

UNCLASSIFIED

PROJECT PAPER

MAURITANIA RURAL ROADS IMPROVEMENT

682-0214

**BEST AVAILABLE COPY**

Authorized: September 14, 1982  
Amount: \$4,810,000

AGENCY FOR INTERNATIONAL DEVELOPMENT

UNCLASSIFIED

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR FOR AFRICA

FROM : AFR/DR, Norman Cohen

SUBJECT: Mauritania Rural Roads Improvement Project (682-0214)

Problem: Your approval is requested for a grant of \$4,810,000 from the Sahel Development appropriation (Section 121 of the FAA of 1961, as amended) to the Islamic Republic of Mauritania for the Rural Roads Improvement Project (682-0214). It is planned that \$3,717,000 will be obligated in FY 1982.

Discussion:

A. Brief description of the Project:

1. The Project will improve the road network to the Guidimaka and Gorgol Regions, making the area accessible year-round from the outside. The roads will make it easier to provide social services and agricultural inputs to potentially high food production areas, as well as improve access to markets for the food produced. Economic and social development of the Guidimaka and Gorgol Regions should increase as a result of the improvement of the roads.

Two hundred and nine kilometers of the 279 kilometer road from Kaedi through M'bout and Selibaby to Gouraye will be improved by A.I.D in this activity. A.I.D and the UN Sudano-Sahelian Office (UNSO) have been planning a joint effort to improve this road network since 1980. UNSO has supplied the heavy road-building equipment for this activity. They began construction of the 70 kilometer link between M'bout and Selibaby in 1982. A.I.D. will continue road construction beyond kilometer 70, pick up construction brigade operational costs, supplement the road construction heavy equipment with spare parts, and complete the remaining 209 kilometers of the road network.

2. A.I.D.'s highest priority in Mauritania is increasing food production in the most productive area of the country. The Guidimaka region, which has high agricultural potential but is isolated from the rest of Mauritania, especially during the rainy season, is central to this effort. USAID activity in the area includes the Guidimaka Integrated Rural Development Project, Small Irrigated Perimeter Development, the P.L. 480 program and USAID/OMVS activities in the Senegal River Basin, including the Integrated Development Project which will build agricultural roads feeding into the Selibaby-Gouraye road.

P.L. 480 Title II Section 206 local currency proceeds from grain sales will also be made available for the improvement of the road network. In the development of the Title II section 206 proposal, the Government of Mauritania (GIRM) has committed itself to a major price policy reform which will encourage the private sector to increase local grain production. The planned

Agriculture Sector grant, focussing on increasing food production in the Guidimaka Region, is expected to encourage more general policy reforms to be identified during the development of that program. The transportation system to be improved by this Project is essential to the success of all of these efforts.

3. The beneficiaries of the Project will be largely those working in food production. As this sector absorbs the vast bulk of the area's productive labor, the Project has the potential of affecting 64,000 people (68% of the population, representing small farmers). Cost per beneficiary is estimated at \$75.

B. Financial summary of the Project:

The life-of-project financing is \$4,810,000 of which \$333,000 will be for local costs. \$3,717,000 will be obligated in FY 1982.

	FY 1982	LOP
Technical assistance	\$1,461,000	\$1,461,000
Commodities	1,923,000	2,930,000
Other	-	86,000
Subtotal	3,384,000	4,477,000
Local cost financing	333,000	333,000
GRAND TOTAL	\$3,717,000	\$4,810,000

In addition to the above Development Assistance-funded resources, \$1,207,000 of P.L. 480 Title II Section 206-generated local currency will be made available for local costs requirements in FY 1984 and FY 1985. The P.L. 480 proposal is currently under review and approval is expected. If for any reason P.L. 480-generated local currency resources are not made available to the Rural Roads Improvement Project, a supplemental request of \$1,207,000 for this Project will be made. These total road construction costs of \$6,017,000 are justified in the economic feasibility analysis of the project paper. However, the Mission would prefer to coordinate P.L. 480 and Development Assistance resources to achieve the improvement of rural roads sought in this effort.

Other assistance is as follows:

The UNSO will procure U.S. source equipment replacement and spare parts material financed by A.I.D. through this project. The UN will also engage in a monitoring role to assist in the supervision of the use and care of heavy equipment. The UNSO contribution in the above effort will be \$200,000 in personnel and administrative fees during the life of the Project.

The GIRM will provide the use of heavy road building equipment and the services of 24 skilled Public Works personnel during the life of the project. The value of the GIRM contribution is \$1,300,000.

C. Socio-economic, technical, and environmental description:

1. Project reviews were held in July and August, 1982. The ECPR was held on August 16, 1982. All issues raised have been resolved. The project has been determined to be economically, financially, technically and socially feasible.
2. No issues of concern to the U.S. exist in the area of human rights.
3. The I.E.E. for the Project resulted in a negative determination on condition that a covenant will be included in the Project Agreement to assure that proper environmental procedures appropriate to road-building activities will be followed during project implementation.

D. The Grant Agreement:

1. There will be one major condition precedent. The Grant Agreement will not be executed until UNSO/OPE (Office of Project Execution) furnishes to A.I.D. in writing a commitment that it will finance the first 70 kilometers of the M'bout-Selibaby road.<sup>1/</sup>
2. Five covenants will be included in the Grant Agreement. The GIRM will agree to make all of the heavy road-building equipment provided to them by UNSO available for exclusive use in this Project until all the planned roads are completed. Without such equipment the roads cannot be improved. The GIRM will covenant to provide all of the Public Works personnel and their compensation called for in the Project Paper. These skilled people are required for the effective functioning of the construction brigade.

The GIRM will covenant to establish a maintenance plan, which will include the assurance of parts and labor for the maintenance of equipment as well as the maintenance of roads. The GIRM will also covenant to continue required road maintenance through a system of Public Works contracts with local village communities. These covenants will be included in order to assure the proper maintenance required for continued use of the roads. An additional covenant will provide GIRM assurance to follow proper environmental actions during Project implementation so that adverse environmental effects will not result from road construction activities.

3. Overall responsibility for Project implementation will rest with the GIRM Ministry of Equipment, Transport, and Telecommunications Directorate of Public Works. USAID will provide needed technical services under a direct A.I.D. contract with a U.S. consulting firm which will be monitored by a USAID Project manager. UNSO/OPE will act as procurement services agent to purchase U.S.-source equipment and spare parts commodities financed by A.I.D.

E. Based on the Project Committee's detailed review of the engineering analysis and the Project's cost estimates, the requirements of Section 611(a) of the FAA are judged to be satisfactorily met. The requirements of section 611(e) are also met based on the Mission Director's certification of GIRM capability as indicated in the cable in Attachment B.

<sup>1/</sup>See Attachment A, memorandum indicating that this condition has been satisfied.

F. The officer in USAID/Mauritania responsible for the Project will be John Grayzel. The officer responsible in AFR/DR is David Dawson.

G. During the ECPR for this Project, it was recommended that, because of the technical nature of the Project and because of the Mission workload requiring engineering expertise, the Project be authorized only on condition that USAID requests a USDH engineer be included on its staff to assure that this Project and other projects in the Mission's portfolio with engineering elements are properly monitored from a technical perspective. The Mission Assistant Director attended the ECPR and made a commitment to create and staff a USDH engineering position. The Mission Director has concurred with this commitment.<sup>2/</sup>

III. Section 121(d) Certification: Pursuant to Section 121(d) of the FAA a certification was made by USAID/Mauritania that no funds from the Project will be released to the cooperating country. A determination to this effect was made by the AA/AFR on July 26, 1982.

V. Justification to the Congress: The Project was included in the 1982 Congressional Presentation as the Rural Roads Improvement Project, 682-0214, appearing on page 78 of the Africa Bureau overview therein. Since the funding level of the Project has changed from that presented to the Congress in the CP, an Advice of Program Change was prepared, and was sent to the Congress on August 10, 1982. The waiting period expires on August 24, 1982.

Recommendation: That you sign the attached Project Authorization, and thereby approve life-of-project funding of \$4,810,000.

<sup>2/</sup>See Attachment B, Mission Director's cabled concurrence with this personnel decision.

Clearances

DAA/AFR:RLove *RL* 9/14

GC/AFR:LDeSoto *LD*

AFR/DR/SWAP:JRMCCabe *JRM*

AFR/DR/SWAP:DDawson (draft)

AFR/DR/SDP:GThompson *GT*

AFR/DR/ENG:JSnead *JS*

AFR/DR/ARD:HFarnham (draft)

DAA/AFR:FCorrel *FC*

AFR/SWA:FGilbert *FG*

AFR/SWA:LWerlin (draft)

AFR/DP:SSharp (draft)

FVA/PPE:FDuncan (draft)

PPC/PDPR:JErikson *JE*

PROJECT AUTHORIZATION

NAME OF COUNTRY : Islamic Republic of Mauritania

NAME OF PROJECT : Rural Roads Improvement

NUMBER OF PROJECT : 682-0214

1. Pursuant to Section 121 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Rural Roads Improvement Project (the "Project") for the Islamic Republic of Mauritania (the "Cooperating Country") involving planned obligations in an amount not to exceed \$4,810,000 (four million eight hundred ten thousand United States dollars) in grant funds over a two year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the Project.
2. The Project consists of assistance to the Cooperating Country to increase access and thereby stimulate economic and social development of the Guidimaka and Gorgol regions by providing an all-year transportation network to facilitate agricultural inputs into potentially high food production areas and to provide access to markets. A.I.D.'s contribution to the project consists of providing technical assistance, operational costs of a mobile construction brigade, and commodities and equipment which will be used to build or rehabilitate approximately 209 kilometers of road between Kaedi-M'bout-Selibaby-Goraye.
3. The Grant Agreement, which may be negotiated and executed by the officers to whom such authority has been delegated in accordance with A.I.D. regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

A. Source and Origin of Goods and Services

Goods and services financed by A.I.D. under the Project shall have their source and origin in A.I.D. Code 000 (U.S.) and in the Cooperating Country, except as A.I.D. may otherwise agree in writing. Ocean shipping financed under the Project shall be financed only on flag vessels of the United States, except as A.I.D. may otherwise agree in writing.

B. Condition Precedent

1. Prior to execution of the Grant Agreement, UNSO-OPE (United Nations Sudano-Sahelian Office/Office of Project Execution) shall furnish to A.I.D. in writing a commitment that it will finance the first 70 kilometers of the M'bout-Selibaby road.

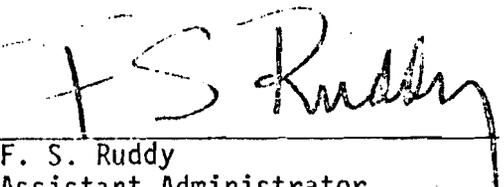
C. Covenants

The Project Agreement shall contain covenants providing in substance as follows, except as A.I.D. may otherwise agree in writing:

1. The Cooperating Country agrees to furnish evidence that it will provide all of the Public Works personnel, and their usual salaries and other benefits, called for in the project description to work with the technical assistance contract team on the construction brigade.
2. The Cooperating Country agrees that USAID shall control the use of the road construction and maintenance equipment provided to the Cooperating Country by UNSO/OPE in connection with UNSO-financed construction of seventy kilometers of the M'Bout-Selibaby road. This equipment shall be used exclusively for USAID-financed road construction and rehabilitation activities financed under the Grant.
3. The Cooperating Country will establish a maintenance plan which will include the assurance of financing spare parts and labor for the maintenance of equipment to be left with the District Public Works Engineer at Kaedi and Selibaby upon completion of the project.
4. The Cooperating Country will continue required road maintenance following the completion of the Project through a system of Public Works contracts with local village communities and adherence to road maintenance planning developed under the Fourth Highway Plan.
5. The Cooperating Country will follow proper environmental procedures appropriate to road-building activities during project implementation, such as those outlined in chapter 2 of "A.I.D. Environmental Design Considerations for Rural Development Projects."

Date: \_\_\_\_\_

9.14.

  
\_\_\_\_\_  
F. S. Ruddy  
Assistant Administrator  
for Africa

AGENCY FOR INTERNATIONAL DEVELOPMENT  
PROJECT DATA SHEET

1. TRANSACTION CODE  
 A = Add  
 C = Change  
 D = Delete

Amendment Number \_\_\_\_\_

DOCUMENT CODE  
3

2. COUNTRY/ENTITY MAURITANIA

3. PROJECT NUMBER  
682-0214

4. BUREAU/OFFICE  
AFRICA [06]

5. PROJECT TITLE (maximum 40 characters)  
Rural Roads Improvement

6. PROJECT ASSISTANCE COMPLETION DATE (PACD)  
MM DD YY  
12 31 86

7. ESTIMATED DATE OF OBLIGATION  
(Under 'B' below, enter 1, 2, 3, or 4)  
A. Initial FY 82 B. Quarter 4 C. Final FY 83

8. COSTS (\$000 OR EQUIVALENT \$1 = )

A. FUNDING SOURCE	FIRST FY 82			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total	3384	333	3717	4477	533	4810
(Grant)	(3384)	(333)	(3717)	(4477)	(533)	(4810)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S.						
1. PL 480, Title II					1207	1207
2. Section 206					1300	1300
Host Country						
Other Donor(s) UNSO				200		200
TOTALS	3384	333	3717	4677	2840	7517

9. SCHEDULE OF AID FUNDING (\$000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE		D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) SH	130	821				4810		4810	
(2)									
(3)									
(4)									
TOTALS						4810		4810	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)  
061

11. SECONDARY PURPOSE CODE  
220

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	B. Amount	BR	BL	BS

13. PROJECT PURPOSE (maximum 480 characters)

to facilitate access to markets and the means of moving social services and agricultural inputs into potentially high food production areas

14. SCHEDULED EVALUATIONS

Interim	MM	YY	MM	YY	Final	MM	YY
	04	83	07	84		11	86

15. SOURCE/ORIGIN OF GOODS AND SERVICES  
 000  941  Local  Other (Specify) \_\_\_\_\_

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of \_\_\_\_\_ page PP Amendment)

17. APPROVED BY  
Signature  
Title  
MISSION DIRECTOR  
Date Signed  
MM DD YY  
07 02 82

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION  
MM DD YY  
07 06 82

TABLE OF CONTENTS

PAGE

Project Data Sheet	I
List of Acronyms and Abbreviations	II
Maps of Project Area	
I. Project Summary and Recommendations	1
II. Project Background and Description	2
A. Background and Problem Statement	2
1. Mauritania and The Guidimaka Region	2
2. AID Involvement	3
3. Other Road Projects - Linkages	4
B. Project Details	4
C. Project Relationship to Development Priorities and to Other Projects	16
1. GIRM Sectoral Priorities	16
2. AID Strategy	17
3. Other AID Projects	18
4. Other Projects and Activities	20
5. Other Road Projects	23
III. Engineering Analysis	25
A. Technical Description of Track Features	25
B. Maintenance: Facts, description of activities and Related Costs	28
C. Analysis of Construction Operations by Force Account with Technical Assistance	31
D. Detailed Operating Costs	37
E. Kaedi-M'bout Road	45
IV. Economic Analysis	46
A. Background	46
B. Costs	46
C. Benefits	47
1. Road User Savings from Existing and Generated Traffic	47
2. Benefits from Diverted Traffic	47
3. Savings in Storage and Inventory Costs	48
4. Production Incentives	49
D. IRR's	50

8

	PAGE
E. Policy Issues: Food Pricing and the Financing of Road Maintenance and Construction	50
V. Social Analysis	52
A. Roads in the Context of the Basic Social Landscape: Soninke Culture	52
B. The Moors	54
C. The Toucouleur and Fulbe	55
D. Women, Children, and Road Benefits	56
E. Roads in Particular	56 58
F. Constraint vs. Quantification for Projection	59
VI. Administrative Feasibility	61
VII. Financial Analysis and Plan	68
VIII. Project Implementation Plan	70
IX. Evaluation Plan	71
X. Conditions, Covenants, and Negotiating Status	72
XI. Logical Framework	72

