650 000

ISN-13598

SUDAN

Southern Rural Infrastructure Project

650-0031

Annexes

July 1979

SUDAN

Southern Rural Infrastructure Project

650-0031

Annexes

July 1979

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ANNEX A

CHECKLISTS OF STATUTORY CRITERIA

ANNEX A

CHECKLISTS OF STATUTORY CRITERIA

I. 5C(1) COUNTRY CHECKLIST

A. General Criteria for Country Eligibility

1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in consistent pattern of gross violations of internationally recognized human rights?	1. The program is designed to provide, in part, poor farmers access to larger urban service/ market centers and, thus help to improve farm per formance. The Governmer of the Sudan (GOS) has r engaged in a consistent pattern of gross violati of human rights.
2. FAA Sec. 481. Has it been determined that the government of recipient country has failed to take adequate steps to prevent narcotic drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully?	2. No.
3. FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the international Communist movement?	3. The Secretary of State has so determined.
4. FAA Sec. 620(c). If assistance is to a government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government?	4. Does not apply to the Government of Sudan.

5.	FAA Sec. 620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?	5. No.
6.	FAA Sec. 620(a), 620(f); FY 79 App. Act Sec. 108, 114 and 606. Is recipient country a Communist country? Will assistance be provided to the Socialist Republic of Vietnam, Cambodia, Laos, Cuba, Uganda, Mozambique, or Angola?	6. No.
7.	FAA Sec. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression?	7. No.
8.	FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property?	8. No.
9.	FAA Sec. 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason?	9. No.
10.	FAA Sec. 620(o); Fishermen's Protective Act of 1967, as amended, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters, a. has any deduction required by the Fishermen's Protective Act been made? b. has complete denial of assistance been considered by AID Administrator?	10. Not applicable to the GOS.

11.	FAA Sec. 620; FY 79 App. Act Sec. 603. (a) Is the government of the recipient country in default for more than six months on interest or principal of any AID loan to the country? (b) Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds?	11. No.
12.	FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the amount spent for the purchase of sophisticated weapons systems? (An affirmative answer may refer to the record of the annual "Taking into Consideration" memo: "Yes, as reported in annual report on implementation of Sec. 620(s)." This report is prepared at time of approval by the Administrator of the Operational Year Budget and can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)	12. Not applicable.
13.	FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?	13. The GOS severed diplomatic relations with tl U.S. in 1967, but they were resumed in 1972. The 1958 bilateral assis ance agreement was reconfirmed and remains in effect.
14.	FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget?	14. Current.

15. FAA Sec. 620A, FY 79 App. Act, Sec. 607 Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism? — 15. No.

16. FAA Sec. 666. Does the country object, on basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA? — 16. No.

17. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it detonated a nuclear device after August 3, 1977, although not a "nuclear-weapon State" under the nonproliferation treaty? — 17. No.

B. FUNDING CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria.

a. FAA Sec. 102(b)(4). Have criteria been established and taken into account to assess commitment progress of country in effectively involving the poor in development, on such indexes as: (1) increase in agricultural productivity through small-farm labor intensive agriculture, (2) reduced infant mortality, (3) control of population growth, (4) equality of income distribution, (5) reduction of unemployment, and (6) increased literacy. — a. Yes.

b. FAA Sec. 104(d)(1). If appropriate, is this development (including Sahel) activity designed to build motivation for smaller families through modification of economic and social conditions? — b. Not applicable.

2. Economic Support and Fund Country Criteria.

a. FAA Sec. 502B. Has the country engaged in a consistent pattern of gross violations of internationally recognized human rights?	a. No.
b. FAA Sec. 533(b). Will assistance under the Southern Africa program be provided to Mozambique, Angola, Tanzania, or Zambia? If so, has President determined (and reported to the Congress) that such assistance will further U.S. foreign policy interests?	b. Not applicable.
c. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?	c. Not applicable.
d. FY 79 App. Act Sec. 113. Will assistance be provided for the purpose of aiding directly the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights?	d. No.
e. FAA Sec. 620B. Will security supporting assistance be furnished to Argentina after September 30, 1978?	e. Not applicable.

II. 5C(2) PROJECT CHECKLIST

A. General Criteria for Project

1. FY 79 App. Act Unnumbered; FAA Sec. 653(b); Sec. 634A.

(a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organisation allocation reported to Congress (or not more than $1 million over that figure)?	(a) Advice of Program change for FY 1979. (b) No. Project is programed for early FY 1980, but may be authorized in late FY 1979 (OYB).
2. FAA Sec. 611 (a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	(a) Yes. (b) Yes.
3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	3. Not applicable.
4. FAA Sec. 611(b); FY 79 App. Act Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?	4. Not applicable.
5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	5. Yes.

6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	6. Project is designed in close collaboration with other donors, including the World Bank
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	7. By rehabilitating an important segment of the rural road network of Southern Sudan, the project will:(a) increas the flow of internationa trade; (b) foster privat initiative and competiti and (c) improve technica efficiency of industry, agriculture and commerce
8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	8. U.S. technical assistanc and equipment will be utilized by this project.
9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.	9. See Financial Plan. U.S. owned local currencies a not available.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	10. No.
11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	11. Yes.

12. FY 79 App. Act Sec. 608. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?

12. Not applicable.

B. Funding Criteria for Project

1. Development Assistance Project Criteria

a. FAA Sec. 102(b); 111; 113; 281a. Extent to which activity will (a) effectively involve the poor in develment, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

a. Project will increase access of rural poor to modern marketing, credit extension services. The roads will be maintained by a combination of capital and labor intensive techniques.

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.)

(1)	(103) for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; (103A) if for agricultural research, is full account taken of needs of small farmers;	(1) Project is specifically designed to improve agricultural production of rural poo by providing all-weather access from farms to markets. Poor road network is chief constraint to improving agricultural production and, thus small farmer income.
(2)	(104) for population planning under sec. 104(b) or health under sec. 104(c); if so, extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems and other modes of community research;	(2) Not applicable.
(3)	(105) for education, public administration, or human resources development; if so, extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;	(3) Not applicable.
(4)	(106) for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is: (i) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations; (ii) to help alleviate energy problems;	(4) Not applicable.

(iii) research into, and evaluation of, economic development processes and techniques;

(iv) reconstruction after natural or manmade disaster;

(v) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;

(vi) for programs of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.

(5) (107) is appropriate effort placed on use of appropriate technology?

(5) Not applicable.

(d) FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

(d) The recipient country will not provide 25% of th costs of the program. Thi requirement will be waived as Sudan is a "relatively least-developed" country.

(e) FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?

(e) Yes to both questions

(f) FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.

(f) The project will fost the growth of local decisi making through the distric councils and, thus, the representative processes. The project has been designed to focus on meeting the socioeconomic needs of the rural poor.

(g) FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	(g) As more fully describe in the PP, the project will directly contribute to economic development. The project aims at improving a road network, the effect of which will foster agricultural production by the rural poor. It is consiste with other GOS development plans and activities as wit nessed by the extensive mul donor effort in road rehabilitation in the souther region of Sudan.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, including reasonableness of repayment prospects.	a. Not applicable.
b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?	b. Not applicable.

3. Project Criteria Solely for Economic Support Fund

a. FAA Sec. 531(a). Will this assistance support promote economic or political stability? To the extent possible, does it reflect the policy directions of section 102?	a. Not applicable.
b. FAA Sec. 533. Will assistance under this chapter be used for military, or paramilitary activities?	b. Not applicable.

III. 5C(3) STANDARD ITEM CHECKLIST

A. Procurement

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of goods and services financed?	1. Standard AID procedures regarding small business participation will be followed as applicable.
2. FAA Sec. 604(a). Will all commodity procurement financed be from the U.S. except as otherwise determined by the President or under delegation from him?	2. Yes.
3. FAA Sec. 604(d). If the cooperating country discriminates against U.S. marine insurance companies, will agreement require that marine insurance be placed in the U.S. on commodities financed?	'es.
4. FAA Sec. 604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity?	4. Not applicable.
5. FAA Sec. 608(a). Will U.S. Government excess personal property be utilized wherever practicable in lieu of the procurement of new items?	5. Not applicable.
6. FAA Sec. 603(a). Compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S.-flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.	6. Yes.
7. FAA Sec. 621. If technical assistance is financed, will such assistance be furnished to the fullest extent practicable as goods and professional and	7. Services will be furnishe by private U.S. consultin firms.

other services from private enterprise on a contract basis? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?	
8. International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will provision be made that U.S.-flag carriers will be utilized to the extent such service is available?	8. Yes.
9. FY 79 App. Act Sec. 105. Does the contract for procurement contain a provision authorizing the termination of such contract for the convenience of the United States?	9. Yes.
B. Construction	
1. FAA Sec. 601(d). If a capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interest?	1. Yes.
2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?	2. Yes.
3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million?	3. Standard AID grant provisions will so provide.
C. Other Restrictions	
1. FAA Sec. 122(e). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?	1. Not applicable.

2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights?	2. Not applicable.
3. FAA Sec. 620(h). Do arrangements preclude promoting or assisting the foreign aid projects or activities of Communist-bloc countries, contrary to the best interests of the U.S.?	3. Standard AID grant provisions will so provide
4. FAA Sec. 636(i). Is financing not permitted to be used, without waiver, for purchase, long-term lease, or exchange of motor vehicle manufactured outside the U.S., or guaranty of such transaction?	4. Any AID-financed vehicle not purchased in the U.S. will be supported by an appropriate waiver approved by the Assistant Administrator for Africa.
5. Will arrangements preclude use of financing:	
a. FAA Sec. 104(f). To pay for performance of abortions or to motivate or coerce persons to practice abortions, to pay for performance of involuntary sterilization, or to coerce or provide financial incentive to any person to undergo sterilization?	a. Yes.
b. FAA Sec. 620(g). To compensate owners for expropriated nationalized property?	b. Yes.
c. FAA Sec. 660. To finance police training or other law enforcement assistance, except for narcotics programs?	c. Yes.
d. FAA Sec. 662. For CIA activities?	d. Yes.
e. FY 79 App. Act Sec. 104. To pay pensions, etc., for military personnel?	e. Yes.
f. FY 79 App. Act Sec. 106. To pay U.N. assessments?	f. Yes.

g. FY 79 App. Act Sec. 107. To carry out provisions of FAA sections 209(d) and 251(h)? (Transfer of FAA funds to multilateral organizations for lending.)	g. Yes.
h. FY 79 App. Act Sec. 112. To finance the export of nuclear equipment, fuel, or technology or to train foreign nations in nuclear fields?	h. Yes.
i. FY 79 App. Act Sec. 601. To be used for publicity on propaganda purposes within U.S. not authorized by Congress?	i. Yes.

ANNEX B

GOVERNMENT OF SUDAN REQUEST

ANNEX B

GOVERNMENT OF SUDAN REQUEST

جمهورية السودان الديمقراطية
The Democratic Republic of the Sudan
وزارة التخطيط القومي
Ministry of National Planning

UNDER SECRETARY'S OFFICE
P.O. BOX [illegible]
Cables: [illegible]
Telex: [illegible]

مكتب الوكيل
ص.ب ٢٠٩٢ ـــ الخرطوم
تلغرافيا : (اعمار)
تلكس : ٣٢٤

Ref. : MNP/101/2/1 ..... النمرة .....

Khartoum, 14.6.1979 ..... الخرطوم في .....

Mr. Gordon K. Pierson
Director
U.S. Agency for International Development
Khartoum, Sudan.

The purpose of this letter is to request the assistance of the U.S. Agency for International Development to reconstruct 440 kilometers of road between Mundri-Kurbek-Nau. As per discussions with you I understand that USAID will consider providing technical and financial assistance to rehabilitate the road, and consider the provision of training and maintenance resources as a component of the project.

We look forward to a timely finalization of your design procedures and early negotiation on the project.

Best Available Copy

Dr. Abdel Rahman Abdel Wahab
Under Secretary
Ministry of National Planning.

ANNEX C

AID/W CABLE ON PID

UNCLASSIFIED

Department of State

OUTGOING TELEGRAM

ORIGIN AID-33

INFO OCT-01 AF-10 /044 R

DRAFTED BY AFR/EA:JWOOTEN:CMW
APPROVED BY AA/AFR:GTBUTCHER
DAA/AFR:WHNORTH
AFR/EA:HJOHNSON
AFR/DR:HCOHEN (DRAFT)
AFR/DR:LHEYLMAN (DRAFT)
AFR/DR:DCOLE (DRAFT)
AFR/DR:MMCDANIEL (DRAFT)
GC/AFR:JPATTERSON (DRAFT)
AFR/DR:HJONES (DRAFT)
PPC/PDPR:ESIMMONS (DRAFT)
AFR/DR:BBOYD (DRAFT)
AFR/DR:GGORINALDI (DRAFT)
AFR/DR/ENGR:TTUMMARELLO (DRAFT)
AFR/DP:CWARD (DRAFT)
DESIRED DISTRIBUTION
1G ACTION AFR CHRON 2 3 8 INFO PPC GC GCAF GCFLD OA ENGR 33P
----------102331 280022Z /75

P 272131Z MAR 79
FM SECSTATE WASHDC
TO AMEMBASSY KHARTOUM PRIORITY
INFO AMEMBASSY NAIROBI PRIORITY

UNCLAS STATE 076419

AIDAC NAIROBI FOR REDSO

E.O. 12065 N/A

TAGS:

SUBJECT: SUDAN-SOUTHERN RURAL INFRASTRUCTURE PROJECT
PID (650-0031)

1. PID APPROVED.

2. AID/W PROJECT COMMITTEE, WITH PARTICIPATION USAID REPS HOLTAWAY AND CHAPMAN, REVIEWED SUBJECT PID ON 2/2/79 AND RECOMMENDED AA/AFR APPROVAL. USAID AUTHORIZED PROCEED WITH PP DEVELOPMENT. FUNDS TO INITIATE SUBJECT PROJECT NOT IN CURRENT OYB, HOWEVER, MISSION SHOULD DEVELOP PP FOR POSSIBLE LATE FY 79 OBLIGATION, SHOULD CURRENT OYB BE INCREASED. ALTERNATIVELY, PROJECT WILL RECEIVE INITIAL FUNDING IN EARLY (FIRST QUARTER) FY 80.

3. COMMITTEE CONCURS IN PRIORITY THAT SHOULD BE GIVEN TO TRANSPORTATION/ROADS DEVELOPMENT IN SOUTHERN SUDAN TO INCREASE ACCESS OF RURAL POOR IN THIS, THE POOREST REGION OF THE COUNTRY, TO CRITICAL COMMODITIES, BASIC SERVICES, AND REGIONAL MARKETS. PID SUGGESTS FOUR (4) PRIMARY CRITERIA FOR SELECTION OF THREE ROAD SEGMENTS FOR IMPROVEMENT: (A) AGRICULTURAL DEVELOPMENT POTENTIAL OF WAU-RUMBEK-SHAMBE-MARIDI REGION, (B) GREATEST POTENTIAL FOR INCREASED ACCESS TO POPULATION, (C) DESIGNATION OF AREAS AS "DEPRESSED" BY SOUTHERN REGION GOVERNMENT (SRG), AND (D) POTENTIAL BENEFICIAL IMPACT TO OTHER AID ACTIVITIES AND OTHER DONOR RURAL DEVELOPMENT PROJECTS. A MAJOR JOB OF PP TEAM IS TO CONDUCT NECESSARY ANALYSES TO VERIFY THESE ASSUMPTIONS OUTLINED IN PID. A MACRO-ECONOMIC ANALYSIS SHOULD BE CARRIED OUT FOR THE PROJECT AREA TO DETERMINE ITS POTENTIAL AGRICULTURAL AND COMMERCIAL PRODUCTIVITY BASED ON ON-GOING AND PLANNED INTERVENTIONS, AND INCIDENCE OF BENEFIT. ANALYSIS SHOULD INCLUDE ECONOMICAL LEVEL OF INVESTMENT TO UPGRADE THE ROADS TO ALL-WEATHER STATUS. AN ESTIMATION OF THE IMPACT OF SEASONAL VARIATIONS ON PROJECTED TRAFFIC WILL ALSO BE NECESSARY TO SUBSTANTIATE RECOMMENDATIONS. COMMITTEE SUGGESTS THAT USAID EXPLORE WITH SRG THE POSSIBILITY OF UPDATING EXISTING DATA (IF ANY) ON CURRENT AND PROJECTE TRAFFIC COUNTS ON RECOMMENDED ROAD SEGMENTS BEFORE REPE BEFORE PP TEAM ARRIVES. BELIEVE SUCH IS CRITICAL TO FACILITATING PP DEVELOPMENT IN RECOMMENDED 2 MONTH TIME FRAME. AID/W WILLING CONSIDER PROVIDING LIMITED TA IF REQUIRED.

4. IF USAID CONTEMPLATING MAJOR ASSISTANCE IN TRANSPOR TION/ROADS DEVELOPMENT IN SUDAN PROGRAM, BELIEVE IT APPROPRIATE TO DEVOTE ATTENTION AT EARLIEST POSSIBLE ST TO PROBLEMS OF ROAD MAINTENANCE - I.E. MAINTENANCE TECHNOLOGIES, RECURRENT COSTS, ORGANIZATIONAL ARRANGE-MENTS, MANPOWER IMPLICATIONS, ETC. - AS RECOMMENDED IN PID. COMMITTEE CONCLUDES HOWEVER, THAT THESE CRITICAL PROBLEMS ASSOCIATED WITH ROAD MAINTENANCE INDEED EXTEND BEYOND THE SCOPE OF SUBJECT PROJECT. AID/W THEREFORE RECOMMENDS THAT USAID EXPLORE ALTERNATIVE WAYS OF ADDRESSING BROADER CONCERNS IN CONCERT WITH OTHER DONOR INITIATIVES. COMMITTEE INFORMED THAT IBRD CURRENTLY DEVELOPING A ROADS MAINTENANCE PROJECT WITH SRG TO ADDRESS THESE AND OTHER ISSUES WHICH WE BELIEVE WILL IMPACT DIRECTLY UPON SUBJECT PROJECT. PP TEAM SHOULD, THEREFORE, EXPLORE POSSIBLE AREAS OF COORDINATION WITH BANK (AND OTHER DONORS) AS APPROPRIATE. COMMITTEE'S RECOMMENDATION NOT NECESSARILY LIMITED TO COORDINATION WITHIN CONFINES OF SUBJECT PROJECT. USAID MAY RECOMMEND ALTERNATIVE FOR ADDRESSING THIS CONCERN.

5. PP ANALYSES SHOULD ADDRESS ISSUE OF ROAD CONSTRUCTIO (OR IMPROVEMENT) TECHNOLOGY - I.E. LABOR-CAPITAL INTENS TAKING INTO CONSIDERATION DUAL CONSTRAINTS IN SOUTH ON AVAILABILITY OF SKILLED LABOR (INCLUDING SEASONAL VARIATIONS IN LABOR AVAILABILITY) AND SCARCITY OF FOREIGN EXCHANGE FOR EQUIPMENT MAINTENANCE. TEAM SHOULD SPECIFICALLY ASSESS APPROPRIATENESS OF AID SUPPORT FOR MCA STANDARDS. COMMITTEE PARTICULARLY CONCERNED THIS POINT IN VIEW (A) POSSIBLE UNDER-STATEMENT OF EQUIPMENT NEEDS FOR RELATIVELY CAPITAL-INTENSIVE IMPROVEMENT TECHNIQUES RECOMMENDED IN PID AND (B) STRAIGHT LINE METHOD OF CALCULATING INFLATION. BELIEVE IT PARTICULARLY NECESSARY COMPOUND INFLATION RATES TO OBTAIN MOST REALISTIC UNDERSTANDING OF MAGNITU OF COSTS. VANCE

ANNEX D

DIRECTOR'S CERTIFICATION PURSUANT TO FAA 611(e)

ANNEX D

DIRECTOR'S CERTIFICATION PURSUANT TO FAA 611(e)

611(e) Certification

Southern Sudan Rural Infrastructure

The project will provide $34,000,000 in physical and human resource assistance to rehabilitate 440 kilometers of road, establish and equip a road maintenance center and improve the host government's road maintenance capabilities through on-the-job training. The principal objectives of this project are to provide isolated rural areas with improved accessibility to public and private factors of production and social services and to establish firmly an institutional capability within the Southern Regional Ministry of Public Works, Transportation and Communications to maintain the roads to minimum-commercial-access standards within the project zone.

Therefore, I, James S. Holtaway, the acting principal officer of the Agency for International Development in the Democratic Republic of the Sudan, do hereby certify that in my judgment the Democratic Republic of the Sudan should have the economic and human resource potential to maintain and utilize effectively the capital assistance provided under this development project entitled SOUTHERN SUDAN RURAL INFRASTRUCTURE.

James S. Holtaway

James S. Holtaway
Acting A.I.D. Director

ANNEX E

LOGICAL FRAMEWORK OF PROJECT

ANNEX E

LOGICAL FRAMEWORK OF PROJECT

Project Title: No: Southern Rural Infrastructure 650-0031

LIFE OF PROJECT
From FY 1980 to FY 1985
Total U.S. Funding $34 million
Date Prepared: June 15, 1979

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Section Goal: The Broader Objective Which This Project Contributes	Measures of Goal Achievement		Assumptions for Achieving Goal Targets
To assist the rural poor to attain increased levels of rural income and improved general welfare.	1. Increase in net income of smallholders in the project area. 2. Increase in numbers of people from outlying villages visiting project area hospitals. 3. Wider selection of goods being sold in the market. 4. Increase in distribution of higher-yielding seeds. 5. Increase in percentage of livestock vaccinated.	1. Project evaluation 2. Hospital records 3. Project evaluations 4. Project Development Unit, Rumbek 5. MOA records	1. Increased use of factors of production (inputs), technology (extension services), and markets will raise agricultural output and real farm income of rural poor. 2. Increased use of social services will increase general welfare of rural poor.
Project Purpose	Conditions That Will Indicate Purpose Has Been Achieved: End of Project Status		Assumptions for Achieving Purpose
To provide isolated rural areas with improved accessibility to public and private factors of production and social services and to establish firmly an institutional capability within the SRMPWTC to maintain the roads to MCA standards in the project zone, i.e., Lakes Province.	1. Increase in commercial and passenger traffic on project road (average annual increase: 13.5%). 2. Increase in quality of maintenance work done on the road. 3. Establishment of an operational maintenance workshop in Rumbek.	1. Vehicle traffic counts 2. Inspection of road; MOA reports 3. Inspection of Workshop; MOA reports	1. Improved road network will increase access to factors of production and social services. 2. Increased access provided by all-weather network will stimulate economic/administrative impetus for agricultural production factors and utilization of social services, inputs, technology, and markets.
Outputs	Magnitude of Output		Assumptions for Achieving Outputs
1. Mundri-Rumbek-Wau road rehabilitated to MCA standards. 2. Maintenance center constructed and equipped. 3. SRMPWTC personnel trained to maintain roads after project completion. 4. Pre-feasibility study - Nile River port access. 5. Technical assistance housing units constructed.	1. 440 km of roads upgraded to MCA standards and accepted by government by 1985. 2. 1,750 m^2 maintenance facility constructed and operating. 3. 153 SRMPWTC personnel trained to operate maintenance facility and to maintain roads. 4. Nile River port access road study completed. 5. Fully equipped three-unit housing compound.	1. Consultant - USAID reports - site visits 2. Consultant - USAID reports - site visits 3. SRMPWTC reports - USAID Evaluations 4. Consultant report 5. Consultant report - site visit	1. Authorization by 9/30/79. 2. Project agreement signed by 9/30/79. 3. Consultant contract signed by July 1980 4. Construction begins by August 1981.
Inputs	Implementation Target (Type and Quantity)		Assumptions for Providing Inputs
First Year / All Year AID: $262,000 / $34,018,000 HOST	A detailed listing of inputs is presented in Section IV-D-2.	1. USAID - Consultant reports 2. Project evaluations	1. Timely consultant selection and award of construction contract. 2. Personnel and inputs available when needed.

ANNEX F

LIST OF CONTACTS MADE BY DESIGN TEAM

ANNEX F

LIST OF CONTACTS MADE BY DESIGN TEAM

KHARTOUM

1. Adam Ibraham El Imam; Assistant Under Secretary for Transport and Telecommunication, Ministry of Planning, GOS

2. Hans Kahle; Ambassador, Federal Republic of Germany

3. Hans Henatsch; Counsellor, Embassy of the Federal Republic of Germany

4. Michael Goff; Engineering Advisor, European Economic Community Khartoum

5. Henning Karcher Arr; Assistant Residential Rep. Transportation UNDP Khartoum

6. Hans Bemmelen; Embassy of the Netherlands

JUBA

1. Joseph James Tomgura; Minister, Ministry of Public Works, Transportation and Communications

2. Serafino Wani Saka; Director, Ministry of Public Works, Transportation and Communications

3. Michael Bulli; Controller of Accounts, Ministry of Public Works, Transportation and Communications

4. Joseph Sebastian; Chief Engineer, Planning & Coordination, Ministry of Public Works, Transportation and Communications

5. Issac Bior Deng; Director, Office of Planning, Ministry of Finance/Planning

6. Andrew Lado; Deputy Director, Office of Planning, Ministry of Finance/Planning

7. Deng Dongrin; High Executive Council, Office of the President

8. Isaiah Kalang; Advisor to the President for Natural Resources

9. Bona Bak Nyang; Director of Fisheries and Animal Resources

10. Bennet Kuyu Balli; Deputy Director of Agriculture

JUBA

11. Albert Dimo; Chief Agricultural Statistician

12. Alex Duncan; Projects Development Unit, Ministry of Agriculture

13. Wesley M. Chicago; Projects Development Unit, Ministry of Agriculture

14. Reverend Azyel Kutyol; Director of the Sudan Council of Churches

15. Robert Koepp; Director World Food Program, Juba

16. Charley Chappel; UNDP Advisor (Engineer), Maintenance of Essential Roads Department

17. Rune Lundqulst; Engineer, UNDP/CIDA Road Project

18. Helmet Schied; Master Mechanic, UNDP/CIDA Road Project

19. Werner Brach; President, Big Five Safaris

20. Claude Aubersant; Interfreight Representative

21. Heinz Malzer; Manager, Steyr Workshop

RUMBEK

1. Abdul Galel Doka; Projects Development Unit, Ministry of Agriculture, Rumbek

2. Steve Ruben; Chief Storekeeper, Ministry of Public Works, Transportation and Communications

WAU

1. Benjamin Bubu; Assistant Commissioner for Agriculture

2. Ernst Baier; Director National Leprosy Training Center, Wau

3. Peter Brewer; German Volunteer Service, May Volunteer Training Institute, Wau

4. Richard Hanna; Program Assistant, World Food Program, Wau

YIROL

1. Mark Johnson; Sudan Council of Churches

WASHINGTON, D.C.

1. S.O. Sigfusson; Highway Engineer, World Bank

ANNEX G

TECHNICAL ANALYSIS

ANNEX G

TECHNICAL ANALYSIS

I. ROAD REHABILITATION PROJECT

A. Background

The existing Mundri-Rumbek-Wau and Rumbek-Yirol-Shambe roads (Figure G-1) are single-lane earth roads that were built during British colonial rule and have reportedly been maintained by hand by the tribes living in the vicinity of the roads.

The British used taxation as a penalty for not maintaining the roads, and they made the tribal chief responsible for seeing that the road was properly maintained. The northern forces, which controlled the supply routes in the south for much of the seventeen-year-long civil war used more forceful means to ensure that those living next to the road maintained it during this period.

In the seven years since the war, road maintenance has been the responsibility of the government. The system consists primarily of ten- to twelve-man road camps located approximately 10 kilometers apart along the road. Each camp is responsible for maintaining its 10 kilometer section by hand. Unfortunately, this system has been ineffective and the road has deteriorated since the end of the Civil War.

Several reasons have been cited for the failure of the system. Two of them seem noteworthy. First, the civil service laws make it difficult if not impossible to use disciplinary action if the road is not properly maintained. Second, the government is often months behind in meeting the laborers' payroll; therefore, instea of maintaining the roads, the laborers use their productive time engaged in subsistence farming in order to feed their families.

The following section documents the failure of the system and pro poses a course of action to rehabilitate the existing road and to maintain it for a reasonable period after rehabilitation.

B. Field Reconnaissance

During the month of May 1979, the project team undertook an aeria and ground reconnaissance of the Mundri-Rumbek-Wau and Rumbek-Shambe roads to determine the nature of the problem and to recommend a program for effectively improving these roads. The aerial reconnaissance was made on May 1 under conditions of unlimited visibility. The flight path (Figure G-2) was Wau-Rumbek-Yirol-Shambe-Bor-Mvolo-Mundri. The route was flown at 1,000 feet (300 meters) above the terrain except for in the Shambe area, which was flown at 500 feet (150 meters).

The ground reconnaissance (Figure G-3) was made between May 4 and May 14. The team was fortunate to be able to drive over all segments of the roads, and all climatic conditions were experienced during the survey; some sections were completely dry, some had been subjected to rain within the previous twenty-four hours, some were driven during spot downpours, and others were driven

FIGURE G-1

PROJECT LIMITS

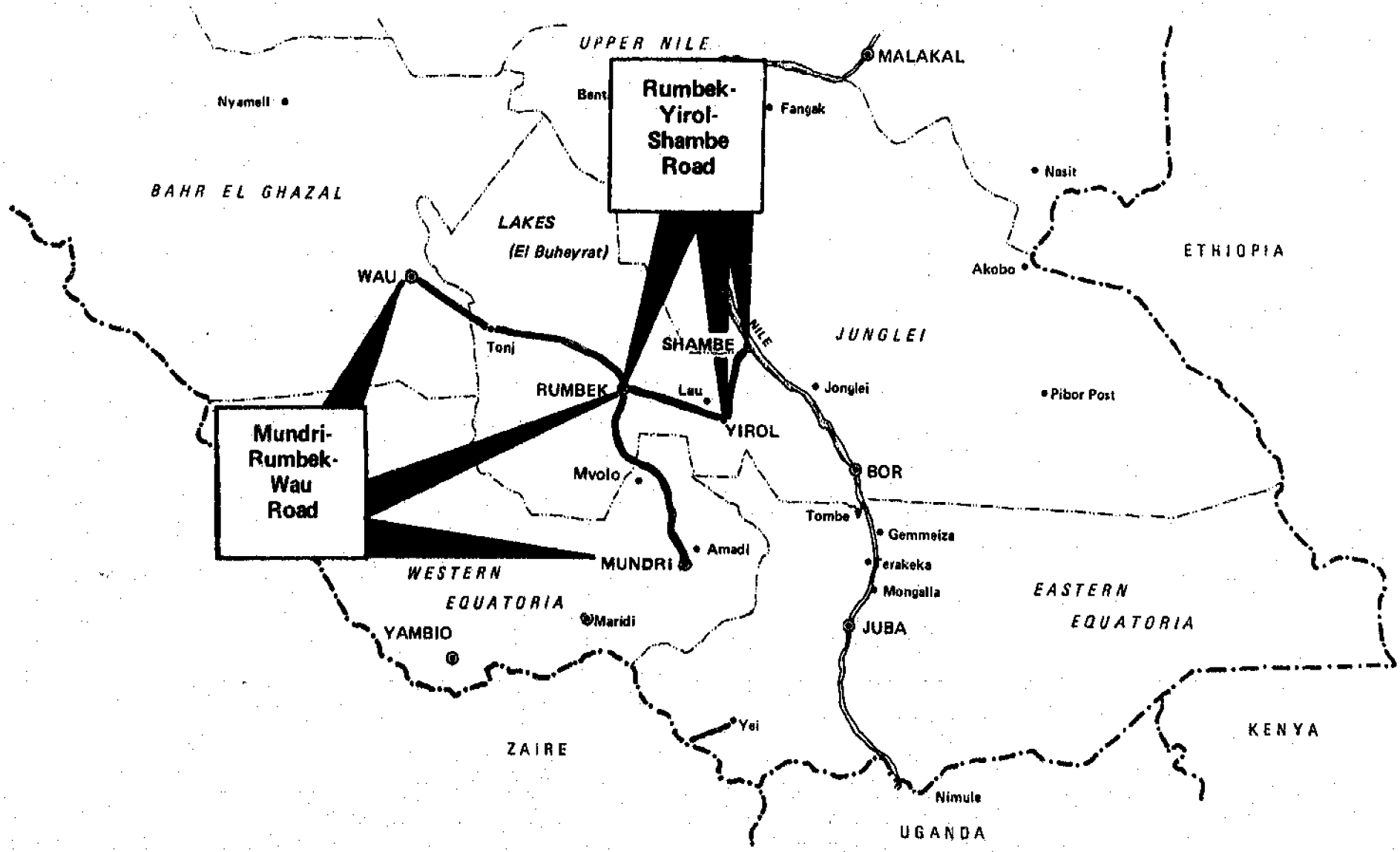


FIGURE G-2

AERIAL RECONNAISSANCE FLIGHT PATH

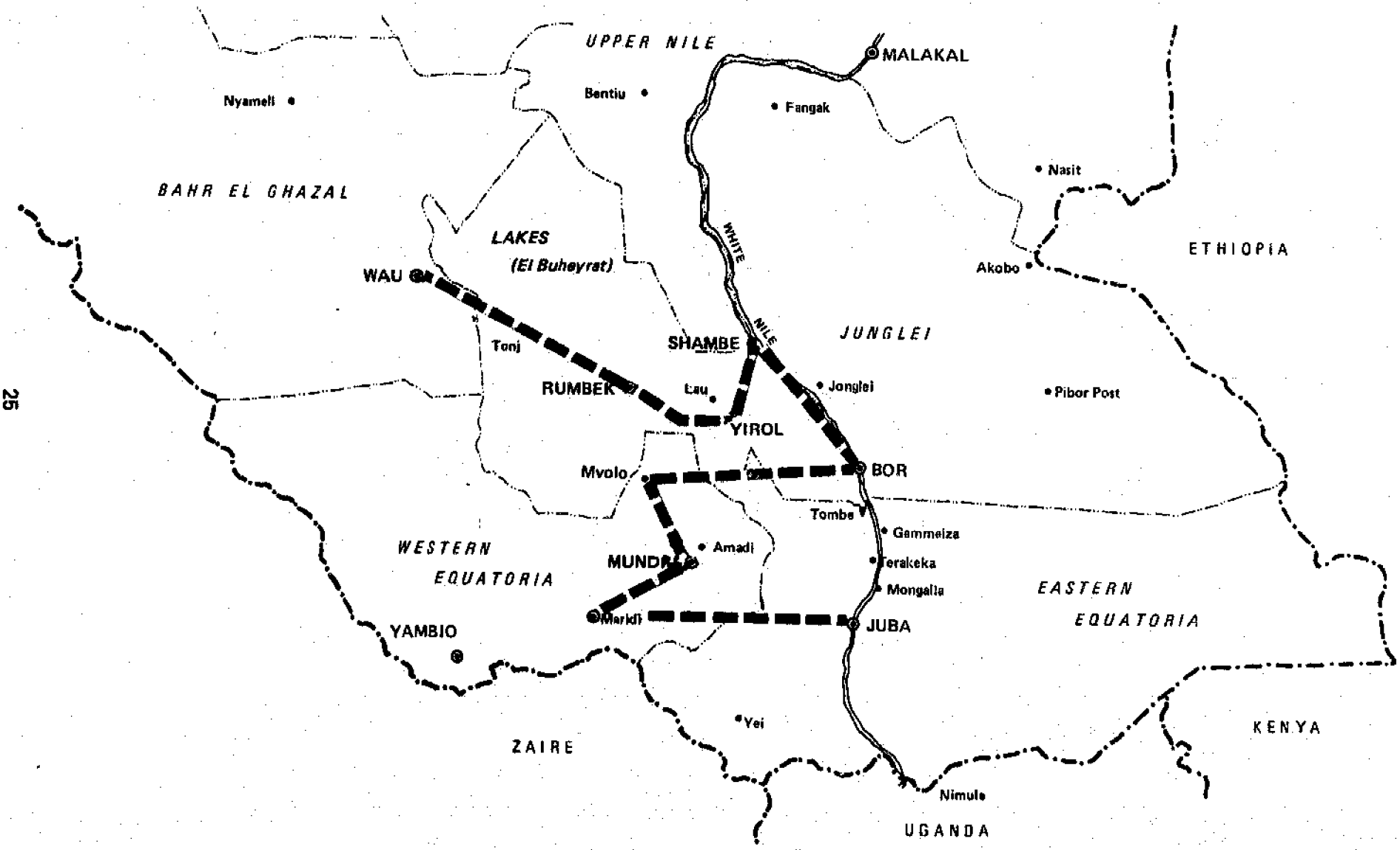
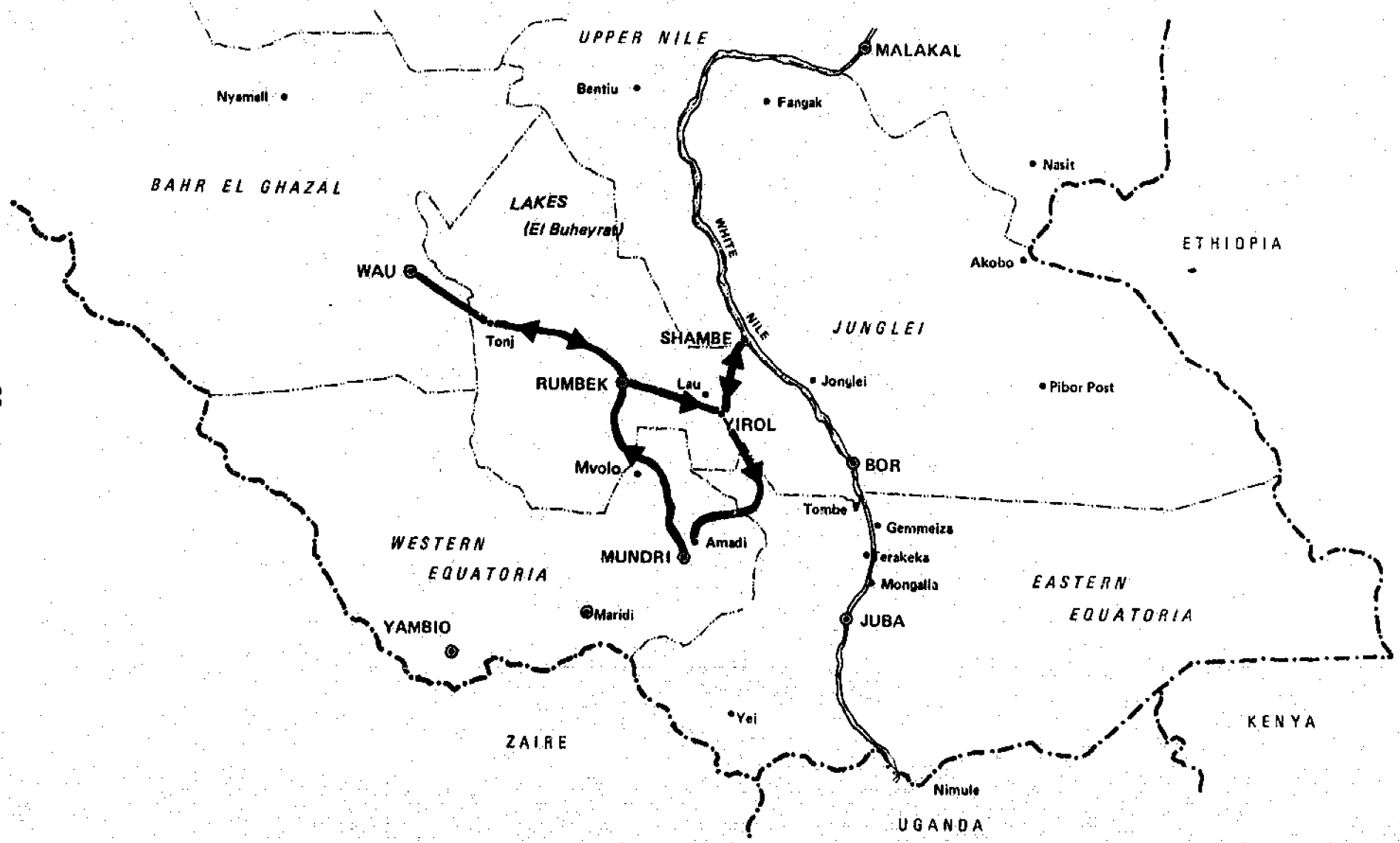


FIGURE G-3

GROUND RECONNAISSANCE COURSE



1. Aerial

The aerial reconnaissance was conducted under ideal conditions of unlimited visibility and little turbulance. The three general engineering features observed were the horizontal alignment, the nature of the terrain, and the color of the soils on the existing road and the surrounding area. In addition, the team observed the ferry crossing at the Payi River (Rumbek-Yirol road), the access road to the Port of Shambe on the White Nile River, and the road being built through Mundri with the assistance of another donor.

The team also undertook a search for an alternative port on the White Nile between Shambe and Bor. Such a port could be served more effectively by the proposed Jonglei Canal, which is currently under construction. The port must also be accessible by road from Lakes Province to meet the goals of the project.

The horizontal alignment appears to be satisfactory for speeds in excess of 100 kilometers per hour with few exceptions. It is estimated that realignment, when necessary, would involve less than 300 meters of existing road at each site.

The terrain appears from the air to be generally flat. No mountainous areas exist along the entire alignment.

The soil colors range from dark reds (assumed to be lateritic) to light browns, dark browns, and black (assumed to be black cotton soils). The following is a summary of the soil colors observed.

- Wau-Tonj: The roadway is dark red. The surrounding areas are reddish except for areas near water courses, which appeared to be light brown and gray in color.

- Tonj-Rumbek: The roadway is a lighter red and light brown or yellow in this reach of the road. Very little red surface is visible in the area surrounding the road.

- Rumbek-Yirol: This section includes two wide river plains The roadway surface is notably light brown and yellow except for some reddish patches between the two plains. The Payi River ferry crossing is located in this reach. Sand banks were observed about 200 meters or more upstream from the crossing. Also, a small dam is located about 50 meter downstream from the crossing, reportedly to ensure sufficient wtaer depth for the ferry to operate all year.

- Yirol-Manyang: The roadway and surrounding area is mostly dark to light red in this reach.

- Mayang-Shambe: The surrounding area is dark brown and dark gray to black in appearance. The roadway surface changes from light red to light brown to gray before it disappears near Shambe. The road begins this reach as a track and narrows to a trail a few kilometers before Shamb

- Mvolo-Mundri: The roadway is red, and the surrounding area appears to be brown and gray.

The Shambe-Bor leg was flown to search for a possible new port site between Shambe and Bor, which is the proposed southern terminus of the Jonglei Canal project currently under construction. Shambe Lake, which is located on the west bank of the White Nile River, is a natural port that serves Lakes Province. It provides direct access to the main river channel, which is located nearer to the east bank for almost the entire distance between Shambe and Bor. Although it is reportedly not as severed as the Sudd further north, this reach of the White Nile has many dead-end channels that parallel the main channel (with its many channels, the river is about 1 kilometer wide).

Prospects for a new White Nile port to serve Lakes Province is not promising south of Shambe to an imaginary east-west line through Lake Yirol to the White Nile, since an access road to the port would have to traverse wetlands and feeder channels that appear even more difficult to traverse than those crossed by the current access road to Shambe. Between this imaginary line and Bor, however, there appear to be more favorable soils conditions for connecting a new White Nile River port by road with Lakes Province It would also appear feasible to dredge an access channel from the west bank across to the main river channel located nearer to the east bank in the vicinity of Bor, which is located on the east ban of the river.

The flight path covered part of the road being constructed with the assistance of the Federal Republic of West Germany between Maridi and Juba. Apart from the road itself, a striking feature of this project is the exposed borrow areas and drainage fly-off ditches. Both of these features were dark red in color, indicatin that the top soils hide a rich deposit of the lateritic soils that are important for road construction.

In summary, the aerial reconnaissance flight was useful in generat an overall impression of the road network and in alerting the team to conditions requiring special consideration during the ground re connaissance that followed.

