supplemented with recommendations by the Project Director. The results can be summarized as follows:

- Drivers had not received any training courses.
- Even though most of the equipment operators had received training courses, there did not exist a solid knowledge of construction methods.
- Most of the experience of operators and drivers had been on highway maintenance.

All course and seminar programs were submitted for the approval of the Rural Roads Chief of Department. The programs included the objectives and content of the course, a schedule of the activities to be carried out, resources needed, and a cost estimate. Extensive use of the existing audiovisual courses at the SNC Training Division were considered for the equipment operator training courses.

The training courses were coordinated with the mechanical advisor. Participation of the SNC Training Division in these courses was coordinated with the Rural Roads and Maintenance Chiefs of Departments. The instructors of this Division would participate in the field training.

Two equipment operator training courses were implemented. One was carried out at the Chapare and the other in Santa Cruz on a rural road program financed by the International Development Bank and the Bolivian Government. Each course included three days of theory and four days of field training.

The areas of training covered by the advisor were:

- General Concepts on Rural Roads,
- Construction Staking,
- Construction Methods,
- Factors Influencing Productivity,

- Construction Safety, and
- Construction Quality Control.

A text was prepared by the advisor covering the above topics. This was complemented by the mechanical advisor with equipment maintenance and operation topics. The SNC Training Division participated actively during the field training portion of the course. This Division has an experienced group of instructors that did an outstanding job with the operators and drivers. Field training was carried out on roads already under execution.

To evaluate results on the theoretical part, an exam was given to the participants. The number of participants and results before and after the course are included in Figure 7-3. A total of seventy-five persons, including foremen, operators, operators assistants, drivers and mechanics were trained. Training effectiveness on the job could not be tested since works were suspended at the Chapare, and the last course was carried out almost at the end of the technical assistance.

Two seminars on Project Planning and Scheduling were conducted for engineers at the upper and middle levels. A third seminar on Evaluation of Rural Roads Projects could not be carried out due to SNC financial problems. Nevertheless, a text was prepared and its content extended with additional topics. One seminar was carried out in Cochabamba at the training facilities located in Suticollo and other in Sucre at the District headquarters. Twenty engineers attended every seminar. Some personnel were sent by the Departmental Development Corporations (CORDECH, CORDECRUZ).

According to SNC priorities, the seminar on Project Execution and Control that had been included in the work plan was changed for the seminar on Evaluation of Rural Roads Projects.

The topics included in every seminar are shown in Figure 7-4. The Seminar on Project Planning and Scheduling was complemented with project management-oriented topics to reflect the SNC priorities defined with the Rural Roads and Maintenance Chiefs of Departments. An introduction to microcomputers was included to illustrate its current use as a management tool. A text was also prepared for this seminar.

Very good results were obtained from the seminars. Since material covered on every topic was extensive and the time available for seminars (six days) too short, the evaluation was carried out by the advisor on a group basis. Practical problems were evaluated by the group and reviewed by the advisor. On both seminars 75 percent or more of the participants had learned the concepts.

Figure 7-3

EQUIPMENT OPERATORS TRAINING COURSE

Evaluation Results

<u>Participants</u>	<u>El Chapare</u>			<u>Santa Cruz</u>		
	<u>No.</u>	<u>Before (%)</u>	<u>After (%)</u>	<u>No.</u>	<u>Before (%)</u>	<u>After (%)</u>
Drivers	10	28	84	12	20	75
Eq. Operators	13	44	63	10	42	64
Opr. Assist.	6	44	58	10	35	60
Foremen	3	48	68	4	52	85
Mechanics	<u>3</u>	45	63	<u>3</u>	25	56
TOTAL	35	April 1986		39	September 1986	

Figure 7-4

SEMINAR CONTENT

Seminar on Project Planning and Schedule

- Concepts on Systems Engineering
 - Critical Path Method (CPM) Applied to Construction
 - Cash Flow Analysis
 - Introduction to Microcomputers--Practical Applications using the CPM
 - Value Engineering
 - Financial Statements; Ratio Analysis
-
-

Seminar on Evaluation of Rural Road Projects

- Methods of Evaluation of Rural Roads Projects
 - Engineering Economics
 - Concepts on Evaluation of Rural Roads Projects
 - USAID Road Selection Procedure
-

It must be recognized the demonstrated enthusiasm of participants and support provided by the SNC authorities to carry out the seminars. Organization of the seminars and coordination of participants from different regions of Bolivia was excellent.