#### APPENDICES - Volume II

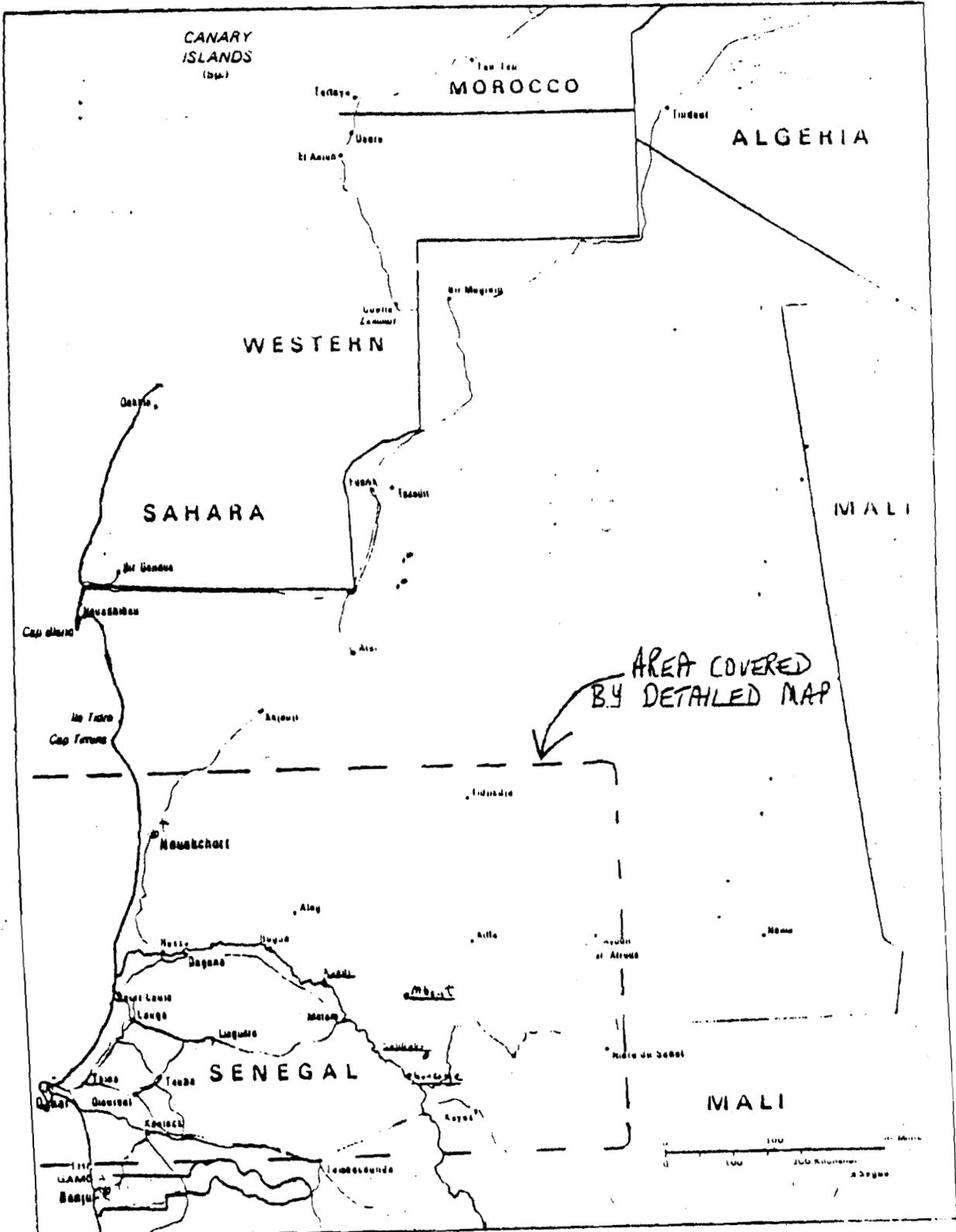
A. PID Approval Cable	
B. Legal Exhibits	
1. 611 (a) Certification	
2. GIRM Request for Assistance	
C. Engineering Annex	
D. Economic Annex	
E. Social Soundness Annex	
F. Procurement Plan	
G. I.E.E.	
H. Project Checklists	
1. Project	
2. Statutory	
3. Country	
I. GIRM Organization Chart: Ministry of Equipment, Transport and Telecommunications	
J. 1. Summary of PL 480 Title II Section 206 Project	
2. Rural Roads Subproject Component of PL 480 Title II Section 206 Project	

9

LIST OF ACRONYMS AND ABBREVIATIONS

CMP	Corrugated Metal Pipe
DRIG	Guidimaka Integrated Rural Development Project
EW	East-West Axis
FAO	Food and Agriculture Organization
FAC	Fonds d'Aide et de Cooperation
FED	Fonds Europeen de Developpement
FENU (UNEF)	Fonds d'Equipement des Nations Unis (UN Equipment Fund)
FDR	Fond de Developpement Rural (Rural Development Fund)
GIRM	Government of the Islamic Republic of Mauritania
IDA	International Development Agency (IBRD)
IFAD	International Fund for Agricultural Development
IGN	Institut Geographique National, Paris
IBRD	World Bank
ILO	International Labor Office
KFW	Kreditanstalt fuer Wiederaufbau
KM	Kilometer
LNTP	Laboratoire National des Travaux Publics
M	Meter
METT	Ministere de l'Equipement, Transport et Travaux Public
MT	Million Metric Tons
OMC	Office Mauritanien des Cereals
OMVS	Organization pour la Mise en Valeur du Fleuve Senegal
RAMS	Rural Assessment/Manpower Survey Project
SNIM	Societe Nationale Industrielle et Miniere
SONADER	Societe Nationale pour le Developpement Rural
SONIMEX	Societe National d'Importation et d'Exportation
TP	Travaux Publics (Public Works; Direction of Infrastructure, Ministry of Equipment, Transport and Public Works)
UNDP/OPE	United Nations Development Program Office of Project Execution
UNSO	United Nations Sudano-Sahelian Office
UM	Monetary Unit in Mauritania 1 Ouguiya = 2¢ U.S. U.S.\$1 = 50.55 UM (May, 1982)

# Mauritania



M2770-1-71 (643100)  
 Lambert Conformal Projection  
 Standard parallels 6° and 32°  
 Scale: 1:500,000  
 Date: 1971  
 1:500,000



I. Project Summary and Recommendations:

A grant of \$4,810,000 to the Government of the Islamic Republic of Mauritania (GIRM) is proposed through the Rural Roads Improvement Project, 682-0214, to increase access and thereby stimulate economic development of the Guidimaka and Gorgol Regions by providing an all-weather transportation network to facilitate agricultural inputs into potentially high food production areas, and to provide access to markets. Two hundred and nine kilometers of roads will be upgraded to all-weather status.<sup>1/</sup> The M'bout-Selibaby road will be upgraded from a point seventy kilometers south of M'bout, where UNSO/OPE will complete its financed improvement of this link, to Selibaby, the capital of the Guidimaka Region and then on to Gouraye in the Senegal River Valley. The M'bout-Kaedi road will also be improved to guarantee a permanent year-round linkage with the national road network serving both the most productive area of the country and the rest of Mauritania.

Improvements on the M'bout-Selibaby road have begun under an UNSO/OPE project which provides heavy road construction equipment, a technical assistance team, and operating costs for road construction through a quasi-force account construction brigade of the GIRM Ministry of Equipment, Transport and Communications - Department of Public Works. The USAID-financed Rural Roads Improvement Project will continue this approach when UN financing has finished and will incorporate a U.S. contract technical assistance team to carry on road construction as well as maintenance and the training of personnel from Public Works until the proposed road network is completed. The initial investment by UNSO/OPE in road construction equipment will be made available to the USAID-financed effort, supplemented by AID-purchased spare parts and construction equipment.

The map on page indicates the roads to be improved in the area. In summary, they are as follows:

<u>ROAD</u>	<u>DISTANCE (KMS)</u>	<u>EXTERNAL FINANCING</u>	<u>TIMETABLE</u>
1. M'bout-70 kms toward Selibaby	70	UNSO/OPE	3/82-5/83
2. 70 kms from M'bout-Selibaby	46	AID-682-0214/ PL 480	5/83-2/84
3. Selibaby-Gouraye	45	" "	2-11/84
4. M'bout-Kaedi	118	" "	11/84 -8/85

1/ The roads will not be paved, but will be improved to the point where access will be unimpeded during the rainy season.

This project should be reviewed in tandem with USAID/Mauritania's proposed PL 480 Title II Section 206 program. The Title II Section 206 program will finance a number of development projects with local currency generated by the sale of PL 480 commodities. The Rural Roads Improvement Project was originally proposed to improve the M'bout-Selibaby-Gouraye road. The Title II Section 206 sub-project for road improvement proposes to upgrade the M'bout-Kaedi road. Since these roads together are part of the same road network and are both vital links in the transportation system, their financing should be considered together. The M'bout-Kaedi road requires foreign exchange inputs unavailable through the PL 480 Title II Section 206 local grain sales proceeds. The M'bout-Selibaby-Gouraye road also has requirements for the use of local currencies. Thus this present project proposal, Rural Roads Improvement, 682-0214, includes the provision of foreign exchange required for rehabilitating the M'bout-Kaedi road. Likewise, local currency requirements for the M'bout-Selibaby-Gouraye road will be primarily met with PL 480 sales proceeds as indicated in the financial section of this Project Paper. However, since PL 480 local currency will not be available until FY 1984, there is also a local currency element to the Rural Roads Improvement Project (to cover requirements prior to FY 1984) amounting to \$333,000. Total costs met by AID contributions for the complete improved road network are \$6,017,000. \$4,810,000 will be financed under the Rural Roads Improvement Project and \$1,207,000 in local currencies under the PL 480 Title II Section 206 program.

## II. Project Background and Description

### A. Background and Problem Statement

#### 1. Mauritania and the Guidimaka Region

Mauritania, located in northwestern Africa, is a vast country of 1,400,000 km<sup>2</sup> (540,400 square miles), equalling the areas of Washington, Oregon and California, with a population of only 1.6 million, the majority of which depends on agriculture and herding. In 1979, national per capita GDP was approximately \$320, but with vast distances and high cost of bringing commodities inland, the \$320 figure represents much less in terms of purchasing power in the rural sector. In the Guidimaka Region the per capita annual income is \$214, but half of this represents income from remittances.

The Guidimaka Region, covering 10,200 km<sup>2</sup> in the southern part of the country lies around the 600 mm isohyet, the only area of any significant rainfall, helping to make the region potentially the area of greatest food production. The area cuts across two production zones, rainfed and irrigated river basin, and represents Mauritania's greatest potential in both. The road system serving the region and linking it with the rest of the country is cut for up to four months during the rainy season, isolating the Guidimaka from the rest of Mauritania.

In the past, the Guidimaka Region was important as a food exporting region; by 1980 it had become a net importer of food grains. Food

14

production has been declining in Mauritania at an annual average rate of 4 percent since 1961, largely because of drought; concurrently, the population has been increasing at an annual rate of 2.5 percent. Annual food grain imports have increased from approximately 20,000 MT per year during the late 1960's to 150,000 MT in 1980. To help reverse this alarming trend, agricultural production must be stimulated in areas of greatest agricultural potential. For this reason, the Guidimaka Region holds a high priority in Mauritanian development plans, and road improvements are necessary to facilitate the development process.

The need for increased agricultural production is apparent in the riverine areas of the Guidimaka and Gorgol regions, as well as in the drier interior. Along the Senegal River, millet and sorghum are not produced in sufficient quantity or marketed at high enough prices to make agriculture competitive with wages that can be earned outside the country. Vegetable production, while desirable from a nutritional standpoint, does not yet have a large market. Rice production on large irrigated perimeters looks attractive in terms of potential yields and selling price, but remains highly questionable in terms of actual profit after investment and yearly carrying costs are deducted.

The situation of the interior populations who rely heavily on agriculture is even more difficult. All the problems faced by river agriculturalists--lack of markets, poor transportation--are even greater in these more isolated areas, and past development plans have largely neglected them.

The 94,000 residents of the Guidimaka Region are also impoverished in other ways. Virtual isolation of the region during the 4-month rainy season, from July through October, precludes intra-regional communications as well as connections with the rest of Mauritania. The people are denied access to regional social services--hospitals, dispensaries, secondary schools and agricultural extension resources. They cannot transport to market what surpluses they may have for sale. Only with extreme difficulty can they obtain fuels and consumer supplies. The underdeveloped condition of the road network reflects the region's impoverishment. It is the consequence of insufficient investment in road improvements and inadequate maintenance due to a lack of funds, organization, equipment and trained manpower. Without outside assistance, including emphasis on training, the road system can only deteriorate further. In addition, the region is located in greater proximity to Senegal than to the capital and main arteries of Mauritania. Thus the poor quality of roads has forced more of an orientation to Senegal which has made the political and economic integration of the region with the rest of Mauritania that much more difficult.

## 2. AID involvement in the region.

As part of its focus on the Guidimaka Region, a number of AID projects, on-going and planned, will benefit from the realization of the Rural Roads Improvement Project. These are:

- Integrated Rural Development Project (DRIG)
- PL 480, Title II - 206 Program

- Proposed Agricultural Sector Grant
- Africare Small Irrigated Perimeters Project
- OMVS Integrated Development Project, 625-0621

These are described in more detail in Section C.3 below.

### 3. Other Road Projects

A number of activities in the road sector are underway or being planned. Among the most important affecting this project are:

- \* The IBRD's Fourth Highway Project, in collaboration with other donor agencies (including elements of highway maintenance)
- \* The Aleg-Boghe road
- \* Feeder Roads to be included in the USAID/OMVS Integrated Development Project

These are covered in more detail in Section C.5 below.

## B. Project Details

### 1. Project Purpose

The project will upgrade some 209 km of track between M'bout-Selibaby-Gouraye and M'bout-Kaedi to all-weather standards to make Guidimaka more accessible to commercial and social services. The project roads will also serve as a major link to all-weather networks outside the region and, locally, as an outlet for a series of projected agricultural feeder roads.

The major features of the project are:

- a) relatively low-cost stage construction emphasizing drainage structures, with standards allowing for future improvement of roadway surfaces as traffic levels increase.
- b) low maintenance requirements by virtue of design: free-flow fords instead of bridges, and substantial diameter culverts; little motorgrading and no resurfacing; cleaning of culverts and emergency repairs only.
- c) Community involvement in the construction phase by providing labor for pay on an hourly basis; and in the maintenance phase by providing labor under contract for compensation at a fixed annual cost.
- d) A parastatal force account approach to construction: UNSO/OPE is managing the first 70 km of the M'bout-Selibaby road much the same as a private contractor, with authority to hire and fire.

- e) A significant institution-building element, through the training of counterparts and workers, leading to the formation of an integrated construction brigade ("Brigade Speciale Autonome") for service either in Guidimaka or elsewhere in Mauritania when the project is completed. The Public Works (TP-Travaux Publics) subdivision for Guidimaka, based in Selibaby, will receive in-service training and, at the end of the project, some light equipment for maintenance and emergency repairs. The District Engineer and his staff will assist the brigade during the construction period and will learn to operate and maintain the equipment which they will receive after the project is completed.
- f) Maintenance costs will be low and consistent with current GIRM budgets for regional TP subdivisions based on fixed-price contracts with the villages.

Track improvements to all-weather standards will have stimulating effects at the farm level by increasing access to goods and services, allowing a more timely and regular supply of agricultural inputs, and providing greater opportunities for selling surpluses of agricultural products.

The project is designed to support agricultural development and to strengthen the institutional framework for proper maintenance of the Guidimaka road network. The project is in effect a multi-donor effort with UNSO/OPE constructing the first phase and then turning over its equipment for use on the USAID-financed second phase. The program will include procurement of road construction and maintenance equipment, spare parts, materials and supplies, training and technical assistance to implement and monitor the track improvement and maintenance program.

The special features of the project will demonstrate a relatively low-cost approach to providing all-weather road service to areas where improved roads are essential to economic growth and social welfare but where expected economic payback will be gradual.