2. Ground

a. Determination of Project Limits

The windshield inventory covered 100 percent of the proposed road project and clarified the elements of the proposed rehabilitation work. The results confirmed that both the Mundri-Rumbek-Wau and Rumbek-Yirol-Shambe roads have deteriorated because of traffic wear, weathering, and insufficient maintenance.

Both roads were found to have a very firm and stable embankment in wetlands areas and areas subject to flooding, where the embank-

ment was built up 1 meter to 4 meters. An exposed rock surface confirmed that the roads were well constructed and that the weak spots were continually reinforced with rock during the years of maintenance that followed.

The embankment, or rather the length of embankment, found on each road serves to illustrate the differences between the two road segments. For example, less than 5 percent of the Mundri-Rumbek-Wau road (440 kilometers) is located on embankment 1 meter or more above ground level, whereas over 45 percent of the Rumbek-Yirol-Shambe road (175 kilometers) is so elevated.[1]

The embankment area represents the most difficult aspect of the rehabilitation work for the following reasons:

- Laterite, ironstone, or concretionary gravels, which are key materials in the construction of the embankment and road surface, are not available in the wetlands areas. Therefore, they must be imported or hauled in from borrow areas a suitable distance from the wetlands.

- Fine materials and black cotton clays (expansive soils), which are poor foundation materials for an embankment, are found in some sections of the wetlands area. In some cases, it may be desirable to excavate a portion of these materials before constructing an embankment.

The cost of construction in such areas depends on the length of haul and the amount of excavation required. These two factors cannot be determined by a windshield survey; the minimum required is a proper soils and materials investigation, which would, preferably, be supported by topographic surveys, design, and quantities calculations. These functions can be carried out in advance of construction on the Mundri-Rumbek-Wau road since they represent a small portion of the work. The haul distance would probably not exceed 5 kilometers. Embankment conditions exist on 45 percent of the Rumbek-Yirol-Shambe road, however, and haul distances may exceed 40 kilometers. Therefore, engineering investigations are recommended before further consideration is given to rehabilitating this road segment.

Other economic and long-range planning factors discussed elsewhere in this paper also support the recommendation that the Rumbek-Yirol-Shambe road not be rehabilitated as part of this project. The following detailed discussion will therefore concern the findings of the windshield inventory of the Mundri-Rumbek-Wau road. The field notes for the Rumbek-Yirol-Shambe road are found in Exhibit A at the conclusion of Annex H.

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[1]All distances noted in this text were recorded from the vehicle odometer and then adjusted; they are thought to be accurate to within ± 5 percent of the actual distances.

b. Findings of Ground Reconnaissance

The windshield inventory itinerary and weather conditions are summarized in Table G-1.

Table G-1

Field Reconnaissance Trip, May 1979

Date	Leg	Distance	Weather Conditions	Driving Time (hours)
4	Mundri-Km 41	41 Km	Clear/dry	1.5
5	Km 41-Rumbek	183 Km	Clear/had rain within 24 hrs	6
7	Rumbek-Wau	214 Km	Clear/had rain within 24 hrs	7
10	Wau-Rumbek	214 Km	Clear/dry	5
11	Rumbek-Yirol	106 Km	Cloudy/spot down-pours	4
12	Yirol-Shambe	68 Km	Clear/dry	2.5
13	Yirol-Tali Post[1]	95 Km	8 hr storm	4

[1] At Tali Post, it was learned that the short route to Juba (5 hours) was impassable because of rain. The alternative all-weather route via Amadi, Yambio, and Lanya (11 hours) took 1.5 days from Tali Post.

Three major engineering features of the existing road were noted during the windshield inventory: the drainage system, the travel-way characteristics, and the road geometry. Details of the survey data for the Mundri-Rumbek-Wau road and 1:250,000 scale geographical maps are provided in Figure G-4.

c. Summary of Windshield Inventory

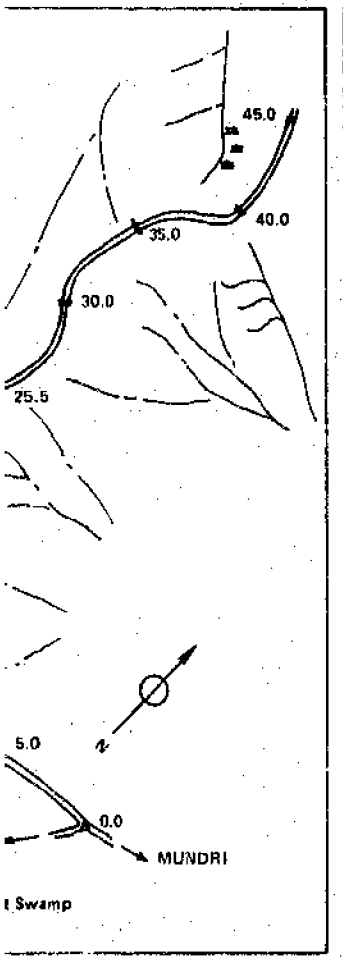
The existing Mundri-Rumbek-Wau road is a 3 to 4 meter-wide laterite road that was built and has been maintained by hand. Existing traffic volumes are estimated to be below fifteen vehicles per day. Traffic wear, weathering, and insufficient maintenance have all resulted in deterioration of the road and in many cases the entire road formation.

The existing cross drainage system includes about sixty culverts, ten minor bridges, and three major bridges--including one 400 meters long. Some of the culverts appear to be unsound. The minor

FIGURE G-4

WINDSHIELD SURVEY - MUNDRI-RUMBEK-WAU ROAD
May 1979

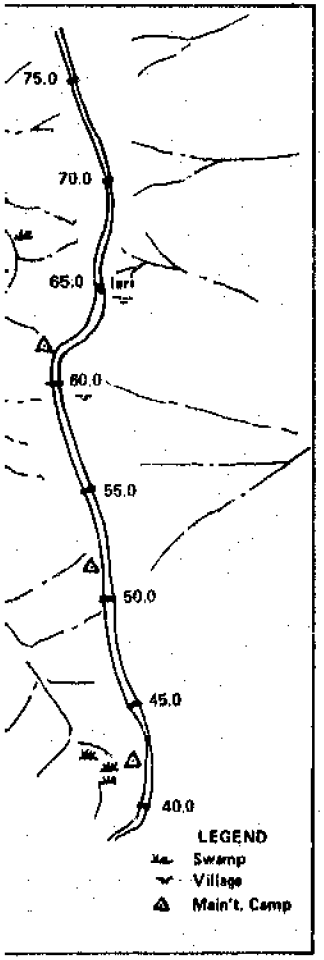
Km Zero - Km 45



KM	DRAINAGE: CROSS TYPE	DRAINAGE: CROSS APPROXIMATE SIZE	DRAINAGE: LATERAL	TRAVEL WAY: SURFACE CONDITION	TRAVEL WAY: MATERIAL	ROAD GEOMETRY: PROFILE GRADE LINE	ROAD GEOMETRY: WIDTH	REMARKS
44.6					laterite red			42.7 maintenance camp
35.0	investigate		clean and					
34.9	investigate		reshape	mostly corrugated		depressed 15 to 30cm		
33.2	pipe culv.	90cm	investigate		light red			
31.6	pipe culv.	45cm	more					
27.2	investigate		flyoffs					
25.3	investigate				laterite red	elevated 50cm	surface	
24.7	2 pipe culv.	45cm each					3-4m	
24.3	investigate		poor drainage, sandy foundation			short crests and sags		
21.4			lost	intermittently	sandy			observed ironstone stock
20.9	investigate		clean and reshape	unable to use travel way because of pot holes, tire ruts (15cm), heavy corrugation or other distortion due to poor drainage			between ditches 6-8m	piles on edge of road
20.4	investigate							
19.9	investigate							
19.2	pipe culv.	90cm						
18.7			laterals widen to 1 to 3m filled with sand		laterite red granular			
18.0	pipe culv.	45cm					cleared	
15.7	pipe culv.	90cm					area	
10.3	investigate		also eroded foundation materials		sandy	depressed 15 to 30cm	10-13cm	
8.6	investigate							
7.9								
7.4					red/browns			
5.8	investigate							
2.2	pipe culv.	45cm			granular			Some of original surface material remains. Recommend scarifying and/or blading to bottom of pot holes, gullies etc. and add new
2.1	investigate		clean					
1.9	investigate		reshape laterals	some corrugation, erosion				

FIGURE G-4 (continued)

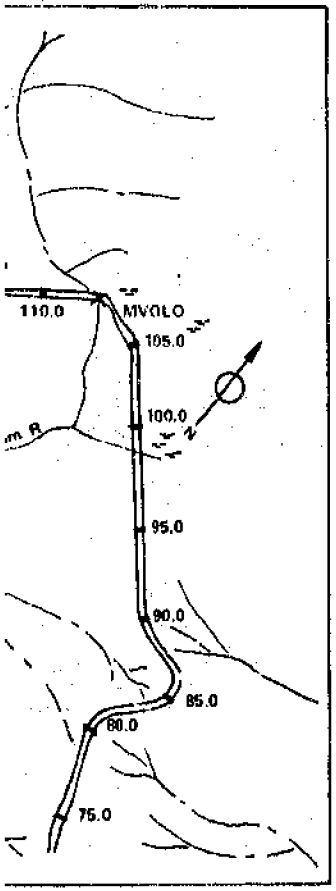
Km 45 - Km 75



KM	DRAINAGE: CROSS TYPE	DRAINAGE: CROSS APPROXIMATE SIZE	DRAINAGE: LATERAL	TRAVEL WAY: SURFACE CONDITION	TRAVEL WAY: MATERIAL	ROAD GEOMETRY: PROFILE GRADE LINE	ROAD GEOMETRY: WIDTH	REMARKS
66.2			routine cleaning and shaping	corrugation	red	depressed 15-30cm	10-13m	
65.0				no corrugation	light red		narrows	IRIE police post
61.2								maintenance camp
59.4	investigate			corrugation	red		clear 10-13m	
54.6			no signs of problems					
53.0				rock outcrops			clear 5-6m	
52.0				original surface			clear area 10-13m	borrow readily availabl
51.0				worn away				
49.2								some maintenance observe
48.1								
47.0	pipe culv.	45cm					surface	
46.8	investigate				laterite	rolling	3-4m	some rock excavation
46.5	pipe culv.	45cm			basalt	level	clear area 5-6m	
44.6				rock outcrops				

FIGURE G-4 (continued)

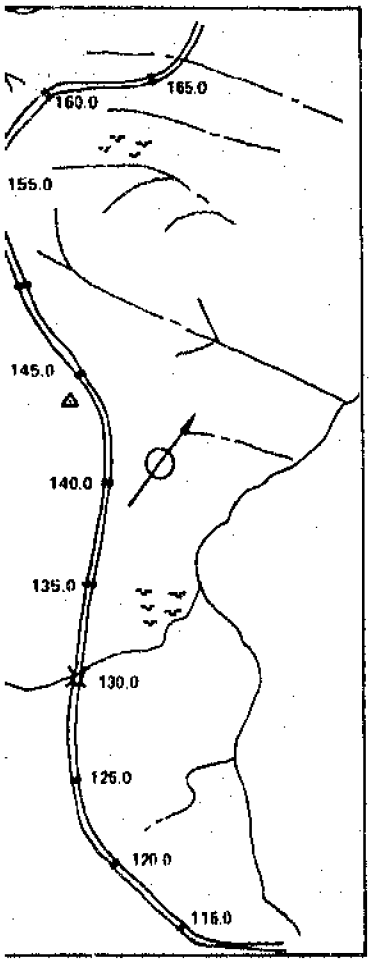
Km 75 - Km 115



KM	DRAINAGE: CROSS: TYPE	DRAINAGE: CROSS: APPROXIMATE SIZE	DRAINAGE: LATERAL	TRAVEL WAY: SURFACE CONDITION	TRAVEL WAY: MATERIAL	ROAD GEOMETRY: PROFILE GRADE LINE	ROAD GEOMETRY: WIDTH	REMARKS
115.2	investigate		clean and reshape					
114.6	bridge	4m mid-span 2m end-spans						
114.5	investigate							
109.5			significant	badly rutted	lt. brown yellow	embankment 10-50cm	clear	
108.3	bridge	4-6m spans					area	Naam River Bridge needs new rails
108.2							6-10m	Mvolo police post
107.5	pipe culv.	90cm						
107.0			some	fair	red			Jct. Mvolo Bypass
106.6								rock on either side of alignment
106.3	investigate							
105.9	investigate							
104.5	investigate							
103.8	investigate		investigate fly offs	intermittent cross drainage	laterite	rolling		stagnant water
103.0	pipe culv.	45cm		channels	red			
102.8	investigate							
99.3	investigate							
99.2								
97.3	investigate			light corrugation		short sags & crest		
97.2	investigate						Surface 3-4m	
94.7								
93.8				rock outcrops	rock		clear	
83.6	investigate						10-13m	
80.9			routine	corrugation	red	depressed 15-30cm		investigate curve widening

FIGURE G-4 (continued)

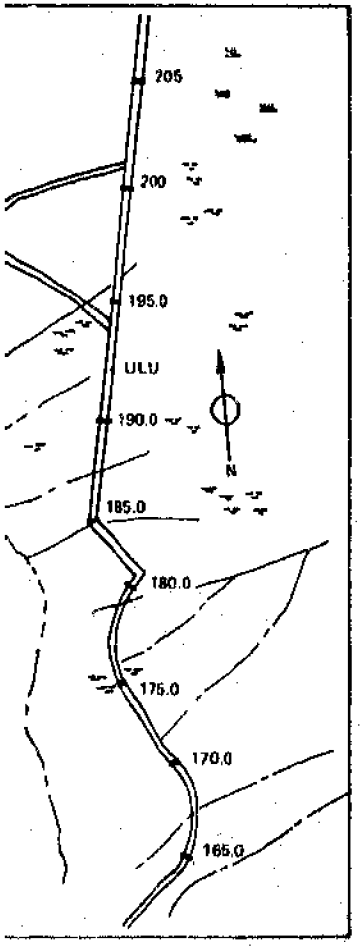
Km 115 - Km 165



KM	DRAINAGE: CROSS TYPE	DRAINAGE: CROSS APPROXIMATE SIZE	DRAINAGE: LATERAL	TRAVEL WAY: SURFACE CONDITION	TRAVEL WAY: MATERIAL	ROAD GEOMETRY: PROFILE GRADE LINE	ROAD GEOMETRY: WIDTH	REMARKS
157.1			investigate					
148.7	investigate		fly offs	intermittent ponding				
144.2						slightly		maintenance camp
143.7				pot holes	lt. brown	depressed	clear	Dug hole 10m east of
142.6	investigate			and ponding	and black		10-13m	alignment. Top 10cm
141.0				no formation				black/brown clay, bel
140.0			ponding	major pot holes	brown		clear area	red but clay-like in
139.1					black	at ground	10-13m	nature.
136.8	3 triple box	1.5 spans			sandy	level		
133.5			intermittent	only track in places no evidence of maintenance	rock		clear area 6-10m	
132.9	double box	1m spans						
131.5	2 bridges	3-4m spans 2-4m spans	wetlands			embankment 0.5-1.5m		needs new handrails
130.4	investigate			foundation completed	intermittent sand			
128.2	investigate			lost				
127.3	investigate		investigate			rolling		
125.0	investigate		fly offs					
124.5	investigate							
122.6								
122.5	6 box culv.	4-5m spans	marsh		red			marsh area
121.9	pipe culv.	45cm					surface	
121.1					sandy		3m	end cross drainage erosion
118.1	investigate			cross drainage erosion			between toe of slopes 6-10m	
117.5			clean and reshape	some corrugation				

FIGURE G-4 (continued)

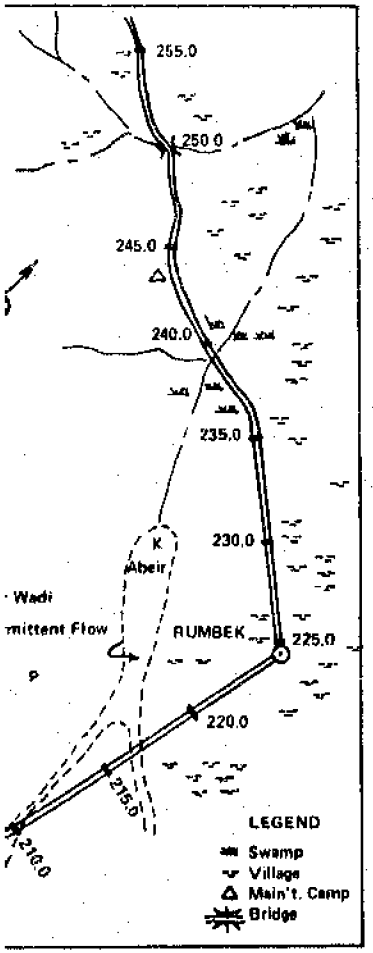
Km 165 - Km 205



KM	DRAINAGE: CROSS: TYPE	DRAINAGE: CROSS: APPROXIMATE SIZE	DRAINAGE: LATERAL	TRAVEL WAY: SURFACE CONDITION	TRAVEL WAY: MATERIAL	ROAD GEOMETRY: PROFILE GRADE LINE	ROAD GEOMETRY: WIDTH	REMARKS
200.6				light corrugation	red	elevated 0.1-1.5m		Jct. rejoin road
199.6				poor surface				
198.2			wetlands		import required	level	clear 6-10m	
197.9								
196.1				track only	rock	crest		
195.4	investigate		investigate					
194.5			fly offs					Jct. road divides the joins 81cm ahead
193.8				exposed ironstone foundation				
192.5								ULU police post
190.3	pipe culv.	90cm	marsh	good condition		elevated 0.1-1m		
185.6	investigate							
179.3			some ponding	corrugation	red			stone foundation alc travel way

FIGURE G-4 (continued)

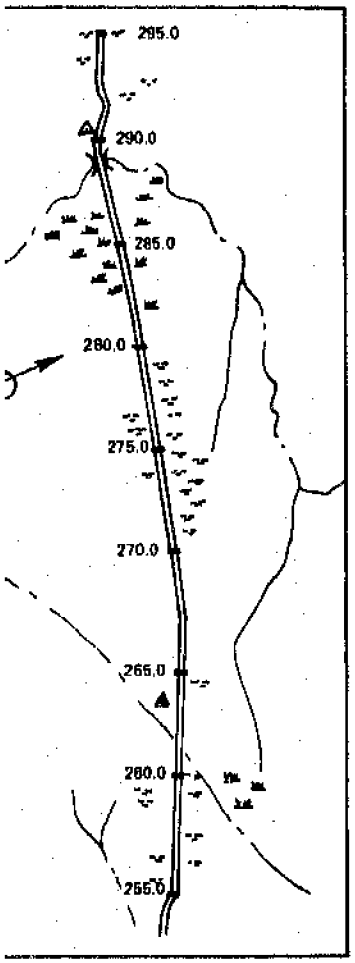
Km 205 - Km 255



KM	DRAINAGE: CROSS TYPE	DRAINAGE: CROSS APPROXIMATE SIZE	DRAINAGE: LATERAL	TRAVEL WAY: SURFACE CONDITION	TRAVEL WAY: MATERIAL	ROAD GEOMETRY: PROFILE GRADE LINE	ROAD GEOMETRY: WIDTH	REMARKS
250.5								observed red stone gravel available
250.4	3 pipe culv.	90cm each	wetlands			elevate		
249.8	bridge	3-5m spans				2.5-3m	toe 8-10m	
249.7	3 pipe culv.	90cm each						
247.4	investigate		investigate					
245.4			fly offs	ironstone base	lt. brown			
243.9					and			maintenance camp
241.6				foundation lost	yellow		surface	
238.8							3-4m	
238.3	4 pipe culv.	90cm each						
238.2	4 pipe culv.	90cm each		exposed ironstone		elevated	between ditch or toe	investigate rebuil + wing walls
238.1	4 pipe culv.	90cm each	wetlands	base	ironstone	0.1-1.5m	6-10m	
238.0	bridge	3m span						needs wing walls
237.9	bridge	3m span			lt. brown			needs wing walls
237.5				intermittent ponding ruts and exposed ironstone base	and yellow			
236.5								
235.7				ponding				
224.8								Purbek center
221.0	double box	1m span	clean and shape	lt. corrugation	red			
211.1				small pot holes	laterite			Army cantonment
209.2	double box	1m span						

FIGURE G-4 (continued)

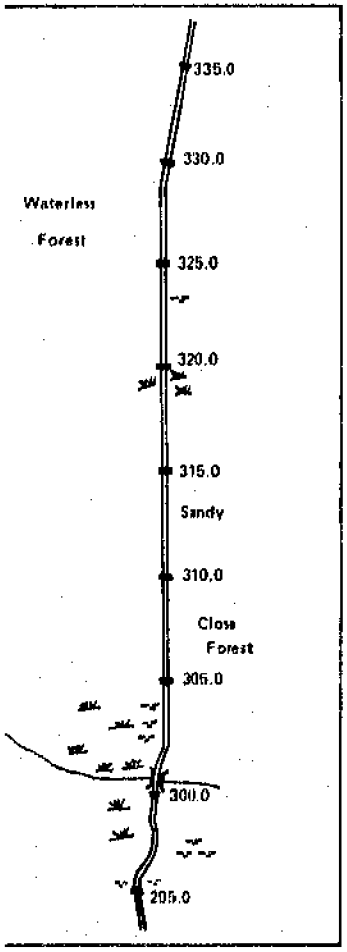
Km 255 - Km 295



KM	DRAINAGE: CROSS: TYPE	DRAINAGE: CROSS: APPROXIMATE SIZE	DRAINAGE: LATERAL	TRAVEL WAY: SURFACE CONDITION	TRAVEL WAY: MATERIAL	ROAD GEOMETRY: PROFILE GRADE LINE	ROAD GEOMETRY: WIDTH	REMARKS
291.0			intermittent wetlands	some pot holes	lt. red	level	clear 10-13	maintenance camp No.
289.9								
289.4	5 pipe culv.	90cm each						
289.1	4 pipe culv.	90cm each						
288.8	bridge	4-5m spans		thin cover	red		surface	River Gel
288.6	3 pipe culv.	90cm each		over ironstone	cover	elevated	3.5m	
287.8	8 pipe culv.	90cm each		base		1.5-4m	toe 8-20	tree-lined to stabil slopes
287.0	2 pipe culv.	90cm each						
286.0			wetlands					
277.1								Choibet police post
275.2								
265.7			investigate	some corrugation	lt. red	level	surface 3-4m between ditches	
265.1			fly offs	pot holes				maintenance camp
263.7								
256.0							6-10	observed red stone gravel available

FIGURE G-4 (continued)

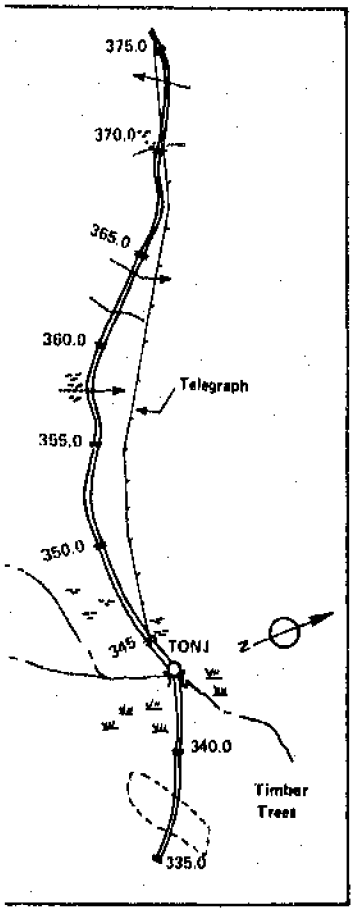
Km 295 - Km 335



KM	DRAINAGE: CROSS: TYPE	DRAINAGE: CROSS: APPROXIMATE SIZE	DRAINAGE: LATERAL	TRAVEL WAY: SURFACE CONDITION	TRAVEL WAY: MATERIAL	ROAD GEOMETRY: PROFILE GRADE LINE	ROAD GEOMETRY: WIDTH	REMARKS
327.8				irregular surface	lt. brown yellow	depressed		
327.4								maintenance camp
320.1			investigate	thin cover over ironstone base some corrugation and ponding			surface	maintenance camp
319.2			fly offs		red	elevated 0.1-1.0m	3-4m	
316.9								
314.1			clean and reshape	pot holes		depressed	between toe of ditch	
308.8				crown and foundation	sandy	0.1-0.5m		
306.9				lost			10-13m	
303.5								maintenance camp
302.3			intermittent	thin cover over	lt. red	embank-ment 0.1-1.0m		
300.8			wetlands	ironstone base				
300.8	bridge	2-5 m span		thin cover over				
299.9	pipe culv.	45cm		ironstone base		embank-ment		
299.7	4 pipe culv.	90cm each						
298.4				corrugated		level		maintenance camp

FIGURE G-4 (continued)

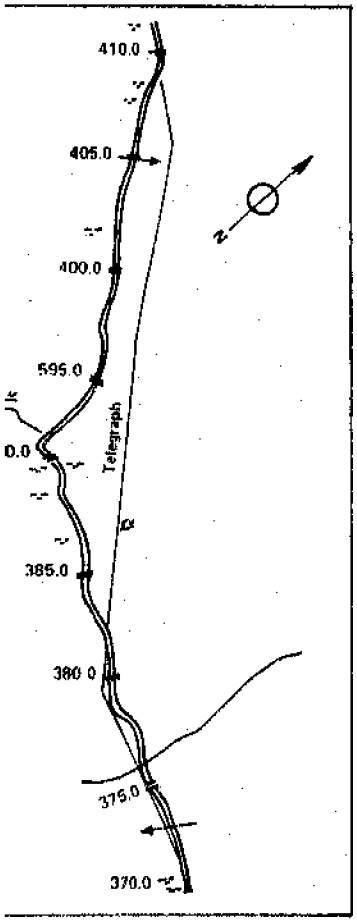
Km 335 - Km 375



KM	DRAINAGE: CROSS TYPE	DRAINAGE: CROSS APPROXIMATE SIZE	DRAINAGE: LATERAL	TRAVEL WAY: SURFACE CONDITION	TRAVEL WAY: MATERIAL	ROAD GEOMETRY: PROFILE GRADE LINE	ROAD GEOMETRY: WIDTH	REMARKS
373.2	investigate		clear and	corrugation		depressed	surface 3m-4m	
368.4			reshape	moderate to		0.1-0.5m		maintenance camp
364.1	investigate			thin blanket	ironstone	except at		
362.6	double box	1m span	investigate	of laterite	lying on	wetlands with		wetlands
358.7			fly offs	gravel over iron-	surface	culverts		maintenance camp
357.5	investigate			stone base in	next to	elevated		boundary Lakes and B El Ghazal provinces
349.4				wetlands	road	0.1-0.5m		maintenance camp
346.3					red		ditches 6-10m	Jct. with air landing strip
345.2			clean and reshape	well maintained	laterite surface	at grade	clear 10-13m	site of proposed Italian bag factory
344.5							except culvert locations	Tonj center
343.6							surface 3m	sharp curve begin To urban area
343.6								end of embankment
343.4	bridge	5-6m span						superstructure built British 1973
343.3	bridge	3-6m span						River Tonj
343.0								island for passing needs reconstructior
342.8								island for passing needs reconstructior
342.4	box culv.	1.5m span	wetlands					
342.2						elevated		Jct. of road to Ulu wl bypasses Rumbek
342.0	3 pipe culv.	90cm each				3-4m	surface	
341.7	bridge	3m span					2½-3m	steel plate investig cast RC slab deck
340.4	4 pipe culv.	90cm each		thin cover over			toe 7-11m	
339.7	4 pipe culv.	90cm each		ironstone	ironstone	elevated		maintenance camp
339.6	4 pipe culv.	90cm each				1½-2m		beginning of River I at Tonj
339.2			investigate fly offs	pot holes	lt. brown & yellow	depressed	clear 10-13	

FIGURE G-4 (continued)

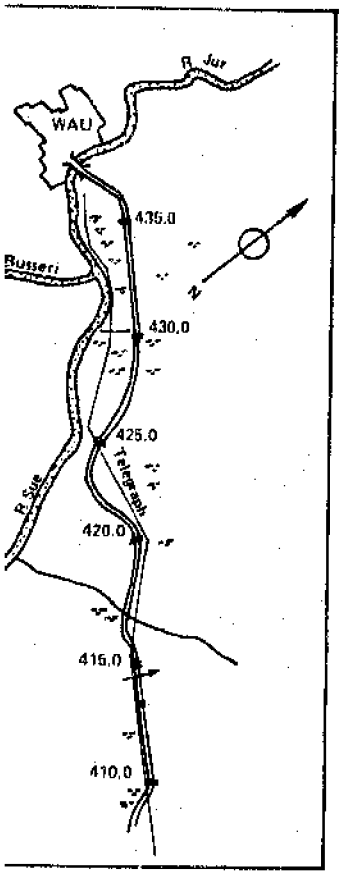
Km 375 - Km 410



KM	DRAINAGE: CROSS: TYPE	DRAINAGE: CROSS: APPROXIMATE SIZE	DRAINAGE: LATERAL	TRAVEL WAY: SURFACE CONDITION	TRAVEL WAY: MATERIAL	ROAD GEOMETRY: PROFILE GRADE LINE	ROAD GEOMETRY: WIDTH	REMARKS
410.2							surface 3-4 m	maintenance camp
409.1					laterite red	grade ½ km		
406.1							between ditches 6-10m	new UNICEF well with hand pump Kawajena town center
405.0	investigate					rolling		
400.3						depressed 0.1-0.5m except wetlands with culverts elevated 0.1m-0.5m	clear 10m-13m except culvert locations surface 3m	
397.7					ironstone frequently lying on surface next to road			maintenance camp
391.4	pipe culv.	90cm						wetlands
386.9	pipe culv.	90cm						wetlands
386.8								maintenance camp
382.7	pipe culv.	90cm						wetlands
381.0	investigate							
379.9			clear and reshape	significant corrugation				maintenance camp - t sharp horiz. curves
375.9	investigate							

FIGURE G-4 (continued)

Km 410 - Km 440



KM	DRAINAGE: CROSS TYPE	DRAINAGE: CROSS APPROXIMATE SIZE	DRAINAGE: LATERAL	TRAVEL WAY: SURFACE CONDITION	TRAVEL WAY: MATERIAL	ROAD GEOMETRY: PROFILE GRADE LINE	ROAD GEOMETRY: WIDTH	REMARKS
438.0	end bridge		↑	↑	↑	↑	↑	Wau
438.2	begin bridge		wetlands			Embankment 3-4m	surface 3m	new bridge built by Italians
437.6	box culv.	1m span			laterite red ironstone frequently lying on surface next to road			
437.1				significant corrugation moderate to thin blanket of laterite gravel over iron-stone base in wetlands				begin river plain at Wau
436.2							↑	maintenance camp
430.1	4 pipe culv.	90cm each	↑			rolling	surface 3-4m between ditches 6-10m clear 10-13m except culverts location surface 3m	wetlands
430.0	4 pipe culv.	90cm each						wetlands
427.1	4 pipe culv.	90cm each						maintenance camp
421.4	investigate					grade 0.1 km		wetlands
417.8			clear and reshape					maintenance camp
417.2	investigate					↑		wetlands
413.8	double box	1m each	investigate flyoffs			rolling		wetlands

bridges appear to be sound but need repair work on the wing walls parapets, handrails and so forth, and major bridges appear new an sound. About twenty additional sites where cross drainage culverts may be required were identified. A little over one-half of the road length appears to have adequate lateral drains. Fly-off should be investigated for the other half of the road to carry surface drainage away from the roadway.

Inadequate surface cover or corrugation of the little remaining cover is the major problem with three-quarters of the road. Pot holes, ruts, and erosion affected movement of traffic on the remaining quarter of the road.

Red lateritic soils were observed on the road surface for approximately three-quarters of the total length. Light brown and yellow soils, which do not have a good bearing capacity, covered the other quarter. This area of the Southern Region is reportedly abundant in laterite soils, ironstone, and concretionary gravels, which are suitable for roads. These soils are generally found between 0.10 and 3.00 meters below the surface of the earth in most areas except flood plains and other wetlands. It is estimat that suitable embankment and surface materials will be readily available adjacent to the road or within 5 kilometers of any road segment.

Two-thirds of the terrain can be classified as flat and one-third as gently rolling. The profile grade line is either depressed or is elevated no more than .5 meters, except for a total of 20 kilo meters through various wetlands areas where the grade rise exceeds 1 meter.

The roadway width varies between 3 and 4 meters, as noted above. The cleared area including roadway and drains varies between 10 and 13 meters. Table G-2 summarizes the specific data obtained during the inventory.

C. Recommended Project Approach

1. Alternatives

A number of project design alternatives that could fulfill the ob jectives of the project were considered. They were developed dur the field reconnaissance and later discussed with the government and other donor groups. They include the following basic approac

- labor-intensive techniques, which were originally employed to build and maintain the road

- capital intensive techniques, currently employed by three donor groups in the region, which include both rehabilitation by a private contractor and rehabili-

Table G-2

Windshield Inventory Summary, Mundri-Rumbek-Wau Road

Drainage System

Cross Drainage	Number	Size
Single Pipe Culverts	18	45 cm - 90 cm
Multiple Pipe Culverts	25	45 cm - 90 cm each
Single Box Culverts	2	1.0 m span
Multiple Box Culverts	11	1.0 - 4.0 m spans
Minor Bridges	10	3.0 - 15.0 m long
Major Bridges	3	30.0 - 400.0 m long
Investigate New Culverts	18	unknown

Lateral Drainage Recommendation	Length of road affected (kilometers)
Clean and Reshape	250
Investigate Flyoffs	220

Travelway Characteristics

Surface Condition, Major Problem	Length of road affected (kilometers)
Corrugation	240
Pot Holes	60
Thin Cover	100
Misc. ruts, washes, etc.	23
Rock Outcrop	7
Maintained Satisfactorily	10

Materials Description	Length of road affected (kilometers)
Red	320
Light brown/yellow	65
Sandy	40
Rocky	15

Road Geometry

Width	Length of road affected (kilometers)
Surface: 3-4 m; between ditches: 6-10 m; clear area: 10-13 m	270
Surface: 3-4 m; embankment between toes: 6-10 m	150
Surface: 3 m; embankment between toes: 8-20 m	20

Profile Grade Line	Length of road affected (kilometers)
Depressed	140
Rolling	130
Grade Rise Less than 1.0 m	150
Grade Rise More than 1.0 m	20

tation by force account with government personnel directed by foreign advisors (technical assistants)

- a mix of labor and light equipment, that is, agricultural tractors and/or livestock pulling implements or hand-loaded trailers, instead of heavy earth-moving equipment like bulldozers, loaders, and motor graders

2. Recommendation

It is the judgement of the team that the project is composed of four separate but inter-related components and would involve the following four entities: United States Agency for International Development (AID); Sudan Southern Regional Government Ministry of Communications, Transport and Public Works (GOVERNMENT); private construction contractor (CONTRACTOR); and private consulting engineering firm (CONSULTANT).

The financing of the project is discussed in another section of this report. Discussed below are the four basic components of the project and the relationship between the four entities involved

1. The CONTRACTOR under contract to the GOVERNMENT would rehabilitate the Mundri-Rumbek-Wau road under the supervision of the CONSULTANT, who would be under a technical assistance contract to USAID.

2. The CONTRACTOR would construct and equip a provincial maintenance workshop and technical assistant housing units in Rumbek under the supervision of the CONSULTANT. The CONSULTANT would also provide technical assistance to rehabilitate the Province's old maintenance equipment, order spare parts, purchase new maintenance equipment, and direct the maintenance of the Mundri-Rumbek-Wau road upon completion of the CONTRACTOR's responsibilities.

3. The CONSULTANT would provide technical assistance to undertake prefeasibility studies of an access road and a White Nile port to serve Lakes Province. This task will include the evaluation of the port at Shambe and the Rumbek-Yirol-Shambe road as well as alternative ports that could be served by the proposed Jonglei Canal. Optionally (not a part of this project), the CONSULTANT could design and the CONTRACTOR could rehabilitate or construct the access road to the port.

4. The CONTRACTOR would train GOVERNMENT personnel in key construction positions. The CONSULTANT would train GOVERNMENT counterparts in construction supervision, equipment maintenance and repair, and road maintenance.

The following section discusses a time schedule for the four components and provides a more detailed scope of work for the CONTRACTOR and the CONSULTANT.

a. Scope of Work for CONTRACTOR

The CONTRACTOR will be responsible for the following major tasks:

- mobilize workers and equipment on the site
- provide and maintain office space, soils testing laboratories and equipment, transportation, housing, and life support for the CONSULTANT's personnel in the field for the duration of the project
- set out the works in accordance with the CONSULTANT's instructions
- rehabilitate the road in accordance with the specifications
- construct and equip the Rumbek maintenance workshop and support facilities
- construct three prefabricated houses and water, sewerage, and power systems for the technical assistants (CONSULTANTS) assigned to the Rumbek Maintenance Center
- maintain the road for one year after it is certified to be complete

b. Scope of Work for CONSULTANT

Short-Term Technical Assistance

- prequalify interested contractors
- prepare engineering estimates for a bill of quantities, specifications, and other bidding documents for the road, Rumbek Maintenance Center, and technical assistance housing
- evaluate bids and assist the government in selecting a contractor

Long-Term Technical Assistance - Rehabilitation

- check the setting out of the work
- inspect the rehabilitation road work
- ensure that the CONTRACTOR is using government counterparts effectively

- inspect the construction of the Rumbek Maintenance Center

- certify the work and payments to the CONTRACTOR

- provide on-the-job training for government personnel on inspection of the rehabilitation and construction project

- undertake a prefeasibility study of the proposed future Rumbek-Yirol-Nile port road project

Long-Term Technical Assistance - Maintenance

- train government counterparts in all aspects of equipmen repair, road maintenance, and management

- identify the mechanical problems with existing governmen road maintenance equipment located in the province

- order parts necessary to rehabilitate the existing equip ment, spare parts necessary to keep the equipment operat ing, and intermediate technology equipment that will be required for road maintenance on completion of the CONTRACTOR's road rehabilitation and maintenance period

- organize and implement a pilot project to train oxen to to pull carts and other implements that may be useful in labor intensive/non-mechanized road maintenance techniqu

3. Rationale for Recommended Approach

a. Scope of Rehabilitation Work

Of the existing Mundri-Rumbek-Wau road, 80 percent could be rehabilitated by reshaping and regraveling. This approach would not eliminate the causes of the current failure, however, nor would it properly provide for projected traffic growth during th next ten to twenty years.

Poor drainage and erosion of surface materials are the major rea sons for the road's deterioration. The drainage problems can be eased by raising the grade about 35 centimeters above the level of the surrounding ground. The erosion problem can be eased by proper maintenance after the rehabilitation work is completed.

With regard to traffic, the existing three to four meterway was adequate when traffic amounted to three or four vehicles per wee or even per day. However, a wider road is desirable to accommod the traffic projected over the ten to twenty years following rehabilitation. In this regard, the government's MCA standard of 4.5 meters wide travelway and 1.0 meter shoulder is acceptable b international standards for the traffic volumes projected over the project period.

The project has been termed a rehabilitation project since selective grade rises and roadway widening are recommended. These tasks will require more effort than is required for initial or even major periodic maintenance activities. It is further recommended that the rehabilitation be done with capital-intensive construction techniques in order to complete the work in the shortest possible time.

b. Private Contractor versus Force Account

It is our judgment that the size of this 440 kilometer road rehabilitation, maintenance facilities construction, and housing installation project would draw the interest of a qualified private contractor. The experience of other donors in southern Sudan has shown that force account construction with government employees supervised by technical assistants (CONSULTANTS) is not the most effective way to rehabilitate roads, nor does it succeed in its objective to effectively train government personnel in road construction.

It is our judgment that government personnel should be trained to inspect the construction work and maintain it on completion. The present project includes training in both of these areas. In addition, it is recommended that the rehabilitation contract provide for the training of certain classifications of government employees who may later be used in maintenance or in the inspection of future works.

D. Engineering Design Recommendations

1. Geometric Design Standards

The road geometric design standards shown in Table G-3 are recommended for this project based on the MCA standard; field observation of the existing geometrics, raffic mix, driving habits, and terrain; and international design standards for similar roads.

Table G-3

Proposed Geometric Design Standards

Design Speed	60 km/hr
Maximum Grade	4%
Width of Travelway	4.5 m
Width of Shoulders	1.0 m
Minimum Horizontal Curve Radius	115 m
Stopping Sight Distance	70 m
Passing Sight Distance	380 m
Width of Structures	3.5 → 4 m
Design, Live Loading (ASSHO or equiv.)	H 15-44

2. Pavement Design

Lateritic gravel surfaces lose materials with time because of traffic wear and weathering; therefore, the surface must be replenished periodically. A thorough discussion of these losses, including estimates of the quantities lost each year, is provided in section IV of this annex.

Because of these losses, it is assumed that the top 20 centimeters of the roadway and shoulders will be constructed of select, sandy-gravely, slightly plastic lateritic soils from borrow pits and that they will be replenished periodically after the top 10 centimeters have been worn or weathered away. The quality of this select material and the method of placement will be specified before construction begins. It is recommended that the select surface materials have a CBR (unsoaked) of not less than 50 percent compacted to 98 percent modified Proctor at ± 10 percent of optimum moisture content. It is further recommended that the embankment material have a CBR (soaked) of not less than 15 percent compacted to 95 percent modified Proctor at ± 10 percent of optimum moisture content.

3. Structure Design

Standard designs for pipe, single, and multiple box culverts should be developed prior to the commencement of the rehabilitation work.

4. Typical Sections

The proposed typical sections in existing depressed sections and elevated sections are shown in Figures G-5, G-6, and G-7. In addition, a typical section of a pipe culvert extension is provided. These typical sections show a composite of the types of road deterioration that has occurred. They are also used in the quantities estimates in Section V of this annex.