Activity 7 -- Reports

An Inception Report detailing the existing situation of the project at the beginning of the technical assistance and the proposed work plan was submitted to SNC and USAID.

Quarterly reports were also prepared according to contract requirements.

Activity 8 -- General Organization

Under this activity, some activities not included in the contract of technical assistance were proposed to reinforce the Rural Roads Department organization. The introduction of a cost accounting system, assistance on developing an integral planning and programming of rural roads at the national level, and applications of microcomputers to construction planning and control, were among the activities proposed. The proposal was made on the grounds of the volume of work which is being currently carried out by the Department and the possibilities, based on current trends, that the work load be increased in the near future.

The acquisition of a microcomputer was also recommended, initially to be used in the execution of the project and for training purposes, and afterwards at the Rural Roads Central Office in La Paz to enhance project management at the national level. With this purpose, a justification was prepared by the advisor and sent to the Chief of Department.

Based on the above recommendations, a microcomputer IBM-PC-XT was procured by USAID with project funds. The time assigned to this activity of ten man-days was among the time used for training according to USAID authorization.

APPENDIX A

ORGANIZATION CHARTS

Figure A-1
NATIONAL ROAD SERVICE

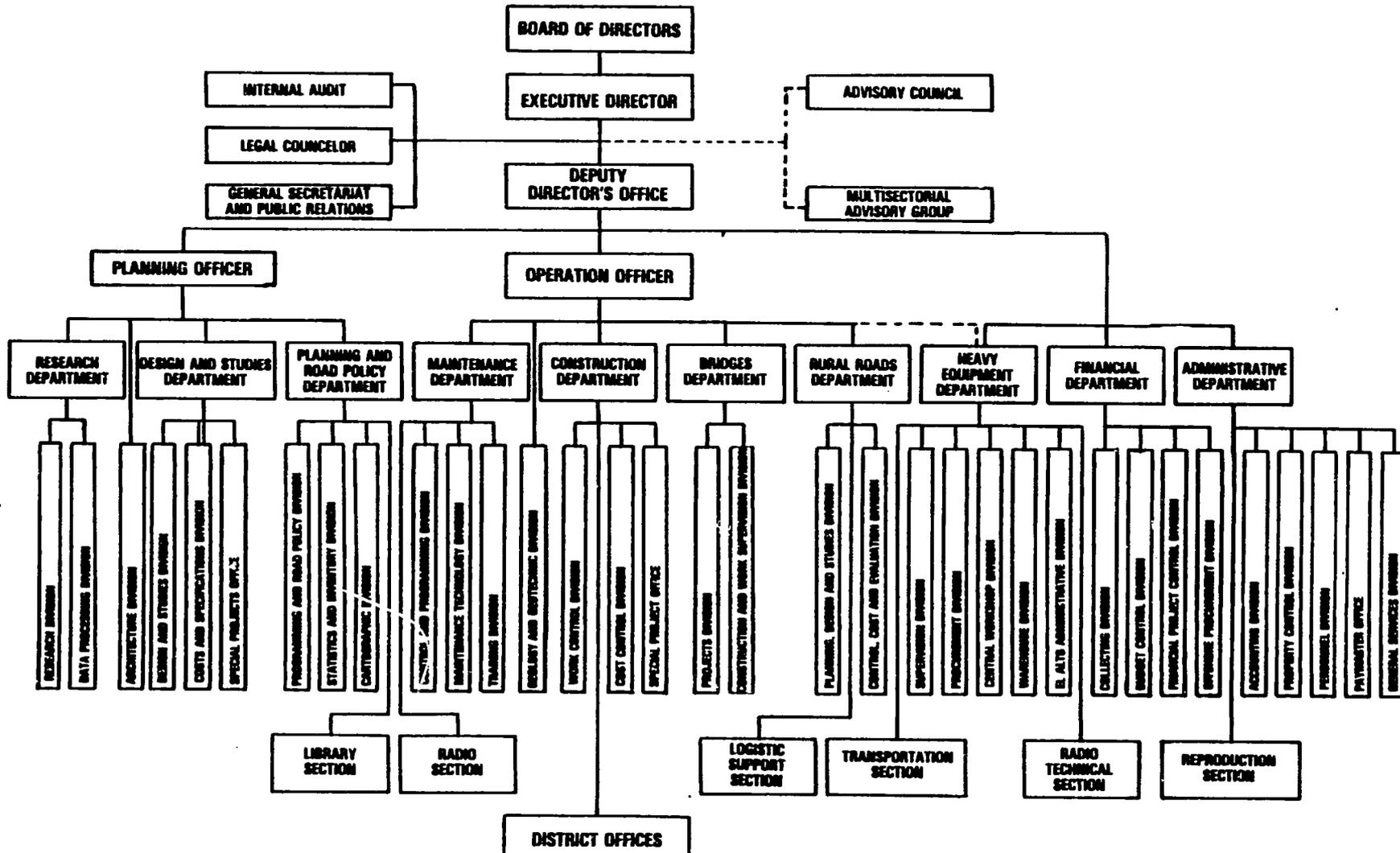


Figure A-2
S N C

RURAL ROAD DEPARTMENT
CENTRAL OFFICE

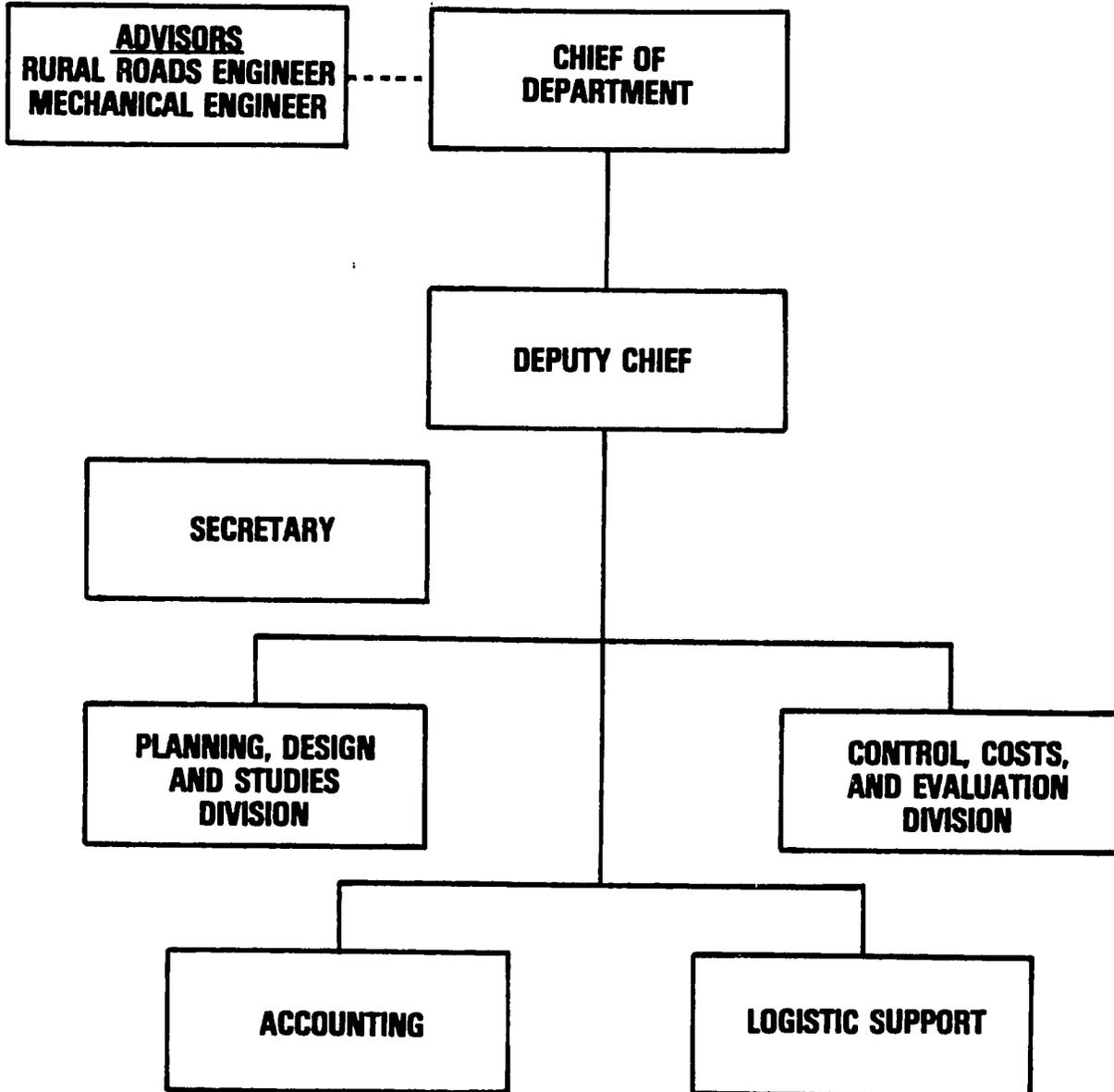


Figure A-3
S N C
TYPICAL ORGANIZATIONAL CHART OF A DISTRICT OFFICE

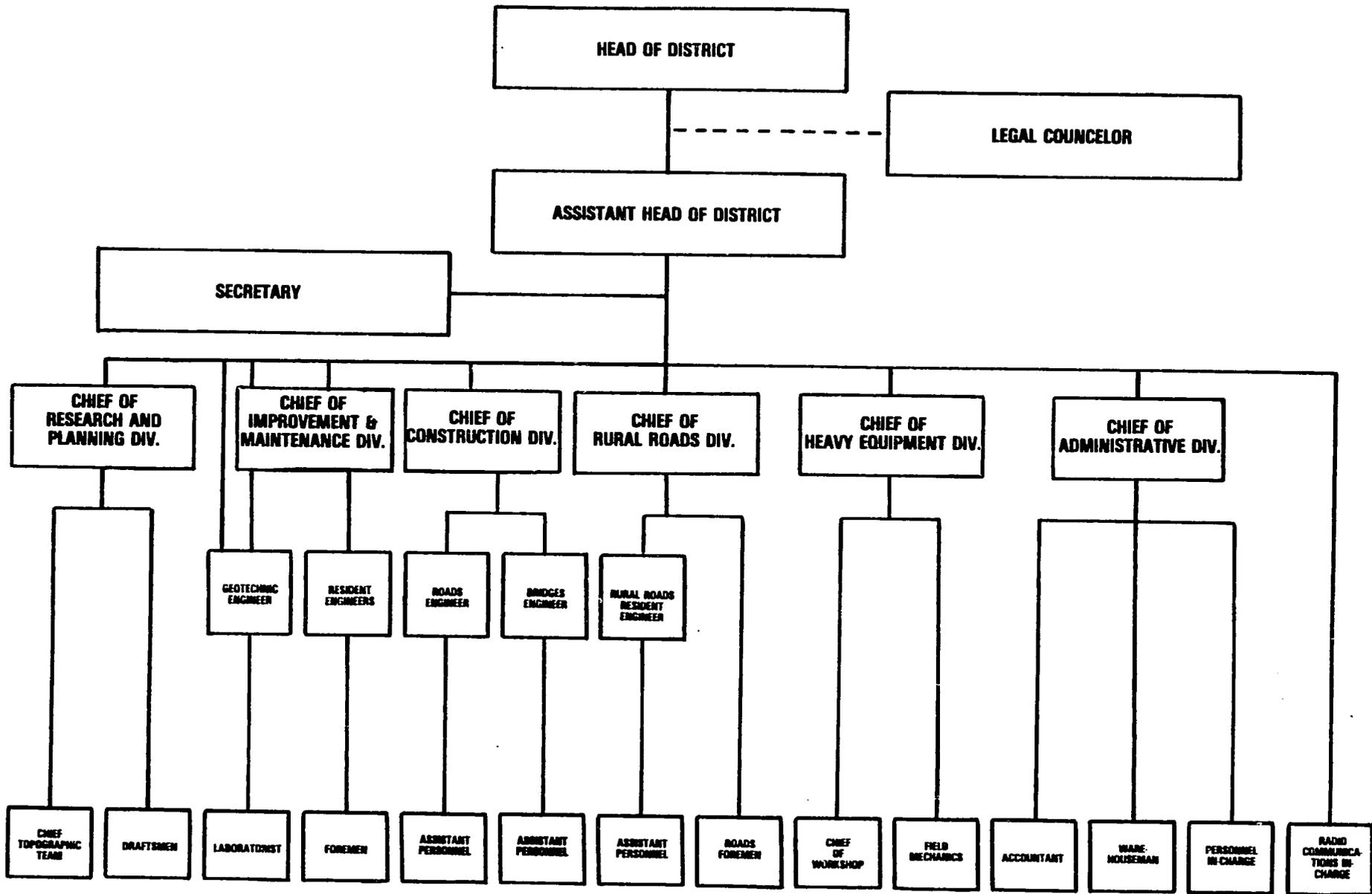


Figure A-4
S N C
RURAL ACCESS ROADS RESIDENCY OFFICE