They will also provide a mechanism whereby rural community human resources can combine with public sector capital, all at modest levels, to maintain the road for all-weather service.

The project will serve as a catalyst to economic development by providing an essential pre-condition to growth: all-weather access. The following events are likely to occur:

- a) Better access, hence increasing the possibility of more visits by agricultural extension agents,
- b) Better access to improved agricultural technology, inter alia animal traction, fertilizers, new seed varieties.
- c) Employment and income creation for villagers hired to

help in construction.

- d) Improvement of rural life--more access to dispensaries, hospitals, secondary schools, administrative and market centers,
- e) Savings in vehicle operating costs to truckers through increased average service speeds, reduced fuel consumption, and reduced vehicle repairs,
- f) Improved truck service and passenger service,
- g) Freight rate reductions,
- h) Increased agricultural production,
- i) Strengthening of the institutional framework for the continued expansion and proper maintenance of the of the feeder road network.

## 2. Beneficiaries

USAID is concentrating its financial resources on two economic groups--small agriculturalists who engage in some associated animal raising, and herders who also farm. These groups have substantial needs, with fair to good potential to become increasingly productive under favorable circumstances. These groups suffer severely from the periodic Sahelian droughts.

Beneficiaries will largely be those working in food production. As this sector absorbs the vast bulk of Guidimaka's productive labor, the project has the potential of reaching up to 64,000 people (68 percent of the region's population, representing rural farmers). If roads open markets for agricultural products, they can also impact positively on women. Women have their own fields in the Guidimaka on which they grow crops for sale. Roads have the potential of raising women's incomes by providing them with greater access to markets, a direct production incentive.

The proposed roads will not open up new lands or other natural resources, but will give year-round access to the immediate area and to certain economic resources. Continuous access to water is the single most urgently perceived need in Guidimaka. Most wells constructed throughout the region have limited capacities and maintenance problems. Because of transportation problems, repairs become equally difficult to perform. Similarly, the proposed roads will facilitate the transport of agricultural inputs such as insecticides and fertilizers, permitting lands to be kept in production which might otherwise suffer from insect infestation and soil infertility.

An estimated 50,000 people will benefit from the project, either directly or indirectly. To a lesser degree, the entire population of Guidimaka will benefit from improved access.

The direct beneficiaries will be:

a) Local workers

Some 90 jobs for unskilled or semi-skilled workers residing in villages along the roads will be provided through construction employment. These jobs will generate approximately 9 million UM (\$180,000) during the 27 months of actual construction.

b) Other workers

Some 40 skilled and semi-skilled workers in the brigade will earn about 20 million UM (400,000 \$) during the life of the project.

c) Truckers

The immediate beneficiaries are truckers who will realize early benefits as a consequence of reduced operating costs. They will also benefit from increased transport demand.

d) Farmers

As a consequence of all-weather roads and access to markets, and assuming other economic inputs, agricultural production is expected to increase gradually. Farmers will receive higher incomes as a result of lowered costs of agricultural inputs and farmers will also enjoy improved access to hospitals, dispensaries and schools.

e) Commercial operators

Miscellaneous small shopkeepers are expected to appear along the road at rest stops, contributing to economic activity as well as the increased activity for tradesmen in towns.

3. Project Components

a) Technical Assistance

To ensure efficient project implementation, a U.S technical assistance team will be engaged for the full period of the project. The principal objectives of this team will be:

- to organize construction works in order to achieve production objectives;
- to supervise all project expenditures in collaboration with USAID;
- to train on-the-job all categories of personnel;
- to ensure coordination with local authorities and other donors.

AID will finance all technical assistance and other project expenditures and will select a contractor following standard AID contracting procedures. The team will consist of the following experts:

- A chief of party, highway engineer, experienced in management and supervision of road construction works;
- A chief mechanic, experienced in managing and maintaining a large fleet of heavy road construction equipment in Africa;
- A mechanic, experienced in maintenance and repair of heavy road construction equipment and trucks;
- A field superintendent, experienced in earth road construction in Sahelian countries and able to manage and organize the work from a technical and logistical point of view.

More detailed position descriptions and task schedules are provided in Appendix C.

b) Training

The training program provided in the project is basically oriented toward in-service training. Mechanics, technicians, truck and equipment operators may require further training, despite the experience they will have acquired with the UNSO/OPE project. The training program will combine shop instruction with field training, with greater emphasis placed on the latter.

Technicians from the TP assigned as counterparts will be urged to gain field experience with the brigade. They will be quartered in the house trailers provided for living accommodations and office space.

The proposed training package under the supervision of the technical assistance team is the most cost-effective means of providing training, since it emphasizes "learning by doing" under the tutelage of experienced technicians.

Training consists of two elements:

- i) On-the-job training of Mauritians hired for the construction phase of the project. These will be largely equipment operators, mechanics and truck drivers. It is expected the majority of these will have worked on the UNSO/OPE project. Upgrading their capabilities will fit them for subsequent employment by contractors in the private sector or by the GIRM.
- ii) In-service training of at least 24 civil engineers, foremen, mechanics and managers within the TP administration who are assigned to the project. They will be billeted in the field at base camps and will work alongside the American technicians and trained Mauritians. It is expected that at the end of the project there will be a nucleus of fully trained TP personnel who could continue to exercise their professional skills in further force account construction or maintenance projects.

#### 4. Project Design

##### a) Choice of region.

The riverine area of Mauritania, along the north bank of the Senegal River, is the land of greatest agricultural potential. The only other section of the country which offers an opportunity for crop farming is that part of southeastern Mauritania which lies below the 500 mm isohyet. It is only in this zone that annual rainfall is sufficient to support non-irrigated agriculture, and the Guidimaka Region lies in this zone. With its more adequate rainfall, reasonably good soil conditions and sizable resident population, it offers in the short term a greater potential for increasing food production than do other areas of Mauritania. For these reasons, the Guidimaka was chosen by USAID as a region for concentration of development efforts such as the Integrated Rural Development Project. The USAID assistance program includes a concentration in the rainfed agricultural zones of which Guidimaka is a part. These zones include the largest number of the target population which are considered the most potentially productive group for AID assistance. However, in comparison with some other geographic zones, the rainfed agricultural zone has been relatively neglected by international donors. Investments in these zones will help to stabilize the rural population and prevent the loss of Mauritania's most important resource, its agricultural and grazing lands. The GIRM fully supports USAID's zone concentration, realizing that the exodus from the countryside, if left unabated, could lead to social disintegration. Moreover, the country's chronic inability to feed itself places Mauritania in an undesirable position of dependence which threatens its very survival. An economically viable rural sector will help reverse these trends.

While Guidimaka lies largely between the 600 mm and 700 mm isohyets and is therefore 100 percent Sahelian zone, there is a narrow band along the southern periphery of Guidimaka bordering on the Senegal River. This fertile area of intense agricultural activity, between 20 and 30 percent of Guidimaka's cultivable land, is part of the Senegal River Basin. The Selibaby-Gouraye road would cut through the middle of the area and link it, through M'bout and Kaedi to

the capital and other towns. The Mauritanian side of the river basin in the Guidimaka Region extends inland up to 50 km and amounts to some 35,000 hectares<sup>1/</sup> of cultivable land devoted largely to sorghum and millet production, with some rice and vegetables cultivated on seasonally flooded lands. The people of this river basin area remain more prosperous because of higher rainfall patterns, exploitable river resources, a cooperative social structure and social values more adaptive to modernization (see Social Analysis, Ch. V). U.S. aid to this area is provided under the auspices of the Senegal River Basin Development Commission (OMVS) and will include extensive perimeter development through the Integrated Development Project, 625-0621, currently under design. Investments in river basin infrastructure in the Diama and Manantali dams, which are being financed by other donors, will assure development of the river basin resources.

It is expected that 20 percent of the area of the Guidimaka Region and 40 percent of its current population of 94,000 will benefit from the OMVS dam projects. However, this is a long-range effort. Completion of the dams is at least 5 years away and benefits from the proposed dams and irrigation works will not accrue before 1990.

The traditional dryland interior zones contain the largest number of the agriculturalist/herder group, which have good economic potential while being relatively neglected by other donors. Suitable investments in transport and complementary inputs here will prevent the decline of much of Mauritania's arable rainfed agriculture, which supports most of the rural population and an overwhelming percentage of the country's livestock.

Investments in this area will induce increased agricultural productivity more easily than in most other locations.

Presently this region is characterized by a mass exodus of adult males for foreign employment to Senegal, the Ivory Coast, the Gambia and France. Because the younger men leave en masse, women assume more of the daily burdens of farm production and family care. Ultimately, the improvement of their lives requires a general revitalization of the agricultural economy and greater income opportunities for both males and females. Women are now the primary work force available in much of the area; they are the cornerstone of development activities. (See Social Analysis, Ch. V).

----

1/ Mauritania Food for Development Program, Background Report, 1981.

22

b) Choice of alignment

USAID discussions with the GIRM in 1978 during the PID stage led to an initial list of roads and tracks considered as having regional development significance. After further analysis of agricultural production data, population and infrastructure, the initial Project Paper team added several more road links.

Following rigorous technical, economic and social criteria, these roads were screened and rank-ordered. Field studies on aggregate and water availability in the region were conducted by the U.S. Department of Transportation Aerial Surveys Branch and a more detailed water study was undertaken by the SNIM (National Mining Corporation) and a further aggregate study was completed by the the LNTP (National Public Works Laboratory) under contract to USAID.

Initial Project Paper design was started in 1981. The candidate roads were costed out and analyzed originally on the basis of a June/July 1981 start-up. Altogether, the following were considered:

- M'bout-Selibaby (112 km)
- Selibaby-Gouraye (45 km)
- Khabou-Solou-Selibaby (57 km)
- Gouraye-Oued B (33 km)
- Dafort-Oudelenguil (35 km)
- Selibaby-Ould Yenge (75 km)
- Ould Yenge-Dafort (50 km)
- Dafort-M'bout (50 km)
- Selibaby-Dafort (60 km)
- Dafort-Soufa Pass (37 km)
- Ould Yenge - Kouroudjel (109 km)

The initial adjusted order of priority was:

- |                                                  |        |
|--------------------------------------------------|--------|
| 1. Gouraye to Khabou with 10 km bypass at Oued B | 58 km  |
| combined with:                                   |        |
| Gouraye-Selibaby                                 | 45 km  |
| and Selibaby-Ould Yenge                          | 76 km  |
|                                                  | -----  |
| 1. subtotal                                      | 179 km |
| 2. Selibaby to M'bout                            | 112 km |
| together with:                                   |        |
| Ould Yenge to Dafort to M'bout-Selibaby          | 100 km |
|                                                  | -----  |
| 2. subtotal                                      | 212 km |

The inclusion of M'bout-Selibaby was also based on the consideration of a joint venture with UNSO/OPE to participate in their financing of this road sector, since UN funding alone was insufficient to complete this link. However, the UNSO/OPE agreement with the GIRM was signed in 1980, heavy equipment purchased by UNEF was on site since July, 1981, and a technical assistance contract was signed with a German firm to begin construction of M'bout-Selibaby in April, 1982. AID was not prepared to meet such an implementation schedule.

AID's procurement and contracting procedures are at variance with the UN's, which posed implementation difficulties for AID participation with commingled financing. (However, this will not be a problem with the UN acting as PSA for procurement exclusively with AID funds in this project). Initial economic analyses also indicated USAID participation was not feasible on the full M'bout-Selibaby road. UNSO financing will thus complete construction only to kilometer 70 from M'bout. A revised economic analysis, based on USAID funding the M'bout-Selibaby road from kilometer 70 south of M'bout through Selibaby to Gouraye plus rehabilitation of M'bout-Kaedi road, presents a more favorable investment picture. The final choice of alignment for this project includes assistance for the improvement of the M'bout-Kaedi road, in connection with the availability of local currency funds from the PL 480 Title II Section 206 project. This will assure that there will be year-round accessibility not only between Gouraye-Selibaby-M'bout, but through to Kaedi and the rest of the agriculturally productive regions and the national road network.

c) Track Improvement Features

An unimproved track is a route described over the natural terrain by the cumulative wear of vehicle wheels which, in time, mark a roadway on the ground. By analogy, these are contemporary counterparts of the historic Oregon Trail in the United States. The present Guidimaka region road network consists of approximately 540 km of tracks. The term is generic, since it pertains to routes-classified or unclassified, surfaced, improved or unimproved--which, either through lack of original improvements or due to continuous neglect, have reached their lowest common denominator--a condition verging on unimproved track.

The road network of Guidimaka and its links to the E-W paved trunk road, Nouakchott-Nema, consists of ordinary tracks without drainage structures, making this road network impassable during most of the rainy season (July - October) and difficult to pass during the dry season. The lack of drainage structures blocks traffic at each major dry stream crossing and at each low point of the track where water accumulates on generally clayey soil, turning it to mud (See Ch. III Engineering Analysis).

In view of the various impediments to the all-weather flow of traffic, standards were devised to accomplish the following objectives:

- i) Provide year-round service at minimum cost, but allow delays of up to one or two days when heavy thunderstorms occur (i.e., fords rather than bridges).
- ii) Reflect the presently low traffic volumes which will gradually increase over time.
- iii) Build drainage structure to adequate design standards which are appropriate for the present as well as future traffic levels and will not require upgrading when traffic will warrant a better roadway (i.e., ultimately, widening and/or paving). This means that the roadbed as well as the structures will be built to a width of 5.5 m according

to the standards being used in the UNSO construction.

d) Structures

With the exception of the crossing of oueds with deep and narrow riverbeds, all the oued crossings will be by fords, paved sections of roadway protected by gabions, over which high water may pass. Crossings for narrow and deep oueds will be achieved by means of small culvert bridges (3-4 meters long on an average) having concrete abutments on spread footings and reinforced concrete slab decks.

Fords are provided instead of bridges because they are less costly and require relatively less maintenance. In Guidimaka there are numerous examples of washed-out bridges, usually box or pipe culverts destroyed for lack of routine cleaning of debris, which eventually clogs open spans under the bridges. With fords, this cannot occur. They are virtually maintenance-free because they offer no impediment to the free flow of water (and debris carried by flood waters).

The one disadvantage of fords is that they reduce speed to a minimum at points of oued crossings, compared with bridges where an almost constant speed can be maintained.

A truly accurate cost comparison can be made only on costs derived from bridges and fords already built. However a rough comparison in magnitude is useful.

From the Kiffa-Nema road some cost indications can be obtained from the Mendes Junior contract (the Brazilian firm constructing the road).

- Fords cost/1 m - 76,000 UM
- Bridge cost/ 1 m - 336,000 UM

The figures are approximate because the bridges consist of two box culvert bridges, two small bridges and five regular bridges.

The cost ratio between ford and bridge is about one to five. It might vary from 1 to 5, minimum, to 1 to 10 depending upon circumstances (sails, terrains, location, etc.).

For smaller transverse drainage requirements, 80 cm and one meter diameter corrugated metal pipe culverts, single or multiple, will be used. These will be imported in nested form, assembled and fitted in place.

e) Causeways

To cross flooding areas, the road surface must be elevated above the high water level through the construction of embankments or

causeways high enough not to be overtopped by water and wide enough to prevent variations of the water content of the ground water under the middle of the embankment. The top of the roadways will be at least 0.75 m above high water level.

f) Earthwork

Where improvements are made, the road section will be 5.5 meters wide, with no shoulders.

The question of width of roadway was subject to considerable debate, including discussions with the various civil servants and technicians involved, and the UNSO. This project will retain the standards as spelled out in the June 4, 1981, Washington meeting (between AID, GIRM, and UNSO), and in the UNSO contract document. (See Appendix C, Engineering, Annex V).