FIGURE G-5

PROPOSED TYPICAL SECTION WITH 50cm GRADE RISE
SUPERIMPOSED OVER DEPRESSED SECTION
SHOWING A VARIETY OF ROAD FAILURES

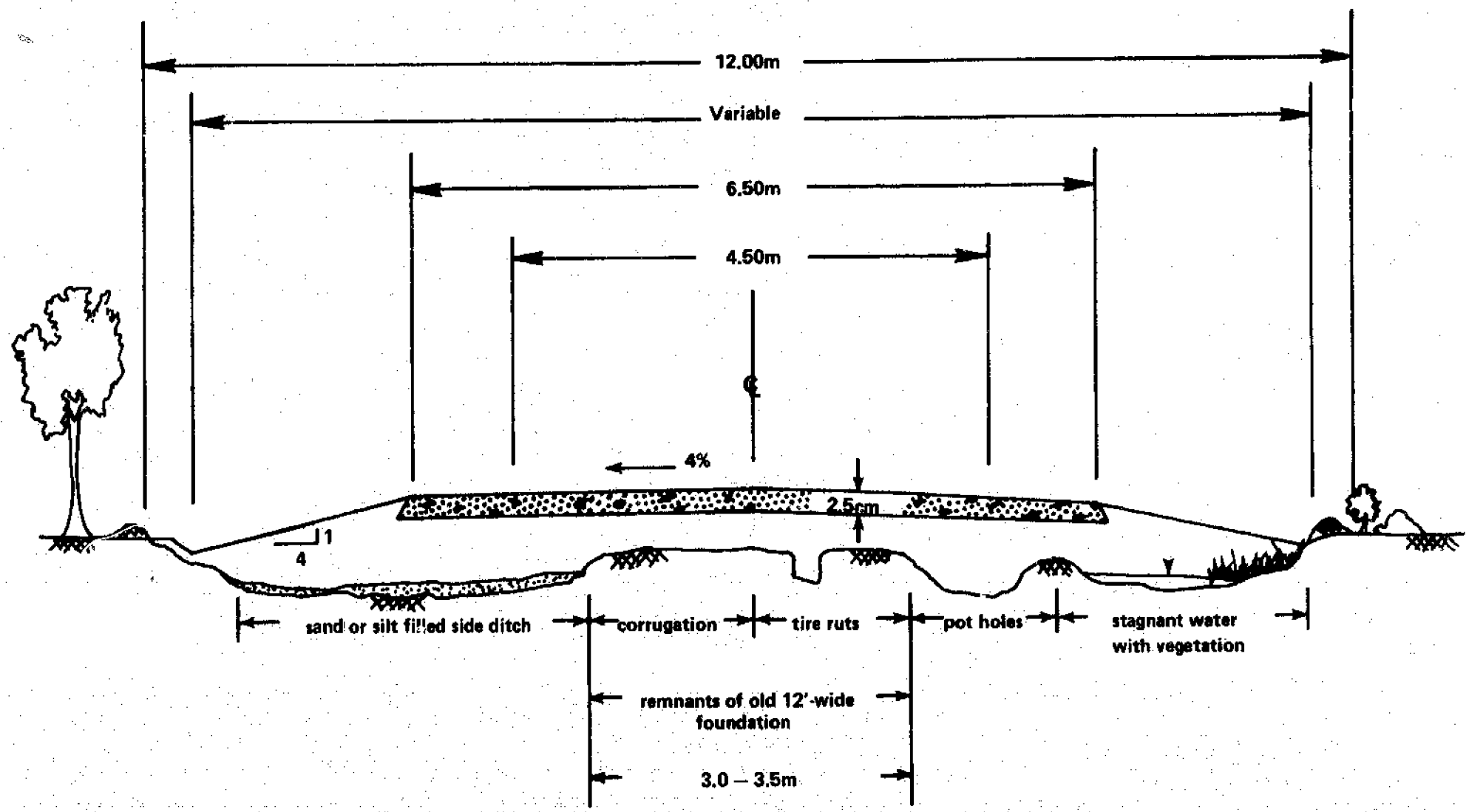


FIGURE G-6

PROPOSED TYPICAL SECTION
SUPERIMPOSED OVER EXISTING ELEVATED SECTION

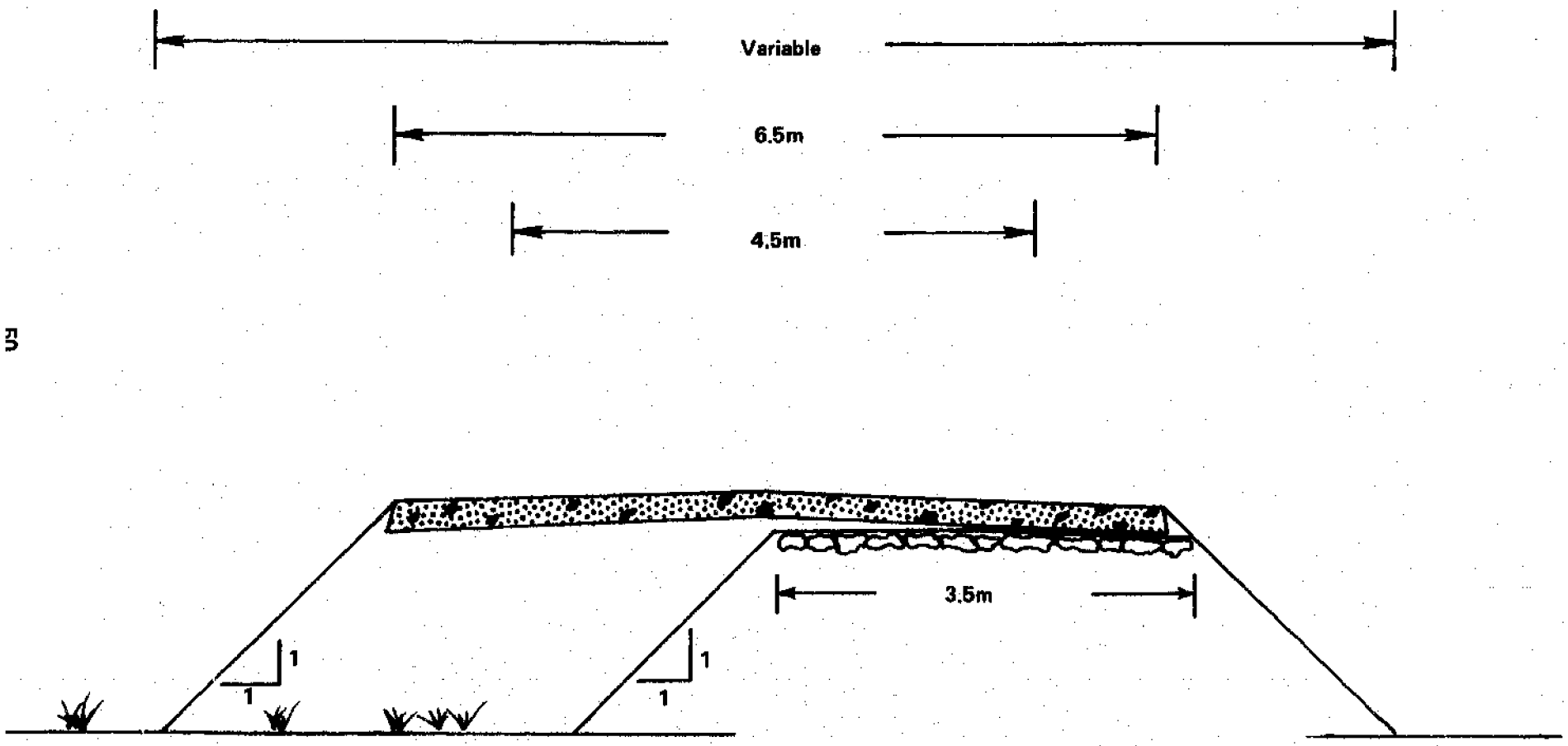
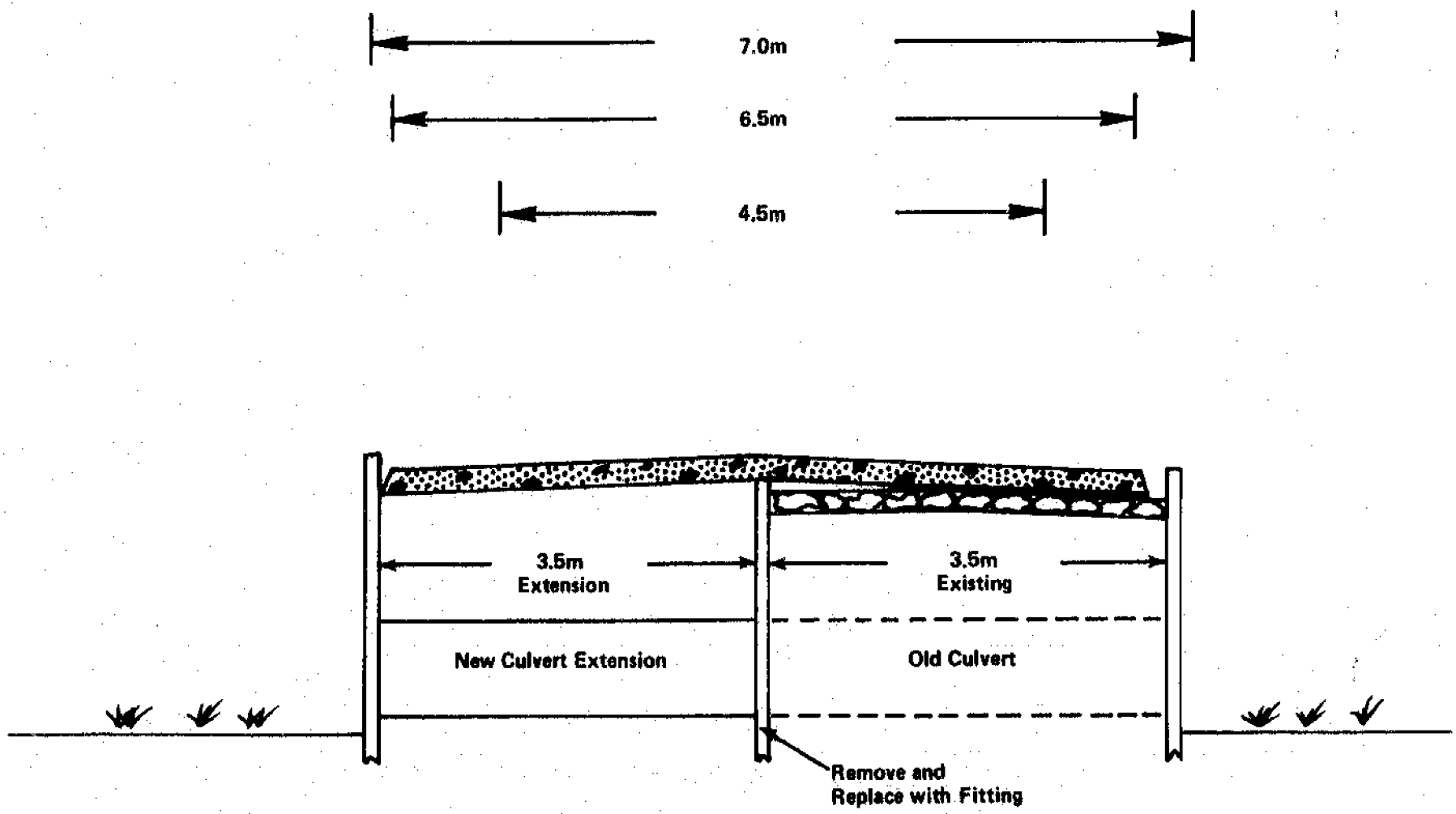


FIGURE G-7

PROPOSED TYPICAL SECTION AT
CROSS DRAINAGE STRUCTURE SHOWING
EXTENSION OF CULVERT



II. RUMBEK MAINTENANCE CENTER: CONSTRUCTION PROJECT

A. Existing and Proposed Service Levels

The existing facility at Rumbek serves principally as a storage area for deadlined equipment and scrap. To term it a workshop would be a misnomer. The three small buildings in the compound total approximately 200 square meters in floor area and are used to house two offices, the small stock of tools on hand, construction materials, a deadlined motorcycle, and a few spare parts. Whatever limited repairs that can be accomplished with this inadequate equipment are made on the front porch of one of the storage buildings.

It became evident to the team during its field inspection that to provide this facility with the capability to undertake even third-echelon maintenance, such as periodic servicing, minor repairs, and replacement of components on a limited basis, would require not simply upgrading but the virtual creation of an equipment maintenance organization at the provincial level. The team is aware that the World Bank is now considering a project that will include the improvement of the Ministry's Central Workshop in Juba. While no details were available during the team's visit to Juba, the Bank's plans will presumably include upgrading the capacity of the Central Shop's major overhaul facilities to support the Ministry's various provincial shops.

For this reason, the new facilities and shop equipment proposed for Rumbek do not include provisions for a machine shop and machining tools, such as crankshaft grinders and lathes, or shop tools for heavy duty repairs, such as a sprocket and track pin press and gear and hub pullers. It is anticipated that the workshop designer, in conjunction with the Ministry's engineers, will provide for any possible future expansion of selected facilities, as tentatively shown on the site plan. It is further expected that the technical assistants responsible for workshop and supply system planning will order a sufficient number of sub-assemblies (for example, short engine blocks, gearboxes, and other drive train units) to minimize equipment down-time during major overhauls. Tables G-4, G-5, and G-6 are lists of personnel, shop tools, and maintenance equipment at Rumbek.

B. Proposed Rumbek Center Project

The proposed facilities are subdivided into the following three construction types:

Type I Buildings

Roofed and completely enclosed on all four sides. Steel frame and roof trusses. Roofing of corrugated fireglass or aluminium. Masonry, non-load-bearing walls.

Table G-4

Personnel Currently Assigned to the Rumbek Workshop

Classification	No.	Pay Group	Years of Experience	Type of Experience
Mechanic, Supervisory	1	IV	7	Heavy & light eq
Mechanic	3	IV	5	Heavy & light eq
Mechanic	1	III		Heavy & light eq
Mechanic	1	II		Heavy & light eq
Asst. Mechanic	6	I	3-4	Heavy & light eq
Blacksmith, Head	1	II	3	
Blacksmith	1	III	4-5	probationary emp
Blacksmith	1	I	5	
Driver, Head	1	III	14	GMC &STEYR D/tru
Driver	4	III	5-21	D/Trucks
Driver	1	IV	23	"
Driver	1	I	5	Light trucks
Asst. Driver	8	I	±7	1st echelon main
Builder, Head	2	VI & V	14	bldg. const; cul bridge repairs
Builder	2	V	13-14	" " "
Asst. Builder	7	II	7-23	" " "
Operator, H.E.	2	IV	13	M/grader
Operator, H.E.	1	III		M/grader
Asst. Operator	1	III	7	loader
Asst. Operator	1	I	7	loader
Storekeeper	1	III	8	
Sr. Timekeeper	1	III	8	
Timekeeper	1	II	8	
Clerk	1	III	2	
Kaffirs (Janitors)	2	II		

Total Employees: 52

Note: One roads engineer and one mechanical engineer are nominally in charge of the workshop. Unfortunately, they were not availible for discussions during the team's inspection.

Table G-5

Shop Tools on Hand, Rumbek Workshop

Item	Quantity
Socket Set, 3/4" drive, w/ratchet, inches	1
Set, end wrenches, various sizes, inches	1
Vise, bench type, approximately 4"	2
Grinder, hand operated, 6" diameter	1
Jack, Hyd., floor, est 2 T, needs repair	1
Jack, Hyd., floor, est 5 T, needs repair	1
Jack, Hyd., floor, est 10 T, needs repair	1
Wheel barrow	5
Shovels, picks, rakes, axes, hoes, sickles	-

Table G-6

Equipment on Hand at Rumbek

o.	Equipment	Condition	Location	Acquisition Date (Approximate)	Team Recommendati
	Motor Grader, CAT 12F	Fair	Rumbek Yard	1974 (from WAU)	Repair as trair ing demonstrati
	Loader, CAT 941B	Good	Shambe	1974 (from WAU)	''
	D/Truck, GMC 7500	Poor	Rumbek Yard	1973-1974 (from Juba)	Auction or scra
	D/Truck, GMC 7500	Poor	Rumbek Yard	''	Auction or scra
	D/Truck, GMC 7500	Poor	Rumbek Yard	''	Auction or scra
	D/Truck, STEYR, 1290, 8T	Needs minor repairs	Rumbek Yard	1973-1974 (from Juba)	Repair as trair ing demonstrati
	''	''	Rumbek Yard	1973-1974 (from Juba)	Repair on prior basis
	''	Poor	Rumbek Yard	''	Auction or scra
	'' ; Chassis & box only	Unserviceable	Rumbek Yard	1973-1974 (from Juba)	Auction or scra
	D/Truck, COMMER 8T	Unserviceable	Rumbek Yard	1973-1974 (from Juba)	Auction or scra
	Tanker, STEYR, 6000 L	Needs minor repairs	Rumbek Yard	1975 (from Juba)	Repair on prior basis
	Lubr. Unit, Port w/	Operational	Rumbek Yard	UNK	Service & utili
	Motorcycle, Kawasaki	Needs minor	Rumbek Yard	UNK	Repair & utili

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grading skills will be undertaken through on-the-job training--with due consideration for the demands of normal production--no marked surge in equipment maintenance capacity is anticipated.

2. Personnel

A proposed organization chart is presented in Figure G-9, which shows the position and lines of responsibility to be instituted at the Rumbek center.

IV. MAINTENANCE ACTIVITY SPECIFICATIONS

A. Specifications

1. TASK 1: Reshaping Laterite Road Surface

Objective: To restore riding quality and intended grade and cross-section to unpaved road surfaces.

Responsibility: Reshaping is a routine maintenance operation and should therefore be the responsibility of the senior roads supervisor.

Application: Reshaping is required when an unpaved road surface becomes corrugated, distorted, eroded, or rutted because of traffic, weather, or a combination of both. Reshaping is necessary on all unpaved roads whether or not there are any defects in road construction. Traffic on any unpaved road surface will wear away material and loosen or displace particles that will subsequently be cast, pushed, blown, or washed away. This wearing action will not be uniform, because traffic usage and material quality is not uniform across the width of the road. In consequen the road section, shaped and graded to provide surface drainage and smooth riding, has to be reshaped and the loosened materials recompacted.

Method of Maintenance: It is recommended that reshaping be performed with an agricultural tractor and the following accessories: a scarifier, compactor, and mold board. If the surface is very dry, a water tank truck should start the operation by wetting down the surface thoroughly. A tractor pulling a scarifier should follow, scarifying the surface 50 to 10 centimeters deep. In some cases, it may be necessary to add materials to make up for losses and to maintain grade and drainage characteristics. The materials should be spread and the surface reshaped by a tractor pulling a mold board. The materials should be wetted again and thoroughly compacted. Without compaction, the same distortions will reappear rapidly under traffic.

Reshaping ditches can accompany the surface reshaping operation. The good quality soil from the ditches can be spread over the road surface or shoulders during the subsequent operation. This procedure is discussed below in this section.

Type II Buildings

The only facility in this category is the general repair shop. This building will also have steel framing and roof trusses and corrugated roofing, but it will be open on all four sides, reducing costs yet allowing adequate cover and protection for general repair work.

Type III Buildings

These buildings will be partially enclosed. The number of walls will depend on the facility location and function. Type of construction will be similar to the Type I building.

The total covered area to be constructed by the project will be slightly over 1,750 square meters. As is noted on the site plan (Figure G-8), certain facilities, such as the general repair shop, have been selected for possible future expansion and/or construction. Table G-7 details the dimensions and areas of the three building types.

Table G-7

Workshop Dimensions and Area

Type I Buildings	Dimensions (m)	Area (m^2)
Control Office/Classroom	20 x 10	200
Parts Storage and Issue	25 x 8	200
Engine/Fuel Injector Testing	8 x 8	64
Engine Overhaul	10 x 8	80
Electrical Shop	8 x 5	40
Battery Room	8 x 5	40
Paint Shop	10 x 5	50
Receiving and Final Inspection Offices	2 x 4 x 4	32
POL Office	4 x 4	16
Gate Houses	2 x 4 x 4	32
Generator Room	5 x 5	25
	S/T:	779
Type II Buildings		
General Repair Shop (Incl. areas for minor repairs, tire repairs, lubrication, compressor, tool issue, office, and toilets.)	30 x 25	750
Type III Buildings		
Welding, Blacksmithing & Radiator Repair Shop	10 x 8	80
Body Repair Shop	10 x 8	80
Carpentry & Upholstery Shop	8 x 8	64
	S/T:	224

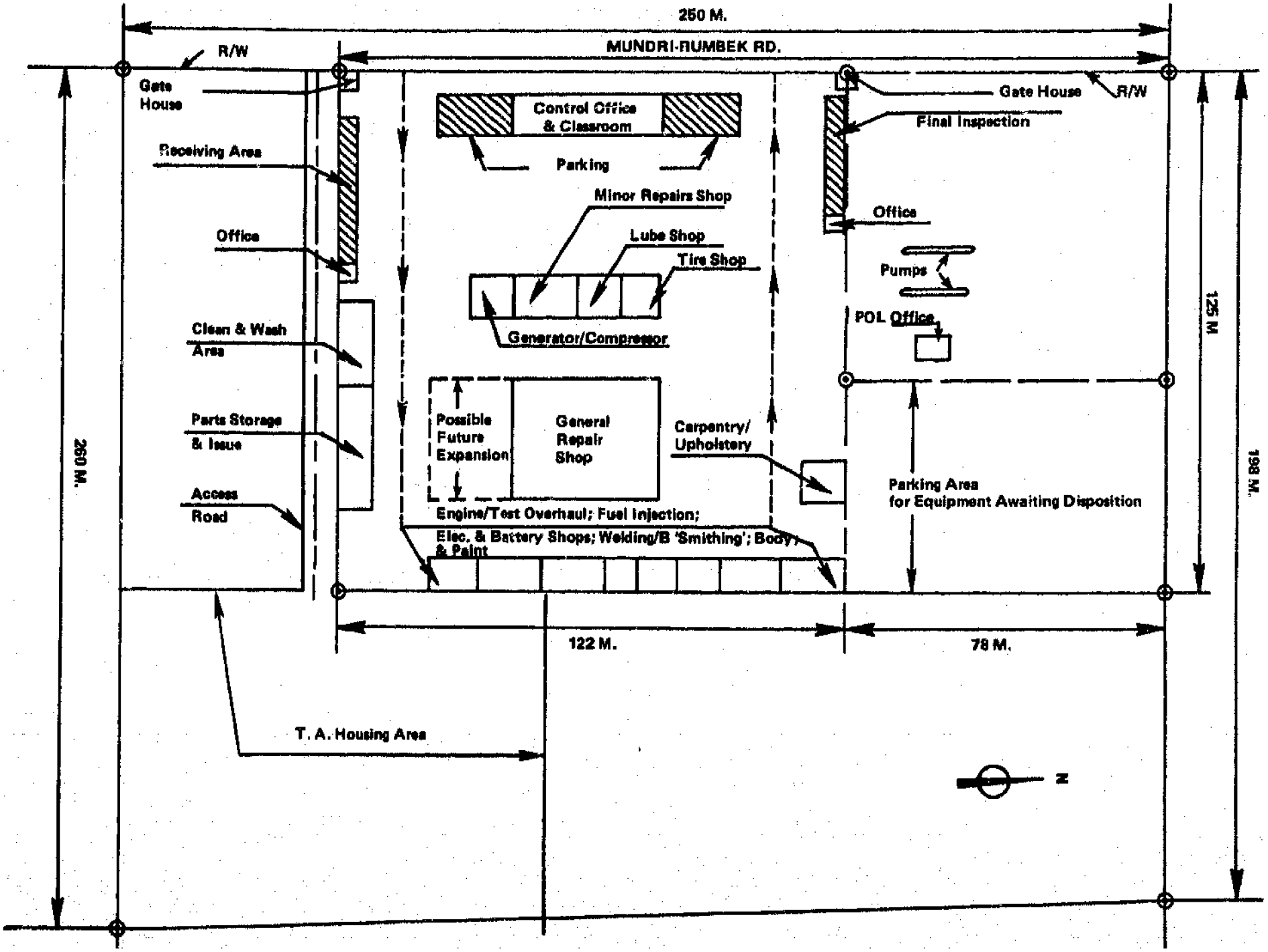
Total Covered Area = 1,753 m^2

FIGURE G-8

SITE PLAN – RUMBEK PROPOSED MAINTENANCE AND TRAINING CENTER

Scale: 1:100

All Dimensions in Meter



There are no existing utilities at the workshop site. A well will have to be drilled and a water tank installed. Sewage disposal could be conducted by means of a central septic tank and drain fiel

Provision has been made in the list of proposed workshop equipment for the purchase of a 30 kilowatt generator, which is considered to be of adequate capacity to supply all of the center's needs for the forseeable future.

III. RUMBEK MAINTENANCE CENTER: ORGANIZATION

A. Future Role

1. Immediate Post-Project Period

The suggestions regarding the transition of the training functions from project to Ministry administration are presented in Annex K. If the project training program critique described therein does not identify any serious flaws in the manner in which the program was conducted, the training activities should continue along the same general lines but on a reduced scope.

This reduction in scope is recommended for several reasons:

- A certain amount of time will be required for the orientation of the newly-appointed training officer and for training the instructors who will be seconded by the Ministry.

- If the project goal of 153 trainees is met, the immediate pressure on the Ministry to fill the most critical job classifications with project-trained, skilled workers will be reduced to a large extent. Again, depending on the program's critique, this reduction will in turn permit a reduction in the number of trainees and perhaps an extension of the training cycles. Additionally, it may be considered advantageous to amplify certain training.

- Since the World Bank's training program in Juba will presumably have been operating at least partially concurrently with the project program, the relatively large number of trained personnel that were required prior to the implementation of the project will be further reduced. The acceptable level of reduction cannot be forecast at this time. This decision will have to be made by the senior management of the Ministry based on the results of the critique and the advice of the training officer.

The implications of the reduction in training activities on the purely equipment-maintenance functions of the center will, in all probability, be minimal. Since virtually all of the project's up-

grading skills will be undertaken through on-the-job training--with due consideration for the demands of normal production--no marked surge in equipment maintenance capacity is anticipated.

2. Personnel

A proposed organization chart is presented in Figure G-9, which shows the position and lines of responsibility to be instituted at the Rumbek center.

IV. MAINTENANCE ACTIVITY SPECIFICATIONS

A. Specifications

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Objective: To restore riding quality and intended grade and cross-section to unpaved road surfaces.

Responsibility: Reshaping is a routine maintenance operation and should therefore be the responsibility of the senior roads supervisor.

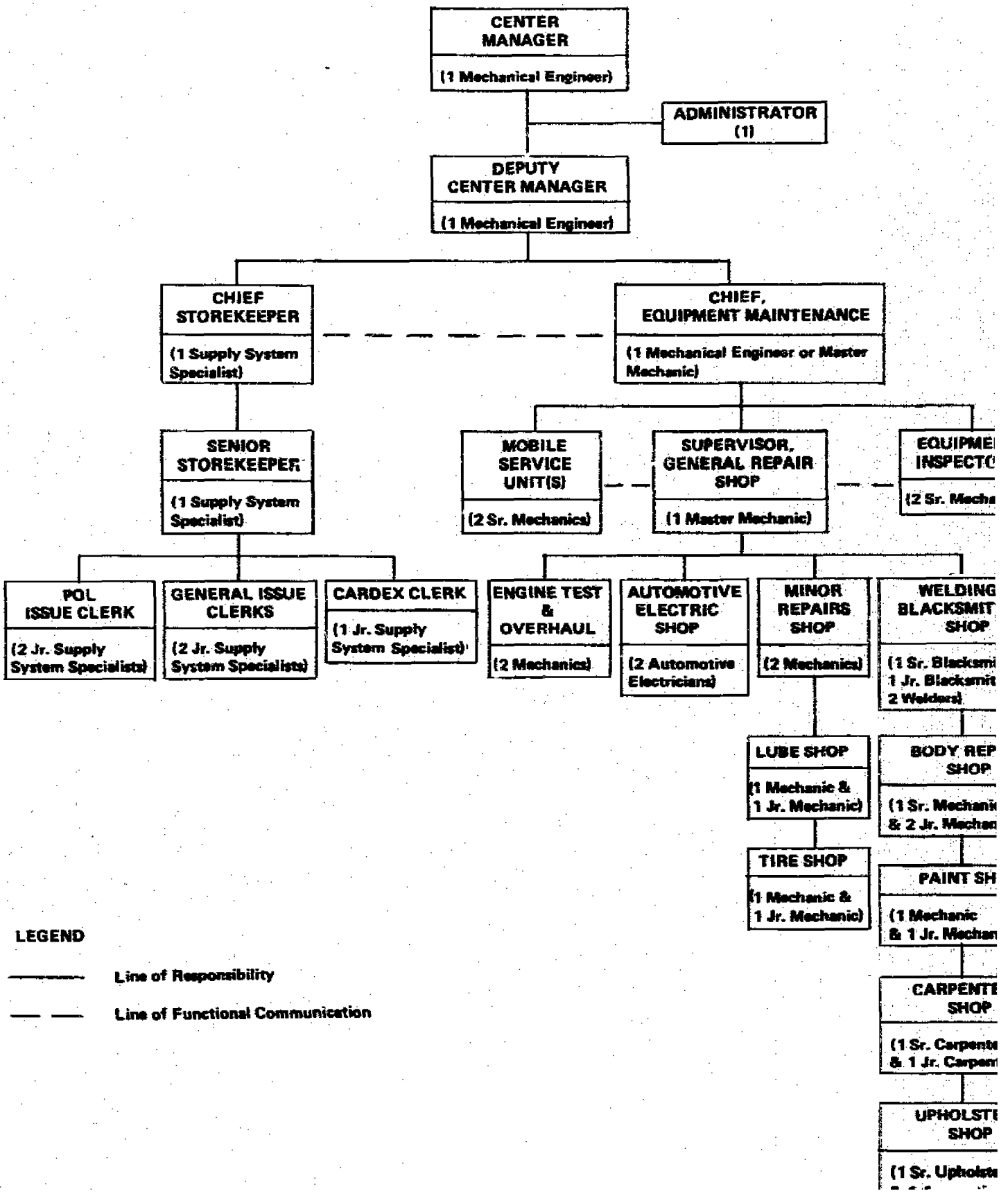
Application: Reshaping is required when an unpaved road surface becomes corrugated, distorted, eroded, or rutted because of traffic, weather, or a combination of both. Reshaping is necessary on all unpaved roads whether or not there are any defects in road construction. Traffic on any unpaved road surface will wear away material and loosen or displace particles that will subsequently be cast, pushed, blown, or washed away. This wearing action will not be uniform, because traffic usage and material quality is not uniform across the width of the road. In consequen the road section, shaped and graded to provide surface drainage and smooth riding, has to be reshaped and the loosened materials recompacted.

Method of Maintenance: It is recommended that reshaping be performed with an agricultural tractor and the following accessories: a scarifier, compactor, and mold board. If the surface is very dry, a water tank truck should start the operation by wetting down the surface thoroughly. A tractor pulling a scarifier should follow, scarifying the surface 50 to 10 centimeters deep. In some cases, it may be necessary to add materials to make up for losses and to maintain grade and drainage characteristics. The materials should be spread and the surface reshaped by a tractor pulling a mold board. The materials should be wetted again and thoroughly compacted. Without compaction, the same distortions will reappear rapidly under traffic.

Reshaping ditches can accompany the surface reshaping operation. The good quality soil from the ditches can be spread over the road surface or shoulders during the subsequent operation. This procedure is discussed below in this section.

FIGURE G-9

PROPOSED ORGANIZATIONAL CHART
MAINTENANCE AND TRAINING CENTER – RUMBEK



Hand patching, which is also discussed in more detail later in this section, should be scheduled to take place immediately before, or concurrent with, the reshaping operations as well as i the periods between reshaping. Any minor material requirements will be furnished by the hand patching crew.

Finally, replacing major, long-term material losses is a separate operation, which is discussed under the title Replenishing Unpaved roads.

Frequency and Discussion: The requirements for reshaping, patching, and replenishing unpaved road surfaces were thoroughly analyzed by a consultant in a 1974 report for the Su Roads and Bridges Public Corporation, and the findings were published in Volume II, Apperdices of the Road Maintenance Program (RBPC). The report estimated the requirements for 3.75 meter, meter, and 6.00 meter roads in Sudan. The following discussion and tables were developed by projecting these requirements to m the needs of the 6.50 meter road proposed for this project. Th 3.75 meter results are also included to show the effects on maintenance of improving the existing road to MCA standards.

a. Total Average Material Losses

Expressed in both volumetric terms per kilometer and in terms o average centimeters wear per year over the entire road surface, the laterite gravel material losses for the proposed road are estimated in Table G-8.

Table G-8

Annual per Kilometer Replacement Requirement

ADT Vehicles per Day	Cm Wear per Year and Laterite Loss by Volume per Year			
	3.75 Meter Road		6.0 Meter Road	
	cms/yr	m^3/yr	cms/yr	m^3/yr
250	4.13	154.9	2.48	161.3
100	1.77	66.4	1.11	72.5
75	1.38	51.7	0.87	57.8
50	0.98	36.9	0.66	42.4
37.5	0.79	29.5	0.54	35.6
25	0.59	22.1	0.43	28.4
12.5	0.47	17.7	0.37	23.8

It can be seen that if lost material is replenished when a given thickness of surface has been worn away, the narrower road, when carrying the same traffic, will require more frequent replacement.

b. Frequency of Scarifying, Reshaping, and Replenishing Materials Losses:

Material requirements are not the sole determinant of relative frequency of maintenance operations on unpaved road surfaces. The width of the road surface will determine to a large extent where on the surface peak wear will occur, and the relationship of peak deformation to average values calculated for the surface as a whole will determine the rate of wear. The team has determined the peak wear to average wear relationships for material losses caused by traffic. The results are as follows:

Road Width	Peak Wear/ Average Wear
3.75 meters	2.40
6.50 meters	1.44

These results correctly imply that, given the same traffic flow on the existing and proposed roads, rutting will be markedly reduced on the proposed roads. Table G-9 applies laterite road peak wear factors to the average laterite wear calculated in Table G-8.

Table G-9

Annual Peak Wear Values for Laterite Roads

	Road Width					
	3.75 meters			6.50 meters		
ADT	Avg. Wear	% Due to Traffic	Peak Wear (cm/yr)	Avg. Wear	% Due to Traffic	Peak Wear (cm/yr)
250	4.13	95	9.64	2.48	91	3.42
100	1.78	88	3.96	1.11	80	1.46
75	1.35	85	2.96	0.87	76	1.13
50	0.98	80	2.07	0.66	68	0.84
37.5	0.79	75	1.61	0.54	60	0.63
25.0	0.59	66	1.14	0.43	53	0.51
12.5	0.47	58	0.85	0.37	43	0.47

Table G-10 translates the results from Table G-9 into annual maintenance frequency when allowing for only 1.6 centimeter peak wear.

Table G-10

Maintenance Operations - Laterite Surface

ADT Vehicles per Day	Reshaping (times/year) 3.75 Meter Road		Reshaping (times/year) 6.50 Meter Road		Replenishing[1] (years/operation) 3.75 Meter Road		Replenishing[1] (years/operation) 6.50 Meter Road	
250	(6.0)	6	(2.1)	3	(2.7)	3	(4.4)	5
100	(2.5)	3	(0.9)	2	(6.3)	6	(9.8)	10
75	(1.9)	2		2	(8.0)	8	(12.6)	13
50	(1.3)	2		2	(11.3)	11	(16.8)	17
37.5		2		2	(14.1)	14	(20.9)	21
25		2		2	(18.8)	19	(25.7)	26

[1]It is assumed that 10 percent of total material loss is replaced during hand patching operations.

Replenishing frequency for laterite roads is also based on allowi 10 centimeters of the 20 centimeter surface to wear away, leaving an absolute minimum laterite thickness of 10 centimeters at all times. Variable laterite quality may require some local modifications to the general average, which can be determined only by acquiring and recording material test data and comparing cost histories on road sections with different quality surfaces.

c. Factors Modifying Maintenance Efforts

Rainfall: Both the length and period during which rains are common and the intensity of rainfall affect the road surface. The number of vehicle miles traveled per mile of road during wet surface conditions increases as the number of rainy da increases. The erosion damage to the road tends to increase as t intensity increases, although the number of rainy days also has an effect.

Material Quality: Laterite quality throughout Lakes Province varies considerably. With experience, a "quality" facto could be introduced through a reasonable laterite sampling and classification survey program along the project road.

Conclusion: The values derived previously give a reasonable basis for calculating maintenance manpower, equipment, and budgetary requirements for this project. They should also serve as a starting point for the road maintenance program. They are not a substitute for basic cost accounting records that will supplant them, as time goes by, as the principal source of data for annual planning of maintenance operations and for execution

2. TASK 2: Hand Patching

Objective: To repair or replace the surface where lc failure has occurred in order to restore structural strength and riding quality.

Responsibility: This task is a routine maintenance activity and should be the responsibility of the senior roads supervisor.

Application: Hand patching of unpaved road surfaces required when:

- weak subgrade has led to the collapse of the surface layer
- badly drained subgrade has led to the collaps of the surface layer
- lack of surface drainage has led to erosion of the road surface by flowing water
- irregular material quality has led to pot-holing
- insufficient surface material has led to rutting

Method of Maintenance: Surface failure on an unpaved road should be investigated to ascertain and correct the true cau of failure. If the surface condition is caused by a deeper sub-grade failure, the subgrade should first be corrected. If a lack of material is the prime cause of failure, additional material sh be brought in. If drainage is at fault, it must be corrected bef surface repairs are made. In an area needing hand patching, the additional material can be obtained from stock piles previously brought in by an agricultural tractor pulling a trailer or a truc and/or bullock carts. Hand labor can then be used to break out t material around the failure and spread it over the surrounding area. The additional material is then placed, wetted, and thorou ly compacted using hand-rammers or a tractor-drawn compactor. Ha patching of small areas must always precede reshaping and compact of large areas.

Frequency: All unpaved road surfaces should be hand patched twelve times per year.

Discussion: Assume that hand patching requires 2 man hours per short ton of material. Also assume a hand-load-ing rate into a trailer, truck, or cart of 5 m^3 per person per day and 1 m^3 = 1.2 short tons. Then add for loading 5 x 1.2, or 6 short tons a man day, which for a 6 hour day gives 1.0 man hour per short ton. Adding the requirement for loading to that for patching, the total labor force required is 1 + 2 = 3 man hours per short ton. Assuming that 10 percent material loss caused by traffic is replaced during hand patching at fourteen potholes per

Laterite Road - Hand Patching Rates

ADT	Material Loss from Traffic (m3) Annual Total	Annual Hand	Monthly Hand	Labor Hours per/ Km	Km per Day Raw	Adjust for Tra Time
250	202.4	20.2	1.7	5.1	11.8	10
100	76.3	7.6	0.6	1.8	33.3	25
75	57.1	5.7	0.5	1.5	40.0	30
50	36.7	3.7	0.3	0.9	66.7	40
25	17.8	1.8	0.2	0.6	100	60

3. TASK 3: Hand Ditching

Objective: To maintain free flow in all ditches, tc maintain ditches at their designed size, and to avoid ponding.

Responsibility: This is a routine maintenance operation and should be the responsibility of the senior road supervisor.

Application: Hand ditching should be used on all lateral drains and channels and for stream beds leading to or fr cross culverts and fly off ditches.

Methods of Maintenance:

Types of Distress	Method Detail
Obstructed ditch	Remove rock, soil, logs, or other obstructions; repair erosion damage on ditch bank by recompacting soil and turfing, riprapping, or otherwise protecting soil.
Eroded ditch bank	Replace and recompact soil in bank and protect with turfing, riprap, or a wood revetment. In general, protection should be superior to that being replaced.
Eroded ditch bottom	Fill to line and grade with gravel or stone choked with sand or soil. Correct cause of erosion by widening ditch, or installing checks, or a combination thereof.
Silted ditch	Excavate silt and dispose of soil locally.

All ditches should be maintained and cleaned over their full length at least twice a year. This task should generally be carried out immediately before and at the end of the rainy season. During rains, and after especially heavy rains, ditche should be checked at least once a month to keep them clean of weeds, debris, and obstructions and to ensure proper functionin

Discussion: The study cited in Task 1 showed RBPC' average monthly output as 500 linear feet (150 meters) when "cleaning drains of silt," which is easy digging of unconsolidated soil that is consistent with an hourly rate of 15 to 20 cubic meters per man hour of work. At this rate, a ditch 45 centimeters wide would be silted to a depth of 2 to 4 centimeters at the time of silt removal.

To adapt average efforts to reflect the effect of terrain, rain fall, and road design, the team determined that the total adjus ment would be 4.24 times average values in the wet Southern Region for an unpaved road with 2.2 kilometers of ditch per kil meter and 30 percent of its length in flat country. Therefore, in the Southern Region, the average man day output is as follow 150 ÷ 4.24, or 35.3 meters/man day. A kilometer would require 28 man days per pass, and if worked on twice a year, would requ 56 man days/year. Based on a crew size of 10 laborers, it is estimated that each crew could cover 2.8 kilometers per day.

4. TASK 4: Cleaning Culverts and Drains

Objective: To maintain free and unobstructed flow through culverts and drains.

Responsibility: Cleaning culverts and drains is routine maintenance and is the responsibility of the senior roads supervisor.

Application: Culverts and drains must be cleaned when they begin to fill up with silt and sand and when rocks, branches, or other foreign matter are deposited in or along the length of the culvert. Bridge deck gutters should be cleaned when silted, and deck drains should be kept open.

Method of Maintenance: Several methods, or a combi ation thereof, may be applied effectively to clean culverts. I the culvert opening is large enough, a person may enter the culvert and excavate sediment by hand. For smaller culverts, a cable or snake may be passed through the culvert and a drag or bucket may then be towed through the culvert on the end of the cable. A variation on this system is to shoot a light line through the culvert using a bow, cross-bow, or similar arrangement and tow a heavier rope through with the light line, the ro serving the same function as the cable.

Frequency: Cleaning culverts and pipes is one of the most important basic maintenance functions, for a blocked culvert can, and frequently does, lead to a road washout.

Pipe inspection and a thorough cleaning should be carried out at least twice a year, generally in conjunction with major hand ditching maintenance and as needed during the rains to ensure functioning drainage.

Discussion: The cause of heavy silting should always be studied. Many times silting can be remedied by correcting channel profile. If blockage by branches or debris is common, a trash rack can be installed. The number of culverts per kilometer, lengths, and average slopes vary with topography. Rainfall intensity varies, of course, with climatic zones.

For the Southern Region of the Sudan, the team has determined that an average of ten man hours per kilometer per year are needed to clean culverts and two man hours per kilometer per year are needed for minor repairs. These averages are applicable to the project road.

5. TASK 5: Cutting Grass and Brush

Objective: To maintain clear sight lines for traffic, to maintain unobstructed drainage, and to maintain the visibility necessary for inspection and easy access to all elements of a highway and highway drainage system.

Responsibility: Cutting grass and brush is a routine maintenance operation and should be the responsibility of the senior roads supervisor.

Application: Cutting is done to reduce weeds, grass, and young woody and grassy growth within the right-of-way and, to a limited extent, along drainage ditches and canals leading to and from the road. Cutting is necessary when the driver's sight distance is being reduced by vegetation and drainage channels and ditches or culvert openings are being, or may be, obstructed by vegetation.

Methods of Maintenance: Hand labor equipped with panga, bill hooks, sickles, and slashers.

Frequency: Frequency will vary greatly with the rate of growth of vegetation in the area, which in turn is a function of rainfall. Frequency in the Southern Region could vary between four and eight times per year. Six is used as an average for the project road.

Discussion: It is assumed for unpaved roads that an average of 3 meters width on both sides of the road over the entire length, or 0.6 hectares per kilometer, should be cleared, that is 3.6 hectares/km/year. Assume 16.7 man days per hectare, or 60 man days per year/km. For a 10 person crew, this will require 6 days/year/km/crew.

6. TASK 6: Minor Repairs to Structures

Objective: To maintain minor structures and appurtenances for drainage and erosion control works in sound structural and satisfactory hydraulic condition.

Responsibility: The routine repair of minor structures is the responsibility of the provincial road supervisor.

Application: Repairs should be made to all broken, badly cracked, spalling, or otherwise damaged masonry works to preserve the structural and functional integrity of the works and to prevent the spread of the damage to the structure or to other highway elements.

Minor structures may include, but need not be limited to: culverts, end walls and aprons; stone masonry or concrete box culverts; small bridge abutements, wing walls, superstructure, and rails; and riprap in ditches and channels.

Method of Maintenance: Cracked or broken culvert pipes should be patched and pointed-up if damage is minor and no settlement accompanies cracking. Badly cracked, settled, or caved-in pipes must be replaced. The latter work must be done by a specially trained crew or by a local contractor and is not considered routine maintenance.

End walls and aprons should be pointed-up when needed (particularly stone masonry walls), and cracks should be sealed. In the case of the marked movement of a wall or settling of an apron, reconstruction will usually be required, and this should be done by a special crew or by contractors working to the design of an engineer. Masonry culverts will require pointing-up, and in the case of culverts with no floor slab, correction of bottom scour may be required. This can usually be done with riprap or grouted riprap by routine maintenance forces. If the work is complex enough to require help, a contractor may be needed.

Small bridge substructures require the same maintenance as masonry box culverts. Only very minor patching of bridge superstructure should be handled by the general labor crew. Specialized repair requires a special structures crew; major repairs require a contractor. Replacing or repairing bridge rails and parapets may be undertaken by a provincial routine maintenance crew or by a regional bridge crew, depending on the scope of the job and the type of rail.

Frequency: Routine inspection and repair should be performed twice each year. A log must be kept of all repair work performed on each structure.

Discussion: Repair of minor structures can be either simple or major. The senior road supervisor's routine maintenance force is staffed and equipped only for minor repairs that are

needed regularly. Any work requiring larger crews or more equ ment must be noted and special arrangements made. The man-hou effort assigned to this activity has already been discussed in conjunction with cleaning culverts and pipes and will not be r peated here.