A 5.5 m wide roadway was selected for all improved sections of the existing tracks for the following reasons:

- i) An element of uncertainty concerning effectiveness of road maintenance; a wider roadway provides greater safety against the types of deterioration such as wear of edges of the roadway under both traffic and effects of rain and rutting of the roadway due to channelization of the traffic.
- ii) Provision for staged road improvements with traffic increase without needing to rework already improved sections, these being considered as final with regard to their expected life span (about 20-25 years for structures and causeways).
- iii) To comply with the GIRM standards for road construction, although the GIRM has already compromised downward for width of "Ordinary earth roads and improved tracks", from 6-7 m to 5.5 m. Construction of side ditches and roadway must take place simultaneously with earthworks, using a motorgrader which will excavate soil to form a side ditch and spread the excavated material, if suitable, on the road bed to form sub base material.

g) Key assumptions

Mauritania, including the Guidimaka region is an impoverished land, lacking in many natural resources, poor in soil fertility, fragile in environment and deprived of adequate precipitation. Food production per capita has declined over a long period; trained human resources are scarce, agricultural proclivities are frequently inimical to economic development, and government capabilities are limited. On the other hand, there are elements in the population eager to adapt new production methods and some relatively good areas of agricultural land.

26

In this environment, one should anticipate a generally lower efficiency of capital investments than elsewhere. Under present conditions, the expected economic return on development projects is likely to be less than under more hospitable conditions, while social welfare benefits may be substantial and immediate. This will be reflected in road transport investments as well as in other development sectors; it is a reality of development in Mauritania. Transportation investments will facilitate a better rate of return for other investments which might not otherwise be made.

The improvements of Guidimaka tracks to all-weather standards is a sine qua non to further development. They are a necessary catalytic agent, facilitating other development inputs.

Complementary agricultural inputs which are assumed in our projections are the following:

- i) Government-supported grain price floors adequate to create incentives for small farmer production.

As part of its general commitment to food price policy reform, the GIRM is making changes in both the consumer and producer food prices. As part of the reform encouraged by the PL 480 Title II, Section 206 Program, the GIRM will raise the ceilings on the market price of sorghum sold by the GIRM's Cereals Office (OMC) by 20% in real terms over this next 2-3 years.

In addition, with encouragement from the donor community, the GIRM is adopting a policy to gradually increase the producer price offered to farmers for millet, sorghum, and rice to reflect real economic costs. These reforms will stimulate price increases for local grains and restore incentives for production of these cash crops. The small farmer must realize an adequate return on his investment. This is a principal pre-condition to expanded production.

- ii) Agricultural extension services will be provided by the GIRM to Guidimaka farmers to encourage the adoption of improved agricultural technology including animal traction and improved seed varieties, and this will have a substantial effect on production within five years.
- iii) Droughts, mild or severe, are to be expected in Mauritania. Observed data indicate a thirty-year cyclical pattern of severe droughts with variation in rainfall in inter-drought periods. If this thirty-year cycle continues, the next serious drought will occur about 2010. Severe droughts affect conditions over a long time but the annual precipitation in 1981 almost reached normal levels. Projections of expected benefits from agricultural development encouraged by track improvements are based not only upon the appropriate application of complementary inputs, but upon assumptions of average precipitation for the next fifteen years.
- iv) Adequate maintenance of completed roadways and of heavy equipment made available to the project is absolutely essential to its success. This is a significant issue, because without a concentrated maintenance effort, the roads will wash out at one or more places during heavy rains, even during the first year.

USAID has devised a road maintenance plan acceptable to GIRM, but the results must be monitored closely on a regular basis. In view that even primary roads, including the new East-West axis extending from Nouakchott to Nema, have not been adequately maintained, this topic has been one of particular concern to the Mission in this project. The GIRM, through its regional representatives, must ensure the performance of culvert cleaning after heavy rainfalls, through compensation of the villagers. This requirement will be the object of a covenant at the Project Agreement stage, including assurance of the provision of parts and labor for the maintenance of equipment assigned to the District Engineer.

In fact, USAID's emphasis on maintenance is being strongly supported by the IBRD's Fourth Highway Project and the UNSO's special maintenance fund. It is thus likely that this concerted joint effort will result in the creation of viable and effective maintenance capabilities within the GIRM over the next 2-3 years.

### C. Project Relationship to Development Priorities and to Other Projects

#### 1. GIRM Sectoral Priorities

During the 4th five-year plan period 1981-1985, new investments planned by Mauritania total UM 90 billion (US \$1.8 billion), as compared to UM 32 billion (US \$640 million) in 1976-80. Of the total, mining will absorb 43%, transportation 10%, and agriculture 25%.

Under a standby arrangement with the International Monetary Fund, the GIRM has adopted a two-year transitional program for the period April 1, 1980, to March 31, 1982. Planned measures include a strengthening of government management, increases in the sales prices of government-controlled commodities, and improved tax collection. These efforts were necessitated in large measure by substantive reductions in external budgetary support.

The increase of domestic revenues is an essential element of GIRM efforts to close the present budgetary gap. In 1980, gasoline prices and some other taxes were increased but the impact on revenues was small. GIRM plans to emphasize the enforcement of current tax laws rather than impose new or additional taxes. As a result of a new taxpayer census, tightened enforcement generally and higher fishing royalties, the GIRM's domestic revenues jumped by 20% during 1981. A closing of the gap in the current budget will be possible by 1988 if there are further 12% annual rises in domestic revenues and if expenditures can be limited to a modest 3% per year rise from the 1980 level.

The GIRM's long-term goal to close its budgetary and balance of payments gaps can only be achieved by expanding domestic production. The GIRM has committed itself to study measures to establish an efficient marketing system and to raise the prices paid to producers. The acceleration of investments being planned is intended to contribute either directly or indirectly to the long-term expansion of production.

## 2. AID Strategy

USAID has identified, within the GIRM rural development priority, those particular areas of assistance where AID can make the most significant contribution. They are food production and rural primary health care.

The Rural Roads Improvement Project impacts on both these areas of concentration.

### a) Increased food production

This priority covers not only agriculture and livestock, but also food storage, transport, marketing and distribution. The Guidimaka Integrated Rural Development Project provides innovative interventions in dryland crop, livestock and range management and environmental restoration. The OMVS-affiliated activities will expand irrigated agriculture significantly throughout the River Basin area. Over the next two years, through a PL 480 Title II Section 206 Food for Development Project, USAID will assist the Mauritanian Cereals Office (OMC) to stimulate food production through the stabilization of farmgate cereal prices at incentive-producing levels. Proceeds from the PL 480 food sales will be used to assure grain farmers of a reliable price for their production. This is intended to provide an incentive to increase cereal production and marketing. A portion of the proceeds will also be available to support further rural roads improvements, notably the critical Kaedi-M'bout link, as well as to support local currency requirements for the M'bout-Selibaby-Gouraye link.

The Rural Roads Improvement Project is intended to complement these efforts by providing all-weather linkages between isolated sections of the agriculturally attractive Guidimaka Region and Mauritanian markets. In joint collaboration with UNSO/OPE, USAID will upgrade the M'bout-Selibaby-Gouraye road and rehabilitate the M'bout-Kaedi road. The project will facilitate future travel of agricultural extension agents and rural development personnel in their efforts to activate small farmers to adopt further improvements in agricultural and herding practices. Improved roads, complemented by changes in GIRM agricultural commodity pricing policies and improved agricultural extension services, are intended to reverse the current trend of declining agricultural production in Guidimaka, and should increase Guidimaka farm productivity and production beyond previous levels.

### b) Rural health care

Access to health services is one of the most significant contribu-

tions of improved rural roads. This was forcefully demonstrated in a number of ex-post evaluations of rural road projects carried out by AID world-wide in 1980. The project will improve farmers' access to health facilities and to schools, both in Selibaby and M'bout.

### 3. Other USAID Projects

To ensure that the potential for Guidimaka development is realized as road improvements are completed, the Mission intends to focus complementary development efforts on the areas of influence of the selected candidate roads. The USAID projects involved in Guidimaka development are the following:

- Integrated Rural Development Project (682-0201) - DRIG
- Small Perimeter Development, AFRICARE OPG (682-0226)
- PL 480, Title II Section 206 Program
- Proposed Agricultural Sector Grant
- OMVS Integrated Development Project (625-0621)

#### a) Integrated Rural Development Project (682-0201) - DRIG

This project, begun in April, 1979, is developing technical innovations to improve agricultural and livestock production and range management. A major concern is that these innovations should be technically appropriate, economically viable, and socially acceptable. For this purpose, three experimental sites and an extension perimeter covering a 20 km radius around Selibaby have been established. Through constant interaction between the 32 villages within the perimeter and demonstration sites, it is hoped that successful innovations can be made.

The major themes being pursued are rainfed cereal production, range improvement and animal health and production. The project includes a revolving fund for providing credit support to the animal traction extension effort now getting underway.

Project management personnel have stated that the poor condition of the roads in the region is a major constraint in pursuing the outreach activities that are fundamental to the expansion of successful interventions identified by the project.

This project would be particularly served by the M'bout-Selibaby-Gouraye Road, as the population served within the road's impact zone would amount to at least 35,000 (28,000 from M'bout to Selibaby and 7,000 from Selibaby to Gouraye), of which about 8,000 are farmers.

#### b) Small Irrigated Perimeters (AFRICARE) 682-0226

The purpose of this project is to familiarize farmers who work irrigated perimeters with techniques of crop production and to establish and support autonomous village organizations. The project is implemented by SONADER (National Rural Development Corporation, a parastatal organization) and AFRICARE. The project is located in the Gouraye sector along the Senegal River Basin and includes ac-

tivities in 12 villages aimed at improved agricultural production on 250 hectares of irrigated perimeters.

Ultimately, SONADER plans to reach 23,000 people in the Gouraye sector by 1985, or about 20 percent of all the irrigated perimeter populations along the Senegal River.

The sector chief at Gouraye has indicated that without improved access along the roads from Gouraye to Maghama and Gouraye to Khabou (both being proposed in the design of OMVS Integrated Development Project), the ability of the new extension agents to effectively reach the population will be severely hampered, and project goals will be difficult to attain. The same holds true for the Selibaby-Gouraye road which provides vital supply links between the sector headquarters and the regional capital.

Complete maintenance facilities for the pumps are located at Boghe, with which transport connections would be assured by the Gouraye-Selibaby-M'bout-Kaedi road link. It is evident that year-round access on the above-mentioned roads is important to the success of this project.

#### c) PL 480 Activities

Through OMC, the PL 480 program will supply sorghum for use in their price stabilization programs. This grain is sold and the proceeds are used to purchase locally-produced grain in order to maintain minimum farmgate prices. This is a critical intervention for maintaining a floor on prices and market-inspired production incentives to the farmers.

In order for OMC to make timely purchases, a year-round access to the production areas is essential. A portion of the \$8.0 million in local currency to be generated over the next three years will be available for inputs to the Rural Roads Improvement Project.

#### d) Food and Agriculture Sector Grant

The purpose of the proposed Food and Agriculture Sector Grant is to increase production and productivity in agriculture, fisheries, forestry and livestock by strengthening those private and public sector institutions that support agricultural and rural development activities; by financing productive interventions in the sector; and by strengthening and enlarging the human resources in the sector. The grant will have two basic components: 1) activities designed to strengthen the local capacity to program, finance, design and implement rural development projects, including reinforcement of the extension system; and 2) funding for a series of food production subactivities in the river basin and rainfed areas.

The project will be designed in FY 1983 following an extensive agriculture sector assessment. It is expected that many of the resources for food production sub-activities will focus on the area to be served by the road network improved by the Rural Roads Project. The Sector Grant represents a consolidation of the major

USAID interventions in agriculture in order to fully tap Mauritania's food production potential. The transportation network linking this productive area is indispensable to develop this potential.

e) OMVS Integrated Development Project 625-0621

The OMVS (Senegal River Basin Development Organization) is responsible for the integrated development of the Senegal River Valley. Its principal development plans include the construction of the Diama and Manantali dams to allow the full exploitation of the agricultural potential in the Basin.

Irrigated agriculture may represent the most significant source of improved agricultural productivity in Mauritania. The purpose of the USAID-supported OMVS Integrated Development Project is to develop irrigated perimeters with a greater role for farmer associations and private institutions in integrating irrigated agriculture into the overall development of the Basin. In Mauritania, the immediate program will include the extension of existing small perimeters and the construction of new perimeters involving 950 hectares in the Gouraye sector of the Guidimaka Region. The project aims at increasing productivity through the introduction of animal traction, water management, crop diversification, fish ponds, and irrigated crop production. The project will also prepare a master plan for the full development of irrigated land in the Gouraye sector, building on experience gained in the immediate production phase. This program could identify up to 7,000 hectares of land in the Gouraye sector that could be developed economically. Central to this development is the viability of road connections from the area to the rest of the country to guarantee the supply of needed inputs and access to markets. A feeder road sub-project component of the OMVS Integrated Development Project is described below in Section II.5 (c), (p 24 ).

4) Other Projects and Activities

Other projects of interest in the area (Guidimaka and slightly north as well) can be summarized as follows:

a) The Regional Agriculture Service

Regional development agencies for the Guidimaka are based in Seli-baby and include services for agriculture, rural development, livestock and environmental protection.

The Extension Service activities have been very limited owing in part to its staff size, isolation and immobility. The Regional Agricultural Service in the past has organized 15 village groups of "pre-cooperatives". Although the service maintains complete lists of these groups, these groups will remain inactive as long as the Extension Service cannot maintain contact and provide guidance.

b) Gorgol Irrigation (Foum Gleita Dam) Project

32

This is a multi-donor funded effort which will provide 3600 hectares (in Phase I) of irrigated land to 4,640 families at Fom Gleita on the Gorgol Noire River (just north of M'bout). The Project's primary sponsors are the World Bank (IDA) and FED. Total external contributions for this project amount to approximately \$100 million. The project involves the construction of: the Fom Gleita dam and conveyance works; secondary and tertiary irrigation and drainage networks; access roads; housing; storage facilities; a rice mill; and other general infrastructure. Participating farmers will benefit from extension, inputs, and credit distribution services. Technical assistance personnel are working with SONADER on the supervision of construction and project implementation. Construction began in 1981, and the project will be implemented over a six-year period.

This project could be directly affected by the M'bout-Gouraye road. However, the main link will be Kaedi-M'bout road. As the Fom Gleita project progresses, increased population and economic activity is expected to generate marketing and other contacts with the regional capital to the south (Selibaby).

It is also noteworthy that the project includes a 10 km connecting link (constructed) to the existing M'bout-Kaedi road and a 140 km tertiary network connecting the irrigation units. It is very important for the success of this project that the M'bout-Kaedi road be improved to all-weather status.

#### c) Forestry Management

The regional service for forestry management consists of three posts in Khabou, Ould Yenge and Selibaby. The regional supervisor resides in Selibaby, while an extension agent is in Khabou and a "forestry guard" is located at Ould Yenge. The forestry service is involved with environmental protection and reforestation activities, controlling service monitors and the exploitation of gum arabic within the region.

#### d) Livestock

The regional livestock service in the Guidimaka consists of an Inspection Headquarters in Selibaby and a Sector Post in Ould Yenge, staffed by paraprofessional personnel. At Selibaby there is a veterinary assistant and at Ould Yenge a veterinary nurse. They engage in some emergency care but mainly in vaccination campaigns once or twice a year. They are also working closely with the DRIG in animal production and husbandry. Mobility has been a major constraint in this program. Improved access throughout the region is seen by the regional service as being an important step toward facilitating their work.

e) Mauritanian Cereals Office (OMC)

OMC is engaged in the purchase and storage of security stocks of grain as well as sales for the stabilization of domestic grain prices. OMC has a storage facility in Selibaby with a capacity of 500 metric tons and a 400 ton facility in M'bout. Locally produced grains are purchased throughout the region, a surplus producer of grain in a normal rainfall year. The following listings show the locations and amounts of grain purchases in 1978/79 in the study area. As can be seen, the purchase points are located mostly along the Selibaby-M'bout road, with over 60% of the tonnage in the M'bout-Selibaby corridor or within 5 km of Selibaby in other directions.

<u>OMC Purchase Site</u> <u>(1978/79)</u>	<u>Distance to +</u> <u>Road</u>	<u>Tonnage</u> <u>Purchased (MT)</u>
Hassi Chaggar	Selibaby-N'Dieo (0)	50.0
Danqueremou	M'bout-Selibaby (2.5)	10.0
Bouly	Selibaby-Ould Yenge (0)	15.0
Zenegas-Toucouleru	M'bout-Selibaby (5.0)	25.0
Soufi	Selibaby-Ould Yenge (0)	20.0
M'baidi Achar	Selibaby-N'Dieo (0)	28.2
Dafort	Selibaby-N'Dieo (0)	52.4
Tachott Botokhollo	M'bout-Selibaby (0)	48.4
Tachott Berane	M'bout-Selibaby (1.0)	40.0
Keninkoumou	M'bout-Selibaby (0)	20.0
Agouemit	M'bout-Selibaby (0)	66.3
Hassi Chaggar	Selibaby-N'Dieo (0)	32.5
		-----
	Total	463.2

of which was stored at Selibaby: 363 MT  
of which was stored at Ould Yenge: 100 MT  
Source: OMC

f) UNDP Small Dams Project

Located in the Assaba region around Kiffa and down into the Guidimaka, this project consists of building and repairing about 22 small retention dams, as well as developing two existing springs. The purpose of the project is to provide water for animals, irrigation and reforestation. It is expected that this investment will provide yield increases and create approximately 100 hectares of previously uncultivable land. Total financing is \$4.3 million over two years. This project, because of its location, will create pressure for the GIRM to complete restoration of the Kiffa-M'bout road.

34

g) IBRD Perimeter Development

The World Bank is in the process of preparing a proposal for funding the development of small irrigated perimeters in the Gouraye sector. The development of these perimeters will be carried out under the auspices of SONADER (the National Rural Development Corporation). This activity is complementary to the USAID OMVS Integrated Development Project described above and will increase the hectareage devoted to cereal production in the area.

5. Other Road Projects

As noted in A.3 of this Chapter, there are a number of road projects, either ongoing or in the planning stage, which bear on this Rural Roads Improvement Project. In addition, there are several projects being held in abeyance pending firm commitments from donors, but which also relate to this project.

The situation as of May, 1982 was as follows:

a) The Fourth Highway Project.

Committed: \$14.7 million over a two year period by IBRD (IDA), Kuwait Fund and Arab Fund for Economic and Social Development (FADES). Starting date is mid-1982 and contains the following major elements:

i) completion of drainage structures and damaged earthworks on Boghe-Kaedi road (100 km) to all-weather standards. FADES financing (\$5.2 million).

ii) drainage and earthworks on 45 km of road south of Atar toward Akjoujt, where paved sections begins. IDA financed (approximately \$3 million).

iii) study and inspection of Nouakchott-Nema road (E-W axis) to identify sections which have deteriorated due to lack of maintenance. Kuwait Fund financing (about \$1.2 million).

iv) emergency rehabilitation and maintenance of Nouakchott-Nema road, which includes provision of equipment, training and operating costs. Kuwait Fund financing (about \$4 million).

v) study for strengthening Rosso-Nouakchott-Akjoujt road. IDA financing (about \$1 million).

vi) study of all aspects of road maintenance throughout the country. This phase will study priority road network for maintenance and set appropriate standards; will also determine the level of investment compatible with resource availability (i.e., GIRM budget or other donor funds) and demand; and will identify appropriate materials and techniques as well as the type of organization required for a permanent road maintenance effort. IDA financing (about \$300,000).

vii) preparation of the Fifth Highway Project for 1985-1987, including use of donor funds to finance maintenance and recurrent costs.

b) Aleg-Boghe Road (65 km)

Reconstruction and paving of this road began in 1982, with FED and KFW financing (about \$5 million). This project is particularly important because it provides the linkage between the road network serving productive agricultural areas in the southern part of the country and the national East-West axis highway to the national capital.

c) Feeder roads component of USAID/OMVS Integrated Development Project (625-0621)

This project is a regional activity which will include interventions in Mauritania in support of the development of irrigated perimeter production of rice in the Senegal River Valley. One aspect of the project includes the construction of feeder roads to link village perimeters to major communications axes. The development of the feeder roads element of the IDP assumes that the Selibaby-Gouraye road (Route Nationale 5) will be built to all-weather capacity and that Selibaby will be linked to the national road network. This assumption will be guaranteed by the Rural Roads Improvement Project. In the IDP, three systems of roads are proposed: 1) upstream, feeding perimeters above Gouraye and branching from RN 5, ten kilometers northeast of Gouraye (sub-total: 75 kilometers); 2) downstream south, linked to RN 5, 25 kilometers northeast of Gouraye (subtotal: 56 kilometers); and 3) downstream north, feeding in the direction of Maghama (subtotal: 63 kilometers). Existing tracks from Maghama provide reasonably good all-weather access in the direction of RN 5 and Selibaby. The total kilometers of feeder roads to be improved is 194 kilometers. This will take place in 1986 and 1987 at a cost of \$3,800,000, after the completion of the improvements to be done in the Rural Roads Improvements Project.

d) UNSO Sahel Road Maintenance Project

The UN is planning a substantial road maintenance activity to maintain roads in the Sahel which it has helped to construct. While initially the UNSO Sahel Road Maintenance Project did not include Mauritania, the UN will add Mauritania to the project based on its involvement in financing the Mbont-Selibaby road. The extent of the UN involvement in support of road maintenance will also include the road network from Kaedi-Mbont-Selibaby-Gouraye and assist the GIRM with maintenance beyond the life of this AID-financed activity.

### III. SUMMARY ENGINEERING ANALYSIS

#### INTRODUCTION

This analysis contains detailed costs and quantities for construction of the M'bout-Selibaby road (starting at km 70 from M'bout, as explained in Ch. II) and the Selibaby-Gouraye road and for rehabilitation of the M'bout-Kaedi road.

In addition, the analysis will cover some general features common to all road elements, such as track features, terrain, maintenance requirements, the determination of unit costs of construction for structures and earthworks and some general standards of productivity for a "Special Autonomous Brigade" similar to the one currently at work on the UNSO/OPE project.

#### A. Technical Description of Track Features

##### 1. Overview of the Project Area

The Guidimaka region consists of alternating plains and minor relief features with the exception of the Assaba Plateau to the northeast which is outlined by an outstanding cliff 50 to 100 meters in height. The transition between the Assaba plateau and the Senegalo-Mauritanian Basin is the immediate area of interest.

The hydrographic pattern is dense and outstanding. Due to a 400 to 700 mm per year rainfall (see App. C, Engineering, Annex I), and generally high runoff, the oueds are submitted to violent floods after each rain (most of these being thunderstorms) and soils are eroded to a large extent when the terrain slope is greater than 1.5 to 2%.

As described in Engineering Annex II, the road network of the Guidimaka area and its connection to the paved trunk road Nouakchott-Aleg-Kiffa consists mainly of ordinary tracks without drainage structures, which make it largely impassable during the rainy season from July through October and fairly difficult to pass during the dry season.

The lack of drainage structures blocks the possible traffic at each major oued and at each low point of the track where water accumulates on generally clayey soil, causing vehicles to get trapped in the mud. During the dry season in the sandy areas, passage is very difficult because of the very soft surface.

##### 2. General Construction Characteristics

In the face of the various obstructions or transit difficulties which have been described above, the following recommendations have been devised to serve as improvement standards with minimal cost and to provide year-round passage, allowing for delays of several

hours when heavy thunderstorms occur and during which time the ford crossings will be inundated:

a) Oued crossings

Two major types of oued crossings can be encountered along the existing tracks:

- \* oueds with deep and generally narrow riverbeds (none wider than 10 m.)
- \* oueds with shallow riverbeds (none wider than 50 m.)

With the exception of oueds with deep and narrow riverbeds, all the crossings will be of the shallow water type. There will be no multiple box culverts required longer than 12 m. on the alignments. Thus the typical structures will be fords (or reversible bridges) surfaced with concrete and protected upstream and downstream by gabions and riprap.

A 30 cm thick, 5.5 meter wide roadway was selected for all improved sections of the existing tracks and at structures for the following reasons:

- i) To comply with GIRM standards for road construction (See Annex V) "Ordinary earth roads and improved tracks"
- ii) An element of uncertainty concerning effectiveness of road maintenance; a wider roadway provides greater safety against the types of deterioration such as wear at the edges of the road-way resulting from traffic and the effects of rain, and rutting of the roadway due to channelization of the traffic.
- iii) Provision for staged road improvements with traffic increase, without the necessity of coming back on already improved sections, these being considered as final with regards to their expected life span (over 20-25 years for structures and causeways).

In order to establish flows and to determine specific sizes of structures and CMP locations, a study will be made at the beginning of project implementation, and most preferably during the rainy season, using both visual inspection of the crossings after heavy rains and available aerial photographs and mapping.<sup>1/</sup>

b) Low areas-flat and flooded areas

These areas are generally very flat or slightly depressed and when it rains the runoff water accumulates and soaks into the ground.

-----  
1/ 1/5000 infrared aerial photographs of the Guidimaka area Feb. 80 are available from Renewable Resources Project and 1/200000 maps from Institut Geographique National.

As the soils in these areas consist of clay, the effect of the soaking is to raise the water content of the soil over its plasticity limit and to make the soils of these low areas very soft and sticky, therefore impassable by vehicle.

In order to remedy this type of situation, the road surface must be raised over water level by construction of embankments or causeways wide enough to prevent variations of the water content in the middle of the embankment, and high enough to not be overtopped by water. (See App. C, Engineering, Annex VI).

c) Soft Sand Areas

These areas are characterized by the presence of very fine eolian sand (dunes) in which the vehicles can sink more or less, depending upon the presence of grass on the surface of the terrain. To improve the durability of tracks in these sandy areas, a layer of selected materials suitable for road construction, which will most probably consist of silty or sandy clay, will be vigorously compacted (the dry density to be obtained should be at least 95% of the dry density of the Optimum Modified Proctor test). The average quantity of selected materials to be placed will be (0.30 x 5.5): 1.65 m<sup>3</sup>/m or 1650 m<sup>3</sup>/km, and will require 80 to 100 m<sup>3</sup> of water per km.

d) Erodable slope areas

These areas are characterized by a 1.5 to 2% or more slope of the terrain and the absence of vegetation to prevent water from running off. Besides the soils are generally clayey sand or silty/sandy clay, sometimes with some laterite, i.e., very fine and therefore subject to intense erosion, the fine soil particles being washed away by runoff water when the latter reaches a speed of about .50 to .75 m/sec.

To prevent the formation of deep channels in the surface of the terrain, the runoff water must be channelized and its speed kept to a minimum above natural ground with longitudinal (side) ditches and lateral ditches, as described in Appendix C, Engineering Analysis, Figures 4 and 5, and Annex VII.

Engineering Annex VIII gives some indications of the production rate of this type of roadbed construction method.

3. Estimated Quantities of Each Construction Item

Several reconnaissances were carried out by various teams between May, 1980 and May, 1982--with various missions but covering the same general project area. (See References 4 to 8). Unfortunately, no actual design study has been done to date of the roads. The present UNSO/OPE contractor is having to determine the road alignment, its embankments and causeways, and of course all ford and

and structure lengths as he goes along. For this reason, a study team consisting of a hydrologist and a surveyor (at a minimum) is planned, within this project, to establish the final alignment and drainage geometry of M'bout-Selibaby-Gouraye during the rainy season preceding construction by USAID. The first part of the study is now planned for July to September 1983.

In the meantime, actual best estimates of quantities have been based on approximate alignments, visual field observations, and approximations derived from technicians with local experience. The figures obtained by previous reconnaissance teams were also taken into account. Results of the field survey are contained in Engineering Annexes XIII and XIV.

B. Maintenance: Facts, Description of Activities and Related Costs

1. Facts.

The following facts regarding road maintenance in Mauritania have to be considered when trying to design institutional maintenance capabilities. These facts have been taken from various sources, including interviews with GIRM officials and various reports dealing with road maintenance in Mauritania. (See References 1 and 3):

a) The required road maintenance budget as of 1977 was estimated at US \$ 9 million for the Mauritanian network (See Engineering Annex II). In 1977, the funds available for road maintenance were \$1,580,000. Therefore, there was a shortfall of \$7.4 million in 1977. Since then the situation has not improved mainly because of other urgent problems and despite the IBRD's Third Highway Project (which did not focus entirely on road maintenance anyway).

Road maintenance will remain a problem in Mauritania because of lack of funds and also lack of qualified personnel. The Fourth Highway Project due to be implemented in 1982 (IBRD, FADES and Kuwaiti cofinancing) will deal with this question to some degree. (See Ch. II. C.4.)

b) A new organization has been devised by the Ministry of Equipment which tends toward decentralization with one District Engineer in each Region of Mauritania. In 1980, the budgets to cover operating costs (not including personnel salaries) for the Kaedi and Selibaby Districts were about \$6,500 and also included maintenance of official buildings.

c) The generally poor financial state of the Ministry and its Directorate of Public Works will not be changed at one stroke. However, the GIRM's growing consciousness of the need for regular road maintenance is indicated by the assistance it is seeking to deal with this problem in the immediate and medium term (IBRD, FADES, Kuwaiti, and UNSO activities).

## 2. Description of Maintenance Activities Related to the Present Project

The principal task will be the preservation of free flow within the culverts and ford crossings, because any kind of obstruction or impediment within such structures could cause major damages to the structures themselves as well as to the adjacent embankments.

The task requires a labor force using only hand tools (pick, shovel, machete) to take out any sand accumulation, straw, branches, trunks, etc., from the openings. Given the incidence of heavy rains in the Selibaby area (Engineering Annex I), we estimate two man-days/km of road to be required 5 to 6 times a year (i.e., 10-12 man-days/km/year).

These figures, 10 to 12 man/days/km per year, are very small but this is the goal of the design standards, which are supposed to lead to almost maintenance-free road improvements.

This type of maintenance work above should be initiated by villagers after each heavy rain, under the overall guidance of the District Engineer. The area of influence of each village could be set at mid-distance along the road to the neighboring villages. This task can be considered as preventive maintenance.

Other tasks will consist of repair maintenance on fords, culverts, embankments and/or causeways damaged by erosion or scour. This type of work will be carried out by the TP subdivision in Selibaby when needed. Similarly, light annual or bi-annual resurfacing should be programmed by the District Engineer.

## 3. Costs related to Maintenance Activities

The amount of labor required to perform the light maintenance activities is 10 to 12 man days/km/year.

When costed @ 25 UM/hour<sup>1/</sup> this amount represents 2400 UM/km/year or \$48/km/year. In addition, the Selibaby District Engineer's budget (about \$4000 in 1980) should be added to the amount above, and some money for vehicle operation and also for villagers' tools replacement. The amount needed is estimated at another \$8,000 for fuel, tools, maintenance and depreciation of the vehicle. The total cost of maintenance as described above is roughly \$100/km/year.

## 4. Maintenance During the Implementation of the Project

Light maintenance will be carried out by project personnel during the rainy season, construction activities becoming slower during those months, especially after each heavy rain during the time needed to

----

1/ Minimum present salary for unskilled labor in Mauritania.

allow ground and oueds to dry up (24 hours). Emergency maintenance funds have been provided and will eventually allow for any type of extra protection required which would become evident after heavy rains and which would have not been foreseen before.

### 5. Recurrent Costs for Maintenance after the Project

The type of maintenance needed after project completion includes repairs and some resurfacing. It is estimated that 2 months of operation of one earthwork and one structures sub-brigade should be more than adequate for M'bout to Gouraye. The equipment for these two sub-brigades should be left with the District Engineer in Selibaby, and a similar complement in Kaedi for the M'bout-Kaedi road.

The regular maintenance (culvert clearing) should always be carried out. The costs for these other maintenance activities will be as follows (for M'bout-Gouraye, the entire length of which falls under the Selibaby District Engineer's authority):

Earthwork Brigade - about \$40,000/mo

Structure Brigade - about \$12,000/mo

Total: \$52,000 x 2 months

Emergency maintenance materials - \$5,000

Tool Replacement \$1,000

Total \$6,000

Total cost: \$52,000 x 2 + 6000 = \$110,000/year

for about 160 km.