7. TASK 7: Replenishing and Restoring Laterite Roads

Objective: To replace surface material worn away under the action of traffic so as to reconstitute the pavement section that was originally built.

Responsibility: The resurfacing operation on late roads is a periodic maintenance activity that will be planned the provincial road engineer in consultation with the regional director of roads and will be executed by a contractor or head-quarters special unit assigned to the region.

Application: Replenishing and restoring operation will be required on unpaved roads when:

- traffic is causing, or is likely to cause, frequent surface failures because surface course thickness is insufficient for the proper distribution of wheel loads to supporting layers

- the proper functioning of surface drainage is being hindered by progressive lowering of the cross slopes

- the riding quality of the road, particularl at bridge approaches or over box culverts, being adversely affected by the lowering of road grade

The operation, like many periodic maintenance operations, is pr ventative as well as corrective and is justified by diminishing routine maintenance costs or by averting an increase in routine maintenance effort.

Method of Maintenance: Resurfacing should be performed on one or more complete control sections at a time. The basic steps are:

- Prior to resurfacing with laterite, a surve should be made and grade control stakes pla by an engineer from the provincial roads engineers office.

- A survey review of performance should be ma and "highway maintenance" sections identifi and studied for correction.

- The actual maintenance will usually begin by thoroughly wetting the area to be worked 24 hours ahead of time, followed by scarifyi the existing road surface 2.0 to 3.0 centimeters deep.

- Additional material must be brought in (abou 10 centimeters blanket average) and should b dumped on the move to minimize "spreading."

- The new material should be spread and blende with scarified material, then moistened and compacted. The initial compaction should be sufficient to firm up the material (usually three to six passes by a 6- to 8-ton roller should suffice, but this may vary considerab with the material).

- The new surface should be fine-graded to required cross-section grade, then be thorough compacted to specification.

Rolling and fine-grading may have to be repeated alternately several times, depending on the skill of the fine-grade operator Once the material is firm, additional material cannot be added without re-scarifying the lower layer. Such additions are subje to rapid break-up under traffic.

Material Specifications: The following specificatic limits are recommended for use on the project road's laterite surfacing:

- particle size: maximum should be 1½ inches and not more than 25 percent passing the No 200 sieve

- plasticity (of No. 40 material): should pre ferably be below 12 percent

Compaction of lateritic surface material should be checked by me of field density tests. It is recommended that 95 percent of AASHTO intermediate maximum dry density be required; this compac effort is achieved in the laboratory by compacting five layers i a standard compaction mold with twenty-nine blows of the compact hammer.

It is not necessary to control the CBR of the different material used in maintenance operations once the borrow pits have been tested and approved.

Frequency and Discussion: The requirements for reshaping, patching, and replenishing unpaved road surfaces is reported in the discussion of Task 1. The relevant outputs of tha discussion are shown in Table G-10.

B. Equipment and Staffing

1. Maintenance Crew Classifications

The types of crews required to maintain the project road after completion of the rehabilitation work are given with the activities for which they will be responsible in Table G-12.

Table G-12

Crew Composition

Crew Title	Activities
Surface maintenance	Reshaping surface
General labor	Hand patching Hand ditching Erosion control Cleaning culverts and drains Cutting brush
General traffic service	Minor repairs to structures
Replenishing	Replenishing

A discussion of the equipment and staffing requirements for each crew and the number of crews required for the project road on completion of the rehabilitation work follows.

2. Surface Maintenance Crews - TASK 1

Production Rate: The method of using an agricultural tractor pulling a scarifier, mold board, and compactor has been discussed. Production rates are shown in Table G-13.

Table G-13

Surface Maintenance Equipment Hours/Km for a 6.5 Meter Road

Equipment	Production		
Tractor +	Number of Passes	Average Speed	Hours per Km
Scarifier	4	10 hrs/km	0.4
Mold	8	10 hrs/km	0.8
Compactor	6	5 hrs/km	1.2
Total	18		2.4

In a six-hour day, the agricultural tractor pulling a scarifier, mold board, and compactor can reshape 2.5 kilometers of a 6.50 meter wide road.

Project Requirements: Assume that one surface maintenance crew is assigned 150 kilometers of road. Three crews would be required for the 440 kilometer long project Mundri-Rumbek-Wau road. Each complete pass over the 150 kilometer section would require 150 ÷ 2.5, or 60 working days, or 10 weeks to complete. Allow 3 months per operation to account for down time for repairs. Table G-10 indicates that two passes per year are required on the project road. Therefore, the surface maintenance crew would be engaged for six months each year, specifically at the end and beginning of the wet season.

It is recommended that during the interim periods the surface maintenance crews be assigned to hauling materials from borrow areas to the roadside for stockpiling for hand patching operations The crew could be assigned to each general maintenance area for ten days twice a year for this purpose.

Resources Requirement: The equipment and personnel required are listed in Table G-14.

Table G-14

Surface Maintenance Equipment and Personnel Requirements

Equipment	Units per Crew	Project Total
Agricultural Tractor	1	3
Truck Tank Water	1	3
Scarifier	1	3
Mold Board	1	3
Compactor	1	3
Truck Flat Bed	1	3
Portable Service Unit	1/3	1
Trailer	1	3
Personnel		
Foreman Equipment	1	3
Tractor Operator	1	3
Truck Driver	2	4
Mechanic	1/3	1
Mechanic Assistant	1/3	1
Mechanic Lubrication	1	1

Note: The road camp labor would assist in this operation. Each road camp would spend about ten days on each pass assisting the surface maintenance crew in the 20 kilometer section for which the camp is responsible. For an additional ten days twice a year, the

3. General Maintenance Crew: TASKS 2-5

Tasks 2-5 are classified as general maintenance and comprise hand patching, hand ditching, cleaning culverts and drains, and cutting grass.

Production Rates: Given the tasks outlined previously the time of the existing maintenance crews based on the site and responsible for maintaining a specific 10 kilometer section would be allocated as shown in Table G-15.

Table G-15

Allocation of Maintenance Crew Time

Activity	Production	Crew Days/Yr (approx.)
Reshaping surface	2.4 km day, or 4.2 days/10 km section - 2 passes/year	9
Stockpiling materials	Loss is 28.3 m^3/yr/km Replace 10%, or 28.3 m^3 load 1 m^3/day/person	3
Hand patching	60 km/day of 0.16 hrs/10 km section, or 1 six-hour day per week	52
Hand ditching	2.8 km/day, or 3.6 days for 10 kilometers - 2 passes/yr	8
Culvert cleaning	120 man-hours/10 km section 10 person crews	12
Brush cutting	6 days/yr/cm/area	60
Total		144

When the road is rehabilitated and surface maintenance crews are trained to maintain the road, each of the existing general maintenance crews will have approximately 150 days, or 6 months, work each year. It is recommended that the number of existing crews be cut in half at that time and that each remaining crew be given responsibility for 20 kilometers of road instead of the current 10 kilometers.

To ease the burden of walking to the site, it is recommended that each crew be given a team of bulls and a bullock cart that would be used for transporting the crew and equipment to the work site and for bringing and stock piling borrow materials to the site.

Resources Requirement: The equipment and personnel required for general maintenance are listed in Table G-16.

Table G-16

General Maintenance Equipment and Personnel Requirements

Equipment	Units/Crew	Project Total
Hand rammers	2	44
Dobbin borrow	2	44
Picks	2	44
Shovels	6	132
Rakes	2	44
Personnel		
Headman	1	22
Bullock cart drivers	1	22
Laborers	10	220
Stores keeper	1	22
Engineer	½	
Foreman	1	
Heavy equipment operators	8	
Light equipment operators	6	
Truck drivers	20	
Laborers	20	
Mechanic	1	
Mechanic assistant	1	

Production Rate: The consultant's 1974 Road Maintenance Program Appendices cited earlier estimated that the replenishing crew should complete 2.2 kilometers/day.

C. Proposed Revisions to Road Maintenance Organization

The existing lines of responsibility in road maintenance are shown in Figure G-10. Also provided is the length of road that each position is responsible for as well as the education and experience level of each member in the chain of command.

The level at which the proposed road maintenance activities will be controlled after completion of the rehabilitation work is shown with asterisks next to the position title.

Figure G-10

Line of Responsibility for Road Maintenance

	Length of Road Responsible For	Education Level	Years of Experience
DIRECTOR TRANSPORT & COMMUNICATIONS			
CHIEF ROADS ENGINEER			
PROVINCIAL ROADS ENGINEER*	All provincial roads	Poly-technic graduate	8
SENIOR ROADS ENGINEER**	150 km - 200 km	Poly-technic graduate	4
ROADS SUPERVISOR***	40 km - 50 km	Technical school	10
HEADMAN	10km	Read and write	6
LABORER 10	10km	None	None

*Replenishing crew assigned to provincial engineer.
**Surface maintenance crew assigned to senior road engineer.
***General maintenance crews assigned to road supervisor.

ANNEX H

FINANCIAL ANALYSIS AND PLAN

ANNEX H

FINANCIAL ANALYSIS AND PLAN

I. INTRODUCTION

The total project cost is based on the estimated cost (using 1979 prices) of the following four elements of the project:

- Construction Contract Price ($24,078,000)
- Technical Assistance ($3,174,000)
- Government Support ($1,242,000)
- Other Donor ($237,000)

A more detailed breakdown of the costs follows.

A. Contract Price ($24,078,000)

This component is the value of the Construction Contractor's contract to rehabilitate the road, construct the Rumbek maintenance facility, and erect the housing complex at Rumbek. It includes:

- The direct cost of equipment, fuel, labor, and materials required to do the work ($11,127,000)
- The indirect cost, which includes the salaries of the support staff and other overhead and materials costs ($7,834,000)
- The cost of workshop tools and equipment for the maintenance facilities at Rumbek ($135,000)
- A contingency factor ($1,896,000)
- A profit factor ($2,086,000)
- A residual value of equipment ($1,000,000)

The total length of the Contractor's contract will be four years, of which four months will be for mobilization, thirty-two will be for rehabilitation and construction works, and twelve will be for road maintenance liability.

Note: This annex is a continuation (Section V) of the Technical Analysis.

B. Technical Assistance ($3,174,000)

Technical assistance is the Consultant's cost to provide on-the-job training and administrative support as well as the cost of equipment and fuel procured for the maintenance element of the project. The elements of technical assistance are as follows:

Short Term

- Prepare contract documents for the rehabilitation of the road and the construction of the Rumbek center: 11 people, 34 man-months ($245,000)

- Undertake a pre-feasibility study of a port and access road to serve Lakes Province: 3 people, 12 man-months ($114,000)

- Evaluate progress and goals achievement ($100,000)

Long Term

- Provide on-the-job training and administration of

  - inspection of the Contractor's work including certification of payments: 6 people, 190 man-months ($1,397,000)

  - equipment repair, shop procedures, and intermediate roadway maintenance techniques: 3 people, 108 man-months ($996,000)

- Procure spare parts for existing government-owned equipment ($51,000); procure new equipment and spares ($211,000); and procure POL for the period of maintenance work ($60,000)

C. Government Support ($1,242,000)

Government support is the cost of the government's contribution to the project. It includes:

- Salaries for

  - supervision of construction counterparts: 30 people, 960 man-months ($195,000)

  - Rumbek workshop trainees and technicians: 80 people, 312 man-months ($280,000)

  - road maintenance crews: 302 people, 4,561 man-months ($328,000)

- Hand tools and livestock for the road maintenance crews ($22,000)

- Land for Rumbek center ($417,000)

D. Other Donor - World Food Program Food Donations ($237,000)

E. Cost Estimate Format

A comprehensive estimate of the cost of the above elements follows. Each estimate is preceded by a description of the methodology used to determine the costs. Basic facts are provided where practical. Assumptions based on judgment and experience are frequently used without explanation, but sufficient information is provided to allow for the re-estimation of costs based on differing assumptions.

II. CONTRACT PRICE

The major cost elements of the contract price are described above and are built up from the most basic costing element. Some cost elements are determined from recent bid prices, however, and others are based on judgments derived from the best available information.

A. Basic Data

The basic cost of the contract estimate is the Contractor's daily cost for equipment, fuel, and labor used in the rehabilitation project.

The contract price is based on the use of resources shown in Table H-1.

1. Equipment Ownership and Operating Cost Analysis

The daily value of depreciation, maintenance, repairs, insurance, and fuel consumption are computed. For the purpose of calculating the Construction Contractor's equipment owning and operating costs, the equipment fleet is depreciated to zero value over a four-year period of use. However, a number of the machines, because of their varying applications, will not be working for the full depreciation schedule. Consequently, this equipment must be considered as having some value at the time that it is turned over to the government. This residual value is estimated at approximately $1 million, or about 17 percent of the initial cost. The maintenance and repairs are assumed to be 100 percent of the delivered price, and the Contractor's insurance is estimated to be 2 percent of the value of the delivered price. Other assumptions and the calculations follow:

GIVEN:

1) All equipment to be imported from US.

2) Insurance and freight (ocean) to Port Mombasa is 33% of purchase price (P).

3) Normal freight Mombasa to Juba is Ksh 1,450 (US $170) per ton or $2m^3$, whichever is greater.

Table H-1

Contract Price Components

(000 US $)

	Estimated Cost
Construction support equipment (new)[1]	6,019
POL	1,427
Personnel	
USA - 14 people - 457 man-months[2]	1,142
TCN - 24 people - 740 man-months	1,354
Sudanese - 175 people - 5,567 man-months	856
Life support (shelter, food, etc.)	4,045
Materials & other overhead items[2]	4,118
Workshop equipment and tools installed	135
Contingencies	1,896
Profit	2,086
Residual value of equipment to be turned over to government	1,000
Total	24,078

[1] The overall contract price could be reduced by as much as 9 percent if the Contractor had available, and used, an existing fleet.

[2] The overall contract price could be reduced as much as 10 percent if a third country or Sudanese firm undertook the work instead of a US contractor.

4) Agent handling fee Kenya is 1.0% of value.

5) Bond charge Kenya is 2% of 20% of the total value.

6) Bond charge Uganda is 1.5% of 20% of the total value.

7) Transit charge Uganda is LS 7.50 (US $15) per ton.

8) Entry charge Sudan is LS 6.50 (US $13) per ton.

9) Agent handling charge Uganda and Sudan is 0.75% of value.

10) Sudan surcharge tax is 15.0% of value.

11) Sudan development tax is 5.0% of value.

12) Depreciate all equipment straight line for four years or 1,800 hours per year with zero salvage value.

13) Maintenance and repairs (parts and labor) are 100% of value delivered on site.

14) Contractor's insurance is 2% of value delivered on site.

15) Diesel fuel cost per 1,000 liters delivered Juba is Ksh 2,292 (US $266).

FIND: Contractor's equipment ownership and operating cost.

CALCULATION: 1) Equipment ownership and operating cost without fuel

a) Delivered price CIF/Port Mombasa is 1.33 x purchase price (P)

b) Delivered price to site assume:

Item	% of Total Va
Agent handling fees, Kenya	1.0%
Freight cost, Mombasa Rumbek	3.5%
Bond charges, Kenya	0.4%
Bond charges, Uganda	0.3%
In-transit charges, Sudan	0.2%
Agent handling, Sudan	0.8%
Sudan surcharge tax (not included)	-
Sudan development tax (not included)	-

Therefore, delivered price (DP) on site is

1.065 x 1.33P, or 1.42P

c) Depreciation is 1.42 ÷ (4 yrs x 1,800 hrs/yr), or 0.0001972P

d) Maintenance and repair is 100% of total va at site, or 1.42P ÷ (4 yrs x 1,800 hrs/yr) or 0.0001972P

e) Annual insurance is 0.2 x 1.42P ÷ 1,800 hr or 0.000016P

Therefore, hourly ownership and operating without fuel is 2 x 0.0001972P + 0.000016P 0.00041P, and daily ownership and operatin cost without fuel is 8 x 0.0041P or 0.0033

The above factors do not include import duty, which if paid, would increase these factors by about 25 percent. As noted, the 15 percent surcharge tax and 5 percent development tax have not be considered either. If all these duties, fees, and taxes were included, these factors would increase by 50 percent.

2) Fuel Costs

The import duty on diesel fuel (about 20 percent) is included herein. Diesel cost per 1,000 liters delivered in Juba from Kenya is Ksh 2,292 (US $266), or US $1.00 per US gallon. Assum fuel and servicing (lube & oil) is US $1.25 per gallon of fuel consumption.

3) The equipment ownership and operating cost analysis is shown in Table H-2 and is based on the estimated cost of equipment in the US and the fuel consumption of each piece of equipment.

2. Daily Labor Salary Cost Analysis

The analysis of salaries for different classifications of construction workers is provided below for both expatriate personnel and local Sudanese.

<u>GIVEN</u>: 1) Assume that the foreman and one operator from each fleet of heavy equipment (dozers, scrapers, etc.) are US expatriate personnel and that the other heavy equipment operators are third country nationals. Assume also that light equipment operators, truck drivers, journeymen, and laborers are Sudanese.

Table H-2

Equipment Ownership and Operating Costs

Description	Purchase Price (000 US$)	Daily Cost Without Fuel US$/day or (0.0033P)	Diesel Fuel Consumption	Fuel & Services Cost at 1.25 US$/ Gal of Fuel Consumption	Total Cost Per 8hr. day in US$	Say: US$
Concrete Mixer	2	7	1	1.25	8.25	9
Concrete Vibrator and Generator	2	7	1	1.25	8.25	9
Chain Saw	2	7	1	1.25	8.25	9
Compactor Pneu. 15f	35	115	30	37.50	52.50	160
Compactor, Hand	2	7	1	1.25	8.25	9
FE Loader, 3cy	60	198	30	37.50	235.50	240
Grader, 135 hp	70	231	30	37.50	268.50	275
Tractor, 100 hp	60	198	25	31.25	229.25	235
Tractor Dozer, 200 hp	110	363	60	75.00	438.00	450
Tractor Scraper, 12cy	20	66	-	-	66.00	70
Truck, Dump, 12cy	50	165	30	37.50	202.50	210
Truck, Service, st	7	23	10	12.50	35.50	40
Truck, Water, 1750 gal	13	43	20	25.00	68.00	70
Roller, Sheepsfoot	15	50	-	-	50.00	50
Backhoe	50	165	35	43.75	208.75	215
Roller, Pneumatic	12	40	30	37.50	77.50	80

2) Project works 8 hrs/day, six days/week, or 26 days per month.

3) Days off the job are as follows:

a)	Official holidays	16
b)	Discharge pay 2 x 7 days, assume 2 discharge/man/year	14
c)	Weather and others	30
d)	Annual leave, 50% get annual leave ½ x 15 days	8
	subtotal	68

or 68 ÷ 12/yr - 5.7 days/month off

4) Private industry pays 25% more than official government rates.

5) Accident insurance is 10% above base pay, and other allowances are 5% above base pay.

6) Third country heavy equipment operators earn US $1,500 per month (US $60/day), and US expatriate operators earn US $3,000 per month (US $115/day). Assume that there are five third country nationals for each US expatriate. Average operator's salary = (5 x 60) + (1 x 115) = $70/day

FIND: Daily salary.

CALCULATION: The effective daily rate for Sudanese is:

$$\frac{1.15 \times (\text{monthly base} + 25\%)}{(26 \text{ days} \times 5.7 \text{ days})}, \text{ or } 0.071 \times \text{monthly base}$$

Table H-3

Construction Workers' Salaries

Category	Monthly Sudanese Base Salary	Daily Salary: Adjusted x LS 0.07	Daily Salary: In US $[1]	Daily Salary: US $ Rounded[2]
Sudanese				
Foreman	64.80	4.60	9.20	11.00
Light equip. operator	56.30	4.00	8.00	9.00
Truck driver	42.60	3.02	6.04	7.00
Laborer	28.00	2.00	4.00	4.50
Carpenter/steel worker	64.80	4.60	9.20	11.00
Expatriate				
Foreman				115
Heavy equip. operator				70

[1] US $1 = LS 0.50.

[2] Rounding accounts for nominal overtime paid at 1½ times straight time and breakfast break.

B. Direct Cost of Rehabilitation and Construction

The direct cost, the first item in the contract price, is the Contractor's cost of resources (equipment, fuel, materials, and labor) required to rehabilitate the road and construct the facilities at Rumbek. When combined together, the resources are quoted as a unit price to undertake a certain function: for example, it costs $3.30 to excavate, haul, place, and compact 1 cubic meter of road surface material. The unit price is determined by estimating the cost per day for the operation (cost of equipment, fuel, and labor) and dividing it by a daily production rate for the task. The estimated unit cost, when applied to the estimated quantity of surface material required, yields the direct cost. The quantity estimates are explained in following sections under each of the tasks required to rehabilitate the road and construct the center.

The following analysis also yields the number of days required for certain tasks and the total value of the resources (equipment, fuel, labor, and materials) required to complete the task. Some of the tasks do not lend themselves to this analysis, such as "Road Rehabilitation Task 1, Preliminary and Provincial Sums." In such cases, only lump sum costs are provided without the accompanying resource breakdown.

1. Road Rehabilitation

The resources required to rehabilitate the road are provided below. Ten tasks are identified, and the equipment, fuel, labor, and materials are estimated for tasks 2 through 7 and 9. The estimated cost of tasks 1, 8, and 10 are determined on a different basis, as will be explained.

The tasks are shown below under a broader engineering heading.

<u>Mobilization</u>

Task 1. Determine Preliminary and Provisional Sums

<u>Site Preparation</u>

Task 2. Clear and Grubb

<u>Earthwork</u>

Task 3. Strip Top Soil

Task 4. Excavate Unsuitable Materials

Task 5. Excavate and Embank

Task 6. Haul Materials in Excess of 1 Kilometer

<u>Surface Course</u>

Task 7. Place Select Surface Course

<u>Structures</u>

Task 8. Install Culverts

<u>Drainage</u>

Task 9. Excavate, Grade, and Shape Ditches

<u>Miscellaneous</u>

Task 10. Perform Miscellaneous and Auxiliary Works

The following analysis provides the quantity, unit cost, estimated cost, number of days to complete, and cost breakdown of these tasks.

TASK 1: PRELIMINARY AND PROVISIONAL SUMS

A. Quantity Estimate

Item	Lump Sum Price in US $
Provide and maintain portable office accomodation for the Consultants, say:	150,00
Provide, furnish, and maintain portable soils and materials laboratory, say:	75,00
Provide and maintain living accommodation and provide life support for Consultants (5 people x 32m + 1 person x 36m) x 30 days x 200/day	1,176,00
Provide and maintain multiple living units for government inspectors and technicians (30 people x 32m x $100/mo)	96,00
Provide for the purchase, maintenance, and running cost of vehicles for the engineer and inspectors 12 vehicles x $10,000 = 120,000 plus maintenance 12 x $ 5,500/yr x 3.5 yrs = $231,000	351,00
Allowance for provisional items not specified above	250,00
Total	$2,098,00

It is estimated that the above items will be on site and operational within three months of the signing of the rehabilitation contract. The maintenance and life support will be continuous for the life of the contract.

B. Unit Cost

Operating Costs		Labor		
Equipment	Fuel	Expatriate	Local	Materials
$148,000	$113,600	$2,300	$29,000	$1,805,100

TASK 2: CLEARING AND GRUBBING

A. Quantity Estimate

Item	Quantity
Existing depressed and rolling sections (270km) require average of 2m wide additional clearing, or	
2m x 270km x 1,000m/km ÷ 10,000m^2/ha	54 ha
Existing elevated section (170km) requires 4m clearing at toe for extension of embankment plus 2m on slope face, or	
6m x 170km x 10,000 m/km ÷ 10,000m^2 ha	119 ha
New flyoffs (220km) 4 required per km each 3m wide 40m long, or	
3m x 40m x 4/km x 220 km ÷ 10,000m^2/ha	11 ha
Borrow area (average one every 10 km) requires 2.0 million m^3 embankment and surface course from depth of 2½m to 3m, say 2.75m allow 20% for working space, or	
2.0 million m^3 ÷ 2.75m x 1.20 ÷ 10,000m^2/ha	87 ha
Subtotal	271 ha
Say:	280 ha

B. Unit Cost

		Cost in US $				
		Unit Rate				Tota
No.	Item	Equip.	Labor	Labor	Equip.	per D
1	Foreman	-	115	115	-	115
1	Service truck	40	7	7	45	56
1	Tractor dozer 200 hp	450	70	70	450	520
15	Laborers	-	4.5	68	-	68
1	Chain saw	9	7	7	9	16
	Miscellaneous	-	-	-	-	10
	Total					781

Daily production, say: 4 ha

Unit cost, say: $195/ha

TASK 2: CLEARING AND GRUBBING (continued)

C. Estimated Cost

280 ha x $195/ha = $54,600

D. Days to Complete Task

280 ha ÷ 4 ha/day = 70 days

E. Cost Breakdown

Operating Costs		Labor	
Equipment	Fuel	Expatriate	Local
$29,100	$6,100	$13,000	$6,400

TASK 3: STRIP TOP SOIL

A. Quantity Estimate

Item		Quantity
Elevated areas under 1.0m (150km) average 4m wide by 10cm deep		
4m x 0.10m x 150km x 100m/km		$60,000m^3$
Elevated areas over 1.0m (20km) average 4m wide by 20cm deep		
4m x 0.20m x 20km x 1,000m/km		$16,000m^3$
Borrow areas (109 ha) average 10cm deep		
109 ha x $1,000m^3$/ha x 0.10m		$109,000m^3$
	Subtotal	$185,000m^3$
	Say:	$185,000m^3$

B. Unit Cost

		Cost in US $				
		Unit Rate				Total
No.		Equip.	Labor	Labor	Equip.	per Day
½	Foreman	-	115	58	-	58
1	Tractor 200 hp	450	70	70	450	520
½	FE loader	240	70	35	120	155
½	Truck, dump	210	9	4	105	109
2	Laborers	-	4.50	9	-	9
	Total					851

C. Estimated Cost

$185,000m^3$ x $1.70/$m^3$ = $314,500

D. Days to Complete Task

$185,000m^3$ ÷ $500m^3$/day = 370 Days

E. Cost Breakdown

Operating Costs		Labor	
Equipment	Fuel	Expatriate	Local
$201,500	$41,600	$60,300	$11,100

TASK 4: EXCAVATE UNSUITABLE MATERIAL

A. Quantity Estimate

Item	Quantity
Culvert extensions average 4m wide by 4m long by 1.0m deep and 80 units, or	
4m x 4m x 1m x 80	1,280m^3
Say:	1,300m^3

B. Unit Cost

		Cost in US $				
		Unit Rate				Tota
No.	Item	Equip.	Labor	Labor	Equip.	per D
½	Foreman	-	115	58	-	58
½	FE loader	240	70	35	120	158
½	Backhoe	215	70	35	108	143
1	Dump truck	210	9	9	210	219
10	Laborers	-	4.5	45	-	45
	Tools	-	-	-	-	25
	Total					648

Daily production, say: 200m^3

Unit cost, say: \$3.25/m^3

C. Estimated Cost

1,300m^3 x \$3.25/m^3 Say \$4,300

D. Days to Complete

1,300m^3 ÷ 200m^3/day = 7 days

E. Cost Breakdown

Operating Costs		Labor	
Equipment	Fuel	Expatriate	Local
\$2,500	\$500	\$900	\$400

TASK 5: EXCAVATION AND EMBANKMENT

A. Quantity Estimate

Item	Quantity
Depressed section (140km) 60cm fill required on average over 6.5m roadway and 2.5m slope, or	
0.60m x 9m x 140km x 1,000m/km	756,000m^3
Rolling section (130km) 35cm fill required on average over 6.5m roadway and 1.5m slope, or	
0.35 x 8m x 130km x 1,000m/km	364,000m^3
Grade rise under 1.0m (150km) replace 10cm strip plus average 35cm on a total of 3m adjacent to existing embankment, or	
45 x 3m x 150km x 1,000m/km	202,500m^3
Grade rise over 1.0m (20km), assume 2.5m high average by 3m wide, or	
2.5m x 3m x 20km x 1,000m/km	150,000m^3
Subtotal	1,472,500m^3
Say:	1,500,000m^3

B. Unit Cost

		Cost in US $				
		Unit Rate				Total
No.	Item	Equip.	Labor	Labor	Equip.	per Day
1	Foreman	-	115	115	-	115
10	Laborers	-	4.50	45	-	45
2	Sheepsfoot roller	285	70	140	570	710
1	Pneumatic compactor	160	9	9	160	169
1	Dozer, 100 hp	235	9	9	235	244
2	Grader	275	70	140	550	690
2	Tractor/scrapers	520	70	140	1,040	1,180
2	Water trucks	70	9	18	140	158
1	Service truck	40	7	7	40	47
1	FE loader	240	70	70	240	310
	Miscellaneous					50
	Total					3,718

Daily production, say: 1,500m^3

Unit cost, say: $2.50/m^3

TASK 5: EXCAVATION AND EMBANKMENT (continued)

C. Estimated Cost

$1,500,000m^3 \times \$2.50/m^3 = \$3,750,000$

D. Days to Complete

$1,500,000m^3 \div 1,500m^3/day = 1,000$ days

E. Cost Breakdown

Operating Costs		Labor	
Equipment	Fuel	Expatriate	Local
$2,591,000	$456,000	$605,000	$98,000

TASK 6: HAUL MATERIAL IN EXCESS OF 1 KILOMETER

A. Quantity Estimate

Item	Quantity
Total embankment is 1,500,000m^3, Borrow area average every 10km and adjacent to the road. Free haul of 1km either side and longest haul 5km. Haul cost incurred between 1km and 5km on average 3km to haul 4/5 of materials, or	
3km x 4/5 of 1,500,000m^3	3,600,000m^{3}km
Say:	3,600,000m^{3}km

B. Unit Cost

No.	Item	Cost in US $ Unit Rate Equip.	Unit Rate Labor	Labor	Equip.	Total per Da
1	Foreman	-	115	115	-	115
2	Foreman, local	-	11	22	-	22
1	Fuel truck	70	9	9	70	79
1	Service truck	40	77	7	40	47
5	Laborers	-	4.50	23	-	23
6	Dump trucks	210	9	54	1,260	1,314
	Total					1,600

$1,600 ÷ 6 trucks, say: $270/truck

Efficiency, assume 50 mins/hr - 15 mins = 35 mins, or 0.6 hrs.

Average speed $\frac{60 \times 2}{40}$ is mins/km - 0.6 = 5 mins/km

Distance in one day $\frac{60}{5}$ is 12km/hr x 8 hrs = 96km/day

Cost per km per truck $270/truck ÷ 96km/day = $281/km/truck/day

Cost per m^3 - km 12m^3 lose = 10m^3 compacted

$2.81 - 10m^3/truck = $0.28/m^3 - km

TASK 6: HAUL MATERIAL IN EXCESS OF 1 KILOMETER (continued)

C. Estimated Cost

$3,600,000m^3$ - km x $0.28/m^3$ - km = $1,008,000

D. Days to Complete

($3,600,000m^3$ - km ÷ $10m^3$) ÷ (96km/day/truck x 6 trucks

360,000 trips ÷ 576 = 625 days

E. Cost Breakdown

Operating Costs		Labor	
Equipment	Fuel	Expatriate	Labor
$687,700	$164,000	$71,900	$84,400

TASK 7: PLACE SELECT SURFACE COURSE

A. Quantity Estimate

Item	Quantity
Twenty cm surface course for full 440km over full roadway width of 6.5m	
0.2m x 6.5m x 440km x 1,000m/km	572,000
	Say: 575,000

B. Unit Price

1. Earthwork

No.	Item	Cost in US $ Unit Cost Equip.	Unit Cost Labor	Labor	Equip.	Total per Day
1	Foreman	-	115	115	-	115
1	Asst. Foreman	-	11	11	-	11
10	Laborers	-	4.50	45	-	45
2	Tractor-scrapers	520	70	140	1,040	1,180
1	FE loader	240	70	70	240	310
2	Pneumatic Compactor	160	9	18	320	338
2	Sheepsfoot roller	285	70	140	570	710
3	Dump trucks	210	9	27	630	657
2	Water trucks	70	9	18	140	158
1	Fuel truck	70	9	9	70	79
2	Service truck	40	7	14	80	94
2	Graders	275	70	140	550	690
	Miscellaneous					50

Daily production, say: 1,500m^3

Unit cost, say: \$2.56/m^3

2. Haul Cost

Assume that materials are found in borrow areas located 10km apart. Average haul would therefore be 2.5km. Use same haul rates as for embankment, or

$$\$0.28/m^3 - km \times 2.5km = \$0.70/m^3$$

Unit cost to excavate haul and place select surface course is

$$\$2.56/m^3 + \$0.70/m^3 = \$3.26/m^3$$

Say: \$3.30/m^3

TASK 7: PLACE SELECT SURFACE COURSE (continued)

C. Estimated Cost

$575{,}000 m^3 \times \$3.30/m^3 = \$1{,}897{,}500$

D. Days to Complete

$575{,}000 m^3 \div 1{,}500 m^3/day = 383$ days

E. Cost Breakdown

Operating Costs		Labor	
Equipment	Fuel	Expatriate	Local
$1,272,100	$278,300	$270,000	$77,100

TASK 8: INSTALL CULVERTS

A. Estimated Cost and Quantities

Item	Concrete m^3 Unit	Concrete m^3 Total	Cost in US $ Unit[1]	Cost in US $ Total
Single pipe culvert (18), replace with 1.0m Ø CMP plus 10% new culverts. Total 20 x 7m long			1,500	30,00
Multiple pipe culverts (25) average 4 each, say ½ are extended only by 3.5				
Total extended 12 x 4 = 50			9,000	45,00
Assume ½ + 10% are new, 1.0m Ø CMP, or 60			1,500	90,00
Single box culverts (2) replace with 1.5m x 1.0m	22	44	5,000	10,00
Multiple box culverts (11) extend 5 by 3.5m				
2 double box -1.5m x 1.0m	22	45	4,500	9,00
3 triple box -1.5m x 10m	30	90	6,600	19,50
Replace: ½ + 10%				
2- double box 1.5 x 10m	45	90	9,000	18,00
3- triple box 2.0 x 1.5m	110	330	24,000	72,00
2- triple box 2.5 x 2.0m	150	330	32,000	64,00
Minor bridge repairs		200		50,00
Total		1,099		407,50

[1] Taken from recent bid prices in Sudan adjusted for conditions in project area.

TASK 8: INSTALL CULVERTS (continued)

B. Unit Cost to Install, not including material costs

No.	Item	Cost in US $ Unit Rate Equip.	Unit Rate Labor	Labor	Equip.	Total per Day
1	Foreman	-	115	115	-	115
2	Carpenters	-	11	22	-	22
1	Steel worker	-	11	11	-	11
20	Laborers	-	4.50	90	-	90
1	Concrete mixer	9	7	7	9	16
2	Vibrators	9	7	14	18	32
1	Water truck	70	9	9	70	79
2	Finishers	-	11	22	-	22
	Miscellaneous					50
	Total					437

Daily production, say: $20m^3$/day

Unit cost to install, say US $21.85/$m^3$

1,099m cost $375,000, or $341/$m^3$; material costs are about $320/$m^3$.

C. Days to Complete

Box culverts, 1,099m^3 ÷ 20m^3/day		55 days
Pipe culverts	644m ÷ 14m^3/day	46 days

D. Cost Breakdown

Operating Costs		Labor		
Equipment	Fuel	Expatriate	Local	Materials
$7,100	$2,700	$11,600	$13,800	$372,300

TASK 9: EXCAVATE, GRADE, AND SHAPE DITCHES

A. Quantity Estimate

Item	Quantity
Drainage: average flyoff problem area (220km) 1.5m wide by 40m long by 50cm deep, say: 4 per km, or	
1.5m x 40m x 0.5m x 220km x 4/km	26,400m^3
Say:	28,000m^3

B. Unit Cost

No.	Item	Cost in US $ Unit Rate Equip.	Unit Rate Labor	Labor	Equip.	Total per Day
1	Foreman	-	115	115	-	115
½	Backhoe	215	70	35	108	142
½	FE loader	240	70	35	120	155
1	Dump truck	210	7	7	210	217
1	Grader	275	70	70	275	345
10	Laborers	-	4.50	45	-	45
	Miscellaneous					40
	Total					1,059

Daily production, say: 50m^3

Unit cost, say: \$21.00/m^3

C. Estimated Cost

28,000m^3 x \$21.00/m^3 \$588,000

D. Days to Complete

28,000m^3 ÷ 50m^3/day 560 days

E. Cost Breakdown

Operating Costs		Labor	
Equipment	Fuel	Expatriate	Local
\$339,900	\$65,000	\$142,800	\$40,300

TASK 10: MISCELLANEOUS AND AUXILIARY WORKS

Say: $250,000 lump sum.

The following is a possible distribution of the resources for this task:

Operating Costs		Labor		
Equipment	Fuel	Expatriate	Local	Materials
$63,000	$24,700	$2,300	$10,000	$150,000

2. Rumbek Center Construction

The estimated cost of the workshop compound and facilities, the three houses for technical assistants, and the resource requirements are shown in Tables H-4, H-5, and H-6, respectively. These costs are estimated on a cost per square meter basis or on a lump sum basis based on recent bid prices. The total cost of the Rumbek center construction is approximately $753,000.

3. Workshop Equipment - Rumbek Center

The workshop tools and equipment for the Rumbek center will be procured and installed by the Contractor. It is included here as a direct cost. However, in estimating the contract price, this cost item will be added in, as other contract costs and 5 percent of the value will be added to cover the Contractor's handling and installation costs. This is discussed further below.

A detailed list of new shop tools and equipment is shown in Table H-7. This list includes nomenclature, quantities, unit FOB prices, and total FOB price. The total estimated delivered cost on-site is $128,663, which has been broken down in Table H-8.

Table H-8

Cost Estimate for New Shop Tools and Equipment

	US $
Basic tools and equipment, FOB/factory	86,293
Spare parts (5% of tools and equipment FOB/factory)	4,315
Subtotal (P)	90,608
Ocean freight, insurance, U.S. Port to Mombasa (33% of P)	29,901
Subtotal, CIF/Mombasa	120,509
Total, delivered price, Rumbek (1.42 x P)	$128,663

It is suggested that detailed purchase specifications be prepared by the Consultant and that a minimum of 5 percent of the FOB factory price, or $4,315, of the shop equipment be used for appropriate spare parts. The specifications should make it clear to the suppliers that these spares must accompany the basic equipment.

Table H-4

New Workshop Compound & Facilities

Type I Buildings	Area (M^2)	Cost M^2 (US $)	Total (US $)
Control office/classroom	200	300	60,00(
Gate houses (2)	32	275	8,80(
Receiving & final inspection offices (2)	32	275	8,80(
Parts storage & issue	200	225	45,00(
Engine/fuel inj. testing	64	300	19,20(
Engine overhaul shop	80	275	22,00(
Electrical shop	40	275	11,00(
Battery room	40	275	11,00(
Paint shop	50	275	13,75(
POL office	25	275	6,87!
Generator Building	25	300	7,50(
Subtotal			213,92!
Type II Building			
General repair shop	750	250	187,50(
Subtotal			187,50(
Type III Buildings			
Welding, blacksmithing, & radiator repair shop	80	150	12,00(
Body repair shop	80	150	12,00(
Carpentry & upholstery shop	64	150	9,60(
Subtotal			33,60(
Subtotal buildings			435,02!
Support Facilities			
Site preparation 25,000 m^2 @ $1.00/$m^2$			25,00(
Perimeter fencing 650 lm @ $45/lm			29,25(
Well, pump & motor			10,00(
Water tank, 40,000 l			15,00(
Septic tank/drain field			10,00(
Subtotal support facilities (approx.)			$ 88,25(
Total Workshop Compound and			

Table H-5

Cost per House for Technical Assistant's Housing Compound

Item	US$
Pre-fabricated, RC, 3-bedroom house, complete w/plumbing, apliances, & furniture CIF/Rumbek	62,050
Site preparation, LS	500
PCC floor slab	850
Water tank	4,000
Septic tank drain field	1,200
Generator, 15 KW	8,000
Total (approx.)	$ 76,000

Note: Three houses are planned; therefore, the total cost for the three house compound is estimated to be 3 x 76,000, or $228,000.