The cost/km will be \$110,000/160 = \$700/km/mo

The total cost/km will be:

Routine Maintenance (culvert clearing): \$100

Emergency repairs & resurfacing:	\$700
Total	<u>\$800</u> /km/year

A similar amount must be considered for M'bout-Kaedi, and has been included in the Economic Analysis.

42

This figure might seem slightly high, but it does include improvement works as well as emergency repairs, and of course some resurfacing and the inexpensive but essential use of a tractor-pulled "Talard" to remove corrugation effects from the roadway.

## 6. Major Maintenance/Rehabilitation

In order to protect the initial road investment, the economic analysis provides, for all roads, a major maintenance intervention 6 years after construction and amounting to \$4000/km.

The chances of this actually being budgeted and done are fairly good, given the new emphasis on maintenance and also the availability of funds through the UN's Sahel Road Maintenance program. USAID's proposed collaboration with UNSO/OPE on these road segments would further ensure future availability of funds for this activity.

## 7. Training

The following GIRM (TP) personnel are expected to receive training during the project:

- District Engineers - (2) - Partial participation
- Senior TP Engineer - (1) - Counterpart to TA Project Manager
- Field Superintendents - (2) - Permanent Project personnel
- Foremen, Equipment Operators  
and Mechanics - 20-25 - Permanent or rotating  
Project personnel

The TP employees will work with their counterparts on the Technical Assistance team in close coordination and on a continuous basis in order to acquire as much experience as possible. Some should preferably be from the Guidimaka area in order to insure follow-up maintenance capabilities for the improved roads. It is anticipated that TP personnel will be entirely financed by the GIRM and that in this way a core force-account team will be developed for future GIRM projects. The rest of the brigade (skilled and unskilled labor, support personnel) will also receive adequate training as needed but will be strictly "project" employees rather than GIRM employees.

## C. Analysis of Construction Operations by Force Account with Technical Assistance

### 1. Introduction - General Existing Inputs

The objective of the project is to construct about 90 km of road and rehabilitate 11<sup>8</sup> km (M'bout-Kaedi) with a "Special Autonomous

Brigade" which will be entirely (personnel, technical assistance materials) financed by the project except for GIRM personnel (i.e., detached from TP). The equipment will be furnished by UNSO/OPE, with a complement from AID. A description of UNSO equipment is given in Appendix C, Detailed Engineering Analysis.

In Section A. the various construction items were described and the equipment need to perform these tasks are as follows:

(a) Earthworks (embankments, causeways, surfacing):

- 1 Bulldozer 150 to 200 HP
- 1 Motorgrader 120 to 160 HP
- 1 Front-end loader (2 m<sup>3</sup> bucket)
- 3-7 Dump trucks, preferably 10 m<sup>3</sup>
- 1 Rubber-tired roller and/or 1 vibratory roller
- 1-2 Water tank trucks (15 m<sup>3</sup>)
- 1 Water pump diesel engine
- 1 Pick-up

(b) Drainage and crossing structures

- 1 Backhoe
- 1 Concrete mixer (250-350L)
- 1 Concrete vibrator
- 1 Small water tank 1 to 1.5 m<sup>3</sup>
- 1 Service Truck to supply materials
- 1 Pick-up
- 1 Vibrating plate compactor

In view of the equipment already in use by UNSO/OPE, the above-mentioned minimum equipment will enable setting up two construction "sub-brigades" for earthworks and one "sub-brigade" for structures.

44

## 2. Outputs - Quantities

### (a) Earthworks

According to best available data and information, the output of one earthworks "sub-brigade" such as described is between 300 and 500 m<sup>3</sup> per working day (see Engineering Annex VI), according to the relative distance of borrow pits from the work site.

Taking into account possible inefficiency (site organization, ability of operators, etc.), remoteness and breakdowns, the average production figure used for the following calculations will be 350 m<sup>3</sup> per "sub-brigade" per working day, either fill or surfacing materials.

### (b) Structures

According to experience and the best available data and information it is considered that the previously described structures or "culvert" sub-brigade is capable of producing 2 to 3 m<sup>3</sup> of culverts per day and 60 m of fords per month.

## 3. Project Brigades, Required Equipment, and Production

Since before construction began on the M'bout-Selibaby road, it was apparent that the UNSO/OPE equipment would not be sufficient given terrain conditions, in particular the large amount of drainage and crossing structures (fords and culverts) required.

As an illustrative example, the UNDP study estimated that 1100 m of fords and 350 m<sup>3</sup> of concrete structures, using one "sub-brigade", would take about 22 months (for the entire M'bout-Selibaby road); while earthworks, with two "sub-brigades", were assessed at roughly 12 months.

Therefore, and whether or not additional equipment becomes available in the interim, it is felt the USAID's project organization must include enough equipment to create one more structure "sub-brigade".

Additional equipment is required as follows, with prices computed as of March, 1981, UNSO/OPE's date of purchases of its equipment, but with 25% added for inflationary adjustments projected to March, 1983:

Equipment Required for Second Structures

"Sub-Brigade"

<u>Item</u>	<u>No. Required</u>	<u>Unit Cost (\$)</u>	<u>Total Cost (\$)</u>
Concrete Mixer (400 L)	2	\$5,000	\$10,000
Water Tank	2	\$5,500	\$11,000
Backhoe	1	\$30,500	\$30,500
Concrete Vibrator	1	\$1,200	\$ 1,200
Welding Set/generator	1	\$15,000	\$15,000
Air Compressor	1	\$25,000	\$25,000
Farm Tractor	1	\$30,000	\$30,000
Service Truck/crane	1	\$80,000	\$80,000
Water Pumps	2	3,000	6,000
			-----
			\$208,700
			+ 25% inflation=260,875
			+ 30% shipping =340,000
			=====

Another \$110,000 is included in the project budget for capital costs at start of construction, in anticipation of further equipment needs to be specified at that time.

For the rest of this analysis, it will be assumed that the second "sub-brigades" equipment, in addition to existing UNSO/OPE equipment, will be available for the project.

Construction time estimates, size of crews and productivity will thus depend on assumed available equipment only, and rounded production rates based on unit estimates in Section C.2, will therefore be:

Earthworks = 2 "sub-brigades" = 16,000 m<sup>3</sup>/month

Structures = 2 "sub-brigades" = 120 m/month of fords

plus 5 m<sup>3</sup>/day of culverts

4. "Special Autonomous Brigade" Organization

(a) Earthworks - Equipment and Personnel

Each sub-brigade should be headed by a road construction foreman, although at present this position is held by the Field Superintendent

46

of the UNSO/OPE contractor's TA team. Equipment listings are given in Appendix C, Detailed Engineering Analysis. In summary, the personnel for the two earthworks "sub-brigades" will consist of:

Construction Foreman	2
CMP Chief of Party	1
Equipment Operators	8
Truck Drivers	10-14
Light Vehicle Drivers	2
Mechanics	4
Unskilled Labor	10-12 (variable time of employment)

(b) Structures - Equipment and Personnel

Each "sub-brigade" for structures should also ideally be headed by an experienced construction foreman, although in the UNDP/OPE project organization this position is not filled, its functions being carried out by the Field Superintendent. For labor cost calculations (see C.6.a. below), it is assumed that these positions will be filled.

In summary, personnel for the two structures "sub-brigades" will consist of:

Construction foremen	2
Equipment operators	5
Truck Drivers	3
Light vehicle drivers	1
Mechanics	4
Masons	8-10
Carpenters	8-10

(c) Base camp-support Equipment and Personnel.

A base camp is currently set up just outside of M'bout. It can be moved once or twice a year, following the work's progress. This base camp equipment is given in Appendix C, Detailed Engineering Analysis, as is the breakdown of support personnel.

5. Summary of Personnel and Equipment.

(a) Personnel Summary:

<u>Position</u>	<u>Earthworks</u>	<u>Structures</u>	<u>Support</u>	<u>Total</u>
Mechanic/foreman	-	-	1	1*
Construction foreman	0-2	1-2	-	4*
CMP C.O.P.	1	-	-	1*
Surveyor	-	-	1	1*
Masons	-	8-10	-	8-10
Carpenters	-	8-10	-	8-10
Iron Workers	-	4-5	-	4-5
Mechanics	4	4	4	12
Operators	8	5	-	13*
Truck Drivers	10-14	3	-	13-17
Light Vehicle Drivers	2	1	-	3
Clerk	-	-	1	1
Storekeeper	-	-	1	1*
Secretary	-	-	1	1
Asst. Surveyor/draftsman	-	-	1	1
Unskilled Labor	20-24	10-20	4-6	34-50
-----				
Total:	47-55	46-60	12-19	103-131

\* Personnel detached from TP/Nouakchott, except for 5 "local" operators. Thus, 24-25 employees will comprise the basic "force account" element of the project, financed by the GIRM.

(b) Equipment Summary:

<u>Item</u>	<u>Earthworks</u>	<u>Structures</u>	<u>Support</u>	<u>Total</u>	<u>1/</u>	<u>2/</u>
Bulldozer	2			2	-	
Motorgrader	2			2	-	
Loader	2			2	-	
Dump Truck	6	1		7	-	
Farm Tractor	1	1		2	1	
Vibratory Roller	1			1	-	
Pneumatic roller	1			1	-	
Water Pump	2	2		4	2	
Water Tank	2	2		4	2	
Pick-up (Toyota Jeep)	2	1		3	-	
Water Truck	3			3	-	
Fuel Truck			1	1	-	
Mobile Lub. Unit			1	1	-	
Lowboy/tractor			2	2	1	
Service Truck/crane			2	2	1	
Concrete Mixer (400 L)		3		3	2	
Concrete vibrator		2		2	1	
Water tank, towed		2		2	-	
Backhoe		2		2	1	
Vibrating plate compactor		1		1	-	
Welding set/generator		1		1	-	
Air Compressor		1		1	1	
Mobile Trailers			6	6	-	
Mobile Workshops			1	1	-	

48

Generator (50 KVA)	6	1	-
Generator (20 KVA)	1	1	-
Land Rover (SW)	2	2	-
Pick-up (Peugeot 404)	2	2	-
Peugeot SW (305)	1	1	-
Transceiver Radio	3	3	-

Additional existing equipment includes hardware, survey equipment, and soils testing laboratory materials. There are also a year's supply of spare parts.

-----

Notes to Equipment Summary listing:

1/ Total is the equipment considered as required for the two earthworks "sub-brigades" and the two structures "sub-brigades" on which all subsequent cost and productivity analyses are based.

2/ "Required" corresponds to equipment necessary to field the second structure "sub-brigade" (USAID equipment).

D. Detailed Operating Costs

1. Labor Costs

Labor costs have been computed largely on the basis of the existing UNSO/OPE "Special Autonomous Brigade" and the contractor's anticipated "full-strength" hiring requirements in the future. The second structures "sub-brigade" is also included. Precise actual costs can only be determined after the fact, of course, but the following analysis attempts to establish the limits of the likely range of costs. An average monthly figure, weighted for inflation and contingencies will be arrived at. It should be kept in mind that labor costs in this type of project (i.e., mechanized) account for approximately 20% of operating costs so that the total's sensitivity to variations in labor costs is not very great. Detailed listings are provided in Appendix C.

Based on Table 3.1, Appendix C, Detailed Engineering Analysis, labor costs will range from:

MIN: \$26,700/Month  
to MAX: \$31,300/Month

in 1982 prices.

Assuming basic wage and benefit increases of 10% per year, we have monthly labor costs:

for mid-1983 to mid-1984: \$29,370-\$34,430  
and for mid-1984 to mid-1985: \$32,310-\$37,870

For the purpose of this project as defined, the average labor costs will be:

During calendar 1983:	\$35,000/month
1984:	\$38,500/month
1985:	\$42,400/month

(of which approximately 30% will be TP personnel).

## 2. Technical Assistance

In order to insure the project implementation, a US Technical Assistance contractor will be hired for the duration of the project. The main missions of this team will be to:

- \* organize construction work in order to achieve production objectives;
- \* train on-the-job, all categories of personnel
- \* insure coordination with local authorities and donors (UNSO/AID);
- \* supervise disbursements; and
- \* prepare the detailed design and plans prior to construction for the various structures

The team will comprise:

- one chief of party, highway engineer,
- one chief mechanic,
- one field superintendent,
- one mechanic.

A more detailed position description and task schedule is provided in Annex IX, Appendix C.

The cost of Technical Assistance is based on the assumption that the team will be provided by a private U.S. Consulting firm under contract with USAID, under current cost and fee conditions.

Under 1982 conditions and prices, the cost of the TA team totals \$38,700/month. For 1983-1984, an inflation factor of 10% is factored in, per year, giving the following totals:

1983:	\$42,500/month
1984:	\$46,700/month
1985:	\$51,400/month

In addition to the permanent TA team the project requires the short-term services of a hydrologist. Some specific studies are necessary to evaluate the necessary culverts of bridge openings, based on studies of aerial photographs (1/50,000), maps (1/200,000) and visual inspection of the sites. This total cost over the LOP<sup>1/</sup> is estimated at about \$2,000/month.

-----

1/ M'bout-Gouraye only.

### 3. Equipment Operating Costs

The equipment operating costs consist of:

- provision for tire replacements
- provision for spare parts
- cost for fuel and lubricants
- provision for repairs outside the project facilities
- miscellaneous

Percentages for contingencies have been added to the provisions for tire replacement and for spare parts as well as for the cost of fuel and lubricants.

#### MONTHLY OPERATING COSTS SUMMARY

<u>ITEM</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
1. Local Labor	\$35,000	\$38,500	\$42,400
2. Technical Asst.	\$42,500	46,700	51,400
- Hydrology	2,000	2,000	-
3. Equipment Oper. Costs			
Tires	4,800	5,500	6,100
Spare parts	30,000	33,000	36,300
fuel	35,000	38,500	42,350
Misc.	1,000	1,000	1,000
4. Sub-contracts			
Local Studies	1,500	1,500	1,500
Well Drilling	3,000	3,000	3,000
5. Miscellaneous			
Tools	500	500	500
local travel/transpt.	2,000	2,000	2,000
emergency maint.	2,000	2,000	2,000
per diem (materials)			
training	1,000	1,000	1,000
Misc. Camp Exp.	2,000	2,000	6,000 <sup>1/</sup>
	-----	-----	-----
	\$163,500	\$177,200	\$195,550

Of which, payable in local currency:

	<u>1983</u>	<u>1984</u>
Local Labor	\$35,000	\$38,500
Technical Assistance		
per diem	6,200	6,800
	-----	

1/ Includes demobilization expenses.

Equipment Oper.

fuel & lubes	(35,000)	(38,500)
repairs	1,500	1,600
misc.	1,000	1,000

Subcontracts:

local studies	1,500	1,500
---------------	-------	-------

Miscellaneous

all items	7,500	7,500
	-----	-----
	87,700	95,400

As percent of total	53.5%	53.3%
---------------------	-------	-------

Note that if fuel costs are considered as a hard currency item, which may well be a contractual condition, the percentage local currency drops to 35%. It is this approximate figure which will be used in the financial plan for disbursement schedules.

4. Cost of materials

Materials to be used for drainage, fords and structures consist of:

- cement
- gabions
- corrugated metal pipe (CMP Ø 80)

Unit costs, projected to mid-1983, are as follows:

Cement	\$215/ton
Steel	\$1400/tgn
Wood	\$ 500/m <sup>3</sup>
Gabions	\$ 25/each ( 2m <sup>2</sup> )
CMP	\$ 125/m

Quantities of materials for drainage structures for each road are estimated below, based on previous studies as field investigations. The smaller quantities ascribed here to the M'bout-Selibaby segment are based on the new (Marchant) alignment and not on the existing M'bout-Selibaby track. Note that from km 70, the new alignment takes 46 km to reach Selibaby. Similarly on the 1-2-1 alignment (see Sheet 1 A and 2 A), Selibaby-Gouraye is 45 km.

a) Materials Cost and Construction Time

- i) M'bout (km 70) - Selibaby (46 km)

52

Fords: 215 m (=1.8 months)

Culvert Vol: 338 m<sup>3</sup> (= 3 months)

CMP: 49

Thus, structures work should take about 6 months with contingencies and possible extra work.

Materials

Summary Quantities and Costs:

<u>ITEM</u>	<u>COST/UNIT</u> <sup>1/</sup>	<u>QTY</u>	<u>TOTAL</u> <sup>2/</sup>
Cement	\$215/ton	301.3	\$65,000
Steel	1400/ton	19.1	27,000
Wood	500/m <sup>3</sup>	122.3	61,000
Gabions	25/each	323	8,000
CMP	125/m	343	43,000
			-----
			\$204,000

1/ 1982 prices + 15%

2/ Rounded

Total (For contingency and possible price variations, add 5%)

\$214,000  
-----

ii) Selibaby-Gouraye (45 km)

Totals: Fords: 285 m (=2.4 months)

Culvert Vol: 122 m<sup>3</sup> (=1 month)

The repair of the three bridges is estimated at 2 months, and thus total structures time should be about six months, including contingencies.

Materials

Summary quantities and costs:

<u>ITEM</u>	<u>COST/UNIT</u> <sup>1/</sup>	<u>QTY</u>	<u>TOTAL</u> <sup>2/</sup>
Cement	\$215/ton	261.5	\$56,000
Steel	1400/ton	14.5	20,300
Wood	500/m <sup>3</sup>	127	63,500
Gabions	25/ea	360	9,000
CMP	125/m	175	22,000
			-----
			\$170,800

1/ 1982 prices + 15%

2/ Rounded

(For contingency and 1984 prices, add 20%) Total: \$205,000  
 -----  
 iii) Kaedi-M'bout - 118 kms

Quantities of the various work items can be estimated as follows<sup>1/</sup>:

360 meters of ford construction (11 fords)

10-15 existing structures to receive protection works  
(ditches, dykes, etc.)

extensive repairs needed on 5 structures

volume of fill to be placed estimated at 140,000 m<sup>3</sup>

When comparing these quantities to the average estimated monthly production of the brigade,

\* fords at 120 m/month = 3 months

\* repairs on structures = 5 months

\* embankments at 15,000 m<sup>3</sup>/month = 9 months

The brigade should be able to perform the work in 9 full operating months.

-----  
 1/ See Annex XIV for detailed inventory

Materials

Summary Quantities and Costs

<u>ITEM</u>	<u>COST/UNIT<sup>1/</sup></u>	<u>QTY</u>	<u>TOTAL<sup>2/</sup></u>
Cement	\$215/ton	415	\$90,000
Steel	1400/ton	38.8	55,000
Wood	500/m <sup>3</sup>	210	105,000
CMP	125/m	245	31,000
			-----
			\$2 81,000

- 1) 1982 prices + 15%
- 2) Rounded

For 1985 prices, add 30% \$3 65,000  
\*\*\*\*\*

5. Final Summary and Conclusions

Total Construction Time and Costs

It is assumed that the earthworks brigades will be able to produce 7.5 km/month. Given the relatively small amount of causeways (elevated to 1.5-2 m above original ground), and the ability of the structures sub-brigades to stay ahead of earthworks the 7.5 km/month goal is considered to be realistically attainable.

This would give:

- for km 70 - Selibaby (46 km): 6 months
- and for Selibaby-Gouraye (45 km): 6 months

However, this time does not fully account for the rainy season (July-October), during which time operations can take place but at an extremely reduced pace. It would thus be necessary to adjust the schedule to take in leave time and other aspects reducing brigade efficiency and output. On the other hand, equipment operating cost would be reduced during this period also, and these represent 45% of monthly operational costs.

Assuming that USAID involvement would begin around May-June 1983 (which appear now to be a likely date for UNSO/OPE's completion of 70 km), we would then expect the first leg to take up to 9 months (from June 1983 to February 1984 ) but to cost no more than 7.5 months in operating costs. The same would apply for the second leg, from March 1984 to December 1984.

The following table summarizes all costs and also derives the overall costs/km excluding depreciation of equipment. This item, however, is factored into the economic analysis, reflecting the use value of combined UNSO/OPE and USAID equipment costs during the life of the project (See Ch. IV, Economic Analysis, Section B).

55

SUMMARY TABLE PROJECT CONSTRUCTION COSTS

	<u>M'bout-Selibaby</u>	<u>Selibaby-Gouraye</u>	<u>Kaedi-M'bout</u>
KM	46	45	118
Full Operating Months	7.5	7.5	7.5
Chronological Months	9	9	9
Total Operating Costs	\$1,228,500	\$1,341,000	\$1,765,000 (\$196,000/month)
Materials	\$ 214,000	\$ 205,000	\$ 365,000
Total Costs	\$1,416,500	\$1,546,000	\$2,130,000
Cost/km	\$ 31,360	\$ 34,000	\$ 18,050

56

E. Kaedi-M'bout Road

The projected improvements will consist of:

- construction of ford crossings where no structure exists now. The fords or "raidiers" are the most suitable type of oued or stream crossing structure in the area because of the shallow river beds which are predominant along this road.

- repair of existing structures and embankments/causeways including the raising of the level of these embankments to prevent overtopping by runoff water.

- addition to a few corrugated metal pipes, 80 cm in diameter to match the required culvert openings.

- construction of protective works such as dykes for oued draining, gabions, etc.

- road resurfacing wherever it will be deemed necessary and in particular in the vicinity of Kaedi.

This cost estimate of rehabilitation for the Kaedi-M'bout road has been devised based on the assumption that work will be performed by the Special Autonomous Brigade with all the equipment available for M'bout-Selibaby-Gouraye.

## IV ECONOMIC ANALYSIS

### A. Background

The proposed road link from km 70 south of M'bout through Selibaby to Gouraye is part of a network of roads linking the productive Guidimaka and Gorgol regions to food deficit areas and urban markets. At the present time, several of the road links become impassable during a large part of the four or five month rainy season with the result that the supply of agricultural inputs is impeded, agricultural research and extension are made difficult, trade and commerce generally are discouraged, and the production and marketing of surplus crops does not take place at their full potential.

As long as any key segment in the road network remains in bad condition and impassable during a significant part of the year, these disincentives to commerce and agricultural production and marketing will continue and the benefits anticipated from building the proposed road will not be fully realized. The east-west highway from Nouakchott to Nema has been completed well past Kiffa, and the GIRM and donors have moved to build or restore other links in the road network. As discussed elsewhere, these road links are: Aleg to Boghe (being paved), Boghe to Kaedi (scheduled construction of structures) and Kaedi-M'bout (planned rehabilitation). Work on the first link has already begun and on the second link already scheduled. Similarly, UNSO has started work on its projected road from M'bout to a point 70 kilometers south so that the costs for these three roads segments can be treated as sunk costs. On the other hand, the restoration of the Kaedi to M'bout road had not yet been scheduled, when the PL 480 Section 206 proposal to finance this road segment was made. The costs of rehabilitation works on the approaches to approximately forty structures on the Kaedi to M'bout road of about \$2.15 million are consequently included in the total costs, as well as \$200,000 costs for the use of some UNSO equipment on this road.

The computed benefits comprise a) road user savings from existing and generated traffic on the three road links, M'bout-Selibaby, Selibaby-Gouraye and M'bout-Kaedi; b) road user savings on traffic diverted from the Nouakchott-Kiffa-Ould Yenge-Selibaby road to the completed Nouakchott-Kaedi-Selibaby road; c) savings in storage and inventory costs on goods formerly stockpiled in M'bout and Selibaby before the onset of the rainy season and the value added from additional crop production induced or made possible through the reduction in transport costs and from guaranteed input supplies at a lower cost and in a timely manner and the facilitation of agricultural research and extension.

### B. Costs

A key condition for USAID participation in this project is for continued use of the equipment procured by UNSO to complete the M'bout-

Gouraye road. The cost of the UNSO equipment was \$2.4 million. The USAID use value on this equipment, assuming five year life and 1½ years USAID use from a point 70 kilometers south of M'bout to Gouraye, will be \$720,000, with \$320,000 in the first year and \$400,000 in the second year. The construction costs are calculated at \$30,800 per kilometer in constant dollars, or \$1.42 and \$1.39 million respectively.

Additional equipment, replacements and spare parts are needed costing about \$450,000. Annual maintenance costs are projected at about \$90,000, or roughly, \$800/km and an intensive refurbishing after 6 years at \$4,000/km for the entire M'bout-Selibaby road. For Selibaby-Gouraye, this comes to \$36,000/year and \$180,000. An evaluation is budgeted at \$50,000 since the analysis of the economic viability of this project is based on perceptions of the design team and on assumptions which are conservative and reasonable, but untested. One objective will be to generate information on baseline socio-economic conditions and traffic levels and costs and the impacts of improved roads on these phenomena. This survey on baseline conditions and on initial impacts in year 4 will be useful not only in assessing the feasibility of USAID participation in future road upgrading in Mauritania, but in assisting USAIDs elsewhere in the Sahel where impacts of road upgrading are also poorly understood and documented.

### C. Benefits

The appendix D, economic analysis, describes the benefits associated with the projected road improvements in details and also provides the supporting calculations. These benefits and calculations are summarized below.

#### 1. Road User Savings from Existing and Generated Traffic

User cost estimates per kilometer for different road surfaces were taken from a 1978 BCEOM/GIRM Infrastructure Directorate report and multiplied by 1.61 to account for intervening inflation. Road counts were made by the 1981 design team and checked against customs and police records by the 1982 design team. Existing traffic is assumed to grow without the project at 1.5% per annum, exclusive of commodity traffic by state agencies, and of projected cereal traffic from the Fom Gleita irrigation project for which user savings were separately calculated.

With the road project, traffic is assumed to triple immediately and increase by 3% per year thereafter. This assumption is in line with recent experience on the St. Louis-Matam road. As explained in the appendix economic analysis, the benefit from the generated traffic is evaluated at one half of the generated traffic's road user savings or, since we are projecting a 200% increase in generation equivalent to the user savings from existing traffic during the first year after the road network is completed.

The user savings on each road per journey is derived by subtracting costs on excellent road surfaces from costs on bad road surfaces. The user savings for 0.5 ton capacity pick-ups on the M'bout-Selibaby road is \$12 per journey and on 10-ton trucks on the same road, \$82.

The user savings for these vehicles on the Selibaby-Gouraye road are \$5 and \$33 respectively and on the Kaedi-M'bout road \$13 and \$84 respectively. Existing daily traffic on these roads are approximately 2 and 2; and 3 and 1/3; and 6 and 4 respectively so that the annual savings, existing and generated, are as follows: M'bout-Selibaby -- \$51,000 (\$19,000 existing since the USAID financed portion is only 46 kilometers; the generated savings is \$51,000 since negligible traffic generation takes place until the entire road network is completed); Selibaby-Gouraye -- \$9,000 and M'bout-Kaedi -- \$112,000.

Separate calculations were made on user savings from the transport of SONADER inputs to the Foum Gleita irrigation project and from the transport of large-scale production from that irrigation project to urban markets. Assuming that each hectare of irrigated production requires 800 kilograms of agricultural inputs and taking into account a gradual increase in irrigated area at Foum Gleita to the peak capacity of 3,600 hectares, the user savings are estimated as follows (in \$000): 16,24,32,40 for year 3-6 and 48 for year 7 and thereafter. The user savings on the transport of one half of the marketed Foum Gleita production are calculated as follows: year 3-23, year 4-35, year 5-45, year 6-57, and year 7 and thereafter 68. The other half of Foum Gleita marketings would be in the direction of Kiffa.

## 2. Benefits from Diverted Traffic

The completed road network from Aleg to Selibaby through Boghe, Kaedi and M'bout is a distance of 407 kilometers compared to 574 kilometers through Kiffa and Ould Yenge and 671 through Kiffa and M'bout. The improved road surfaces with all-weather capability combined with the much shorter road length should lead to road diversion over and above the traffic levels assumed under traffic generation, keeping in mind also that the routes chosen by haulers depend also upon the opportunities for intermediate cargoes. These road diversion savings on cereal imports before they are phased out by increasing local production are calculated as follows (in \$000): year 3-55, year 4-41, year 5-29, and year 6-14. On agricultural inputs for Gouraye and assuming gradual increases in cultivated area to 3,000 hectares by year 10, the savings are calculated as follows (in \$000): year 3-20, year 5-49, year 6-59, year 7-69, year 8-78, year 9-88, and year 10-98. The diversion savings on other traffic might be appraised at \$15,000 annually. An alternative more optimistic scenario projects diversion of all private Nouakchott-Selibaby traffic to the new road, with a benefit in year 3 of \$296,000.

## 3. Savings in Storage and Inventory Costs

Because M'bout and Selibaby are inaccessible during much of the rainy season, state agencies and private traders must stock materials to last until roads again become passable. These storage and inventory carrying costs are estimated at about \$50,000 annually.

#### 4. Production Incentives

The main value of upgrading roads in Mauritania is to help bring about substantial increases in the production of food. The proposed road improvements would generate increased food production in two ways: 1) Road user savings for inputs and other commodities and on produce marketed toward such food deficit areas as Kiffa would raise the effective prices received by farmers for their crops and hence enlarge the farmer's purchasing power. This enhanced purchasing power would constitute an important incentive to increased production. 2) The existence of an all-weather road network would guarantee the timely receipt of seed, spare parts and other inputs and make more possible agricultural research and extension activities throughout the producing regions. This assurance on the timely arrival of input supplies and the facilitation of much wider dissemination of improved crop production techniques should be an even more important stimulus to increased crop production. We have evaluated the first impact in appendix D at \$147,000 per year and the second beginning in year 3 at \$50,000, rising to \$629,000 in year 14 in line with steady production increases in both drylands and irrigated areas. Due to the speculative nature of projecting the impact of improved roads on increased production, we have also constructed an alternative production scenario.

The first calculation is arrived at through assuming that all road user savings (\$147,000) are passed on to producers, that the project roads have an impact on one half of the drylands production in the Gorgol and Guidimaka regions totalling 35,000 tons\*, and through utilizing the calculation in the 1982 PL 480 section 206 project paper that the value added to crop production under improved technology net of the opportunity cost of labor, other production costs and transportation costs is about 35%. While there is no information on the elasticity of supply to increased prices, it is assumed that this elasticity is unity in consideration of the abundant room for more intensive use of rainfed and irrigated land, local creation of more small-scale irrigated perimeters, and increased adoption of available dryland varieties and techniques. The savings in transport costs are estimated to be about 0.6 UM per kilogram which is believed to operate as an incentive on both the input and output sides.

The second calculation is based on the assumption that the production of drylands cereals in the two regions will rise from the present 35,000 tons to 60,000 tons over the next 15 years. Production from the Fom Gleita area and the Gouraye perimeters should peak at about 33,000 tons. Naturally, much the greater causes for these production increases will be the investments made in the new agricultural production facilities and in the increases in real producer prices stimulated both by the road user savings (already captured above) and deliberate USG/GIRM policies\*\*. We have made the conservative assumption that only 10% of the increases are attributable to the assurance of input supplies and the stimulus afforded to agricultural research and extension. Mauritanian development experience is replete with long delays in starting cultivation, in procuring spare

\* GIRM's extremely conservative figures total 25-28,000 tons.

\*\* In 1981, the GIRM raised producer prices for millet/sorghum from 8-13 UM / kg in a dramatic effort to stimulate local production. Further increases to 15.5 are under discussion.

parts, and many promising research results are spread very slowly, because of the difficulties of transporting extension agents. All-weather improved road surfaces should consequently be assigned some value in making possible, or speeding up, planned increases in agricultural production. Using the 1982 PL 480 section 206 project paper calculation of UM 15,500 per ton as the economic value of production in Mauritanian surplus producing areas, this benefit at the peak becomes:  $58,000 \text{ tons} \times .10 \times 15,000 \text{ UM} \times 0.35 = \text{UM } 31,465,000$  or \$629,000.

#### D. Increased mobility

The benefits to increased passenger mobility and passenger time savings are not quantifiable in Mauritania. Evidence from similar road projects elsewhere in the developing world, including Sierra Leone, Liberia, and Kenya suggests that passenger mobility benefits are quite large. As a very rough approximation of what might be the case in Mauritania, incremental net benefits were increased by 30% as a proxy for passenger mobility benefits.