Table H-6

Resources Requirement for Rumbek Center
(000 US$)

Item	Days to Complete	Operating Costs		Labor		
		Equip.	Fuel	Expatriate	Local	Materia
Buildings	100	7.8	2.8	12.6	14.8	397.0
Bldg.support	30	1.5	0.7	2.6	3.0	80.5
TA housing	45	-	-	3.0	0.9	186.0
TA support	8	1.5	0.3	1.5	0.9	35.4
Total		10.8	3.8	19.7	19.6	698.9

Table H- 7

Proposed Workshop Equipment

Item No.	Quantity	Item	Unit Price (FOB) (US$)	To Pr (F (U
1	6	Tool set, general purpose	1,000	6,
2	4	Wrench, torque,3/4" sq. drive	350	1,
3	4	Tools, socket set, 3/4" drive	450	1,
4	2	Wrench, oil filter	15	
5	1	Wrench, giant adj., 24"	125	
6	1	Wrench, giant adj., 36"	140	
7	4	Timing light, ignition	50	
8	1	Analyzer, engine, universal	2,500	2,
9	1	Tester, voltage, amp, portable	350	
10	1	Tester, armature	135	
11	2	Tester, compression, gas & diesal	175	
12	1	Tester, fuel injection	1,025	1,
13	3	Ignition wrench set	25	
14	4	Spark plug gauge set	10	
15	1	Spark plug cleaner	150	
16	1	Glaze breaker, engine cylinder	30	
17	1	Ring groove cleaner, engine	15	
18	2	Ring compressor	15	
19	2	Ring spreader	15	
20	1	Grinder, valve seat	900	
21	1	Reamer, ridge, cylinder	250	
22	1	Valve refacer	700	
23	1	Hone, connecting rod	75	
24	1	Hone, engine cylinder HD	175	
25	1	Tester, battery, 600 amp. capacity	325	
26	1	Charger, battery, constant current	500	
27	1	Water distillation unit	100	
28	4	Hydrometer/thermometer	20	
29	1	Carrier, battery	25	
30	4	Filler bulb, battery	5	
31	4	Pliers, battery cable terminal	5	
32	4	Brush, battery terminal	2	
33	4	Filler, battery	5	
34	2	Apron, acid-proof	10	
35	2	Pair, gloves, acid-proof	5	
36	4	Set, jumper cables	5	
37	1	Brake reliner	375	
38	3	Brake-spring pliers	5	
39	1	Balancer, wheel, static	250	
40	1	Wheel alignment set, light duty	300	
41	1	Tire demounter, air oper, HD	2,200	2,
42	2	Tire inflator w/gauge	50	
43	4	Tire pressure gauge	10	

Table H-7 (continued)

Best Available Copy

Item No.	Quantity	Item	Unit Price (FOB) (US$)	Tota Pric (FOB (US$
46	3	Wheel lug wrench, 4-way, HD	15	4
47	1	Vulcanizer	15	1
48	1	Welding set, elec., 160 amp, port.	2,200	2,20
49	1	Welding set, O & A, portable	350	35
50	1	Set, body and fender tools	450	45
51	1	Set, blacksmithing tools	500	50
52	1	Set, body repair jacks, hyd.	325	32
53	1	Forge, electric	750	75
54	2	Anvil, 500-700 lbs	200	40
55	1	Pipe bender	50	5
56	2	Metal snips (shear set)	10	2
57	1	Grinder, disc type, elect., port.	150	15
58	1	Grinder, bench type, electric	180	18
59	1	Sander, electric, portable	50	5
60	1	Drill, electric, ½", w/2 sets drills	125	12
61	1	Drill, electric, 3/4", w/2 sets drills	250	25
62	8	Hacksaw frame, hand, w/blades	5	4
63	2	Bolt cutters, HD	25	5
64	3	Blow torch	15	4
65	3	Soldering gun, electric, HD	50	15
66	1	Punch & chisel set	15	1
67	1	Extractor, screw/bolt/stud	5	
68	1	Set, C-clamps, steel, deep-throat	25	2
69	1	Set, pipe & adjustable wrenches	30	3
70	1	Set, paint spray gun, 1 L capacity	50	5
71	1	Set, tap & die, Engl. & metric	1,100	1,10
72	1	Set, micrometers, 1-6" outside	240	24
73	1	Set, micrometers, 1-6" inside	135	13
74	1	Set, calipers, 1-6" Engl. & metric	50	5
75	2	Set, master feeler gauge	60	12
76	1	Set, carpentry tools	300	30
77	1	Sewing machine, HD	800	80
78	1	Set, sailmaker's & upholstery needles	20	2
79	1	Electric engraver, vibrating	30	3
80	1	Set, steel stamping, ltrs & nos.	25	2
81	1	Set, hollow punches	10	1
82	1	Set, comb. center drill & counter-sink, 1/8", 3/16", ¼", 5/16", & 7/16"	40	4
83	1	Set, screwdrivers, sq. & Phillips	10	1
84	4	Pliers, snap-ring	5	2
85	4	Vise, bench type, 6"	80	32

Table H-7 (continued)

Item No.	Quantity	Item	Unit Price (FOB) (US$)	To Pr (F (U
86	1	Vise, drill press	75	
87	1	Vise, blacksmith's	40	
88	1	Vise, comb. pipe & bench	30	
89	1	Vise, tool room, 4½"	20	
90	1	Vise, bench, chain	20	
91	1	Vise, woodworking, 10½"	20	
92	1	Engine, lift sling	10	
93	1	Stand, engine/trans. repair	125	
94	1	Stand, generator/alternator test	50	
95	12	Stand, safety	40	
96	2	Jack, hydraulic, floor 5 T	150	
97	2	Jack, hydraulic, floor 10 T	200	
98	2	Jack, hydraulic, floor 12 T	300	
99	1	Dolly, dual-wheel	400	
100	1	Hoist, ratchet, hand 3 T	350	
101	1	Hoist, ratchet, hand 1.5 T	240	
102	4	Grease gun, hand	15	
103	2	Pump, suction , for oil recovery	20	
104	2	Pump, rotary, hand	25	
105	3	Set, oil filter measure	5	
106	4	Set, funnel	5	
107	6	Fuel can w/nozzle	10	
108	2	Helmet, welding (arc)	10	
109	4	Goggles, welding (O & A)	5	
110	8	Face shield, general purpose	10	
111	4	Set of general shop supplies: creepers; trouble lights; hammers; crowbars; wrecking bars; tape & steel rules (Engl. & metric); pipe taps; cutters & reamers; tubing; fittings, etc.	300	1
112	1	Kit, tire patching, for all sizes	500	
113	2	Sledge hammer, 8 lbs	15	
114	2	Sledge hammer, 10 lbs	15	
115	8	First aid kit	25	
116	12	Fire extinguishers, dry powder	25	
117	12	Fan, extractor, 18" Ø	60	
118	100	Bin, Spare parts storage, steel	10	1
119	15	File, Cardex, stock record card	75	1
120	3	Typewriter, 14", 18", & 24"	450	1
121	1	Photocopier, plain paper	750	
122	4	Calculator, electronic, rechargeable	50	
123	1	Banding machine w/extra tapes	60	
124	4	Embossing machine w/extra tapes	30	
125	1	Intercom system, 8-station	1,000	1

Table H-7 (continued)

Item No.	Quantity	Item	Unit Price (FOB) (US$)	Total Price (FOB) (US$)
126	1	Lube unit, stationary	4,700	4,700
127	1	Degreasing tank	1,000	1,000
128	1	Compressor, shop, 60 CFM	3,500	3,500
129	1	Generator, 30 KW	12,000	12,000
130	4	Tank, fuel storage, 10,000 L	5,000	20,000
131	1	Pump, gasoline, w/meters, hose & valve	1,200	1,200
132	1	Pump, diesel, w/meters, hose, & valve	1,200	1,200

C. Indirect Costs

These are the Contractor's costs for overhead labor, materials, equipment, rent, insurance, and so forth, which are required to support the rehabilitation and construction operations. The indirect costs are broken down into labor and other overhead costs.

1. Labor

It is estimated that a US contractor would require the US, third country national (TCN), and Sudanese staff shown in Table H-9 to support field operations.

2. Other Overhead

The other overhead items include vehicles for the support team, vehicles to move equipment from site to site, life support (food, lodging, etc.) for the Contractor's personnel, shops and warehouses, home office support, office rental, and bonds and insurance premiums. The estimated costs of these items are shown in Table H-10.

D. Other Contract Costs

Other contract costs include a 10 percent contingency over the direct and indirect cost of rehabilitation and construction; a 10 percent profit factor over all of the above; the cost of workshop tools and equipment, plus 5 percent for handling and installation; and a residual value (SP) of the equipment that the Contractor will turn over to the government at the conclusion of the project.

E. Summary of Contract Price

The estimated value of the rehabilitation and construction contract with a private US construction company is provided in Table H-11. The estimate is based on the Contractor's use of key US personnel and an entirely new fleet of US-manufactured equipment. If the Contractor were permitted to use its existing fleet, the overall contract price could be reduced by as much as 9 percent. If a third country or Sudanese firm were to do the work without US personnel, the overall contract price could be reduced by an additional 10 percent.

F. Resources Requirement Summary

The following is a summary of the resources required under the contract price to rehabilitate the road and construct the Rumbek center.

Labor Costs

		Total Man-Months	Salary Unit	Total US $	Cost in US Foreign Exchange	Cost in US Local Curr
Expatriates on Site						
1 US	Project Manager	36	3,000		108,000	
1 US	Asst. Proj. Manag.	32	2,000		64,000	
1 US	General Super.	36	3,000		108,000	
1 TNC	Office Engineer	33	1,800		59,400	
1 TNC	Field Engineer	32	1,800		57,600	
1 US	Master Mechanic	32	2,000		64,000	
2 TCN	Asst. Mechanic	64	1,500		96,000	
1 US	Office Manager	33	2,000		66,000	
1 TCN	Chief Acc't	33	1,200		37,600	
3 TCN	Clerks	66	750		49,500	
1 TCN	Camp Manager	32	1,500		48,000	
14 US	Benefits only (Soc. Security, insur. workmen's comp., etc.)	457	1,000		457,000	
	Subtotal				1,217,100	
Sudanese on Site						
5	Clerks/Interpreters	165	300		49,500	
2	Survey Parties	64	1,500		96,000	
15	Mechanics	450	300		135,000	
20	Drivers	320	100		32,000	
1	Camp Manager	32	500		16,000	
30	Domestic Camp	1,000	50		50,000	
	Subtotal				378,500	
Juba & Mombasa Offices						
2	Officer Manager	64	1,000	64,000	32,000	3
6	Clerks	192	400	76,000	48,000	2
	Subtotal			[illegible]	[illegible]	[illegible]

Table H-10

Other Overhead Costs

No.	Item	Unit Cost	Cost in US $ Foreign	Local
15	All wheel drive vehicles	10,000	150,000	
10	5-ton flat bed trucks	15,000	150,000	
2	50-ton tractor/lowboy units	45,000	90,000	
14	Expatriate transport (2 trips)	3,600	50,400	
24	TCN transport (1 trip)	1,000	24,000	
14	Expatriate, salary x 10%	1,130,000	113,000	
14	Expatriate, housing & life support (457 months)	5,000	2,200,000	85,00
24	TCN housing & life support (612 months)	500	200,000	106,00
93	Sudanese tech., housing & life support (2,150 months)	50	50,000	57,50
90	Sudanese laborers (3,000 months)	25	25,000	50,00
LS	Shops & warehouse, (9,000m^2 x 400)		1,080,000	
LS	Radios		25,000	
LS	Home office support		200,000	
LS	Office equipment & supplies		100,000	
LS	Juba office rental (32 months)	400		12,30
LS	Mombasa office rental (32 months)	500	16,000	
LS	Survey equipment		30,000	
27	Vehicle maintenance, $5,500/vehicle by 2.75 years		408,000	
	Subtotal		4,911,400	311,30
	Bond & insurance, 3.5% of $25,000,000		875,000	

Table H-11

Contract Price For
Road Rehabilitation and Rumbek Center Construction

Item	Foreign Currency (000 US $)	Local Currency (000 US $)	Total (000 US $)
Direct Cost			
Road Rehabilitation			
Task 1: Prelim. & Prov. Sums	1,787	311	2,098
Task 2: Clear & Grub	48	7	55
Task 3: Strip Top Soils	304	11	315
Task 4: Ex. Unsuitable Materials	4	-	4
Task 5: Ex. & Embankment	3,652	98	3,750
Task 6: Haul Materials	924	84	1,008
Task 7: Surface Course	1,821	77	1,898
Task 8: Install Culverts	394	14	408
Task 9: Ex. & Grade Ditches	548	40	588
Task 10: Misc. & Aux. Works	230	20	250
Subtotal	9,712	662	10,374
Rumbek Center			
Task 1: Constr. Maint. Facility	477	46	523
Task 2: Constr. TA Housing	228	2	230
Subtotal	705	48	753
Subtotal Direct Cost	10,417	710	11,127
Indirect Costs			
Labor	1,297	439	1,736
Other Overhead	5,787	311	6,098
Subtotal	7,084	750	7,834
Subtotal Direct and Indirect Cost	17,501	1,460	18,961
Other Contract Costs			
Contingency @ 10% of DC & IC	1,750	146	1,896
Profit @ 10% DC & IC + Cost $20,857,000	2,086	-	2,086
Workshop Tools & Equipment			
Tools and equipment	129	-	129
5% for installation	6	-	6
Residual Value of Equipment	1,000	-	1,000
Subtotal	4,971	146	5,117
Total Contract Price	22,472	1,606	24,078

Table H-12 gives the kind and number of equipment required, the nationality of the operator, and the cost of the equipment. In addition, the types and nationalities of foremen are given and the government trainee positions for on-the-job taining are proposed.

Table H-13 gives the Contractor's total staff requirement by nationality.

A comprehensive breakdown of resources required for the works appears in Table H-14.

G. Work Schedule

The Construction Contractor is scheduled to begin mobilizing in April 1981. The road rehabilitation work is scheduled to be completed by March 1984, and the Contractor's one-year maintenance liability is scheduled to be over by March 1985. A schedule for each task to be performed by the Contractor is provided in Figure H-1.

III. TECHNICAL ASSISTANCE

An architect/engineering consulting firm will be responsible for providing short- and long-term technical assistance in the four separate but interrelated elements of the project. Short-term TAs will be required for pre-contract engineering (11 people - 34 man-months) and the pre-feasibility study of the port and access road to serve Lakes Province (3 people - 12 man-months). Long-term TAs will be required for construction supervision/inspection (6 people - 190 man-months) and for the following maintenance management and training (3 people - 108 man-months).

Figure H-2 shows the TA positions, scheduling, and man-month efforts. A brief description of the responsibilities of each TA is provided in the following pages.

The estimated cost of the Consultant's contract is based on the estimated requirements for the TA services plus expenses and the estimated delivered price of spare parts, new equipment, and fuel that will be procured for the follow-on maintenance work.

A. Pre-construction Engineering

Short-term technical assistance will be required to: prequalify Contractors; prepare bidding documents; and assist the government in selecting a Contractor.

Table H-12

Summary of Field Staff and Equipment Requirements

Item	Number		Operators/Foremen				Unit Cost	
			Expatriates		Sudanese			
Equipment	Days (Approx)	(Req'd)	US	TCN	Local Hire	Govt.	(000 US	$)
Concrete mixer	100	1			1		5.68	[illegible]
Concrete vibrator	200	2			2		5.68	1[illegible]
Chain saw	70	1			1		5.68	[illegible]
Compactor, pneum.	800	2			2		99.4	19[illegible]
FE loader	800	2	1	1			170.4	34[illegible]
Grader	3,500	6	1	6		1	198.8	1,19[illegible]
Tractor 100 Hp	3,500	6			5	2	170.4	1,02[illegible]
Tractor 200 Hp	2,500	4	1	4		1	312.4	1,24[illegible]
Dump trucks	5,000	10			10		142.0	1,42[illegible]
Service truck	2,500	5			5		19.9	9[illegible]
Fuel truck	1,000	2			2		36.9	7[illegible]
Water truck	3,000	6			6		36.9	221
Scraper	2,500	5					56.8	284
Roller, sheepsfoot	2,500	5					42.6	21[illegible]
Subtotal			3	11	34	4		6,338
Foremen								
Embankment	1,000	2	2			1		
Haul	2,000	4	1		3	1		
Surface course	800	2	1		1	1		
Ditching	500	1	1			1		
Misc; Build. & Ste.	500	1	1			2		
Subtotal			6		4	6		
Subtotal Technicians			9		38	10		
Labor					60			
Total			9		98	10		

Table H-13

Staff Requirements Direct and Indirect Cost

Category	Office				Field		Total	
	Site		Other Location					
	No.	MM	No.	MM	No.	MM	No.	
Expatriates								
US	5	169			9	288	14	
TCN	9	260	4	128	11	352	24	
Local Hire								
Technicians & clerical	436	1,223	4	128	38	1,216	85	2,
Laborers	30	1,000			60	2,000	90	3,

Table H-14

RESOURCES REQUIREMENT SUMMARY

ROAD REHABILITATION AND RUMBEK CENTER CONSTRUCTION

		Estimated Cost (000) US $	Days to Complete (Working days)	Cost Breakdown (000) US $					Resources Breakdown			Currency (000) US $	
				Operating Costs		Labor		Materials & Other Costs	Fuel gal(000)	Labor (man-months)		Foreign Exchange	Local
				Equip.	Fuel	Expatriate	Local			Expatr.	Local		
DIRECT COSTS													
	Road Rehabilitation												
Task 1	Preliminary & Prov. Sums	2,098	650	148	114	2	29	1,805	91	1	320	1,787	311
Task 2	Clearing & Grubbing	55	70	29	6	13	7	-	5	7	59	48	7
Task 3	Strip Top Soils	315	370	202	42	60	11	-	33	37	46	304	11
Task 4	Excav. Unsuitable Matls.	4	7	2	1	1	-	-	-	1	4	4	-
Task 5	Excav. & Embankment	3,750	1,000	2,591	456	605	98	-	365	394	739	3,652	98
Task 6	Haul Materials	1,008	625	688	164	72	84	-	131	31	462	924	84
Task 7	Select Surface Course	1,898	383	1,272	279	270	77	-	223	151	396	1,821	77
Task 8	Install Culverts	408	101	7	3	12	14	372	2	5	143	394	14
Task 9	Excavate, Grade,etc. Ditches	588	560	340	65	143	40	-	52	83	303	548	40
Task 10	Misc. & Aux. Works	250	50	63	25	2	10	150	20	1	103	230	20
	Sub-Total Road D.C.	10,374	650	5,342	1,155	1,180	370	2,327	922	711	2,575	9,712	662
	Rumbek Ctr. Construction												
	Buildings	435	100	8	3	12	38	374	2	9	150	397	38
	Buildings Support Facilites	88	30	2	1	2	8	75	1	2	30	80	8
	Tech. Asst. Housing	190	45	-	-	3	1	186	-	2	9	189	1
	Tech. Asst. Housing Sup.Fac.	40	8	2	-	2	1	35	1	1	9	39	1
	Sub-Total Maint.Ctr. D.C.	753	100	12	4	19	48	670	4	14	198	705	48
	Sub-Total Direct Costs	11,127	650	5,354	1,159	1,199	418	2,997	926	755	2,773	10,417	710
INDIRECT COSTS Sub-Total		7,834	730	665	268	1,297	438	5,166	214	557	2,159	7,084	750
	Total Resources Requirement	18,961	730	6,019	1,427	2,496	856	8,163	1,140	1,312	4,932	17,501	1,460

FIGURE H-1

SCHEDULE OF ACTIVITIES

ROAD REHABILITATION AND RUMBEK CENTER CONSTRUCTION

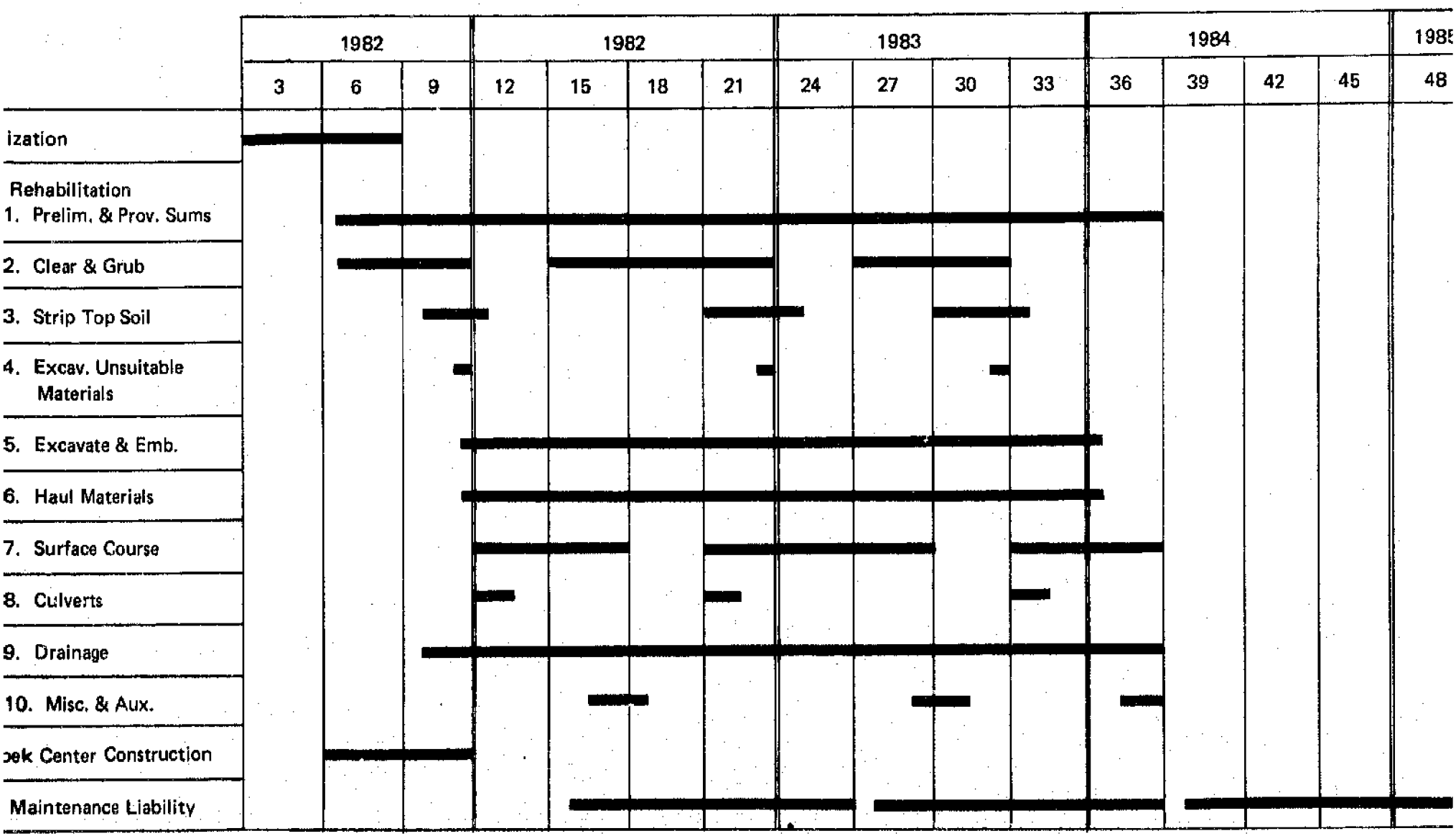
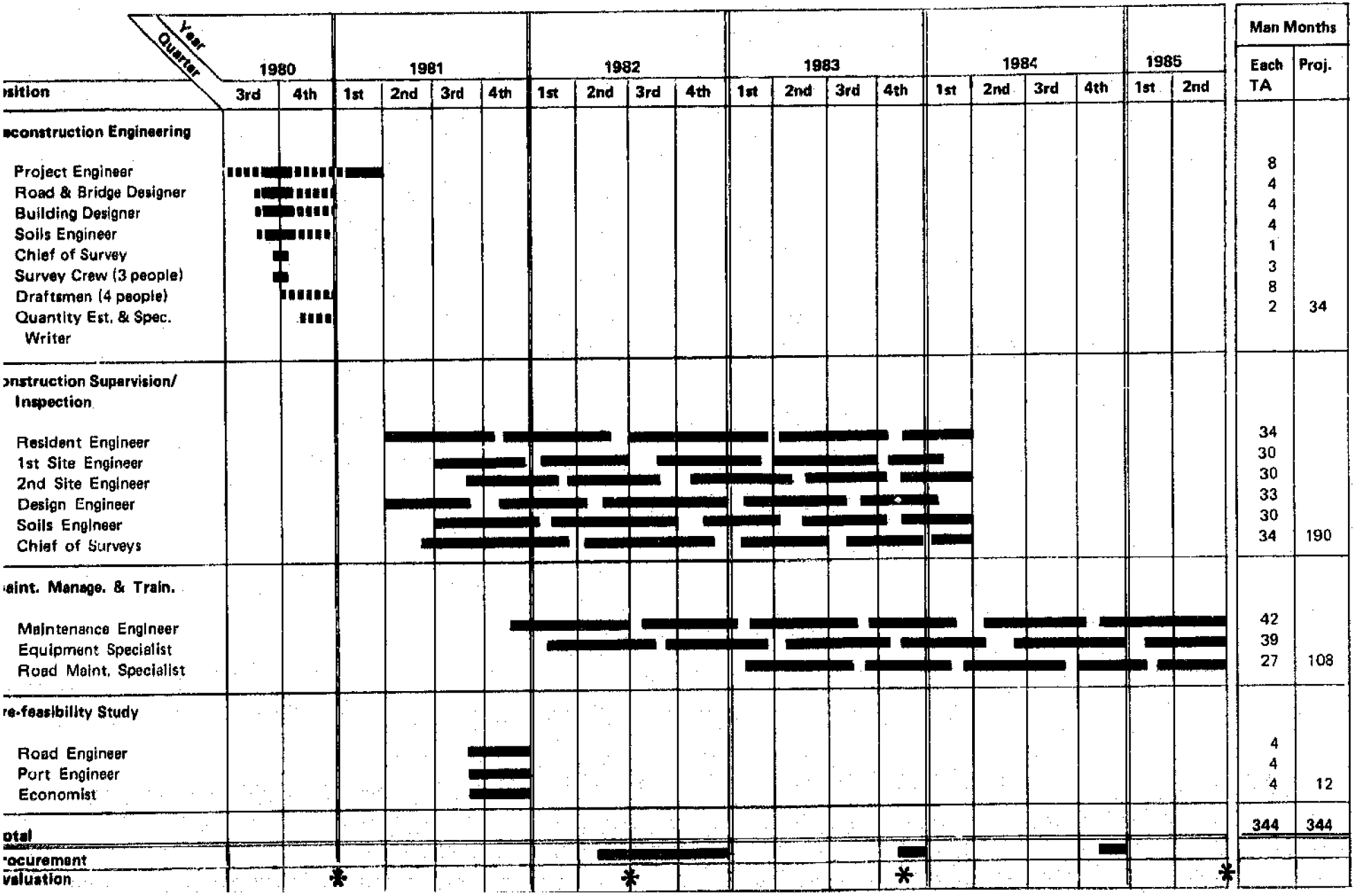


FIGURE H-2

SCHEDULE

TECHNICAL ASSISTANCE STAFFING



Four engineers (20 man-months) and nine supporting technicians (14 man-months) will be required between July 1980 and February 1981.

It will not be necessary to engage in a full-scale engineering design of the project prior to the commencement of the rehabilitation work. However, some field services (8 people - 13 man-months) will be required to collect data in order to prepare a bill of quantities, design the buildings, and develop appropriate standard designs for culverts. There will also be home office services (9 people - 21 man-months) to prequalify contractors, prepare contract documents, and coordinate the bidding documents.

1. Staffing

Following is a brief description of the responsibilities of each member of the pre-construction technical assistance team.

Consultants

Project Engineer (8 man-months)

- Coordinate all field and home office activities
- Prepare pre-qualification documents
- Evaluate pre-qualification data submitted by contractors
- Schedule field investigation
- Approve design criteria
- Direct preparation of bidding documents
- Conduct contractor briefings and road inspection tour
- Assist GOS and AID in selecting Contractor

Road and Bridge Designer (4 man-months)

- Establish criteria for road geometry, plan, and profile
- Prepare and direct road survey program and evaluation data
- Take complete road inventory

- Prepare and direct soils and materials testing program and evaluate data for surface course design

- Prepare typical sections and standard structural drawings for road and bridge work

Building Designer (4 man-months)

- Direct survey and soil testing program for building and other site work at Rumbek center

- Prepare designs for buildings and support facilities at Rumbek, including selection of TA houses

- Establish criteria for quantity estimates and building specifications

Soils Engineer (4 man-months)

- As directed by the road and bridge engineer and the building design engineer, collect samples, make field tests, arrange for and analyze laboratory test results

- Assist the roads and buildings engineer in designing pavement and footings

Technicians

Chief of Surveys & Surveyors (4 people - 4 man-months)

- Direct ground surveys required by road and buildings engineer and document all findings (surveyors are TCNs)

Draftsmen (4 people - home office - 8 man-months)

- Prepare drawings, structural drawings, building designs for bidding documents

Quantity Estimator and Specifications Writer (2 man-months)

- Prepare estimates from road and building drawings and/or preliminary drawings (roads). Prepare specifications, special provisions, general conditions of contract, and other bidding documents as directed by project engineer.

2. Cost Estimates

The estimated cost of the short-term technical assistance required for pre-construction engineering is based on the

positions and schedule of participation shown in the bar chart and is detailed in Table H-15.

B. Pre-feasibility Study

Short-term technical assistance (3 people - 12 man-months) will also be required to undertake the pre-feasibility study of a White Nile port and access road to serve Lakes Province. The team would be in the field between September 1981 and January 1982. The proposed staffing for the study follows.

1. Staffing

Port Engineer (4 man-months)

- Investigate the engineering requirements of a new White Nile port between Shambe and Soi
- Estimate the throughput requirements and facilities requirements for the port
- Coordinate with other team members and prepare report findings

Road Engineer

- Investigate the engineering requirements of an access road from the alternative White Nile port
- Prepare preliminary soils investigation program for soils engineer working on road rehabilitation project
- Prepare preliminary ground survey program
- Coordinate and report

Transport Economist

- Investigate economic justification for White Nile port to serve Lakes Province
- Coordinate and report

2. Cost Estimates

It is assumed that the construction survey and soils teams and their equipment can be used during the feasibility study witho additional cost for services and that vehicles from the supervision fleet will be made available at no additional cost. Table H-16 details the TA costs for the pre-feasibility study.

Table H-15

Pre-construction Engineering: Cost of TA Services and Reimbursable Expenses

	Man-Months	Rate (US $)	Total Cost (US $)
Technical Assistant			
Project engineer	8	7,000/month	56,000
Road and bridge designer	4	6,500/month	26,000
Building designer	4	6,500/month	26,000
Soils engineer	4	5,600/month	22,400
Chief of surveys	1	5,600/month	5,600
TCN surveyers (3)	3	2,000/month	6,000
Draftsmen (2)	8	4,000/month	32,000
Quantity est. & spec. writer	2	5,000/month	10,000
Subtotal	34		184,000
Reimbursable Expenses			
Travel cost US/Juba (4 trips)		2,300/trip	9,200
Travel cost Sudan (3 trips)		1,000/trip	3,000
Life support and trans. Sudan (360 days)		100	36,000
Shipment of survey and other equipment		LS	2,000
Communication		LS	500
Drafting supplies, printing, typing, etc.		LS	10,000
Subtotal			60,700

Table H-16

Prefeasibility Study, Cost of TA Services and Reimbursable Expenses

	Man-Months	Rate (US $)	Total Cost (US $)
Technical Assistant			
Road engineer	4	6,500/month	26,000
Port engineer	4	6,500/month	26,000
Economist	4	6,500/month	26,000
Subtotal	12		78,000
Reimbursable Expenses			
Return airfare US/Sudan (3 trips)		2,300/trip	6,900
Air charter Khartoum/site (1 trip)		5,000/trip	5,000
In-country air transport (3 trips)		130/trip	390
Nile River charters (1 trip)		500/trip	500
Per diem			
Juba/Rumbek/Shambe (180 days)		25/day	4,500
Khartoum (180 days)		92/day	16,560
Typing, printing, etc.			1,500
Miscellaneous			250
Subtotal			35,600
Total (approx.)			114,000

C. Construction Supervision/Inspection

Long-term technical assistance (4 people - 190 man-months) will be required to certify the Contractor's work and provide on-the-job construction supervision training for government personnel (20 people - 640 man-months). The following is a list of TAs and their responsibilities.

1. Staffing

Resident Engineer/Project Manager (34 man-months)

- Responsible for acceptance of all completed work
- Insure the Contractor is adequately staffed, equipped, and organized to undertake the rehabilitation and construction work according to specifications
- Approve change orders
- Certify Contractor's payment certificates
- Order any work to stop that in his judgment is not being completed to specification
- Plan, implement, and administer on-the-job training of government personnel

Site Engineer (2 people - 30 man-months each)

- Supervise the work of the Contractor under the direction of the resident engineer
- Insure that all rehabilitation work is in accordance with specified line and grade
- Order required sampling and testing of materials
- Measure and record all contract item quantities at end of Contractor's work day
- Maintain a daily record of all Contractor's personnel and equipment and number of hours worked, any materials moved on or off the site, work accomplished, time lost because of weather or other conditions, samples taken, and any other relevant entries
- Coordinate with the Contractor's engineer or superintendent regarding work planning and scheduling

- Train and direct government counterparts in performing above inspection work.

Design Engineer (33 man-months)

- Prepare daily work assignment for survey parties

- Train and direct government personnel in the preparation of drawings from survey notes

- Direct the design of alignment and profile to be completed in front of construction works

- Establish invert elevations for culverts and grade for drainage flyoff ditches

- Guide the Contractor in setting out the work

- Estimate quantities from working drawings prepared by Contractor and checked by TA surveys

Soils Engineer (30 man-months)

- Set up and organize the soils testing laboratory and establish routine sampling and tesing procedures in accordance with specifications

- Recommend approval or rejection of all materials to be incorporated into the works

- Train and direct government personnel in all aspects of soils and materials quality control, that is, field sampling, laboratory testing, and analysis of data

Chief of Surveys (33 man-months)

- Organize and train two field survey parties

- Supervise field survey parties in obtaining topographical information for the designer and in checking the Contractor's control points, finished grades, cross sections, ditch layouts, and culvert elevations

- Supervise all measurements for payment and report all current pay item quantities to the site engineer

2. Cost Estimates

The cost of services and reimbursable expenses to get the TAs to and from the project are provided in Table H-17. The costs for offices, transportation, life support (housing and food) are included in the contract price.

Table H-17

Construction Supervision/Inspection: Cost of TA Services and Reimbursable Expenses

	Man-Months	Rate (US $)	Total Cost US $
Long-Term TAs			
Resident Engineer	34	7,000/month	239,000
Site Engineers (2)	60	6,500/month	390,000
Deisgn Engineer	33	6,500/month	214,000
Soils Engineer	30	5,900/month	177,000
Chief of Surveys	33	5,600/month	184,800
Subtotal	190		1,203,800
Reimbursable Expenses			
Air travel NY/Juba, including personal shipment (6 trips)		5,000/trip	30,000
Air travel, leave (6 trips)		2,300/trip	13,800
Air travel, Nairobi (3 each, 18 trips)		250/trip	4,500
Expenses in Nairobi (180 days)		100	18,000
Subtotal			66,300
Subtotal Services + Expenses			1,270,100
10% Contingency			127,000
Total (approx.)			1,397,000

D. Maintenance Management and Training

Long-term technical assistance (3 people - 108 man-months) will also be required to ensure that the road is maintained after the Contractor's liability ends. The focus of this element of the project is a transfer of technology from the provincial roads engineer in Lakes Province to the laborers who will be maintaining the project road. The maintenance program and the introduction of new intermediate technology is discussed previously in Section IV. Following is the list of TAs and their major responsibilities. This list is followed by estimates of the spare parts, equipment, and fuel required for the project.

1. Staffing

Maintenance Engineer (42 man-months)

- Organize and direct the implementation of all workshop and maintenance programs for the Rumbek center and Mundri-Rumbek-Wau road
- Provide day-to-day advice to the Lakes Province road engineer and senior road engineer on the maintenance planning, scheduling, and budgeting of all roads in Lakes Province
- Direct the implementation of intermediate technology roadway maintenance training and improved equipment maintenance and supply systems management at Rumbek center
- Approve the order for spare parts, new equipment, and fuel for the maintenance project

Equipment Maintenance Specialist (Master Mechanic) (39 man-months)

- Provide on-the-job training in diagnosing problems and repairing heavy and light maintenance equipment
- Develop improved workshop organization and procedures
- Prepare the purchase specifications for spare parts for maintenance equipment
- Train and direct the repair of maintenance equipment
- Organize, implement, and direct on-the-job training of equipment inspectors, mechanics, auto electricians, fuel injection specialists, welders, and other equipment maintenance trades

- Conduct preventive maintenance training for all equipment operators, road foremen, mechanics, and drivers

Road Maintenance Specialist (27 man-months)

- Develop, implement, and direct intermediate technology on-the-job training program on the project road with tractors and a pilot program with animal-drawn carts

- Advise the senior road engineer and road supervisors regarding the maintenance of all roads in Lakes Province

2. Spare Parts, Equipment, and Fuel

The maintenance management and training element of the technical assistance program will require the procurement of 1) spare parts for existing deadlined maintenance equipment, 2) new intermediate technology equipment and implements, and 3) fuel to maintain the Mundri-Rumbek-Wau road.

3. Cost Estimates

The cost of the TA services and reimbursable expenses are shown : Table H-18. The costs of spare parts, new maintenance equipment and fuel follows.

a. Spare Parts

The estimated cost of spare parts required for deadlined heavy equipment now stored at Rumbek is as follows:

Equipment

1 Caterpillar 112 motor grader
1 Caterpillar 941B tracked loader

Assumptions

a) Machines are restorable, based on inspection by PP team. Although reportedly acquired in 1974, the loader has apparently seen little service. While the motor grader shows evidence of greater wear, it is believed that a thorough overhaul will render it serviceable.

b) Total present residual value (RV) of US $60,000.

Table H-18

Maintenance Management and Training:
Cost of TA Services and Reimbursable Expenses

Technical Assistant	Man-Months	Rate (US $)	Total Cost (US
Project Manager	42	6,500/month	273,00(
Master Mechanic	39	6,000/month	234,00(
Road Foreman	27	6,000/month	162,00(
Subtotal	108		669,00(
Reimbursable Expenses			
Return airfare including air & surface shipment of goods - avg. family 3 members (9 trips)		14,500/trip	130,50(
Annual R&R to Athens every 6 months or Nairobi every 4 months, 9m-yrs & 3 in family (9 trips)		3,000/trip	27,00(
Annual home leave (7 trips)		6,000/trip	42,00(
Education, allowing 3 away from post or 7 child years		6,000/year	46,20(
Post differential 25% base pay (108 months)		750/month	81,00(
Subtotal			326,70(
Total (approx.)			996,00(

Recommendations

a) Initially, invest 10% of the RV, or $6,000, in parts to restore to service.

b) Plan to purchase at least 50% of the RV, or approximately $30,000, to maintain in service for a three-year period.

c) Disassemble and reassemble the machines as a training exercise under the direct supervision of the master mechanic and his Ministry counterpart (see Annex K).

Estimated Cost

Delivered price = ($30,000 + $6,000) x 1.42 = $51,000

b. New Equipment

It is estimated that the new agricultural tractors and accessory equipment (scarifiers, mould boards, compactors, and trailers) would each cost $22,000 FOB the manufacturer. Three surface maintenance crews would be established and equipped with this maintenance equipment. If it is assumed that 100% of value is required in spares, the estimated delivered price is:

($22,000/crew + 100% of $22,000) x 3 crews x 1.42, or $187,400

c. POL

The estimated cost of petroleum, oil, and lubricants is obtained below from the estimated surface maintenance costs found under the heading "Government Support." The estimated cost is $59,500.

IV. GOVERNMENT SUPPORT

Government support is provided in each of the following areas:

- Land acquisition
- Salaries
  - Rehabilitation trainees
  - Rehabilitation inspectors and technicians
  - Equipment workshop personnel and trainees
  - Road maintenance personnel and trainees

A. Land Value

The estimated fair market value of the land required for the Rumbek maintenance center and TA housing complex is $417,000.

B. Salaries

The salary estimates for government personnel assigned to the road rehabilitation, maintenance center construction, Rumbek equipment repair workshop, and road maintenance crews follow.

1. Road Rehabilitation

The government will assign ten road rehabilitation foremen and heavy equipment operators to the Construction Contractor's team and twenty inspectors, soils technicians, and surveyors to the technical assistance team for on-the-job training. Say the average salary plus relocation allowance is LS 100/mon Then

LS 100/mo x US $2 /LS x 30 people x 32.5 mos. = $195,000

2. Equipment Workshop Rumbek

The government will staff the Rumbek maintenance center with managers, foremen, mechanics, related trades people, storekeepers, and clerks. Say the average salaries are LS 45 per month. Then

LS 45/mo x US $2 /LS x 80 people x 39 mos. = 280,000

3. Road Maintenance

The estimated annual maintenance costs for the 440 kilometer Mundri-Rumbek-Wau road are provided below. It is estimated th semi-skilled and unskilled labor salaries between March 1983 and June 1985 will be $328,000. In addition, hand tools, cart and livestock will have an additional depreciated value of $23,000.

C. Annual Maintenance Costs

The estimated annual cost of maintaining the Mundri-Rumbek-Wau road through the life of the project (June 1985) and through the economic benefit period is provided below. The estimates include replenishing the surface between Rumbek and Wau in 197 and between Rumbek and Mundri in 2002.

1. Agricultural Tractor and Trucks

a) For the annual cost of trucks without fuel, assume the same factors as for construction costs: 1.42P ÷ 4 yrs depreciation straight line, or 0.355P

b) For the annual cost of tractors without fuel, depreciate over 10 yrs: 1.42P ÷ 10 yrs depreciation straight line, or 0.142P

c) For maintenance and repair assume 100% of a and b

d) Annual cost without fuel:

Trucks 0.710P
Agri. tractor 0.284P

e) For fuel and service costs, use same as construction costs, or $1.25 per gallon of fuel consumed

f) Annual cost of maintenance equipment.

Table H-19

Annual Cost of Maintenance Equipment per Crew
(000 US $)

Description	Purchase Price	Annual Cost Without Fuel Trucks/ 0.71P Tractor/ 0.284P	Annual Diesel Fuel Consumption	Fuel & Service Costs @ $1.25/ Gal. Consumed	Tot Ann Cos Eq &
Agri. tractor	14	4.0	2,250	2.8	[illegible]
Agri. tractor implem.	8	2.3	-	-	[illegible]
Truck, water	13	9.2	4,500	5.6	1[illegible]
Truck, flat bed	15	10.6	2,250	2.8	1[illegible]
Truck, service	7	5.0	2,250	2.8	[illegible]
Total	-	31.1	-	14.0	4[illegible]

2. Labor Cost for Surface Maintenance Crew

Assume government wage rates plus 15% insurance and benefits. Then

Annual cost = 1.15 x monthly base x 12 mo/yr x US $2 /LS or 27.6 x monthly base. See Table H-20.

3. Annual Cost for General Maintenance Crew

The annual cost for a general maintenance crew is shown in Table H-21.

4. Livestock, Cart, and Hand Tool Costs

See Table H-22 for a breakdown of annual costs of livestock, carts, and hand tools.

5. Replenishing Laterite

The cost of replenishing laterite is shown in Table H-23.

6. Annual Cost of Maintaining 440 Kilometers

Table H-24 details the annual cost of maintaining 440 kilometers

Table H-20

Annual Cost of Labor per Crew
(000 US $)

Position	Monthly Base (LS)	Annual Rate (27.6 x base)	Number Required	Tot
Foreman	64.80	1.788	1	1.
Small equip. op.	56.30	1.553	3	4.
Mechanic	49.00	1.352	1/3	0.
Assistant mech.	32.10	0.886	1-1/3	1.
Total				8.

Table H-21

Annual Cost per General Maintenance Crew

Position	Monthly Base (LS)	Annual Rate (27.6 x base)	Number Required	Total
Headman	32.10	0.886	1	0.9
Livestock tender	30.00	0.828	1	0.8
Storekeeper	30.00	0.828	1	0.8
Laborers	28.00	0.773	10	7.7
Total				10.2

Table H-22

Annual Cost of Livestock, Carts, and Hand Tools
(000 US $)

Item	Cost Locally Obtained	Depreciation Basis (Years)	Number Required	Total
Bulls	0.400	4	2	0.2
Carts	0.400	4	1	0.1
Hand tools	0.100	½	10	0.5
Total				0.8

Table H- 23

Cost of Replenishing Laterite

No.	Item	Cost in US $ Unit Rate Equipment	Unit Rate Labor	Labor	Equipment	T p D
½	Engineer	-	12	6	-	
1	Foreman	-	11	11	-	
1	Tractor dozer	450	9	9	450	
2	FE Loaders	240	7	14	480	
5	Graders	275	9	45	1,375	1,
2	Compactor pneumatic	160	7	14	320	
2	Sheepsfoot roller	285	9	18	570	
2	Agricultural tractors	15	7	14	30	
15	Truck, dump	210	7	105	3,150	3,
1	Truck, fuel	70	7	7	70	
3	Truck, water	70	7	21	210	
1	Truck, service	40	7	7	40	
20	Laborers	-	4.50	90	-	
1	Mechanic	-	7	7	-	
1	Mechanic, assistant	-	5	5	-	
	Total			373		7,

Daily Production, Say: 2.2km/day
Unit Cost, Say: $3,200/km

Estimated Cost: 440 km x $3,200/km = $1,408,000

Days to Complete: 440 ÷ 2.2 = 200 days

Say, Rumbek-Wau requires replenishing in 13 years after completi or 1995, and Mundri-Wau requires replenishing 17 years after com tion, or 2002.

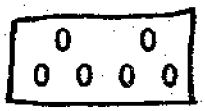
Table H-24

Cost Analysis: 1983 - 2003

Period	Length (km)	Crew type	No.	Unit Cost	Total Cost	Cost. Equip.	Breakdown Fuel	Breakdown Labor
4/1983-	100	Surf.Maint.	1	53.3	40.0	23.3	10.5	6.2
12/1983		Gen. Maint.	5	11.0	41.9	3.0	-	38.2
					81.2	26.3	10.5	44.4
1/1984-	100+	Surf.Maint.	2	53.3	106.6	62.2	28.0	16.4
12/1984	170	Gen. Maint.	14	11.0	154.0	11.2	-	142.8
					260.6	73.4	28.0	159.2
1/1985-	270+	Surf.Maint.	3	53.3	80.0	46.6	21.0	12.3
6/1985	170	Gen. Maint.	22	11.0	121.0	8.8	-	112.2
					201.0	55.5	21.0	124.5
	Total during TA phase:				542.8	155.2	59.5	328.1
1/1985-12/1985					301.0	55.5	21.0	124.5
1986-1994					402.0	111.0	42.0	249.0
1995					1,122.0	760.5	74.5	287.0
1996-2001					402.0	111.0	42.0	249.0
2002					1,087.0	745.1	56.9	285.0
2003					402.0	111.0	42.0	249.0

No salvage value

V. RUMBEK-YIROL-SHAMBE WINDSHIELD SURVEY

Km	
0.0	Rumbek Jct. to Yirol
23.4	Grade rise, 4 meters wide, grass side slopes
24.0	Culvert 1½ meters beginning of swampy area, grade rise 1 - 1½ meters, surface pot holes, embankment eroded, drainage problem
24.4	Culvert 2 meters
24.9	Bridge 25 meters, pipes, and box culvert
25.0	Culvert new
25.1	Small bridge 1 meter
25.2	Culvert new
25.3	Culvert 1 meter
25.4	Culvert 5 pipes, bridge ½ meter, B. culvert
25.7	Culverts, 2 pipes 45cm
25.9	Culverts, 2 pipes 45cm
26.2	Small concrete slab bridge 2 meters, ironstone abutments, concrete slabs wing walls/no head walls
27.1	Culvert, 2 pipes 45cm
27.6	Culvert, 3 pipes 45cm
+ 50 meters	Culvert 1 meter span
27.8	Culvert new
28.4	Culvert, 3 pipes 45cm
28.5	Bridge 5 spans girder on 2 meter span
	Box culvert  etc.
+ 25 meters	Box culvert

Km	
28.7	Culvert new, washed
29.0	Culvert pipe 4
29.4	Culvert 1 meter box
29.7	Culvert new
29.8	Culvert new
30.0	Culvert new
30.2	Culvert 2/45cm pipes
30.6	Culvert ½ meter culvert
+ 10	Culvert new
+ 20	Culvert new
30.7	End of causeway over river Gel
30.9	Culvert
31.0	Culvert 3/45cm
33.1	Kouch police station, road widened no grade rise, soils yellow to pink, evidence of few pot holes
36.5	Good sub-surface materials, lateritic gravel on side of road - road surface improves
38.1	Road is heavily rutted - ½ km light brown and yellow
38.6	Culvert 5 meters long 5/45cm
38.7	Failed road
+ 25	Culvert, surface improves - soils light brown and reddish - sandy
49.4	Malik primary school (school of President of High Executive Council), soils become red, road widens to 10-15 meters, wide rain beginning, road required some grade rise and blanket of gravel

Km	
59.4	Air strip
59.8	AWA village police post slight grade rise - sandy - light color - grass on side slopes
62.7	Jct. of road to Mvolo soils red - ironstone on side of road near surface ALNAALNAK road narrows - surfaced, laterite gravel
63.7	Rock base road 3 meters
70.0	Beginning of embankment
70.8	Culvert 2 meters
70.9	Culvert 2 meters
71.5	Culvert ½ meter sand
+ 50	Culvert 3 meters wide, 1-1½ meter grade rise
72.5	Culvert 1½ meter broken head wall
72.9	Culvert 3 meters, road comes down to ½ meter rise, soils sandy
74.2	Culvert 2 meters
74.3	Culvert 2 meters, head wall broken ½ meter rise
74.5	Culvert 1½ meters, head wall broken
75.4	Culvert 2 meters
76.2	Culvert 2 meters, head wall broken
76.4	Culvert 2 meters, head wall broken
76.7	Box culvert 1 meter span
77.2	Box culvert 3 meters
+ 25m	Box culvert 2 meters

Km	
+ 20m	Bridge 3 spans, 2 meters each
+ 25m	Culvert 4 meters
78.1	Culvert 3 meters
+ 20	Culvert 2 meters
78.6	Culvert 2 meters
79.1	Small bridge 2 - 2 meter sapns
+ 25	New culvert required, embankment 1 meter 3 meters wide, badly deteriorated in places
80.3	Culvert 2 meters, grade rise 1 meter/rock base 3 meters wide
81.0	Culvert 2 meters head wall
81.1	Culvert 2 meters head wall
81.3	Culvert 2 meters head wall
81.4	Culvert 5 meters with hole in deck
81.5	Culvert 1 meter
81.6	Culvert 2 meters
+ 25m	Culvert 1 meter
+ 50	Culvert 2 meters
82.0	Culvert 1 meter
82.3	Culvert required
82.5	Culvert 2 meters
82.5	Culvert 3 meters
+ 25	Culvert 1 meter
82.8	Culvert 3 meters, embankment 3 meters wide, grade 1 meter
86.3	Culvert 1 meter

Km	
+ 15	Culvert 2 meters
86.9	Culvert 1 meter
87.1	Culvert 2 meters
87.2	Culvert 2 meters, damaged head wall, no islands
87.3	Culvert 1 meter
87.5	Culvert 1 meter
87.8	Culvert 1 meter, embankment 2 meters high
87.9	Culvert 2 meters
88.0	Culvert 3 meters, damaged head wall
88.4	Culvert 1 meter
88.6	Culvert 1 meter, pipe smashed, headwall gone
89.0	Culvert 2 meters
89.2	Bridge 2 spans, 2 meters wide
89.5	Culvert 1 meter pot holes bad
90.1	Culvert 2 meters
90.6	Roadway widens out, embankment ½ meter
90.7	Culvert 4 meters
90.9	Culvert 3 meters, embankment 1 - 2 meters high, 3 meters rise
91.1	Culvert 3 meters
91.2	Culvert 2 meters, embankment pot holes continue
91.4	Embankment destroyed
91.6	Embankment 2 meters
+ 50m	Embankment destroyed

Km	
92.0	Embankment requires culvert
92.1	Culvert 5 meters
92.3	Culvert 1 meter
92.5	Culvert 3 meters
92.9	Culvert 3 meters
93.3	Culvert 1 meter
93.6	Culvert 3 meters, head wall destroyed
+ 25	Culvert 3 meters, head wall destroyed
93.7	Culvert 3 meters, head wall destroyed
93.9	Culvert 2 meters
94.2	Ferry crossing river now, 2 car ferries
94.5	Culvert 1 meter
+ 25	Culvert 1 meter
+ 25	Culvert 1 meter
+ 20	Culvert 1 meter, embankment 1 - 1½ meters high, 3 meters rock
95.2	Culvert 2 meters
97.6	Culvert 2 meters
98.6	Road surface improves slightly
+ 25	Culvert, slight grade rise
100.6	Pot holes more infrequent, culvert 1 meter embankment ½ - 1m, pot holes more frequent
101.0	Small bridge 3½ meters, off embankment again, road surface improves
101.5	Small culvert

Km	
101.6	Culvert 4 meters, sharp curve, embankment 1 meter high
102.2	Culvert 2 meters
102.6	Culvert 2 meters, side caved in, metal plate
102.8	Culvert 3 meters
103.0	Culvert 1 meter
+ 25	Culvert 1 meter
103.1	Bridge 3 meters
103.4	Culvert 3 meters
+ 50m	Box culvert 5 meters + 1 meter off embankment, road surface improves
105.9	Market area Yirol
106.4	Begin at 8 am. culvert needs cleaning right turn
107.1	Out of urban area/new grade rise - 6 meters wide - 5 meters
108.0	Surface condition good air strip - left
110.96	Culvert 1 meter, road 3 meters wide
112.1	Culvert 1 meter, embankment ½ meter, color soil grey light yellow
113.0	Jct. - Track, sandy
114.1	Culvert required - formation badly eroded
114.9	Culvert for cross drainage, some lateral drainage problems, soils sand reddish color
116.1	Road bed chanalized - sandy road acting as drainage course

Km	
116.5	Surface erodes side ditches, deep-rain in last 24 hrs but no evidence of ponding
116.7	Culvert required
117.7	Culvert required, 45 - 90cm pipe culverts can be manufactured in Rumbek
118.7	Culvert required - soils and moisture improves ride
120.3	Considerable flooding, ponding, road surface changes rock base
121.8	Road surface improves, flooding and ponding finishes, excellent source of material
124.3	Stone quarry rock condition good, stone near surface 4 km x 6 km, Junios Village/Tipper next to road had minor problem not fixed now stripped
128.1	End of quarry area, road elevated ½m, 3 meters wide, some ponding soils dark but surface red
129.6	Road camp, one tipper working, one new one stripped
131.1	Culvert 1 meter
+ 20	Culvert 1 meter
131.5	Culvert 1 meter, rock and wood covered with blanket of gravel
132.1	Culvert 1 meter, timber/vegetation thinning out, embankment 1½ meters high
136.5	End of laterite carpet - light brown surface rutted badly - evidence of vehicles being stuck
137.3	Rock materials, surface improves
137.8	Condition deteriorates - light brown soil

Km	
140.5	Jct. road to ADOR - another materials source 8 km from project road
141.7	Embankment condition prevails - rock base - surface is a track, pot holes
141.9	Surface condition improves, 20 - 80 meters of weak soils with rutting and ponding
146.0	Culvert required - ride improves
146.2	Culvert required, cross drainage channel
150.0	Soils become sandy, ride improves
152.9	Cross drain erosion, culvert required
153.7	Cross drain erosion, culvert required
153.8	Cross drain erosion, culvert required
153.9	Wood culvert
154.5	Wood culvert erosion, culvert required
154.6	Wood culvert erosion, culvert required
+ 25	Wood culvert collapse
+ 10	Wood culvert collapse, get cost/meters of culverts manufactured in Rumb
155.3	Cross drainage channel culvert required
155.4	Cross drainage channel culvert required
155.8	Corrugated metal pipe collapsed - replace
156.0	Corrugated metal pipe collapsed - replace
157.1	Wood culvert collapse - replace
157.2	Wood culvert collapse - replace
157.5	Wood culvert collapse - replace
157.6	Wood culvert collapse - replace
157.7	Two culverts to replace

Km	
157.8	Wood culverts replace
157.9	Wood culverts replace
158.5	Wood culverts replace
158.6	Wood culverts replace
+ 5m	Wash bigger culvert required
158.7	Culvert required
+ 10m	Culvert required
+ 10m	Corrugated pipe culvert - replace
158.9	Wood culvert replace
159.2	Wash requires culvert
159.4	Culvert required
+ 20m	Culvert required, soils light red to light yellow, surface hard
160.0	Culvert required
161.6	KAREAR
166.8	Culvert
167.7	Culvert 1 meter
+ 25m	Culvert
168.0	Low-boy stripped, 9413, bulldozer out of action for one year because of fule injector
168.2	Culvert required
+ 10m	Culvert required
168.2	Beginning of swampy area and culvert
+ 15m	Culvert required
168.5	Culvert caved in

Km	
173.5	Culvert required
173.6	Culvert required
173.8	Culvert required
173.9	Culvert required
174.2	Culvert required
174.5	End of project - Shambe

ANNEX I

ECONOMIC ANALYSIS

ANNEX I

ECONOMIC ANALYSIS

I. INTRODUCTION

Initially, the Southern Regional Government asked USAID to undertake the rehabilitation of approximately 620 kilometers of road consisting of the segments of Mundri-Rumbek, Rumbek-Wau, and Rumbek-Yirol-Shambe. The PID team concurred with the government's request and recommended the rehabilitation of the entire 620 kilometers.

As noted elsewhere, the design team, after spending three weeks in the project area travelling over all of the proposed road segments and talking to government officials and donor agencies, has recommended that only 440 kilometers, Mundri-Rumbek-Wau, be rehabilitated at present. The reasons for this decision are: (1) the Mundri-Rumbek-Wau segment is by far the most important road segment as it connects the region's two most important cities--Wau and Juba--with the provincial capital of Rumbek and (2) the future status of Shambe as the principal port of Lakes Province is questionable.

The importance of the Mundri-Rumbek-Wau road is well documented everyone, including the government officials, donor agencies, and local traders, has testified to the necessity of improving it.

The Rumbek-Yirol-Shambe route, however, was the subject of much discussion during the design team's field work. Under the British administration, Shambe was the principal port for the Yirol and Rumbek region. The British built and maintained a road connecting the port to these two towns and constructed a police post, warehouse, wharf, and guesthouse at Shambe as well Over the past twenty years, however, due to the hardships resulting from the Civil War, the port has fallen into disrepai The road is in very poor condition, and even during the dry season, the last 2 miles are under water. The warehouse and the guesthouse are flooded with 4 feet of water from the Nile, which has washed away some of the river bank. It is even impossible to get from the police station, which is still operating, to the wharf without going through water.

Last year 5,000 bags of dura unloaded at the port were left to rot because there was no way to move them to Yirol. As a result, few boats now unload goods at Shambe. During the field trip, the team just managed to make it to Shambe in a six-wheel drive army assault vehicle, and they were told that it was the first vehicle to reach the port in over a year.

In the government's Six-Year Plan, three development projects are listed for the Shambe area: a port redevelopment program, a game reserve project, and a fishing cooperative project. Currently, however, there are no funds available for these projects and they are not high on the government's priority list even though the area is rich in fish and wildlife.

Another factor that could alter the traditional port status of Shambe is the construction of the Jonglei Canal, which is planned to terminate at Bor, more than 100 miles south of Shambe. With the opening of the canal, Shambe will be bypassed on the main Kosti to Juba route and it is quite likely that another river port, possibly Minkaman or Terakeka, will become the major port for Lakes Province.

There is no doubt that Yirol will become an important center for future economic activity, and as an integral part of Lakes Province, it will need to be connected to Rumbek. Currently, however, there are less than ten vehicles per week using this road. Therefore, the design team has recommended that the road segment to Yirol and the possibility of connecting it to a river port (either Shambe, Minkaman, or Terakeka) be studied in 1982 during the rehabilitation of the Mundri-Rumbek-Wau road. Consequently, the following description and economic evaluation of the project area will refer only to the area influenced by the 440 kilometer road from Mundri to Rumbek to Wau.

II. DESCRIPTION OF PROJECT AREA

A. Location

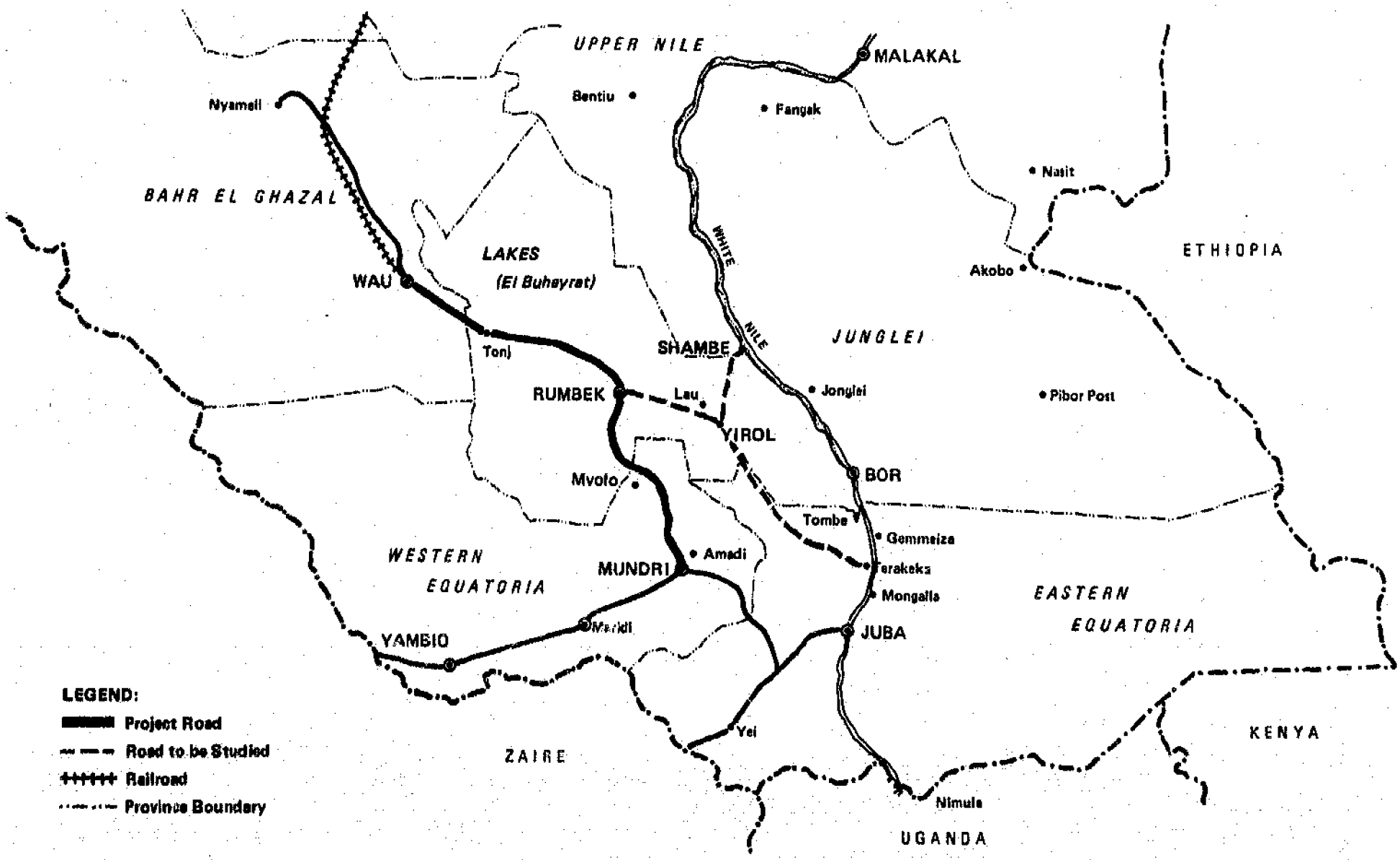
The 440 kilometer project road, from Mundri to Rumbek to Wau, passes through three of the Southern Region's six provinces. It begins at Mundri in Western Equatoria Province at the junction of the Maridi-Juba road and proceeds north 108 kilometers to Mvolo. From Mvolo, the road enters Lakes Province and goes for 136 kilometers until it reaches Rumbek, the provincial capital. From Rumbek the road proceeds in a northwesterly direction for 100 kilometers to Tonj and terminates at Wau, the capital of Bahr el Ghazal Province, 96 kilometers away (see Figure I-1).

B. Physical Characteristics

The project road passes through an area commonly called the Ironstone Plateau. The plateau runs from an elevation of around 800 to 1,000 meters along the Nile-Congo watershed to an area about 500 meters high where it meets the clay flood plains of the Nile. The northeastern boundary of the Ironstone Plateau runs roughly to the north of a line connecting Aweil,

FIGURE I-1

PROJECT ROAD AND ROAD TO BE STUDIED



Tonj, Rumbek, and Yirol. It therefore covers the four districts--Wau, Tonj, Rumbek, and Mundri--that are located along the project road.

The mean annual rainfall in this zone is between 900 and 1,300 millimeters, which fall over a six- to eight-month period, with a somewhat pronounced intensity between July and September. The soils are formed from ironstone deposits and are mainly lateritic. They are generally acidic and low in nutrients with soil fertility dependent mainly on depth.

C. Demographic Patterns

1. Distribution

The official census estimated the population of the Southern Region to be 3,015,000 in 1973. This figure has been widely questioned, however, and Dr. Robin Mills has estimated that at least 375,000 people were left out of the census, resulting in an estimated 1974 population of 3,390,000 inhabitants in the region.[1] Based on an examination of demographic data, annual growth rates of 1.9 percent from 1973 to 1977 and 2.3 percent from 1977-78 are assumed, which results in the 1978 provincial population estimates for the Southern Region shown in Table I-1.

Table I-1

Southern Region Provincial Population (1978)

Province	Total	Urban	Rural
Eastern Equatoria	750,125	117,687	632,438
Western Equatoria	362,797	59,274	303,523
Lakes	675,797	51,196	624,600
Bahr el Ghazal	964,003	100,289	863,714
Upper Nile	592,317	48,081	544,236
Jonglei	319,482	12,287	307,194
Total	3,664,385	388,814	3,275,571

The Southern Region has a population density of approximately 4.5 inhabitants per square mile. In general, however, the population distribution varies according to the availability

[1] Mills, Robin, Population and Manpower in the Southern Sudan, MPSAR, 1977.

of water and the presence of the tse tse fly. An analysis of the population densities shown in Table I-1 and an aerial reconnaissance of the project road reveals that the vast majority of the population is located along the road. The area from Mundri to Yeri, the entire Rumbek area, the area from Rumbek to Cuiebet, and the area from Tonj to Wau are particularly densely populated. The area around Mvolo, by contrast, is very sparsely settled because of the presence of the tse tse fly. Figure I-2 shows population densities in the project area.

2. Age and Sex

In the south, 43 percent of the total population is below 15 years old, 51 percent is between 15 and 49 years, and 6 percent is over 50 years. The distribution by province is given in Figure I-3.

Because of a high proportion of males recorded in the younger age groups, the number of males appears to predominate in the Southern Region. The region's sex ratio is 103 (M/F x 100). Information on the three project-specific provinces shows that males below 15 years of age are more numerous than females in the rural areas and that the urban population below 35 years contains more men than women. Females, though, form the largest segment of rural societies in almost all age groups over 14 years.

Based on the revised 1973 census, the project area contains the following urban population: Wau - 53,402; Rumbek - 18,101; and Tonj - 8,470. These centers are composed of more males than females. In the age category 15 years and over, the sex ratio is 128 for Wau and 115 for Rumbek. This is primarily due to migration in search of work opportunities.

The proportion of males to females in the early age groups is higher than one would expect. It is probably because male children are more likely to be registered in the census, and when the sex of an infant is not declared, they are later classified as male. The overall high proportion of women over 14 years can be attributed to male migration and death of men during the Civil War.[1]

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[1] The prevalence of female-headed households was discussed by Southern Region representatives at the recent Ahfad College conference on the changing status of Sudanese women.

FIGURE I-2

MAIN LOCAL FACTORS

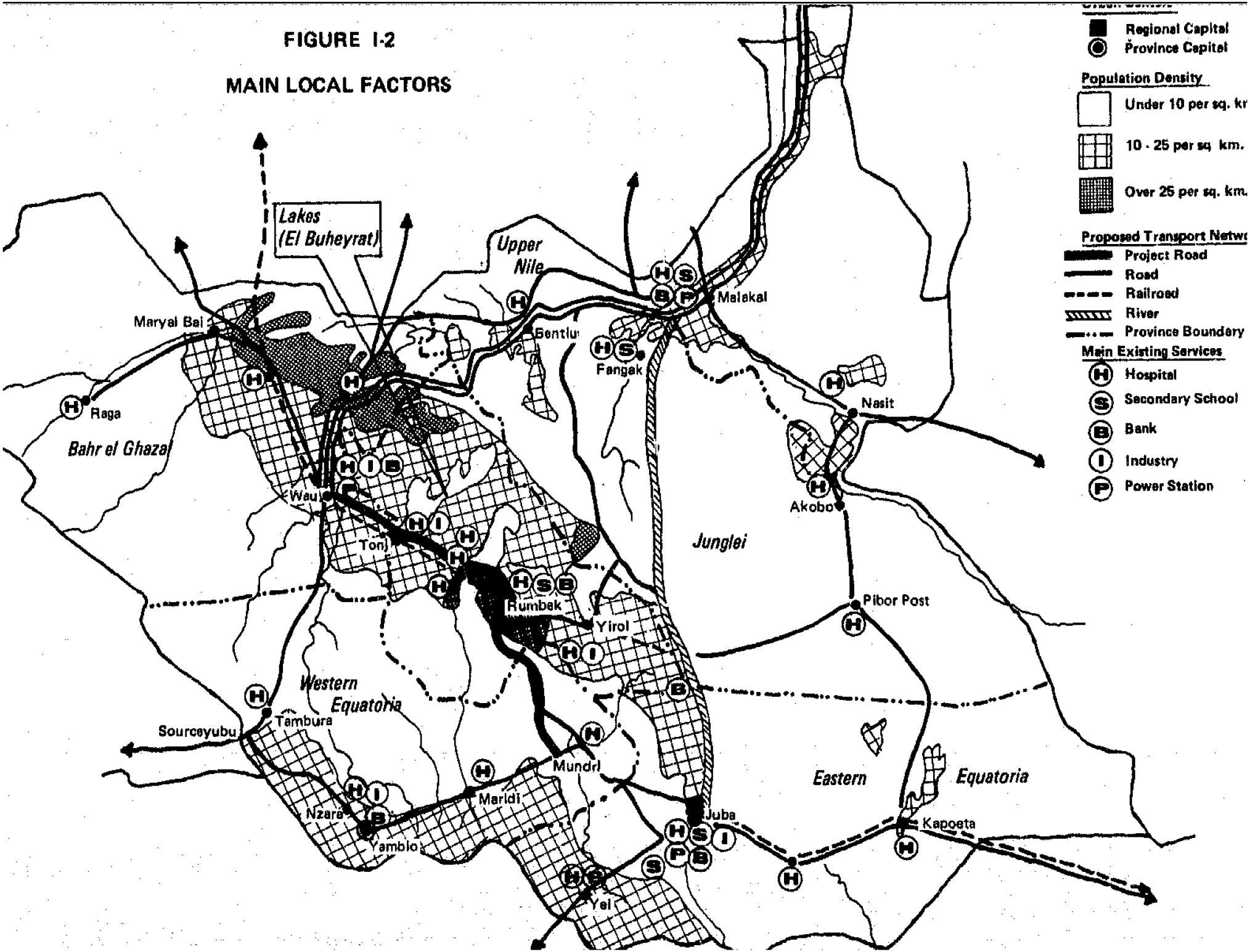
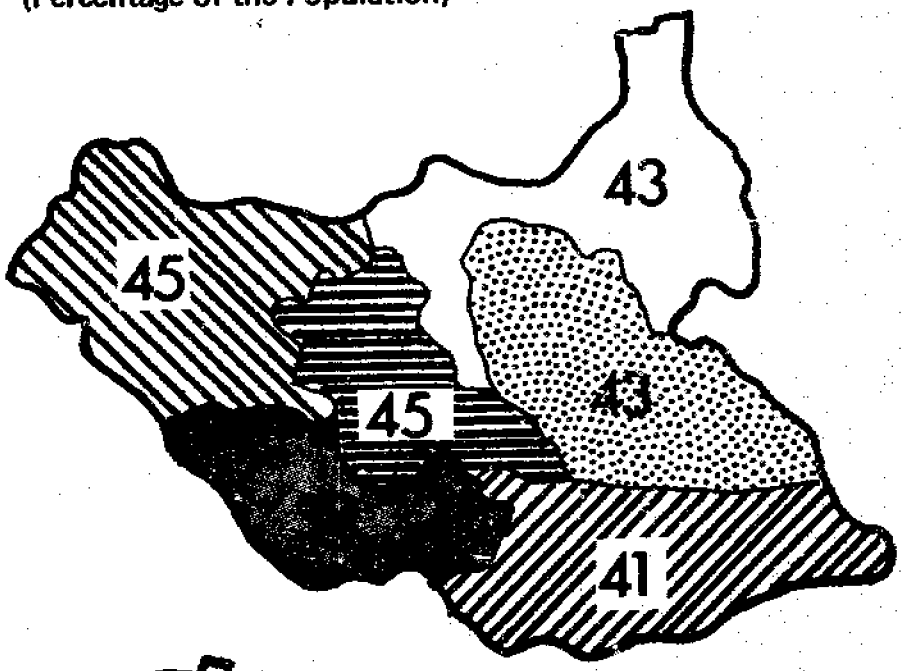


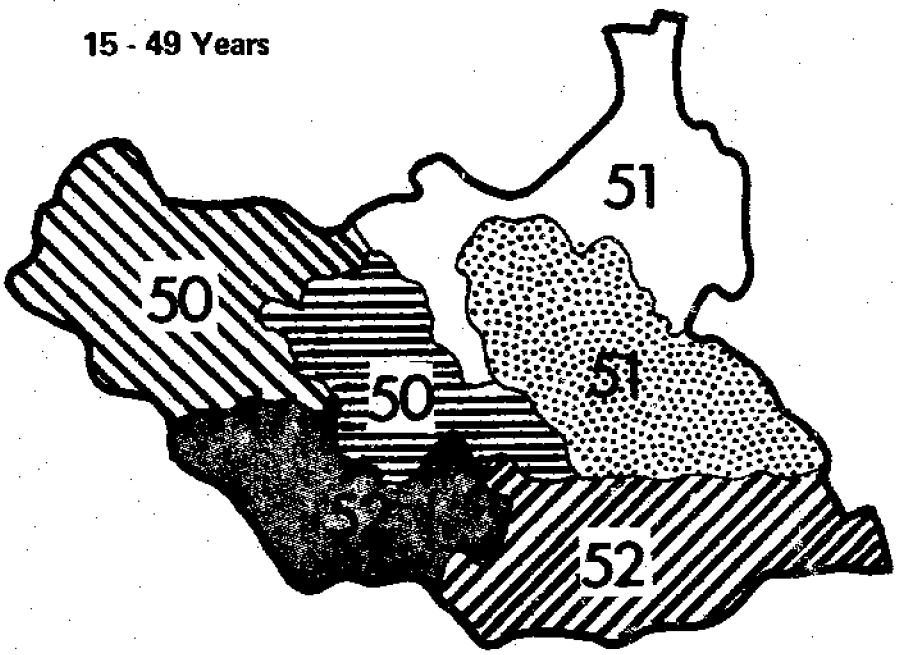
FIGURE I-3

AGE DISTRIBUTION
(Percentage of the Population)

0 - 14 Years



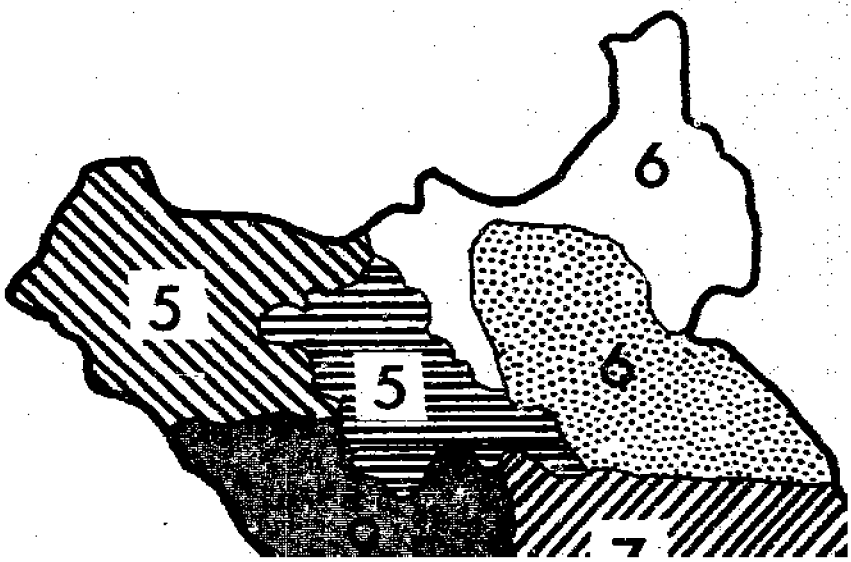
15 - 49 Years



Province:

- Bahr el Ghaz
- Lakes (El Bu
- Western Equ
- Eastern Equa
- Upper Nile
- Junglei

50 and over



3. Population Growth

The annual rate of population increase in the Southern Region is currently estimated to be 2.3 percent. Based on this and other available population data, projections have been developed that assume the Southern Region will begin to attain the average 3 percent annual growth rate of other east African countries. For the purpose of this analysis, it is assumed that the regional growth rate will be as follows:

1977 - 1980	2.3 percent
1980 - 1985	2.5 percent
1985 - 1990	2.6 percent
1990 - 1995	2.7 percent
1995 - 2000	2.8 percent
2000 - 2005	2.9 percent

The population projections for the duration of the project period are shown by province in Table I-2.

4. Urbanization

The population projections in Table I-2 assume a similar growth for each of the region's six provinces, and for the purpose of this analysis, it is sufficient. However, the growth of the region's two major cities, Juba and Wau, has been striking. Therefore, the projected growth of the major urban and semi-urban areas in the project area is examined in Table I-3.

The projections in Table I-3 are based on an analysis of numerous studies that have detailed forecasts of urban growth in the Southern Region. The projections used in this analysis are an average of those estimates. For example, the Norconsult report[1] projects Juba's annual growth rate at 8 percent, and both the Mefit report[2] and the Sudan Shelter Sector Assessment Study[3] forecast a growth rate of 7.5 percent, which is used in this analysis.

The recent assignment of Rumbek as the provincial capital and the fact that the city's geographical position at the junction of the routes to and from the south (Juba, Mundri, Amadi, and Yei), the east (Yirol, Shambe, and possibly Bor or Terakeka),

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[1] Norconsult AS, Kenya-Sudan Road Link Appraisal, 1978.

[2] Mefit SPP Consulting Engineers, Southern Region Regional Development Study, 1978.

[3] USAID, Sudan Shelter Sector Assessment, 1978.

Table I-2

Southern Region Provincial Population Projections (1978-2005)

ince	1978	1980	1985	1990	1995	2000	2005
ern Equatoria	750,125	785,028	888,187	1,009,813	1,153,701	1,324,521	1,528,043
ern Equatoria	362,797	379,677	429,570	488,394	557,985	640,602	739,035
s	675,661	707,099	800,017	909,570	1,039,174	1,193,037	1,376,356
el Ghazal	964,003	1,008,857	1,141,429	1,297,735	1,489,881	1,710,477	1,973,304
r Nile	592,317	619,877	701,333	797,373	910,990	1,045,873	1,206,580
lei	319,482	334,348	378,284	430,085	491,368	564,121	650,803
tal	3,664,385	3,834,886	4,338,820	4,932,970	5,643,099	6,478,631	7,474,121

Table I-3

Population Growth of Urban Areas in Project Area

(000)

rban Area	1955-1956	1964-1966	1973-1974	1978	1985	1990	2000	200
uba (Eastern Equatoria)	10.7	19.8	56.7	90.2	150.0	215.3	443.8	637
% annual growth rate	-	(6.7)	(13.2)	(9.6)	(7.5)	(7.5)	(7.5)	(7
au (Bahr el Ghazal	8.0	14.8	52.8	76.1	126.3	181.3	374.6	536
% annual growth rate	-	(6.7)	(16.3)	(7.6)	(7.5)	(7.5)	(7.5)	(7
umbek (Lakes)	-	-	18.1	25.8	42.8	61.5	126.8	181
% annual growth rate	-	-	-	(7.5)	(7.5)	(7.5)	(7.5)	(7
onj (Lakes)	-	-	8.5	10.9	15.3	20.4	36.9	49
% annual growth rate	-	-	-	(5.0)	(5.0)	(6.0)	(6.0)	(6

ources: IBRD, Sudan Shelter Sector Assessment, 1978; International Lab rganization, Growth, Employment, and Equity: A Comprehensive Strategy f udan, 1976; Mefit SPA Consulting Engineers, Southern Region Regional Dev ent Study, 1978; Norconsult AS, Kenya-Sudan Road Link Appraisal, 1978; he 1973 Census.

and the northwest (Cuiebet, Tonj, and Wau) makes Rumbek one of the region's main growth centers. The Mefit report, previously cited, predicted an annual growth rate of 8.5 percent for Rumbek, but this has been tempered to 7.5 percent in this analysis.

Tonj is expected to grow at 5 percent a year until 1985, at which point the Tonj Kenaf Plant should begin operation and substantial economic activity will be generated in the area. Therefore, from 1985 to 2005 an annual growth rate of 6 percent is forecast.

D Area of Influence

The area of influence of the project is comprised of two categories, primary and secondary. The primary area of influence extends approximately 15 kilometers to either side of the project road. This distance is based on the average number of kilometers a villager in the Rumbek area normally walks to the market. At this distance, the villager can comfortably walk to the market, sell his goods, and return home before sunset. It is the primary area of influence where the greatest development impact (particularly in health, education, agriculture, and marketing), is expected to occur as a result of the road project.

Based on an examination of the four districts through which the road passes, it is estimated that the primary area of influence has a 1978 population of approximately 450,000 people. By the end of the project period in 2005, there will be almost 1 million people living next to the road, which will be 12 percent of the region's total population.

The secondary area of influence extends to the Raga, Gogrial, and Aweil districts of Bahr el Ghazal Province; the Yirol district of Lakes Province; the Yambio and Tambura districts of Western Equatoria Province; and the Juba district of Eastern Equatoria Province. This area currently consists of approximately 2.3 million people, and by the year 2005, this figure will rise to 4.7 million or 63 percent of the region's total population. Obviously, the project road will not impact directly on a large proportion of the people, but through significantly reduced transport costs, many of the people will benefit indirectly, particularly those living in the districts of Juba, Yirol, and Aweil.

III. DEVELOPMENT ACTIVITIES

A. Road Rehabilitation

The Southern Regional Government, in concurrence with numerous development studies, has defined transport

Region. Seventeen years of civil war fought in the south have left the region economically depressed, essentially cut off from commercial ties to northern Sudan, and isolated from the outside world. Within the south, provincial capitals and district centers are isolated during much of the year when heavy rains wash out the remaining skeletal road network. Therefore, the Southern Regional Government has given highest priority to the development of a basic, effective all-weather network of roads, rail, and river transport. It is unanimously agreed that without an improved transportation network to allow an inexpensive and reliable supply of goods and services throughout the region, meaningful and sustained development is not possible. As a result of this conclusion the government developed a program to rehabilitate the region's primary road network (Table I-4).

Table I-4

Southern Region Primary Road Network

Nimule-Juba	175 km
Juba-Torit-Kapoeta-Lokichokio	365 km
Juba-Yei	163 km
Juba-Mundri	318 km
Mundri-Maridi-Yambio-Tambura-Wau	736 km
Mundri-Rumbek-Wau	440 km
Juba-Bor-Malakal-Kosti	1,118 km
Rumbek-Yirol-Shambe	120 km
Total	3,435 km

The government's first priority was to improve the Juba-Nimule road link, which continues into Uganda and then to Kenya. This link was critical because of the supplies that come over this road from the port of Mombasa. The Dutch Government has already completed this road and started work on the connecting Juba-Bor road. The Dutch will probably continue the road along the Jonglei Canal to Malakal and Kosti.

The government's second priority was to support the numerous agricultural development projects along the Juba-Mundri-Maridi-Yambio-Tambura-Wau axis, and this scheme was taken up by the Federal Republic of Germany, which will finish the Juba-Maridi section by 1980. Work on the Maridi-Wau section should continue through 1984.

Recently the Southern Regional Government has had to place the Juba-Kapoeta-Torit-Lokichokio (Kenya) road at the top of its priority list because of the recent closing of the supply route through Uganda. This has caused tremendous supply problems for the Southern Region and the future use of this route is in doubt. As a result, many donors, such as the European Development Fund, Great Britain, Norway, and AID, are interested in the Kenya road link. To date, however, no firm commitments have been made other than 10 million Units of Account by the EDF.

The government's next priority is in the development of the newly created Lakes Province, especially the capital city of Rumbek. The 440 kilometer project road from Mundri to Rumbek to Wau is expected to reduce development constraints in the area and shorten the distance on the rehabilitated, all-weath road between the two major cities of Juba and Wau by more tha 200 kilometers. Another road in Lakes Province proposed to AID by the government is the 120 kilometer segment from Rumbe through Yirol to the Nile River port of Shambe. This road, which was discussed earlier, will be the subject of a feasibility study in 1982.

In addition to the road rehabilitation projects being carried out in the Southern Region, the UNDP and, more recently, the World Bank have been active in strengthening the road improve ment programs by developing a regional maintenance capacity. Under the current plan, the Dutch will establish provincial maintenance facilities at Bor, the Germans have already established one in Maridi, the Canadians have provided funds in trust to the United Nations to set up a maintenance facility for Eastern Equatoria, and under this project, AID will establish a maintenance and training center in Rumbek. In addition, the World Bank will develop a regional maintenance workshop in Juba and provide administrative and technical assistance to the Southern Regional Ministry of Public Works, Transport and Communications (SRMPWTC) to enable them to more effectively manage the provincial maintenance centers.

B. Project Area

In the immediate post-war period, the area that now comprises Lakes Province was generally neglected in favor of the more fertile areas around Maridi, Yambio, and the regional capital of Juba. However, in the Six-Year Plan of Economic and Socia Development, 1977/78 to 1982/83, the Southern Regional Government began to emphasize the development of Lakes

Province. As a result, the government has planned the following development schemes along the 440 kilometer Mundri-Rumbek-Wau road corridor:

Ministry of Agriculture

Amathadol Dura Scheme (30,000 feddans)
Yeri Dura Scheme (30,000 feddans)
Cueibet Dura Scheme (30,000 feddans)
Rumbek Cattle Ranch
Rumbek Dairy Center
Rumbek Ox-Plough Training Center
Afforestation Project near Rumbek
Hides and Skin Improvement Project
Agricultural Marketing Project
Wau Dairy Farm
Wau Poultry Farm
Mobile Veterinary Vaccination Program
Re-equipment of Wau Sawmill

Ministry of Cooperatives and Rural Development

Tree Plantation and Propagation of Root Crops - Tonj
Development of Community and Rural Market Centers
Ground Water Development
Well Digging Project - Tonj

Ministry of Commerce, Industry, and Supply

Wau Handicraft Center
Wau Fruit Canning Factory
Tonj Kenaf Project
White Nile Brewery - Wau

Ministry of Education

Teachers Training Center - Tonj
In-Service Training Facility - Wau
Vocational Training Center - Wau
Rumbek Senior Secondary School

Ministry of Health and Social Welfare

Provincial Laboratory - Wau
Onchocerciasis Project - Wau
National Leprosy Training and Demonstration Center - Wau
Tuberculosis Chest Clinic - Wau
Neighborhood Center - Wau, Rumbek, Tonj
Vagrant Children Rehabilitation Home - Wau
Health Center - Wau
Village Midwifery School - Rumbek

Primary Health Care Units - Lakes Province
Renovation of Seven Dispensaries - Lakes Province
Upgrading of Hospitals - Wau, Rumbek, Tonj
Social Welfare Center - Rumbek

Many of the projects under the region's Six-Year Plan are being supported by donor agencies. For example, the National Leprosy Training Center was built and is run by the Germans, and the Veterinary Vaccination Program is also being carried out by the Germans. The Sudan Council of Churches has been responsible for the Rumbek Ox-Plough Center and the Lakes Province Ground Water Development Project. UNICEF is undertaking the Water Development Program in Bahr el Ghazal, and ACROSS is responsible for water development from Mundri and Yeri to Mvolo, as well as the operation of health clinics in these villages.

In addition to the numerous development schemes planned along the project road under the Six-Year Plan, the World Bank is operating the Project Development Agricultural Unit in Rumbek and a livestock improvement ranch and dairy farm near Wau at Marial Bai. The EEC is supporting a large, mechanized rice scheme north of Wau at Aweil, the World Food Program centers in Wau and Juba are distributing 1,283 metric tons of food throughout both Lakes and Bahr el Ghazal provinces each year, and AID will soon begin its Southern Manpower Development project, which has one component in Rumbek.

Obviously there is a significant amount of development activity in the project area. However, many of these projects are beset by implementation problems. Transportation difficulties are a major factor. The rehabilitation of the Mundri-Rumbek-Wa road will substantially support these development projects. Although rehabilitation will not ensure their success, it will be a significant step towards meaningful and sustained development of the project area.

IV. ECONOMIC ACTIVITY

A. General Economic Structure

The economy of the Southern Region in general, and the project area in particular, is characterized by its weak productive structure, which is primarily of a subsistence nature and to a large extent not monetized. The multiple and complex causes of this condition include the physical environment, social conditions, and traditional attitudes. From an economic rationale, however, two main factors are cited: the completely insufficient process of accumulating capital and the serious deficiencies in the transport infrastructure.

The first of these factors is caused by the chronic lack of any flow of private investment that might increase the present productive capacity of the region. This in turn has brought about an almost absolute dependence for public investment on the central government and international donor organizations.

Secondly, the lack of transport infrastructure has prevented the development of any appreciable interchange of goods within the region or with the north and neighboring countries. This problem has caused a state of immobility in the regional economy and continues to keep the region at a subsistence level.

In the project area, the economy is at a state of development in which the per capita income is still at extremely low levels and revenues from taxation are negligible. The economy is very dependent on external sources for all modern goods, investment materials, and even for essential foods. Local production is concentrated on simple agricultural activity with only minor attempts made to increase production through mechanization or credit and marketing improvements. Industrial activity is seriously lacking except for some agro-processing units located principally around the major urban areas of Juba and Wau.

B. Commerce and Trade

1. Regional

The Southern Region's imports and exports are carried by three distinct transport modes: (1) by river from Kosti, Renk, and Malakal to/from Juba, (2) by rail from Port Sudan and Khartoum via Babanusa to/from Wau, and (3) by road from Mombasa and Nairobi, Kenya through Uganda to/from Juba. There are also two road routes to the south, one from Malakal to Bor and Juba and the other from El Obeid to Kadugli and Wau, but these are only passable during the dry season. In addition, there is commercial air service from Khartoum to Malakal, Wau, and Juba.

The river network is navigable throughout the year between Kosti and Juba. The scheduled transport service is provided by the state-owned River Transport Corporation, which operates several units consisting of a passenger steamer towing an average of three 500-ton barges. Steamer service is scheduled to reach Juba once every two weeks, but due to various problems, only reaches Juba once every three weeks. In addition to the scheduled service, there are some barges serving intermediate points on the river from Renk to Bor. In total, an average of 75,000 tons is shipped on the river between Kosti and Juba each year. This consists mainly of dura and petroleum fuels, but also includes cement, salt, sugar, flour, and other consumer

items. However, 35 percent of these goods are destined for Malakal and approximately 15 percent are offloaded at intermediate towns, so in fact only about 37,500 tons are offloaded at Juba.[1] As with all transport in the Southern Region, river transportation is plagued by empty backhauls. An annual average of only 5,000 tons is loaded at Juba, and overall, only 30,000 tons are carried north on the river between Juba and Kosti.

Rail transport service is provided by Sudan Railways, which schedules one train each week from Babanusa to Wau. In fact, only one train operates every two weeks. It consists of a locomotive and approximately ten cars of 10 tons each. The main commodities carried are fuels, dura, wheat flour, sugar, and cement.

Two international trucking firms, Interfreight Ltd. and Transexpo Ltd., provide overland service from Mombasa and Nairobi to Juba. These firms, which operate 25 and 30 ton Mercedes trucks throughout the year, imported 17,015 tons from Kenya in 1976, consisting mainly of cement, fuel, and wheat to support internationally funded development projects. These trucks carry goods only one way as there is nothing from southern Sudan exported to Kenya. In total, very little is exported by truck to neighboring countries, only 96 tons of soap to Uganda and 350 tons of fish, salt, and other goods to Zaire. These goods are carried by local traders in 5 to 7 ton souk lorries.

The transport costs for all three of these modes constitute a very high proportion of the total costs for goods shipped to and from the Southern Region. This is attributed to three factors: (1) the large distances between the region's principal production and consumption centers (Juba and Wau) and its supply centers (Khartoum, Port Sudan, and Mombasa); (2) the large deficit in the region's economy, which is reflected in the irregular loading of the vehicles used for transporting goods from the region to the rest of the country; and (3) the inefficiency of the external and, above all, internal transport network, which is caused by the infrastructural and administrative inadequacy of every mode of transport and by poor coordination among the different transport modes.

2. Project Area

There is no formal marketing system in the project area and what surplus goods are produced in the local villages are either sold or bartered there or headloaded to a nearby town.

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[1] Mefit S.P.A. Consulting Engineers, Southern Region Regional Development Study, Vol. 2, p. 96a, 1978.

Trade and transport in the project area is dominated by a relatively small number of northern Sudanese, Greek, and Lebanese traders. They are well-organized and maintain wholesale depots in Juba and Wau and strong connections with merchants in Khartoum. Within the project area there are sixteen wholesale depots in Juba, twenty-two in Wau, nine in Rumbek, three in Tonj, and two in Mundri. However, although these wholesalers are located in the urban and semi-urban areas, they often control a number of retail stores or "bush shops" throughout the region. These stores offer a limited range of goods such as soap, salt, onions, kerosene, bicycles, and cloth to rural consumers.

The close relationship between the wholesaler and the retailer makes the marketing system very efficient. The wholesalers purchase commodities from Khartoum and truck them from Wau and Juba to retailers throughout the Southern Region; the retailers in turn purchase whatever goods are available from the local producers and forward them to wholesalers in the nearby towns. The wholesalers own the souk lorries to transport the goods, a warehouse to store the goods, and enough money to purchase supplies from Khartoum. As a result, the wholesalers can, and often do, control the market by hoarding basic commodities until situations of scarcity permit higher prices and therefore very high profit margins.

An example of this situation is the marketing of lubia oil. Local people gather the fruit of the lubia tree, which is primarily grown in the project area, and extract a widely used seed oil. In the Rumbek area, surplus production of this oil is sold to a retail shop owner, who in turn sends it by lorry to Wau where it is purchased and stored by a wholesaler. After a few months, when scarcity results in higher prices, it is forwarded to retailers in Aweil and Gogrial for sale.

However, the wholesale merchants cannot be blamed entirely for the current marketing situation. Profit margins must be sufficiently high to cover price variations and the unreliability of transportation, which results in increased storage and transit costs. The traders are also justifiably reluctant to send their vehicles over the worn and pot-holed roads because of the very high vehicle operating costs and the uncertain availability of spare parts and fuel. As a result, the transport charges for shipping goods in and out of the project area are extremely high and uneven, as illustrated in Table I-5.

Table I-5

Transport Costs in Project Area for 7 Ton Truck

Trip	Cost (LS)	Distance (km)	Veh/Km Cost	Ton/Km Cost
Wau to Juba via Rumbek	550	758	.73	.10
Wau to Juba via Yambio	650	1,054	.62	.09
Wau to Tonj	120	96	1.25	.18
Wau to Rumbek	200	196	1.02	.15
Juba to Rumbek	420	562	.75	.11

Source: Local traders.

The high transport costs and the merchants' policy of high profits on small turnover discourage the development of crop production. Even though most of the agricultural commodities produced in some areas of the project area are in short supply in the rapidly growing urban centers of Wau and Juba, they are not being marketed because of the transportation problems. Therefore, without the project road, trade will remain confined to a few traders distributing "imported" foodstuffs and commodities and a few basic necessities to the rural markets at a high profit.

C. Industry

The industrial activity of the Southern Region is very weak and contributes less than 5 percent to the regional economy. In 197 the food, beverage, and tobacco sector produced 62 percent of the whole industrial sector, and even at this level the manufacture of food products in the region was not sufficient to satisfy demand--as 15 percent had to be met by imports. The second most important industrial activity is construction: houses, buildings, plants, and roads. In 1976, construction accounted for 28 percent of industrial production. The remaining 10 percent of industrial production was divided between quarrying and manufacture of non-metallic products and other manufacturing industries.

Most of the modern industrial activity in the Southern Region is located close to the major transport links to the north in either Wau or Juba, both of which are located in the project area of influence.

Wau, situated at the terminus of the railway line from the north and the project road from the south, has the following industrial activities: fourteen bakeries, eleven flour mills, six brick works, five sawmills, and one each of a fruit and vegetable canning factory, a mineral water plant, a dairy farm, a brewery, and an ice factory. Of these industrial activities, the rehabilitation of the Wau-Rumbek-Mundri road will have a significant impact on the Wau Canning Factory and the soon-to-be-inaugurated White Nile Brewery.

The Wau Canning Factory is a modern plant that was opened in 1968 and employs 485 people, yet it has been beset by the same problems that have plagued all industrial endeavors in the Southern Region: equipment breakdowns, lack of spare parts, unreliable supply of raw materials, and difficulty in distributing finished products. As a result of these problems the plant is operating far below its potential capacity. Although the plant was designed to supply canned vegetables and fruit to the entire Southern Region as well as Khartoum, it is now marketing its 3 million tins mostly in Wau and Juba.

The other major industrial facility in Wau is the White Nile Brewery, which was begun in 1973 and has just been completed. The brewery will have an annual production capacity of 14 million litre bottles, which will be distributed throughout the Southern Region. A large percentage of the final product will be transported over the project road to Rumbek, Bor, and Juba.

One of the major industrial projects in the Southern Region is located 96 kilometers east of Wau along the project road in Tonj. As part of Sudan's drive to develop import-substituting industries, the Tonj Kenaf Scheme was designed at an estimated cost of $25 million to reduce Sudan's current annual import of 70 million burlap sacks. The Tonj plant was designed to have an annual output of 11 million sacks and 9 tons of hessian upon its completion in 1977. The plant is currently only 65 percent complete, two years behind schedule, and only 2,000 of the 40,000 feddans have been prepared for the Kenaf plantation. Much of the equipment for the Tonj plant has been sitting in Port Sudan for months, and the contracting company has not been able to procure enough cement from the Sudanese Government to complete construction. It is fairly safe to assume that within the next six years the plant will begin operations, and at that time the project road will have an immense impact on the Kenaf Scheme, since all of the supplies for the factory as well as the finished goods will have to be transported over the road to either Wau or Juba.

There are no major industrial facilities presently planned for the Rumbek area. Currently, the only industrial activity in the area is a sawmill, a flour mill, and three bakeries. There is no industrial activity along the Rumbek-Mundri segment of the project road. However, it is anticipated that with the rehabilitation of the project road Wau will become an even more important industrial center as it will then have road, rail, and water transport connections linking the north and the other provinces of the south.

In addition to the modern industrial activity previously described, there is a considerable amount of traditional industrial activity in the project area. In the Rumbek area, 40 percent of the Southern Region's clay pots, containers, and pipe bowls are made and fired with firewood. This activity is carried out by the women, and many of the pots are sold in the market. Another traditional activity in the region is blacksmithing. There are twenty-one blacksmiths in Wau and five in Rumbek who make knives, spears, hoes, and axes. A third significant traditional industrial craft in the Rumbek area is the weaving of grass bee hives, which are placed in trees to facilitate the collection of honey.

D. Agriculture

1. Regional

The economy of the Southern Region is overwhelmingly agrarian and production is predominantly subsistance level based on shifting cultivation by small farmers. There is no shortage of land, although the more fertile areas have a greater concentration of people. The farmers generally live on their holdings, which are usually close to the roads, and nearly all land is held under customary tenure based on past use.

The main crops grown in the Southern Region are dura (sorghum), millet, groundnuts, cassava, sesame, yams, maize, and beans. There has never been an agricultural census in the Southern Region nor has there been any long-term systematic collection of statistics. As a result, it is extremely difficult to estimate present levels of agricultural production; however, Tables I-6, I-7, and I-8 present the Ministry of Agriculture's latest estimate of provincial crop area, production levels, and yields. Despite this production, the Southern Region is unable to feed itself and approximately 15 percent of its annual food requirements have to be imported from the Northern Region.

Table I-6

Area of Traditional Sector Food Crops by Province, 1978

Crop	Eastern Equatoria	Western Equatoria	Bahr el Ghazal	Lake	Jonglei	Upper Nile
Sorghum (dura)	108,315	46,719	268,000	146,000	54,000	108,(
Bulrush millet	1,184	334	27,500	18,600		
Elucine (finger millet)	13,926	57,101	7,000			
Maize	34,815	47,757	27,500	6,000	2,600	5,(
Rice	1,048	15,449				2
Groundnuts	58,026	42,088	76,700	35,000	2,600	2,(
Sesame	33,268	21,284	52,600	25,500	1,000	40,5
Cousbeans	14,699	10,382	25,000	12,800	650	1,3
Cassava	31,871	36,132	27,000	500		
Sweet potatoes	13,231	12,921	9,000	5,000		

Source: Southern Regional Ministry of Agriculture.

Table I-7

Production of Principal Food Crops by Province, 1978

(metric tons)

Crop	Eastern Equatoria	Western Equatoria	Bahr el Ghazal	Lakes	Jonglei	Upp Nil
Sorghum (dura)	32,603	14,716	75,309	34,018	11,340	27,
Bulrush millet	179	105	4,455	2,381	-	
Elucine (finger millet)	3,217	15,703	1,764	-	-	
Maize	12,395	19,103	9,928	1,638	731	1,
Rice	410	4,820				
Groundnuts	19,961	16,020	27,996	9,485	520	
Sesame	6,221	4,236	10,257	4,055	132	7,
Cousbeans	2,749	2,398	5,575	2,022	92	
Cassava	32,158	43,864	27,627	491	-	
Sweet potatoes	9,050	8,954	6,246	2,775	-	

Source: Southern Regional Ministry of Agriculture.

Table I-8

Yield of Principal Food Crops by Province, 1978
(kilogram/feddan)

Crop	Eastern Equatoria	Western Equatoria	Bahr el Ghazal	Lake	Jonglei	Uppe Nile
Sorghum (dura)	301	315	281	233	210	223
Millet	151	126	162	128	-	-
Elucine (finger millet)	321	275	252	-	-	-
Maize	356	400	361	273	281	283
Rice	391	312	-	-	-	411
Groundnuts	344	381	365	271	200	251
Sesame	187	199	195	159	132	190
Cousbeans	187	231	223	158	142	151
Cassava	1,009	1,214	1,001	981	-	-
Sweet potatoes	684	693	698	555	-	-

Source: Southern Regional Ministry of Agriculture.

2. Project Area

Although agriculture is the major activity, the project area has a food deficit and each year dura has to be imported from other provinces to feed the population. Poor soils and the scarcity of water during the dry season cause the majority of the population to live along the project road from Rumbek to Tonj where the soils are better.

In a recent study in this area, 93 percent of the heads of household and 97 percent of their wives listed agriculture as their main economic activity.[1] The average household consists of 6.7 people, 2.4 man-equivalent labor units of which are employed in agriculture. The average cleared land per household is 6.0 feddans, of which 4.5 feddans is estimated to be cropped in any year. This land is generally around the homestead, although because of diminishing land fertility, some households cultivate fields several miles away.

The most commonly grown crops in the area are dura, groundnuts, cowpeas, and some maize, with cassava and yams grown on a limited number of fields. Several varieties of dura are grown, most significantly Kec. There is a long-season type (6 to 7 months) that is a higher yielding variety and supplies the bulk of the household's food, and the short-season types (3-5 months) that are important for providing grain early in the season when there are food shortages. The earliest food each season, however, is provided by a short-season variety groundnut and maize. The crops are planted in both pure and mixed stands, although maize and vegetables are usually planted in pure stands immediately around the homestead.

Land preparation begins before the rains arrive and all grass is burned to facilitate planting. Planting starts as soon as the rains become reliable, usually in April. The crops are generally sown by scattering the seed on the cleared land, which is then turned by the cultivator, who works on his knees and uses a flat hoe. The cultivation continues for two months until the weeds become too thick and the cultivators are forced to stop planting and start weeding. Weeding is generally done only once, on hands and knees, and with the aid of a dibbling stick, which is a tool with a 4 inch blade on the end of a pole.

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[1] IBRD, Project Development Unit Survey, 1978. The entire description of agriculture and agricultural potential in the project area used in this analysis is heavily based on this study and the IBRD Southern Region Agriculture Project Appraisal Report of 1979.

Harvesting takes place for Dura Kec in November and December and for the short-season varieties in September. Maize, groundnuts, sesame, and libia are harvested in August and September. Accurate yield figures are impossible to establish, but Table I-9 gives the estimated yields for crops grown in the project area. On the basis of these yields, annual production per household is estimated in Table I-10.

The annual production of dura per household of 670 kilograms, or 100 kilograms per person, is adequate to support the existing population if it is evenly distributed between years, between families, and between individual members of one family. However, with the annual fluctuations and inequalities that exist, at least part of the population in the project area is hungry during the period from May to August every year. The per person production of groundnuts in the project area is also very low, and this crop provides an important protein supplement to the local diet.

Based on these production figures, it is easy to understand why there is not much of a marketable food surplus in the area and why, in fact, dura has to be imported from other provinces. In the Rumbek study, only 11 percent of the households were reported to have sold or bartered (for cloth or salt) dura during the year, usually less than one sack each and mainly to traders; in contrast, 19 percent of the households were reported to have bought dura. During this transaction period, the traders make a big profit. They buy the dura immediately following the harvest at LS 3-4 per 90 kilogram sack and then resell it from May to August at LS 12-22 per sack.

3. Agricultural Potential

The government realizes that agriculture is the most important economic activity in the Southern Region and as a result has allocated 46 percent of the Six-Year Plan's development budget towards increased agricultural output. For the Southern Region, where agriculture is still overwhelmingly at a subsistence level, attainment of these objectives implies a need for substantial expansion in land and labor productivity together with increased market integration of the farming and pastoral community so that surpluses can be created to feed the deficient areas, meet the growing urban demand, and generate savings through import substitution. As a result, the government has developed a four-pronged approach for increasing agricultural production and attaining food self-sufficiency:

- extension of the area under smallholder cultivation
- intensification of existing smallholder crop production

Table I-9

Estimated Yields in Project Area
(kilograms/feddan)

Crop	Stand	Estimated Yield
Dura Kec	Pure	225
	Mixed	175
Short Season	Pure	200
Groundnuts	Pure	220
Sesame	Pure	120
	Mixed	80
Cowpeas	Pure	200
Maize	Pure	320

Source: IBRD, Project Development Unit Survey, 1978.

Table I-10

Estimated Crop Production Per Household and Per Person
(kilograms)

Crop	Production	
	Per Household	Per Person
Dura Kec	570	85
Short Season	100	15
(Total Dura)	(670)	(100)
Groundnuts	110	33
Sesame	56	8
Maize	32	5
Cowpeas and other legumes	40	6

Source: IBRD, Project Development Unit Survey, 1978.

- introduction of new cash crops under smallholder cultivation

- development of mechanized cultivation under large scale and capital intensive management

Each of these approaches is discussed in the following sections in relation to increasing agricultural production in the project area.

a. Extension of Smallholder Cultivation

In the project area, labor availability is the major constraint to increasing the amount of land under smallholder cultivation. Generally, the farmer cultivates only as much land as his family can clear, weed, and to a lesser extent, harvest by hand. There are two main alternatives that exist for relieving this constraint. First, the efficiency of existing labor can be increased by the introduction of improved hand tools such as a broader hoe for weeding light soils, particularly for row-planted groundnuts. Second, the availability of farm power may be increased through the use of tractors or oxen.

In view of the shortage of fuel, spare parts, and trained operators and mechanics, tractors are not feasible for the small farmers in the project area unless cooperatives are organized. The use of oxen for ploughing, inter-row cultivation, and perhaps haulage is feasible for farmers in the area, most of whom own cattle, and would allow the average farmer to increase his cultivated land up to 10 to 14 feddans. The Rumbek Ox-Plough Center is introducing this concept, and although the program is hampered by the traditional tribal values of the Dinka, some progress is being made, particularly with local traders and chiefs, who realize the financial potential of renting out teams of oxen to plough other farmers' fields. During the next two years, five additional extension ox-plough centers will be established in the project area. Two in the Yirol district, one in Mundri, one in Cuiebet, and one in Wau.

The large-scale introduction of ox-ploughing in the area will require a closer integration of cattle and agriculture (mixed farming) than is presently the case, and some changes will be necessary. In order to maintain soil fertility and to ensure the presence of strong oxen at the homestead during the late dry season and the early rainy season, dry-season water supplies and improved veterinary services will have to be developed. In addition, fodder production will have to be introduced in areas where there is no grazing land.

b. Intensification of Smallholder Crop Production

The second alternative to increasing agricultural output is through intensification of existing crop production in the project area. The principal method of raising yields is to introduce technology that does not add to the peak labor demand, such as higher-yielding crop varieties, fertilizer or manure, or pesticide. In the project area, the introduction of higher-yielding crop varieties will have the greater impact, particularly for groundnuts and dura.

In crop tests at the IBRD sponsored Project Development Unit in Rumbek, an improved variety of groundnut (Mari Pintar) has exhibited remarkably better yield and disease resistance characteristics than the local variety. On experimental plots yields of up to 1,000 kilograms per feddan have been achieved. Results from dura varieties are less impressive and no immediate major improvement is likely over the local Kec variety. However, there is an imported variety, Serena, which has shown consistently good results and produced yields up to 850 kilograms per feddan under experimental conditions in Rumbek.

c. Introduction of New Cash Crops

In the project area, there is very little potential for introducing new crops for cash sale. The principal reasons for this are the relatively poor soils in the project area and the importance of producing food crops in this deficit region. As a result, the government's main efforts to introduce cash crops will be centered in the richer soils areas of Eastern and Western Equatoria, where cotton, coffee, and tea will be cultivated.

d. Development of Mechanized Cultivation

The government's fourth approach to increasing agricultural potential is to introduce mechanized cultivation under large-scale and capital intensive management of farm operations. Because of the relatively small quantities of labor required, this approach offers an attractive complement tc increasing smallholder cultivation. Mechanized farming has been fairly successful in northern Sudan, particularly in the provinces of Kassala, Blue Nile, Kordofan, and the northern part of Upper Nile. However, the experience of mechanized cultivation in the Southern Region has been very limited and pilot projects have been disappointing.

For example, a 15,000-feddan mechanized dura scheme is being established at Jebel Lado, 15 kilometers northwest of Juba, which currently has 500 feddans under cultivation. Although yields have been lower than expected, the government expects them to improve, and under the Six-Year Plan it intends to expand the Jebel Lado farm to 30,000 feddans. In addition, the Six-Year Plan has allocated funds to develop other mechanized farms, including three along the proposed project road, one in Yeri, one in Amathadol (near Rumbek), and one in Cuiebet. The project road will also impact on two other planned mechanized schemes, one north of Wau in Aweil and the other east of Yirol in the Aliab Valley.

The mechanized dura farms in Yeri, Amathadol, Cuiebet, and Aliab Valley are currently at an embryonic stage of development as each of these has only 200 feddans under cultivation out of a planned scheme of 30,000 feddans each. In addition, there is in fact no mechanization--almost all cultivation is being done by hand. There are many reasons for this (such as shortage of funds, equipment, and fuel), but in each one of these schemes the lack of transport and the general logistics and supply difficulties are two of the principal constraints.

The Aweil Rice Scheme is being funded by the UNDP and the EDF, and although the project is encountering the usual problems, officials are very pleased with the progress of this scheme. It is expected that a large percentage of the total annual rice production from this scheme will be transported over the project road to feed Lakes and Eastern Equatoria provinces.

e. Livestock

Livestock is a major resource in the project area but due to traditional husbandry techniques and attitudes, poor disease control, and an inefficient marketing system, probably less than 15 percent of the economic potential is exploited. The great majority of the livestock in the project area is cattle that primarily belong to the pastoral and traditional Dinka tribes. Within the project area, animal husbandry is generally restricted to an area north of the project road between Rumbek and Wau because of an infestation of tse tse flies south of the road around Mvolo.

Although detailed information concerning herd composition, productivity, and management is unavailable, a recent survey has estimated the region's livestock population, as shown in Table I-11.

Table I-11

Southern Region Livestock Population, 1978

Province	Cattle	Sheep	Goats	Donkeys
Bahr el Ghazal	1,227,707	718,238	604,099	1,346
Lakes	700,719	333,130	303,946	38
Western Equatoria	229	1,269	20,055	-
Eastern Equatoria	797,774	914,824	N/A	-
Junglei	1,404,553	174,619	460,900	3,179
Upper Nile	1,428,092	1,047,465	375,866	3,081
Total	5,559,074	3,189,545	1,764,866	7,644

Source: IBRD, Review of the Southern Region Agricultural Rehabilitation Development Project, Annex 10, p. 2, 1978.

At present, large herds are kept by the pastoral Dinka in the floodplain sections of the area. During the rainy season, the cattle are moved towards the drier plains area around Rumbek and the more thickly populated area along the Rumbek-Tonj road. In many cases the cattle are not brought to homesteads in the Rumbek area, or if they are, it is only for a short period because the herders are afraid of trypanosomiasis (sleeping sickness), which is prevalent south of Rumbek. With the onset of the dry season, the cattle gradually are moved back down onto the seasonally flooded "toich areas" of the Nile, where they remain until the next rainy season.

Because of strong traditional views held by the Dinkas, very few of the animals are slaughtered. It is estimated that 2 to 3 percent of the herd are killed for local consumption, usually for ceremonial purposes, another 1 to 2 percent are sold to traders for shipment to urban markets, and another 5 to 6 percent die of disease and natural causes. When the Dinkas do sell their cattle it is usually out of necessity, as most of the slaughter and/or sale of cattle occurs during the May to August period when the grain supplies in the project area are at their lowest.

Although there is an almost total absence of any data on the livestock potential of the area, it is thought to be substantial. The project area is located midway between the two largest urban consumer centers in the Southern Region, Wau and Juba, where demands for meat and milk are not being met. In 1976 for example, Wau imported 135 tons of powdered milk by rail, Juba imported at least 25 tons by river, and during the same time period, the World Food Program distributed 1,010 tons of milk powder in the region.[1]

The main reasons for the nearly nonexistent economic utilization of the livestock population are poor communications and marketing channels, inadequate livestock and veterinary service agencies, lack of capital, and conservative traditional husbandry. Recently, a mobile veterinary vaccination program has been organized with German assistance to try to reduce the number of livestock deaths by preventive vaccination, but there have been problems in reaching the cattle-raising areas, particularly during the rainy season.

Additionally, the IBRD is funding a Livestock Improvement Ranch at Marial Bai just north of Wau to test the viability of ranch management and improved cattle breeding. A smaller-scale extension of this project, community livestock centers, will be established in Tonj and Rumbek. Each center will consist of an office, store, feed store, dip water point, tank and troughs, and up to 400 hectares of fenced paddocks for use in an experimental artificial insemination program. Pilot dairy schemes, which have been established at Juba, Wau, and Malakal, have proved that commercial dairy farming is feasible in the Southern Region. Another major livestock development project involves the establishment of a modern abattoir just north of Juba along with a holding ground for fattening cattle.

V. PROJECT EVALUATION

A. Methodology

The rehabilitation and maintenance of the 440 kilometer Mundri-Rumbek-Wau road will result in three major categories of benefits: 1) reduced transportation costs (vehicle operating costs savings); 2) increased agricultural production induced by improved access to markets, inputs, credit, and technology; and 3) improved social welfare due to improved

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[1] IBRD, Review of the Southern Region Agricultural Rehabilitation Development Project, Annex 10, 1978.

to Sudan's economy. However, even with the above consideration it seems likely that by 1985 the above constraints will have eased somewhat and with the construction of the road the three dura schemes will become feasible.

It is assumed that the dura scheme in Cuiebet will increase the area under cultivation in 1985 by 300 feddans and will increase the area by 500 feddans for each of the following two years. From 1988 through the end of 2004, the cultivated area will increase by 1,000 feddans per year, so that by the end of the project benefit period a total of 18,500 feddans will be under mechanized cultivation. The Amathadol and Yeri schemes are assumed to increase their cultivated area in the same proportion: Amathadol will begin in 1986 and by 2004 is expected to have 17,500 feddans and Yeri will begin in 1987 and by 2004 will have 16,500 feddans under cultivation. The total area expected to be under mechanized cultivation with the road project is presented in Table I-17.

Yields for dura cultivated under the mechanized schemes are expected to be similar to improved varieties used by the P.D.U. (355 kilograms per feddan). The economic value of dura, as discussed in the previous section, is $55 per ton. Based on a paper by the Mechanized Agricultural Corporation that is quoted in the Norconsult report, the economic net value of production after deducting all investment and cultivation costs is approximately 20 to 25 percent of the gross value. Based on this, the incremental value is LS 4 per feddan, which seems quite low. However, lacking any other detailed data, this figure is used in the analysis shown in Table I-17.

4. Livestock

It is anticipated that the project road will have two important effects on the development of livestock production in the project area: it will facilitate veterinary and livestock extension work and it will stimulate livestock marketing.

According to reports, there are an adequate number of veterinarians to cover the region, but the lack of transport and pharmaceuticals frequently prevents them from working. When vehicles and drugs are available, the improved project road will contribute to an increase in the veterinarians' efficiency in providing services to livestock owners. This is particularly true during the wet season when the cattle are concentrated around the permanent villages close to the project road.

Table I-17

Total Mechanized Farm Benefits - Cuiebet, Amathadol, Yeri

Year	Total Additional Area Cultivated	Total Value of Increased Production (000 US $)[1]	Road Benefit Value (000 US
1985	300	2.4	1.2
1986	1,100	8.8	4.4
1987	2,400	19.2	9.6
1988	4,400	35.2	17.6
1989	6,900	55.2	27.6
1990	9,900	79.2	39.6
1991	12,900	103.2	51.6
1992	15,900	127.2	63.6
1993	18,900	151.2	75.6
1994	21,900	175.2	87.6
1995	24,900	199.2	99.6
1996	27,900	223.2	111.6
1997	30,900	247.2	123.6
1998	33,900	271.2	135.6
1999	36,900	295.2	147.6
2000	39,900	319.2	159.6
2001	42,900	343.2	171.6
2002	45,900	367.2	183.6
2003	48,900	391.2	195.6
2004	51,900	415.2	207.6

1 Assumed economic value of LS 4 ($8) per feddan.

2 Assumes road rehabilitation only responsible for 50 percent of total benefits as other 50 percent benefits should be allocated to complementary investments.

In the project area, livestock owners acknowledge the value of the government's vaccination program. About three-fourths of the cattle owners in the Rumbek area Farm Management Survey[1] claimed to have had at least some cattle vaccinated, although only about one-third reported to have had cattle vaccinated during the past year. Approximately one-fourth of the owners said that all their cattle were vaccinated. Although the study does not reveal the type of vaccinations received, it can be assumed that they were part of the program against rinderpest and contagious bovine pleuro-pneumonia.

The marketing system is currently operated by local traders on an irregular basis, and all cattle are delivered on the hoof to the major consumer centers. This is not only time consuming but also results in weight loss and lower prices to the seller. At present, livestock trading is hampered during the wet season by the muddy conditions, yet it is at this time that the Dinka need to sell their cattle to buy dura. A regular marketing system in the major towns and the introduction of trucks for transporting the cattle to Juba, and Wau will be possible with the road project. A decrease in transport costs will also allow a greater range of consumer goods to be made available in the markets. This, in turn, should provide a cash stimulus to induce pastoralists to increase their livestock sales.

Based on these considerations, it can be assumed that with the rehabilitation of the project road improved veterinary services, and a better marketing system the commercial offtake in the project area will increase over the twenty-year period 1985 to 2004, as shown in Table I-18.

The economic value of an average head of cattle was estimated to LS 25 in the IBRD Southern Region agriculture project.[2] However, based on higher cattle prices in the project area this has been raised to LS 30 per head. The results of the livestock valuation are shown in Table I-18.

D. Total Road Benefits

The total road benefits, consisting of both road user benefits and agricultural production benefits, are presented in Table I-19.

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[1] Duncan, Alex, Results of a Farm Management Survey in the Rumbek Area, 1978.

[2] IBRD, Southern Region Agriculture Project Appraisal Report, 1979.

Table I-18

Total Livestock Benefits

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Year	Project Area Herd Size (000)	% Increased Commercial Offtake with Road[1]	Total Increased Value (000 US $)[2]	Total Road Be (000 U
1985	650	.0025	97.5	48
1986	663	.0025	99.5	49
1987	676	.0050	202.8	101
1988	690	.0050	207.0	103
1989	704	.0050	211.2	105
1990	718	.0050	215.4	114
1991	732	.0075	329.4	164
1992	747	.0075	336.2	168
1993	762	.0075	342.9	171
1994	777	.0100	466.2	233
1995	792	.0100	475.2	237
1996	808	.0100	484.8	242
1997	824	.0100	494.4	247
1998	841	.0125	630.7	315
1999	858	.0125	643.5	321
2000	875	.0125	656.2	328
2001	892	.0125	669.0	334
2002	910	.0150	819.0	409
2003	928	.0150	835.2	417
2004	947	.0150	852.3	426

1 Represents the asssumed percentage increased commercial offtake with road project over that without the road project.

2 Head of cattle valued at LS 30.

3 Assumed road rehabilitation only responsible for 50 percent of the t benefits as other 50 percent should be allocated to complementary in ments.

E. Costs

There are two types of cost that are commonly considered in the economic appraisal of a rural road project: construction and maintenance costs. These financial costs are developed in detail in Annex H and are summarized in Table I-20. For the economic evaluation, inflation has been omitted and the costs for unskilled labor have been shadow-priced at 25 percent of the market wage to reflect the real economic resource cost to the country. Therefore the costs presented in Table I-20 are lower than those developed in Annex H.

F. Evaluation Parameters

Before the economic evaluation can be carried out and the various input factors can be determined, evaluation parameters must be established and defined.

Construction Period

Rehabilitation of the first road segment is expected to begin in April 1981 and the last road segment will be complete by March 1984.

Project Benefit Period

The project lifetime is defined to start in the first full year the entire road is open for traffic, i.e., January 1985. The project road will have a lifetime of twenty years; therefore, the project life will terminate in December 2004.

Transition Period

Because the road will be completed in three stages--Wau-Cuiebet; Cuiebet-Mvolo; and Mvolo-Mundri--some benefits will be obtained before January 1985.

Economic Prices

All prices used in the analysis are economic prices and net of any taxes, duties, and transfer payments. Prices have been developed in 1979 constant dollars.

Residual Value

No residual value is assumed after the twenty-year life of the project.

Table I-20

Total Project Costs
(000 US $)

Year	Rehabilitation and Construction Costs		Maintenance Costs	
1980	245		-	
1981	13,311		-	
1982	5,846		-	
1983	5,267		48	
1984	1,685		141	
1985	246		215	
1986	-		215	
1987	-		215	
1988	-		215	
1989	-		215	
1990	-		215	
1991	-		215	
1992	-		215	
1993	-		215	
1994	-		215	
1995	-		873	
1996	-		215	
1997	-		215	
1998	-		215	
1999	-		215	
2000	-		215	
2001	-		215	
2002	-		893	
2003	-		215	
2004	-		215	
Total	26,600	+	5,825	= 32,42

Discount Rate

In keeping with the discount rate used by the IBRD for evaluating rural development projects in the Southern Region, a discount rate of 10 percent is used for the benefit/cost analysis. Sensitivity tests are done at 15 percent and 20 percent.

Shadow Prices

In an economic project analysis, the country's market wages and prices should be adjusted to reflect the true economic value of those resources. In this analysis, it has been determined that the economic value of skilled labor is accurately reflected by the market wage. However, the market wage for unskilled labor exceeds its economic value. Therefore, in accordance with the shadow wage used by the IBRD for Southern Sudan, the shadow wage for unskilled labor is assumed to be 25 percent of the market wage.

G. Evaluation Criteria

Three basic criteria are used in this evaluation: internal rate of return (IRR), benefit/cost ratio (B/C ratio), and net present value (NPV).

The IRR of the road project is the discount rate at which the present value of the streams of benefits and costs over the twenty-year project lifetime are equal. As shadow prices were used for labor costs and benefits, the IRR is considered the internal economic rate of return. The B/C ratio is the present value of the benefits divided by the present value of the costs. The present value of net benefits and the B/C ratio are calculated at a discount rate of 10 percent.

H. Results

The results of the economic evaluation of the project road are presented in Table I-21.

I. Sensitivity Analysis

Sensitivity tests are performed by evaluating the project at discount rates of 15 percent and 20 percent as shown in Table I-22.

Table I-21

Costs and Benefits of the Southern Sudan Road Project
(000 US $)

Year	Road User Benefits	Agricultural Production Benefits	Total Benefits [1]	Total Costs [2]	Net Bene
1980				245	- (245
1981				13,311	-(13,311
1982	339		339	5,846	-(5,507
1983	1,238		1,238	5,315	-(4,077
1984	1,922		1,922	1,830	92
1985	2,432	101	2,535	461	2,072
1986	1,749	154	2,902	215	2,687
1987	3,100	302	3,402	215	3,187
1988	3,497	392	3,889	215	3,674
1989	4,002	506	4,508	215	4,293
1990	5,317	627	5,944	215	5,729
1991	5,765	803	6,568	215	6,553
1992	6,267	901	7,176	215	6,961
1993	6,711	1,064	7,775	215	7,560
1994	7,221	1,251	8,471	215	8,256
1995	7,858	1,414	9,272	873	8,399
1996	8,253	1,558	9,811	215	9,596
1997	8,659	1,715	10,374	215	10,159
1998	9,063	1,923	10,986	215	10,771
1999	9,486	2,087	11,573	215	11,358
2000	9,989	2,262	12,251	215	12,036
2001	10,461	2,450	12,911	215	12,695
2002	11,050	2,714	13,764	893	12,871
2003	11,579	2,924	14,521	215	14,306
2004	12,149	2,977	15,126	215	14,911

Internal Rate of Return:	16.77
Net Present Value at 10%	22,271
Benefit/Cost Ratio at 10%	2.48

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1 From Table I-19.

2 From Table I-20.

Table I-22

Economic Evaluation Summary
(000 US$)

Criteria	Discounted at 10%	15%	20%
Present value of benefits	54,234	20,203	11,887
Present value of costs	21,884	18,944	16,677
Benefit/cost ratio	2.48	1.07	.71
Present value of net benefits	22,271	4,047	-5,496
Internal rate of return:		16.77	

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ANNEX J

SOCIAL SOUNDNESS ANALYSIS

ANNEX J

SOCIAL SOUNDNESS ANALYSIS

I. INTRODUCTION

The Southern Region, which contains about one-fifth of Sudan's population and covers about one-fourth of the country, is relatively disadvantaged compared to the Northern Region. It has only about 10 percent of the country's medical facilities and similar public services, and the number of children in school, in relative terms, is less than half the national average. A significant proportion of the south's administrative posts are unfilled because of a lack of qualified personnel. Per capita income in the Southern Region in 1979 is estimated to be about $80, which is 25 percent to 30 percent of the national average.[1]

Although the 440 kilometer road will pass through three of the Southern Region's six provinces--Western Equatoria, Lakes, and Bahr el Ghazal--the primary beneficiaries will be the inhabitants of Lakes Province. This is only proper since Lakes Province is one of the poorest and most neglected provinces in Sudan: A study by Italian consultants in 1976 analyzed the standard of living in each of the provinces of the Southern Region by comparing the total per capita consumption to the level of total consumption; as shown in Table J-1, Lakes Province had by far the lowest per capita consumption.

Table J-1

Total Consumption per Capita (LS)

Province	Per Capita Consumption
Eastern Equatoria	104.7
Western Equatoria	149.9
Bahr el Ghazel	101.6
Lakes	75.9
Junglei	112.9
Upper Nile	106.5
Southern Regional Average	108.6

Source: Mefit, Regional Development Plan, Vol. 1, p. 56.

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[1] World Bank, Sudan: Southern Region Agriculture Project - Credit and Project Summary, April 26, 1979.

The Mefit report also examined the nutrition levels of the six provinces on the basis of an average ratio of availability/need, and as shown in Table J-2, Lakes Province was once again the lowest in every category.

Based on this evidence and the design team's three week field work, there is no doubt that the project area is one of the poorest and least developed parts of the Sudan and quite possibly the world. It is not that Lakes Province has been purposely neglected: its condition has merely evolved over the years. After the cessation of the Civil War, most development aid and effort was focused on the resettlement of refugees in the border provinces of Eastern and Western Equatoria. Later donor activity continued in these areas because: (1) projects were already established; (2) the areas are close to the regional capital of Juba and the supply lines from Kenya; and (3) the areas are rich in agricultural potential. This trend continued with Lakes Province being allocated only 9 percent of the development projects proposed in the Six-Year Plan even though it has approximately 18 percent of the region's population.

One of the major reasons why Lakes Province has not received greater allocations is the wretched condition of its roads, which adds considerably to the logistical and operating problems of any development activity and reduces the economic feasibility of many projects. It is for this reason that the present road project has been given a high priority in the Southern Region's strategy to develop its transport system to facilitate economic and social development of the Mundri-Rumbek-Wau axis. The project road network links the railhead at Wau with Rumbek, the Lakes Province capital, and it also provides these two urban centers with a direct route to the regional capital at Juba.

Evidence from a recent survey by Mefit implies that the intended project beneficiaries view the improvement of roads as a priority need. In listing their need for social services, villagers in Wau District rated improved health service, water availability, and roads as their top three priorities. Their response reveals that the lack of adequate roads is felt by not only administrators and traders but by the rural inhabitants as well, and it suggests that villagers recognize the benefits that will result from an improved road network.

In the long term, the project is expected to benefit over 2 million inhabitants of the Southern Region by improving inter-regional linkages and better integrating the south into the Sudanese economy. Upgrading the Southern Regional Ministry of Public Works, Transport and Communications (SRMPWTC) staff

Table J-2

Avera e Ratio: Availability/Need

Province	Calories	Protein	Beta/Carotene	Thiamine	Riboflavine	Nyacin	Ascorbic Acid
Equatoria	96.7	260.3	303.5	142.4	73.0	97.3	186.3
Equatoria	101.6	291.9	225.9	135.7	94.4	122.5	273.2
hr el Ghazal	88.1	264.8	163.0	102.8	52.7	82.3	92.5
kes	77.7	220.0	104.3	81.9	34.7	67.1	28.2
nglei	100.2	280.5	181.9	182.5	62.9	115.2	66.0
per Nile	121.2	347.4	188.7	233.0	91.8	143.1	37.2
Regional Average	97.2	275.8	204.8	145.1	67.6	102.7	118.7

urce: Mefit Report, Volume I, page 45.

and improving the Ministry's system of commodity procurement and logistical support should affect their activities throughout the region.

In the short term, and more directly, the project will affect the approximately 450,000 people who currently live within the primary zone of influence in Tonj and Rumbek districts of Lakes Province, Wau District of Bahr el Ghazal Province, and Mundri District of Western Equatoria Province. This social soundness section focuses primarily on people within this primary zone of influence.

II. CULTURAL PATTERNS

There are numerous tribal groups and subgroups located along the project road. The Moru, who live in the area around Mundri and Yeri, make up approximately 4 percent of the Southern Region's population and are engaged primarily in growing dura, cassava, peanuts, and some citrus. On the plateau between Mundri and Rumbek around the town of Mvolo live the Bel tribe, who like the Moru, belong to the Sudanic language classificatory group. These people live in small, scattered villages and are primarily cultivators, with off-season gathering activities and bow and arrow hunting in the bush areas. The presence of trypanosomiasis and onchocerciasis in this area precludes the raising of cattle and even prevents the establishment of settlements.

The most densely populated area along the road lies in the southern highlands section of the floodplains between Tonj and Rumbek. This area is primarily inhabitated by Dinka, a Nilotic tribe who raise cattle, cultivate, and, to a lesser degree, fish. The Dinka are the largest Nilotic group in the Sudan and constitute approximately 40 percent of the population of the Southern Region. They are divided into twenty-five independent tribes, three of which are located along the project road: Dinka Agar around Rumbek; Dinka Gok near Cueibet; and Dinka Rek in the vicinity of Tonj. Also living around Tonj is the Bongo tribe, who are ethnically related to tribes in Zaire.

From Tonj to Wau the area is also well populated and most of the inhabitants belong to the Jur tribe, who engage to a greater degree in agriculture than livestock husbandry.

III. ORGANIZATION, LEADERSHIP, AND STRUCTURE

The Dinka are divided into about twenty-five independent tribes, based predominantly on territorial groups. These tribes consist of sub-tribes, which are futher divided into sections. A

section is the largest fully corporate community, although large sections are further segmented. Each section herds together, has common grazing areas, protects land through joint action, and usually camps together. Age-sets are also delineated at this level. Each section is an association of lineages, comprising clans, which produce spearmasters (noble clans) and warrior clans (commonors). A spearmaster, the most important leader of a section, is believed to have divine origins. He has mainly religious powers, although he does serve as an arbitrator. Through personal achievement, some spearmasters obtain wider powers and influence.

The most significant features of Dinka society are its segmentation and the fluidity with which segments combine and then separate, depending on the issues involved. It is the family and localized territorial group, however, which influence and provide the greatest meaning to the individual.

Although Dinka society is highly egalitarian, laced with reciprocal rights and obligations, it is structured according to descent, sex, and age-sets. One's ascribed status in either a noble clan or a warrior clan denotes social position, although it does not affect social interaction. Sex more strongly signifies social position and social prescription. The society favors males, but it recognizes that women provide the means to the more male-oriented goal of permanent identity and influence by primogeniture.

Society is also structured by age-sets. The size and range of ages included in female age-sets, which are formed at longer intervals than are those of men, make them less cohesive than men's. Furthermore, a member terminates group participation when she marries. Male age-sets are formed about every five years and their group activities continue into middle age. This structure of Dinka society tends to be maintained by emphasis on unity and harmony among members and segments.

The other ethnic groups located in the zones of dense vegetation on the Ironstone Plateau, such as the Moru, have a smaller-scale and more localized organizational pattern than the Dinka. Each homestead is an independent sociopolitical unit. The homestead, based on patrilineality and patrilocality, usually contains members of three generations.

Leadership in a community is based on both descent and achievement. The head of a prosperous household may win recognition in the neighborhood that elects him to the status of Big Man by a special ceremony of investiture during which he is expected to distribute most of his grain. Thereafter, the Big Man is given respect and his advice is usually sought. He may also serve as patron to some of the poor within the neighborhood.

Other persons are Big Men by virtue of their ritual status, such as chief of the path, father of the land, or rainmaker. These positions are nearly always based on descent. The father of the land, usually a descendent of a pioneer settler in the area, apportions land to those who want it; rights to use remain with a family as long as they assert them. The main function of father of the land, a religious figure, is the conduct of proprietary exercises to assure good harvests.

Besides the traditional pattern of organization and leadership, government organizations operate at the community level. Village councils, the lowest level of the local government system, contain members chosen for four-year terms through direct elections on limited franchise. The council's role is to enlighten and mobilize citizens and promote self-help schemes. Its administrative duties include collection of taxes and other levies and control of local markets.

Besides the tribal organizations, there are government organizations that also operate at the local level. Village Development Committees (VDCs), under the direction of Community Development Officers, consist of eleven elected members, serving a one-year term, based on a constituency of 500 or more people. The VDCs are charged with participating in the selection of schemes to be carried out on a self-help basis, instructing local leaders, and contacting local people to gain their interest and participation in self-help activities. As of 1977/1978, the districts in Lakes Province contained the following numbers VDC: Rumbek - 14; Yirol - 15; and Tonj - 24. Mundri District in Western Equatoria had 13; Wau District, 0.

The legitimacy and influence of the VDCs and village councils vary from one community to another. Overall, though, they are weak, representing an outside structure hampered by financial and personnel problems.

IV. PROFILE OF DINKA HOUSEHOLDS[1]

A household survey undertaken in villages located on the project road 20 miles west of Rumbek to 50 miles east provides information on household composition, economic activities, income, and food consumption and shortages. The data are indicative of a large portion of the population in the project impact area.

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[1] This part is based primarily on "Results of a Farm Management Survey Carried Out in the Rumbek Area," by the Project Development Unit, Regional Ministry of Agriculture, Southern Sudan, in 1978. All tables are from this source.

A. Site

The permanent villages inhabited by Dinka lie on high land that is usually free of flooding on the southern perimeter of the flood plain. The soils tend to be well-drained, but leaching of nutrients is a problem. Many villages lack water during the dry season, which sometimes leads to temporary migration. The settlement areas, which have fairly dense tree cover, are infested with tsetse flies.

During the wet season the cattle are usually kept on limited high areas that are relatively free from disease. The average distance between the wet season grazing area and the homestead is 13 miles. Because of a shortage of adequate grazing land during this season, the livestock are often fed crop residues. As flood waters to the north recede, cattle are moved to intermediate lands, and by the height of the dry season the cattle camps are concentrated on lowland pastures.

B. Household Characteristics

The average household contains 6.7 members, of whom 1.85 are males over 15 years and 1.75 are females in the same age category. Heads of households are predominately male, owing to the definition used to identify heads as well as the practice of widows being absorbed by the household of an adult son or brother of the deceased husband.

The household heads are largely between 35 and 44 years old (45 percent) and are monogamous (65 percent). Only an insignificant proportion (3 percent) have three or more wives, and some (11 percent) are not yet married. Almost all of the household heads (94 percent) are illiterate, and one may assume a high rate of illiteracy among other household members.

C. Agriculture

Virtually all households grow dura (sorghum); almost all plant a long-season variety (94 percent) and at least one short-season variety (85 percent). Groundnuts are cultivated by 100 percent of households, sesame by 85 percent; small vegetable plots are also common. Local conditions tend to be ill-suited for tuber crops and only about one-fifth of the households plant cassava and a few cultivate yams.

The average area of cleared land is 6.0 feddan per household. An estimated one-fourth of this land is left fallow, giving 4.5 feddan of cultivated area. Fields are generally located around the homestead and are contiguous. Declining soil

fertility, however, forces some to cultivate several miles from their house. Tethering of cattle on clearer land is not common, because of the presence of trypanosomiasis and the scarcity of water during the dry season.

Agricultural labor is provided mainly by family members. Table J-3 shows the categories of agricultural labor input (1977) in land preparation and planting, weeding, and harvesting. It is regrettable that more detailed information is not available.

Table J-3

Agricultural Labor, 1977

Task	Male HH[1] Members	Female HH[1] Members	Male Relatives	Female Relatives	Working Parties	Hir Lab
Land preparation and planting	88	95	9	4	18	4
Weeding	85	92	8	2	9	7
Harvesting	88	93	9	2	[illegible]	2

[1]Household.

While hiring workers is not common, more prosperous households use working parties, an arrangement by which friends, neighbors, and relatives work on a field and receive food, beer, and tobacco as a reward. (It is not an actual exchange since items are not given in proportion to the amount of labor performed.) Participation in work parties during the peak agricultural season is to a great extent the result of a seasonal lack of food which affects households to varying degrees. Members of a household with an inadequate supply of grain may join a working party in order to eat well. At the same time, families with a surplus of grain or livestock may hold a working party, which increases their chances for a large harvest.

Most of the agricultural output is domestically consumed. A portion, however, is given as gifts to relatives, neighbors, and friends; is consumed in community feasts; or is bartered. Some families give food to those in need, based on the principle of delayed reciprocity, and to agricultural work parties. A small percentage of households report that they have sold crops (1977/1978), but usually only on one occasion. The

amount sold tended to be less than one sack. Table J-4 shows the percentage of households selling crops, distinguishing between households that used working parties and those that did not.

Table J-4

Percentage of Households Selling Crops 1977/1978

Crop	Households Using Working Party	Households Not Using Working Party
Dura (sorghum)	16	9
Groundnuts	13	8

Most marketed dura (64 percent) was reported to have been sold to traders rather than to other farmers (36 percent). Those selling did not have to purchase food later in the year; hence, they sold only a small surplus.

D. Food Consumption and Shortages

The relative contribution of livestock products and agricultural produce to family diet has been estimated at an aggregate level. The estimate does not take into consideration seasonal variations and excludes fish, which forms a significant ingredient in the diet of at least half the Dinka households. The data reveal the relative importance of agricultural produce to the average diet. Of a total estimated 1,552 calories per person per day, 85 percent are derived from agriculture. These crops, listed in descending order of caloric value to daily diet, are dura, groundnuts, sesame, cowpeas, and maize. Only 13 percent of a person's daily caloric intake comes from milk and meat. Also, protein is derived largely from agricultural crops. The data suggest that an increase in crop production will have a greater effect on the nutritional status of the household than would a similar increase in livestock production.

Food shortages, especially of dura, which is the staple item in diets, are common. Forty percent of the households claimed in 1978 not to have enough dura to last until the next harvest. The sufficiency of a family's food supply is dependent on factors such as size of family, size of fields cultivated, quality of land, and agricultural techniques. Therefore, variations may exist between neighboring homesteads. The high percentage claiming to have an inadequate supply of dura, however, suggests a significant deficit in food supplied by household production.

E. Livestock

Cattle play an extremely meaningful role in Dinka society. Preoccupation with the aesthetics of cattle, though primarily expressed by women and young men, is a significant feature of Dinka society. Important also is the religious significance attached to cattle: through sacrifice, cattle are the medium by which the living confront God and ancestral spirits. A particular significance is attached to oxen. Male youths are given an ox by their fathers. This is the youth's personality ox, which symbolizes beauty, gentleness, and sensuality. Livestock also are important in the maintenance of lineages and establishment of kinship bonds through the practice of bridewealth. In order to marry, a man must transfer an agreed number of stock to the family of the bride. Stock acquired by the bride's family is distributed among the bride's relatives and may be used in the marriage of sons. The need to have cattle in order to marry spurs young men, especially from poorer families and families without daughters, to engage in economic activities. Many young men become livestock traders as a means of establishing their own herd, while others seek wage employment in other towns and provinces as far away as Khartoum in order to purchase cattle.

The contribution of livestock to the welfare of a household is closely linked to the high value Dinka place on cattle. Livestock provides milk and meat for domestic consumption; meat for guests and a reward for agricultural working parties; hides and skins for domestic use (e.g., waterskins); manure for soil fertility (primarily in grazing areas); dung-ash to repel insects; dung fuel; and a means for acquiring grain through barter or sale.

Almost every Dinka family owns cattle, sheep, and goats. The pattern of seasonal migration of livestock is explained in Section IV-A above. Some exceptions to the basic pattern occur. About one-fourth of the households keep a few cattle at home during the dry season, mainly if the animals are sick and, to a less extent, to provide milk for domestic consumption. In other households cattle are brought to the settlement for a short period at the beginning and end of the wet season. Also, often some sheep and goats are kept at the homestead during the dry season.

While some families own no cattle, others have large herds. Precise data on herd size are difficult to obtain since owners are reluctant to reveal this information. Herds may contain over fifty cattle, but the average size is much smaller. It is estimated that the family average is 9.5 cattle, 4.0 sheep, and 3.6 goats.

The system of transhumant pastoralism requires relatively little labor, particularly given the practice of several families sharing herding duties. About 60 percent of the families in any given year will have relatives looking after their cattle. Herding is usually done by unmarried men. It is not uncommon, however, for young women, either within the household or relatives, to take the cattle to dry season grazing areas. About 16 percent of the dry season herders are female. Other girls, young women, and mothers may accompany the herders or visit their camps.

The animals are usually kept at night in cattle camps. The concentration of cattle and the number of herders together depends largely on the extent of available grazing. During critical times, members of different sub-tribes may share the same grazing area. Cows are milked once in the morning before going out to graze and on their return in the evening. Milking is done mainly by women, girls, or boys.

The most common transaction concerning livestock is bridewealth exchange. Since several households may contribute animals to a marriage, about one-third of the families may dispose of cattle, sheep, or goats for bridewealth in any one year. This custom means that there is roughly the same number of families receiving livestock in the bridewealth transaction. Livestock may also be acquired as a gift.

Buying and selling of stock are also common. In a normal year 20 percent to 25 percent of the families purchase cattle, sheep, or goats. While those buying cattle are inclined to obtain only one head, usually two or three goats are purchased and two sheep. Stock is usually disposed of to obtain cash, although small animals may be exchanged for dura. Most often, sales are by auction. The Dinka sell cattle mainly to buy dura (29 percent), pay school fees (16 percent), and meet tax obligations (13 percent).

Slaughtering of cattle is less common than slaughtering of small stock. The main reasons for slaughter are to provide meat for ceremonies (66 percent), household consumption (18 percent), working parties (13 percent), and sale (5 percent). Stock deaths and losses account for a significant offtake from herds.

F. Other Economic Activities

Numerous economic activities other than livestock husbandry and agriculture are undertaken by household members. Most of these are seasonal, although some, such as livestock trading, can be full time. Fishing, a common activity engaged in by men mainly during the dry season, is done with spears or, to less extent, hook and lines. The bulk of the fish is dried and subsequently consumed domestically or sold to traders.

Livestock trading is an important undertaking by young men. The Dinka Apak sub-tribe is especially active in the trade. In mose cases, the men stop this activity after they acquire a sufficiently large herd of their own.

Other income-generating activities for men are cultivating of tobacco, owing a shop, growing vegetables, making implements, and collecting honey. For women, the most common income-generating activities are making pots and brewing sorghum beer. To a smaller extent, they sell shea butter and soap, and vegetables. There is little opportunity for formal employment in the rural areas, and women particularly are disadvantaged. A small percentage of men are employed as chiefs or sub-chiefs, policemen, and laborers.

G. Household Income

Households have an estimated total annual income of approximately LS 304.95, or LS 45.51 per person, as detailed in Table J-5. Forty-five percent of the household income is derived from livestock husbandry, 42 percent from agriculture, and 13 percent from other activities.

Table J-5

Sources of Household Income (LS)

Source	Amount		Percentage
Livestock			
Food, cash, and products	67.66		
Appreciating herds	69.48		
Subtotal		137.14	45
Agriculture			
Dura production	64.64		
Groundnut production	29.73		
Other crops	33.44		
Subtotal		127.81	42
Other Sources		40.00	13
Total		304.95	100

V. SOCIAL IMPACT ASSESSMENT

A comprehensive methodology for assessing the social impact of the proposed infrastructure project would ideally be based on empirical data. Unfortunately, little primary research has been done in any field in Southern Sudan, and social welfare is no exception. However, the following discussion will examine both the direct and indirect effects the proposed road project is anticipated to have on the patterns of social behavior in the area.

A. Direct Effects

There are three ways in which the proposed road project will directly affect the social structure of the area: through employment; through purchases of goods and services; and through land acquisition.

1. Employment

The proposed project should contribute substantially to local employment. This is particularly true for the road rehabilitation phase, as the road contractor will require forty-nine semi-skilled and skilled laborers and ninety unskilled laborers during the three-year period. While it is envisaged that almost all of former category will be brought in from outside the project area, it is assumed that most of the unskilled positions will be filled by local labor.

Local labor will also be required to erect the housing and shop facilities for the maintenance and training program. No additional labor is expected to be required for the actual road maintenance however, as this will be executed by personnel on the permanent payroll of the SRMPWTC.

It is expected that the problem of finding local laborers will be minimal because many young men from the Dinka tribes in the area currently migrate in search of work to western Sudan for the groundnut harvest, to Khartoum for construction work, or to other provinces of the Southern Region for cattle trading. In fact, a positive aspect of the project will be that many of the local men will find work on the project instead of migrating to other areas.

2. Purchase of Goods and Services

It is expected that the major portion of the project funds will be spent on the purchase of construction equipment and materials for the maintenance training center and on logistics support

for expatriate personnel. These goods would be procured primarily in the United States. However, a significant amount of the funds will almost certainly be spent in the local area. The magnitude of this spending will depend on the construction laborers' (local and expatriate) consumption patterns.

3. Land Acquisition

There will be no land acquisition problems caused by the proposed road project, for the Southern Regional Government currently owns the existing right-of-way. Since the proposed plan is to rehabilitate the existing road, no alignment changes are expected. The land required for the maintenance and training center and expatriate housing in Rumbek currently belongs to the provincial government of Lakes Province, which has agreed to allocate the land to the project. Therefore, the proposed project will not take any land away from small farmers or out of agricultural production.

B. Indirect Effects

Improving these barely passable roads to an MCA or all-weather standard will also have an indirect impact on the social structure of the project area. Generally, the impact will resul from the change in accessibility experienced by the people who live near, or travel on, the improved roads.

It must be stressed, however, that even though roads are a major factor in the rural economy, their mere presence will not automatically ensure social and economic development. The magnitude of change depends on many factors, including: local travel patterns, local social customs, and provision of complementary investments.

Therefore, in order to assess the impact of improved access on rural society, this analysis will examine various aspects of the project area: health; education; family and community life; the role of women; basic commodities; and migration and urbanization.

1. Health

Since the end of the Civil War, the Southern Region has made great strides in reconstructing its nearly defunct health delivery system. In the project area, communicable, infectious, and endemic parasitic diseases are the most common health problems. These diseases, often related to malnutrition and poor sanitation, most commonly affect infants and children and account for the majority of morbidity and mortality among them. The major communicable and infectious diseases are measles,

tuberculosis, endemic disease, polio, pertussis, cerebrospinal meningitis, and hepatitis. The list of endemic and potentiall epidemic diseases is extensive. In particular, malaria, schistosomiasis, and gastroenteritis are widespread. Onchocerciasis is found in Bahr el Ghazal Province and in the regio between Mundri and Rumbek.

Recent and reliable data on the distribution of health facilities in the Southern Region are not available, but in 1975 it was reported that Bahr el Ghazal Province (which is now split into Bahr el Ghazal and Lakes Province) had 76 dressing statio 23 dispensaries, 1 health center, 6 district hospitals, and 1 provincial hospital. Medical personnel consisted of 17 doctors, 82 medical assistants, 5 technicians, 5 sisters, 852 nurses, 6 health visitors, 18 sanitary overseers, and 6 public health officers. In addition, there were 905 government-trained village midwives.

Because the population is spread over a large area and there is a shortage of trained medical personnel, it is difficult for the government to provide adequate health coverage through hospitals and dispensaries. Thus, the government has embarked on a Primary Health Care Program aimed at providing maximum coverage to the rural population through a preventive as well as curative system at the community level. Under this program existing dressing stations have been upgraded to Primary Healt Care Units and additional units are being constructed.

Improved road access to health service facilities will benefit the local inhabitants in the following ways. First, it will make it easier to supply these facilities with necessary drugs and equipment. These supplies provided primarily by the Medic Supply Department in Khartoum and transported by train to Wau and then trucked to the Rumbek area, but drugs requiring refrigeration are flown to the major hospitals in Juba and Wau Second, it will contribute to better supervision and inspectio of the new Primary Health Care Centers because health official will be able to travel much faster and visit many more facilities. Third, an improved road will facilitate visits to villages by Primary Health Care workers as they will be able t go and return to the centers in one day instead of the current two or three days. Fourth, it will increase the probability that vehicle transport will be available to villagers who may require serious medical attention at the provincial hospital.

2. Education

Educational facilities will also benefit from the improved roa Within the project area there are the following schools: in

Lakes Province are sixty primary (three are self-help), eight junior secondary, one senior secondary, one technical secondary, and one teacher training college; in West Equatoria Province are twenty-five primary schools (ten are self-help), one junior secondary school, and one teacher training college in Mundri District; and Bahr el Ghazal Province has forty-five primary (three are self-help), four junior secondary, one senior secondary and one technical secondary school in Wau District.

The majority of the primary schools are located in the project area, but since most students walk to school, the poor road condition is not a constraint except during the rainy season, when it becomes thick with mud. For secondary and technical schools, distance is a more serious constraint limiting access to educational opportunities; however, it is unlikely that road improvements alone will solve this problem as only the wealthier students could afford bus transportation or a bicycle.

Nonetheless, poor or seasonal road service does adversely affect: administrators' decisions on where to allocate scarce resources, the supply of books and other teaching materials, the willingness of teachers to work in such areas, and the ability of supervisory personnel to inspect the schools. In this respect, improved road access should have a beneficial impact on the quality of education in the project area.

3. Family and Community Life

Based on development experience in other countries and observations in the Southern Region, improved road access will probably have a significant impact on traditional family and community life. Generally, as more contacts are made with the outside world through education, modern medicine, marketing, or travel, a marked decrease is shown in the degree of mutual dependence on the nuclear family, the clan, or the tribe. This change is part of the development process, but it is not always an easy one for the rural inhabitants as it often causes stress between the older and younger generations. These negative aspects, however, should be offset by an improved quality of life through better nutrition, health care, educat , and economic opportunities.

4. Role of Women

Because of the death of men during the Civil War and male migration, women make up the largest segment of the adult rural population in the project area. The women are responsible for managing the households on a day-to-day basis, fetching water and wood, preparing and processing food, and raising children.

Furthermore, they play a major role in preparing land, planting, weeding, harvesting, transporting, and marketing. Some young Dinka women herd livestock, while others accompany male heders. Less than 5 percent of Dinka women own livestock, however.

Opportunities to earn cash income are primarily limited to selling beer, pots, and to a lesser extent, shea butter and soap, vegetables, and baskets. A very few women serve as government-employed midwives, while others are traditional midwives. Employment possibilities for women are severely limited in the formal sector, mainly because of their lack of educational qualifications. The few who are educated sometimes encounter difficulties even though the Sudanese constitution grants women equal job opportunity and equal pay for equal work.

As explained by Victoria Yar Arol, a member of the People's Regional Assembly of Southern Sudan: "It is a woman's right to be employed in a government department. Sometimes, however, the authorities or head of that department may use the job as if it were a favor for a certain woman. The department head may want to make the woman feel that the job was not given to her because it is her right, but only because he arranged it so."

A female employee of the Department of Social Welfare in Juba emphasizing women's lack of awareness of their legal rights and poor living conditions reports: "We have many women who are destitute. . . . We need, first of all, to change their social and economic circumstances. . . to improve the quality of their lives, and to bring their economic life to a normal level, so they can provide for themselves and their children."

A symptom of the poor quality of life is that about 80 percent of the southern Sudanese women suffer from anemia, which is attributable to nutritional inadequacies. This illness results in high incidences of spontaneous abortions, miscarriages, and premature births.

Although the project is expected to affect men and women equally, women may in fact be placed in a more difficult working position, as the children, who usually help them, will be sent to school. In addition, with more opportunities and local incentives given to farmers to raise crop production, a disproportionate share of the additional labor required will be borne by the women. In order to offset the women's increased workload, extension programs should undertake activities specifically aimed at meeting the needs of rural women, such as providing hand pumps in villages and better tools for land preparation, weeding, and harvesting.

To aid women in child care and family health, the project will improve ease of access to health facilities, enable Primary Health Workers to visit villages, and facilitate delivery of medicines to health units. Furthermore, women will have greater accessibility to local markets where they sell, exchange, and buy items, thus increasing their participation in commercial activities. However, because of cultural norms, women are not expected to benefit from employment on the road project, and because of the lack of women in relevant ranks in the Ministry of Public Works, Transport and Communications, they will not be among those trained under the project.

5. Basic Commodities

Commodity shortages are often felt throughout the region, but Lakes Province is particularly an area of relative scarcity. Seasonal variations in the sources of commodity supply, mutually reinforced by production and marketing cycles, and a long-term process of road degradation have led to this state in the province. The dry season route directly supplying Rumbek with goods from the Port of Shambe is almost abandoned. Commodities from the north as well as from Kenya and Uganda pass through Juba and are trucked along the Mundri-Rumbek road, and goods from Wau are trucked over the Wau-Rumbek road, but because of the very bad condition of the road, transporters are unwilling to send their trucks over these routes. As a result, there is frequent appropriation of Lakes Province allocations of critical fuel, oil, spare parts, and medical and veterinary supplies by officials in other provinces that are already better supplied.

The project will result in a more equitable interprovincial distribution of commodities and give quicker access. Goods arriving by rail at Wau will be more easily transported to Lakes Province. Also, improvement of the Rumbek-Mundri segment will facilitate the distribution of sorghum, which comes via Juba from Renk in Upper Nile Province, throughout the food-deficient area of Lakes Province. Town dwellers ought to be able to obtain a greater variety, and a more reliable supply, of essential commodities. In particular, the rural population will benefit by a more constant supply of food, if supply factors remain constant.

In the short term, the purchasing pattern of the rural inhabitants is expected to remain the same. However, there may be a negative effect in the long term if an influx of cheap manufactured goods replaces the market for locally made items, such as clay pots, baskets, spears, and hoes.

6. Migration and Urbanization

It is possible that the project road will indirectly contribute to increased migration to the towns located along the route, such as Rumbek, Tonj, Wau, and Juba. The major reason for migration to towns is the possibility for work. If a better transportation network stimulates job opportunities in urban areas, then increased migration will probably result.

A recent survey by Mefit in Wau reveals that migrants come mainly from areas within the same province as the urban center in which they settle. More than two-thirds of them maintain close ties with their area of origin by observing obligations to relatives and family, such as contributing to and participating in marriage and funeral ceremonies. Over half visit their original home whenever possible. Furthermore, more than half of the migrants send money or gifts to their area of origin, and some (15 percent) do this at regular intervals. Most migrants (82 percent) still maintain land rights, and approximately half even own cattle kept in their original home area. About half express the intent to eventually return to live in their place of origin. Thus, if the project does contribute to migration, it will have some positive features in regard to urban-rural linkages.

VI. SPREAD EFFECT - DIFFUSION

An improved road will almost certainly increase rural people's mobility and their number and extent of contacts. This mobility will facilitate the growth of more complex sets of social relationships that cut across family, clan, and tribal units. Furthermore, it will contribute to increasing ties between town dwellers and relatives. Enhancing the scope and frequency of social contact means improving the flow of person-to-person communication, which broadens one's knowledge of social, economic, and political topics. In addition, mobility allows people to witness innovations in other areas, and a demonstration impact is therefore felt. Diffusion of innovation research in Africa has shown that the greater a person's mobility the more likely she/he is to adopt innovations.

The project road should also attract more government services and projects to the area because of the ease of access. An improvement in linkages between local level government bodies and higher levels of decision-making and resource allocation is also likely to occur. This improvement should enhance the effectiveness of the government's development effort. Also, administrative ties between the provincial capitals of Wau and Rumbek and the regional capital will be strengthened by improved accessibility.

The establishment of the Rumbek maintenance center, as well as the training of its personnel, will increase the capacity of the SRMPWTC, which should further its ability to undertake other road improvements, especially in Lakes Province. Moreover, the project should have a spread effect by increasing the Ministry's capacity to administer road maintenance projects throughout the region.

VII. SUMMARY

In the long term, the road project is expected to benefit a large portion of the Southern Region's 3 million inhabitants by improving inter-regional linkages and better integrating the south into the Sudanese economy. In a shorter time frame and more directly, the project will affect 450,000 people who live in the Rumbek and Tonj districts of Lakes Province, the Wau District of Bahr el Ghazal Province, and the Mundri District of Western Equatoria Province. Evidence from a recent survey implies that the intended project beneficiaries view improvement of roads, better health care, and the availability of water as their priority needs.

The direct impact zone contains mainly Dinka, a Nilotic group that practices transhumant livestock husbandry. In addition to benefitting Dinka households, the project will have a positive effect on small ethnic groups such as the Jur, who are engaged more in agriculture than livestock, and the Moru, who are agriculturalists.

Rural inhabitants will derive project benefits from increased access to basic services, commodities, and regional markets. Lower commodity prices as well as greater availability of items in markets may be realized. In the immediate future, an increase in produce marketed will probably be limited to crops such as groundnuts and tobacco. In addition, the project road should facilitate better supervision, inspection, and supply of services and institutions operating in the impact zone and encourage their further development as well as the establishment of new ones.

An improved road will almost certainly increase rural people's mobility and their number and extent of contacts. This change will contribute to enhancing their opportunity to witness and learn about innovations in other areas, thus resulting in a demonstration impact. Diffusion of innovation research in Africa has shown that the greater a person's mobility, the more likely she/he is to adopt innovations.

No groups are expected to be negatively affected by the project. Women as well as men will benefit.

A project spin-off should be the attraction of more government services and projects to the zone because of ease of access. With an improved road, the potential will exist for the Sudanese government to implement projects specially aimed at meeting the needs of rural women and to extend existing programs such as those providing water. Monitoring and evaluation in the impact zone will be necessary to document the extent to which the project goal is achieved and whether some groups inadvertantly benefit more than others.

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ANNEX K

TRAINING PROGRAMS

ANNEX K

TRAINING PROGRAMS

I. INTRODUCTION

The training program proposed for the project will focus on the evident immediate need for skilled personnel in two major sectors: equipment maintenance and roadway maintenance. Of the Ministry's total present work force of 4,700, only 393 employees can be categorized as skilled.

The program will be planned, implemented, and administered by the Consultant and will be centered around on-the-job training.

While serving the needs of the project, the consultants will make every effort to assure compatibility with the training objectives of the World Bank's Second Highway Project.

In the equipment maintenance sector, there is a critical need for skilled workers in these job classifications:

- Mechanic - all grades
- Automotive Electrician
- Machinist
- Welder
- Blacksmith

Apart from the straightforward task of upgrading technical skills, there is a definite need for workers to "unlearn" bad habits that have been acquired in the past. For example, the practice of cannibalizing parts from one or more machines to keep another operating is prevalent. In view of the limited stock of spares on hand, this approach is understandable. However, to render a relatively new piece of heavy equipment unserviceable by stripping it of major components to keep an older machine running (and this has been observed) is simply poor equipment maintenance management and must be discouraged through the training of senior workshop staff in correct management procedures.

It should be borne in mind that there are only four storekeepers on the Ministry's entire payroll. Consequently, to avoid having the presently critical parts and supply situation reach disastrous proportions, the need for selecting and training additional storekeepers in modern supply system management must be considered of the greatest importance.

The roadway maintenance sector, in addition to the requirement for developing more effective general supervision, will present

fresh training needs. As discussed elsewhere in this paper, the project will introduce simpler and less costly industrial tractors accessorized with scarifiers, mouldboards, compactors, and so forth for the performance of roadway maintenance tasks. This innovation will require that the operators and foremen be trained in the correct usage and application of the lighter equipment.

II. PROPOSED TRAINING METHODOLOGY

A. On-the-Job Training (OJT)

In view of the pressing need to intensify both equipment and roadway maintenance efforts while upgrading technical and management skills, it is recommended that emphasis be placed on on-the-job (OJT) training. OJT is quite flexible and can very easily be adapted to maintenance production requirements.

It is anticipated that the Technical Assistants (TA)--together with the SRMPWTC's senior management counterparts--will plan, schedule, and directly administer this element of the program with respect to middle- and lower-level technicians. This joint approach is suggested for two reasons: first, to acquaint the counterparts with the manner in which OJT should be conducted, for future, post-project application, and second, to ease any communications problems that may arise due to language.

Because of the informal nature of OJT, no standardized testing procedures should be designed or adopted. Skill-testing should center around demonstrated technical competence as evaluated by the TA/counterpart teams.

B. Rehabilitation of Deadlined Equipment

As mentioned in Annex G, there are several items of deadlined equipment now on hand in Rumbek and near Shambe that the team considers restorable. Two of these are US made Caterpillars: one 12F motor grader, and one 941B loader.

It is suggested that, soon after the scheduled beginning of equipment maintenance training in April 1982, these machines be inspected by the TA master mechanic and required repairs and parts be determined. A selected group of trainee senior mechanics should be made available to observe and work with the TA during this inspection and to participate in any necessary disassembly. The same group should follow through with the TA during the parts requisitioning process and, if possible, to the reassembly and road testing stages.

Although this is a relatively small step along the way, it is considered valuable for the following reasons:

- This initial "working together" approach will help to "break the ice" of the expatriate-instructor/trainee relationship, which can frequently be the key to the successful transference of skills.

- The TA will be given an early opportunity to assess the present skill levels of a select group of senior mechanics.

- The trainee will be able to observe, at first-hand, the correct procedures for diagnosing mechanical defec and for rectifying them.

- Hopefully, two badly needed pieces of heavy equipment will be restored to service.

C. New Equipment Indoctrination

1. Shop Tools and Equipment

Indoctrination in the operation and maintenance of the new sho tools and equipment to be provided by the project could begin in May 1982 and should be given in the following sequence:

- Shop inspection of tools/equipment and brief demonstration of usage.

- Classroom and shop sessions in nomenclature, preventiv maintenance, applications, and usage limitations. Training aids should include manufacturers' illustrate operating manuals; film strips and slides; wall charts and so forth.

- Additional shop demonstrations by the TA and beginning of performance of simple tasks by trainees using the machine.

- Demonstration of disassembly, maintenance, and reassem bly, followed by trainee participation.

- At satisfactory proficiency levels, limited production operation by trainees.

Where considered applicable, and when production demands permi a certain amount of cross-training should be given. For examp all general repair mechanics should be familiar with both the electric and oxygen/acetylene welding sets, engine analyzer,

and fuel injection and electrical testing devices; blacksmiths and body repairmen should be able to interchange up to a certain level; equipment inspectors, and to a lesser extent, field mechanics, should be oriented in most, if not all, shop equipment functions.

2. Roadway Maintenance Equipment

Indoctrination could begin in February 1983 and should include the following

a. Roadway Maintenance Foremen

- Inspection and familiarization with the basic industrial tractor.
- Demonstration of the tractor using the various accessories; explanation of the applications and limitations of tractor-drawn maintenance implements and how they differ from self-propelled machines.
- Orientation in preventive maintenance.
- Familiarization with operating the tractor using the accessories.

b. Tractor Operators

- All of the foregoing subjects, with special emphasis on, and a much longer practice period in, operation.

c. Equipment Maintenance Personnel

- Thorough orientation on the tractor (its engine, drive train, hydraulics, and so forth) and all of the accessories.
- Classroom review of all manufacturers' publications, such as service and operating manuals and parts books; at least one week should be devoted to parts identification.

D. Consultant-Provided Training

As a first step in the formation of a cadre of engineers and technicians within the Ministry who are familiar with the duties and responsibilities of construction supervision, it is proposed that the Consultant be required to agree to provide on-the-job training to selected Ministry employees during the construction phase.

This OJT would function on a counterpart basis. It should include the following classifications:

- Resident Engineer
- Office Engineer
- General Roadway Inspector
- Structural Inspector
- Surveyor
- Soils and Materials Technician

III. SELECTION OF TRAINEES

Because of the apparent wide diversity of educational levels, degrees of technical proficiency, and communications abilities among the classifications of employees that require training, it is proposed that, initially, no standard entrance criteria be fixed for participation in the program. However, prerequisites should be set for each category.

In the interim, it is believed that the following procedure might serve:

1. Announcements soliciting nominations for training should be circulated throughout the Ministry accompanied by a brief questionnaire outlining the nominee's educational background, years of experience in job classification(s), and an evaluation by the nominee's supervisor.

2. These data should be screened by the TA project manager, who would prepare a roster of nominees to be interviewed.

3. Interviews should be conducted jointly, with the Consultant's counterpart in attendance to avoid any misunderstandings due to language.

4. Where applicable, a demonstration of skill level by the nominee in the field of training for which he is being considered should be conducted prior to final selection.

5. Upon selection, the nominee's supervisor should be advised of the date and time to report to Rumbek to begin training.

IV. POST-PROJECT TRAINING

A. Appointment of Training Officer

To assure the continuance of the program after the project's completion and the smooth transition from project to Ministry administration, it is proposed that a full-time training officer be appointed to the Ministry's central office staff in Juba.

This individual should be recruited and be in position by the summer of 1984. He should take full advantage of the TA's remaining time on the project to observe and consult and ultimately to jointly plan and schedule post-project training activities. Included in this planning would be the development of possible modifications to (a) methodology, (b) curricula, (c) training course duration, and (d) trainee selection procedures, based on the experience gained during the project period.

Ideally, the candidates for this post should be civil engineers with at least five years of experience in road construction and maintenance and some grounding in equipment application, operation, and maintenance. The team encountered one such suitably qualified engineer in the Ministry's employ, and in all probability, there are others.

B. Instructor Training

Approximately six months before the completion of the project, a screening of all trainees who have successfully participated in the program should be conducted by the TAs to identify those individuals who might be considered as instructors at the Rumbek Center.

This screening, and subsequent selection, should be limited to the following training categories--at least initially--until such time as the Ministry is satisfied that a sufficient number of trained personnel have been produced to adequately cope with the inevitably increasing maintenance work load:

Recommended Training Categories

- Foreman, Roadway Maintenance
- Operator, Industrial Tractor
- Operator, Heavy Equipment
- Driver, Heavy Duty Truck
- Foreman, Equipment Maintenance
- Mechanic, Senior
- Automotive Electrician
- Welder
- Storekeeper

It is not intended that the candidates selected for these post-project activities devote full-time to training. They should occupy in-line, productive jobs and administer training within the limits of production demands.

The planning and scheduling of classes and OJT sessions should be made jointly by the Rumbek center manager and the training officer, in coordination with the Ministry's senior staff in Juba.

Incentive pay for these additional training responsibilities should be given early consideration.

V. PROPOSED TRAINING

Tables K-1, K-2, and K-3 show a current listing of SRMPWTC personnel, some of whom will be selected for training.

Table K-1

Skilled SRMPWTC Personnel

Classification	Number
Engineer, Civil	10
Engineer, Mechanical	7
Superintendent, Roads (Sr. Rds. Supv.)	14
Superintendent, Roads, Assistant	5
Superintendent, Mechanical	4
Superintendent, Mechanical, Assistant	9
Foreman, Maintenance, (Supv.) Roads	20
Foreman, Maintenance, Workshop	6
Overseer, Roads	60
Mechanic, Senior, Plant	15
Mechanic, Senior, Vehicle	27
Mechanic, Plant	23
Mechanic, Vehicle	50
Electrician, Automotive	4
Machinist	5
Welder	6
Blacksmith	8
Operator, H.E.	27
Operator, H.E., Assistant	19
Storekeeper	4
Mason	30
Carpenter	40
	393 of 4,600

Table K-2

On-the-Job Training Summary

Road Rehabilitation and Rumbek Center Construction	No. of People	Man-months Training
Rehabilitation Foreman*	6	192
Heavy Equipment Operator*	4	128
Engineers (Counterparts/Inspector)	8	256
Technicians (lab, survey, etc.)	12	384
Subtotal	30	960
Rumbek Equipment Maintenance Center		
Managers and Foreman	11	429
Mechanics	18	702
Related Trades	14	546
Storekeepers and Sr. Clerks	7	273
Subtotal	50	1,950
Road Maintenance		
Provincial Engineers	4	168
Surface Maintenance Crews	17	283
Road Supervisors and Gen. Maintenance Foreman	20	485
Livestock Teams	22	345
Subtotal	73	1,279
Total	153	4,189

*Trained by Contractor's personnel under supervision of the TAs.

Table K-3

Proposed Staffing and Annual Costs,

Equipment Maintenance Center - Rumbek

Position	Monthly Base (LS/Mo)	Annual Rate (27.6xBase)	# Required	Annual Cost (000 US $)
Center Manager	100	2,760	1	2.8
Dep. Center Manager	85	2,346	1	2.3
Administrator/Timekeeper	49	1,352	1	1.4
Chief, Equipment Maintenance	75[a]	2,070	1	2.1
Supervisor, General Repair Shop	64.8	1,788	1	1.8
Foreman, Electrical Shop	56.3	1,554	1	1.6
Foreman, Engine Test & Overhaul	56.3	1,554	1	1.6
Foreman, Welding & Blacksmithing; Body Repair; Paint; Carpentry & Upholstery Shops	56.3	1,554	1	1.6
Foreman, Minor Repairs; Lube & Tire Shops	56.3	1,554	1	1.6
Equipment Inspectors	56.3	1,554	2	3.1
Mechanic, Sr.				
- General Repair Shop	49	1,352	2	2.7
- Mobile Service Unit	49	1,352	1	1.4
Mechanic				
- General Repair Shop	42.6	1,178	4	4.7
- Engine Test & Overhaul	42.6	1,176	2	2.4
- Minor Repairs	42.6	1,176	1	1.2
- Mobile Service Unit	42.6	1,176	1	1.2
Mechanic Assistant				
- General Repair Shop	32.1	886	4	3.5
- Engine Test & Overhaul	32.1	886	1	0.9
- Minor Repairs	32.1	886	1	0.9
- Mobile Service Unit	32.1	886	1	0.9
- Lube & Tire Shops	32.1	886	2	1.8
Electrician, Automotive	42.6	1,176	1	1.2
Electrician Automotive, Apprentice	32.1	886	1	0.9

Table 4-4 (Continued)

Position	Monthly Base Salary	Annual Base Salary	# Required	Annual Cost (Thousands)
Blacksmith, Head	49	1,[illegible]	1	[illegible]
Blacksmith	42.6	1,[illegible]	1	1.2
Welder				
- General Repair Shop	42.6	1,[illegible]	1	1.2
- Welding & Blacksmithing Shop	42.6	1,176	1	1.2
Body Repairman (includes automotive painting skills)	42.6	1,176	3	3.6
Carpenter	49	1,352	1	1.4
Carpenter Apprentice	32.1	886	1	0.9
Upholsterer	42.6	1,176	1	1.2
Storekeeper, Chief	56.9	1,584	1	1.6
Storekeeper, Senior	49	1,352	1	1.4
Clerk, General Issue	37[a]	1,021	2	2.0
Clerk, POL Issue	37	1,021	1	1.0
Clerk, POL Issue, Assistant	32.1	886	1	0.9
Clerk, Cardex	37	1,021	1	1.0
Clerk/Typist	37	1,021	3	3.1
Driver	32.1	886	2	1.8
Guard	32.1	886	6	5.3
Laborer	28	773	16	12.9
				86.2

[a] Approximately.

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ANNEX L

WAIVER REQUESTS

ANNEX L

WAIVER REQUESTS

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR FOR AFRICA

FROM: James S. Holtaway, Acting Director, USAID/Sudan

SUBJECT: Cost Sharing Waiver (FAA Sec. 110(a)): Sudan

PROBLEM: Approval is requested for waiver of the FAA Section 110(a) "Cost Sharing" for the project, Southern Sudan Rural Infrastructure (650-0031).

DISCUSSION: The Foreign Assistance Act of 1961 (FAA), as amended, states that under sections 103 through 107 assistance shall not be furnished by the U.S. to a country until that country provides assurances to the President that it will contribute at least 25 percent of the total costs (including "in kind") of the activity to which such assistance is to be furnished. This cost-sharing statutory requirement may be waived if the country is determined by A.I.D. to be "relatively least developed" (RLDC) in accordance with the United Nations Conference on Trade and Development list of "relatively least developed countries". Sudan has been so determined and thereby declared eligible for waiver purposes of the requirement associated with Section 110(a) of the Foreign Assistance Act. Authority for this waiver has been redelegated to the Assistant Administrator for Africa.

Sudan has a per capita income of less than $300. The population lacks adequate government services in health, education and other sectors. The country has accumulated a staggering foreign debt which has become increasingly difficult to service and has resulted in a significantly curtailed development program. If development efforts are to be maintained and strengthened, donors for the next several years must be prepared to assume even greater financial responsibility for project costs. The Project Paper presents a budget allocating approximately 92 percent to the USG and 8 percent to the Government of Sudan.

RECOMMENDATION: For the above reasons, it is recommended that you conclude (1) that waiver of Section 110(a) of the Foreign Assistance Act of 1961, as amended, requiring host country contribution of 25 percent cost-sharing of project costs is warranted by existing circumstances and (2) that you certify that non-waiver of Section 110(a) would seriously impede the attainment of U.S. foreign policy objectives and the objectives of the foreign assistance program.

APPROVED _____

DISAPPROVED _____

DATE _____

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR FOR AFRICA

FROM: James S. Holtaway, Acting Director, USAID/Sudan

SUBJECT: Commodity Procurement Source Waiver

PROBLEM: Approval is requested for a procurement source waiver from Geographic Code 941 (Selected Free World) to Geographic Code 935 (Special Free World):

a.	Cooperating Country:	Sudan
b.	Authorizing Document:	Project Paper
c.	Project:	Southern Sudan Rural Infrastructure (650-0031)
d.	Nature of Funding:	Grant
e.	Description of Commodities:	Unidentified spare parts as may be necessary for construction/ maintenance equipment on urgently needed basis
f.	Approximate Value:	$200,000
g.	Probable Procurement Origin:	U.S.
h.	Probable Procurement Source:	Kenya, Sudan

DISCUSSION: A.I.D. Handbook 1B, Chapter 5, states that the authorized source for procurement of project commodities under a grant to a relatively least developed country (RLDC) is Geographic Code 941 (Selected Free World). Sudan is an RLDC. In accordance with Handbook 1B, procurement of commodities from Code 935 sources under a grant financed project requires a waiver. A waiver may be granted if an essential commodity is not available from eligible sources or there are circumstances determined to be crucial to the attainment of U.S. foreign policy or foreign assistance program objections. Authority for making the special determination and waiver has been redelegated to the Assistant Administrator for Africa.

The majority of spare parts for the construction and maintenance equipment procured and utilized under this project will be procured from the U.S.

However it is anticipated that in ordering these spares a small percentage of certain parts may be omitted or not received, or the demand for additional spares on an urgent basis will be difficult to fill if they must be ordered and shipped from the U.S. The project area is relatively remote and inaccessible and often cut off from the rest of the world in terms of transportation, communications and supplies. Shipment of goods is often delayed.

Because of potential non-availability and shipment time of spare parts from the authorized source (Code 941) and the fact that such availability is essential to carrying out the project, it was determined that special circumstances exist which justify waiving the source/origin requirements generally set forth in Handbook 1B.

RECOMMENDATION: For the above reasons, it is recommended that you conclude (1) that special circumstances exist at this time that warrant the procurement from Code 935 sources and (2) that you certify that exclusion of procurement from the source requested would seriously impede the attainment of U.S. foreign policy objectives and the objectives of the foreign assistance program.

APPROVED _____

DISAPPROVED _____

DATE _____