#### E. IRR's

Based on the above admittedly tenuous assumptions and limited information, the IRR calculated for the basic scenario of traffic growth and production increase is 5%. The second scenario, with more optimistic diverted traffic estimates, but more conservative estimates of increased production, also yields an IRR of 5%.

If we disaggregate the two scenarios, we can do modest sensitivity analysis. Taking from the first the relatively high projections of increased production, and from the second the relatively high estimates of user savings, we arrive at an IRR of 11%. If we increase the incremental net benefit by 30%, to account for benefits due to personal mobility and time savings by passengers not previously quantified, the IRR becomes 15%. On the other hand, if the low estimates of user savings in the first scenario are combined with the low estimates of increased production in the second, and no mobility benefits, the IRR becomes negative (-2).

#### F. Policy Issues: Food Pricing and the Financing of Road Maintenance and Construction

##### 1) Price Policy Reform

Two policy issues are closely related to the magnitude of benefits from the proposed project. First, GIRM food pricing and marketing policy affects the amount of grain marketed over the proposed roads. Grain imports comprise approximately 66% of total Mauritanian grain consumption. Concessional and free distribution of imports--especially in the potential surplus regions of Guidimaka and Gorgol--have likely been a disincentive to increased production, and reduced the potential benefits from interregional trade.

In an effort to address this situation of disincentive effects of donated food aid, the GIRM has committed itself to major price policy reform. This reform will serve to coordinate and rationalize its food sector.

In preliminary discussions with USAID in 1981, the GIRM agreed to raise local sale price of PL 480 imports to a level equivalent to FAS (USA) plus Mauritanian internal distribution costs. It has not only carried out this agreement, but is approaching, under the impetus of the proposed PL 480, Title II, Section 206 grant, a true pricing policy where PL 480 imports will be sold at import parity price (cost and freight,

62

Nouakchott) plus internal distribution costs. This will allow the private sector to enter the grain trade and reduce government costs.

Other donors of food aid are encouraged by this GIRM move towards a more economic pricing system. Grants in food aid from the World Food Program, Germany, the E.E.C. and other lesser donors will also be tied to this policy reform. In addition, a revolving fund will be set up to ensure an economic platform price for marketed local production. These recent developments represent a significant departure from previous policy, and can be expected to lead to increased incentives for production and, thereby, increased road use and increased benefits to this project.

This price policy reform is targeted at local millet and sorghum prices. Production and consumer prices for rice and consumer prices for commercially imported wheat are being addressed in discussions between the GIRM and the donor community. The entire USAID dollar-funded portfolio of projects-- particularly the proposed Agricultural Sector Grant will encourage and support more general price policy reform.

These increased prices are integral to the benefits to be accrued from the Rural Roads Improvement Project. Experience has shown that infrastructure and remunerative prices must go hand in hand if increased marketed production is to result.

For a more detailed description of the three year PL 480, Title II, Section 206 Program and this price policy reform, see the Summary Description in Appendix J-1.

## 2) Road Maintenance

The second policy issue relates to the financing of road maintenance and the repayment of past loans for road construction. Benefits accruing to the proposed project will be short lived unless the road is regularly and adequately maintained. Maintenance costs are estimated at \$800/km/year, or \$125,600 annually for the M'bout-Bellilbaby-Gouraye link and an additional \$91,200 for the Kaedi-M'bout link. In the short to medium term, UNSO is planning to maintain the road under its upcoming Sahel Road Maintenance Project. At the same time, the World Bank's Fourth Highway Project, scheduled to begin later this year, will assist the GIRM to develop a maintenance system to maximize the impact of the limited resources currently allocated to road maintenance. At the end of this project (and the Aleg-Boghe and Boghe-Kaedi projects, financed by other donors) there will be a substantial pool of skilled road workers and foremen coming from the construction brigades of these projects. These skilled workers could certainly be drawn on to constitute future road maintenance brigades.

The primary constraint to road maintenance, then, will be fiscal, rather than management personnel. This fiscal constraint may affect the proposed road only in the medium term after termination of the planned UNSO Sahel maintenance project. The charges imposed on road users in the form of import duties on vehicles and spare parts, fuel taxes, and fees for licenses and registration are already high by international standards so that the revenue therefrom can not realistically be expected to increase through higher per vehicle charges, but rather through general economic development and the gradual establishment of a much larger vehicle fleet. International experts recommend that the GIRM allocation for road maintenance which now amounts to about UM 100 million annually be at least quadrupled, while the GIRM repayments during 1982 on past loans for road construction are amounting to nearly UM 400 million. These GIRM repayment obligations are scheduled to rise steeply in future years as grace periods on recently completed construction expire.

While the GIRM appears to face long range problems in maintaining its national road network, actions are planned in the short and medium term which can help the

GIRM to come to grips with this question. This Rural Roads Improvement Project is designed to facilitate simple maintenance and to encourage the GIRM to mobilize local population in the performance of this task in the project area. The World Bank/FADES/Kuwaiti- sponsored Fourth Highway Plan will examine the problem of road maintenance on a national level and will identify the most appropriate mechanism for planning and implementing a road maintenance system given Mauritanian's resource constraints. and donor financing availability. The UNSO Sahel Road Maintenance Project will provide medium term road maintenance financing. This combination of planning, experience, and resources available as identified through these three activities should enable the GIRM to establish an effective maintenance program.

## V. SOCIAL ANALYSIS

### A. Roads in the Context of the Basic Social Landscape

Two systems exist concomitantly in the Selibaby area. The modern system administratively consists of a regional governor, department prefets and the head of governmental services such as agriculture, health, and public works who are representatives of their respective ministries in Nouakchott but under the immediate authority of the governor. Juxtaposed to this are the traditional communities and ethnic groups and their hierarchical class structure.

The areas's population is comprised of several sub-groups: Soninke (55%), Haratin and Bidan (20%), Toucouleur and Fulbe (25%). Along the proposed routes this proportion varies with a slightly higher percentage of Soninke in the northwest (Selibaby-M'bout) and a slightly higher number of Toucouleur-Fulbe in the south (Selibaby-Gouraye). However, because of their strong attachment to the region and to agriculture, and in general their possession of the best land, the social dynamics of the Soninke clearly dominate the situation. In reality it is almost impossible to predict the exact effects of a road, since the road itself creates a new, dynamic and continuously changing situation. It is precisely because of this that socio-economic monitoring of communities along the road should occur during the life of the project. However, it is possible to at least outline the socio-economic pressures that make up the situation. As will be seen, these pressures--somewhat unique given the region's historic adjustment to male outmigration--seem to indicate no clearly discernable negative effects from the introduction of new all-weather transportation but to the contrary seem to be overwhelmingly positive in nature.

#### 1. Soninke Culture:

Soninke civilization and social structure has evolved as one primarily adapted to agricultural production. The fact that the Soninke are found in the extreme fringes of the ecological zone conducive to major agricultural production has forced them to evolve additional survival mechanisms in the form of migratory commerce and labor. However, even while working in the factories of France, they continue to maintain their basic social unity and organization.

The major characteristic of their system is extremely strong patriarchal group control, with an emphasis on group unity and self-help. The major production unit is the extended family compound, dominated by the eldest male of the family who controls younger brothers, sons and sometimes cousins. Production centers on the family field,

though younger males and women have small individual fields as well.

The patriarchal system is replicated on the village level where control rests with the oldest male of the founding family assisted by a council of males from other important families. This group controls other newer or socially lower families, mainly by being recognized as the controllers of the village land. Given the strong emphasis on community unity, it is not easy for any community member to be denied or deprived of land as long as they fulfill their community responsibilities. However, as it is the controlling group that determines rights and responsibilities, the distribution is not completely equal.

## 2. The Attachment of the Soninke to their Region and Culture:

Generally all of Mauritania's people demonstrate a fierce loyalty and strong attachment to their home areas despite their problems and poverty. This is certainly true of the Soninke who, despite years abroad in centers of modernization both in Africa and Europe, not only continue to send large sums of money home, but maintain their families there and return to their home communities at around 40-45 years of age, while they could still be active elsewhere. Money is sent to support the family, the community and Soninke culture. Many communities evidence a renaissance of traditional architecture and decoration to an extent that bespeaks an effort to compensate for the threatened disintegration due to modernization and urbanization occurring elsewhere but not there. It can be said that as a group they have already evidenced strong positive actions to maintain their home area as a vital community and would be willing to do so in the future if the opportunity is offered.

## 3. Male Outmigration and Labor Availability Among the Soninke:

### Effects on Migration

The present situation in the Guidimaka consisting of well-established pattern of male out migration and the now arising pattern of female out migration raises the question of the roads effects on total migration. There has been established, from prior experiences in many countries, a generalization that roads led to increased migration per se. However, this is unlikely to be the case in this given situation since migration is already the established way of life. To the contrary the roads in addition to stabilizing the communities in the area by providing greater access to goods and services, should lead to more frequent returning to communities by males working during the dry season in Nouakchott or along the river.

Chart One, Appendix E, represents comparative estimations of population broken down by age and sex, in Mauritania's regions. Quick perusal makes evident the preponderance of females over males during the most productive ages of 15/40. Moreover, not only are 20-30% of the male work force out of the region, but those who go and succeed in foreign work markets are almost by definition the most

energetic, ambitious and capable.

The situation vis-a-vis male outmigration frames the entire picture as concerns labor availability in the area. This out-migration is actually an ancient phenomena and is virtually an inherent part of Soninke manhood. This situation existed in past times when the Soninke specialized as traders into Black Africa. During the colonial period they specialized as boat workers both along the river, to Europe and worldwide. The latest major alteration came around the years of independence in 1960 when, as a result of the end of the Algerian war, France began to replace Algerian workers with manpower from her former African colonies.

The drought of the last few years therefore is not the cause of male migration but has had a serious effect by threatening the viability of the home communities to which they have almost always returned. To counteract this threat requires inputs especially in terms of labor assisting devices, whether plows for weeding or machines for retention dam construction, to assist what is a relatively weak labor force of women, children and older men. In many cases, due to their employment overseas, there is significant investment capital that goes into other areas such as mosque construction or hiring of Bambara from neighboring Mali. Other more modern investment potentials, such as those already mentioned, seem frozen due to the area's isolation. (People have, for example, bought plows in Mali or Senegal but despite promises they have never received any instructions from local agricultural agents. When asked why, local service personnel cite the transportation problem).

Meanwhile, the labor shortage puts good labor on a competitive basis with salaries available elsewhere. During the rainy season, day laborers earn 200-300 UM per day. A minimal monthly salary is approximately 3700 UM (\$80). While these look high, the figures represent necessary earnings to support a family in light of the high cost of imported goods including food. Preliminary studies indicate the region's population has the highest dependency on outside remittances of anywhere else in Mauritania (RAMS study).

Given the fact that the Soninke are the major agricultural producers; that their production system appears the most promising in terms of increasing yields and that they have the most solid traditional claims on productive lands in the region, it seems that the regeneration of the region's economic vitality will benefit them the most and that they will be the most active direct participants in related action.

B. The Moors (Approximately 25%)

The Moors are basically represented by three sub-groups, the noble warrior Bidan (White Moors), The Zenega (White Moor tributary herders), and the Haratin (freed slaves). In the past, Bidan groups of their tributary Zenega, used the Guidimaka as seasonal pasture land. Important groups established tributary slave villages that engaged in agriculture and provided the ruling groups with a share of the crop. Today the majority of Moor villages are former slave communities or newly settled areas of Zenega. There are some noble Bidan who, having lost their herds during the drought, are attempting to establish new

67

sedentary mixed farming-small herding communities. These villages, especially those of the Haratin, are among the poorest in the area. Because they are generally small in size, it is unlikely that they will in the foreseeable future be provided major infrastructure, and therefore access to health and education facilities is closely tied to commuting to the nearest large settlement.

The Haratin provide the major day-laboring population of the region. Because they do not possess the best lands, they must by necessity supplement their own agricultural earnings. More than any other group they are dependent on the existence of manual labor jobs that come with transport infrastructure development, whether road maintenance, truck loading and unloading and, especially for women, small detail market operations such as bread and daily condiment selling. As a group, therefore, they would be the most direct beneficiaries of any newly created labor jobs that resulted from the new roads.

Bidan traders dominate the mid-level commercial sector (one and two room stores that sell the variety of imported food and materials needed on a daily basis, such as canned milk, sugar, cloth, etc.). This group prospers on the availability of transport for goods and mid-level market opportunities. As such, they are the major suppliers of goods to remote areas and in this sense their prosperity is directly related to the increase in business in isolated communities. The small Bidan stores found elsewhere in the country are generally absent from all but a few of the largest settlements of the Guidimaka.

### C. The Toucouleur and Fulbe (Peul)

These people represent a common linguistic group but are strung along a cultural spectrum the ends of which differ enormously in terms of production and community organization. Toucouleur villages along the river represent substantial sized communities whose economic existence is traditionally based on river recession agriculture, supplemented by dryland agriculture on nearby lands, fishing, and some livestock. Like the Soninke, they receive substantial inputs from men working out of the community. Social organization of production is on the nuclear family level and the communities do not have the patriarchy of the Soninke. Most of the major settlements are in the south and southwest. In many cases, these communities are better serviced in terms of available supplies and in and out access because their proximity to the river.

The Fulbe (Fr. Peul) are at their cultural epitome on the other end of the spectrum, living in small seasonal hamlets of a few families, devoted to livestock, and engaging in agriculture only as a secondary activity. The small size, isolation and seasonal nature of their settlements put them on the lowest end in terms of either public or private services being directed to them. These communities will

generally only be served if they are along the access route to larger settlements.

In between the prototype large Toucouleur river agriculture settlement and the small temporary Fulbe hamlet lies a growing number of intermediate communities where sedentary agriculture is combined with transhumant cattle raising (only selected family member travel with the animals). Such communities offer potentially expanding models of the type of highly adaptive mixed farming-herding units that would spring up with proper inputs.

#### D. Women, Children and Road Benefits:

Women and children represent not only a special concern in terms of USAID objectives but also in terms of understanding what is happening in the Guidimaka and what will probably happen in the future depending on whether or not a new development infrastructure is introduced into the region. USAID has supported investigation of the situation of women in Mauritania, including those in the Guidimaka. Among the findings was that the combination of male outmigration and drought has dramatically increased the burdens on Soninke women. Traditionally, women and children were expected to contribute labor to the family field, but this still remained the primary responsibility of the men. Women had fields of their own<sup>own</sup> which secondary crops such as peanuts, indigo, etc. were raised as a side income. Today, due to the combination of labor shortage and poor production, the women's fields are being used to provide the basic family grains, thus, women are laboring more but have experienced a significant drop in their discretionary income. This greatly increases the already burdensome responsibilities of the women in other areas such as house construction, and their primary responsibility for providing clothing, education and medical care for their children.

Women and children would be the majority of beneficiaries if the general welfare of the area increased. In terms of productive labor, revitalization through labor assisting devices would both directly assist them, and re-establish the productivity of the family fields under male control. This would relieve women of this burden and free them to return to earning a secondary income of which they are the primary beneficiaries.

There is also an important corollary to the situation concerning women. The burdens are becoming so great that female outmigration to join men is beginning. This phenomena, if it develops substantially, will be the death knell of traditional communities and with it the area's basic and most valuable hope for improvement. To prevent this system's collapse requires fairly quick improvement in the quality of life per se, improvements that must reach the remote villages and which cannot reach them given present means of access.

#### E. Roads in Particular

##### 1. The Present Transportation Situation

At present, movement in the Guidimaka is effected in one of four ways: vehicles, animals, foot and by boat. None of these is always

possible at all times throughout the year, since when the gullies are flooded after a rain even foot traffic between villages is hampered. In this sense, the value of roads should be seen as more inclusive than the measure of motorized transport use than can be envisioned, for in fact, the creation of all-weather passages will enhance the ease and regularity of pedestrian and animal traffic as well as trucks and cars. Moreover pedestrian capacity is a fair measure of a road's area of influence. As long as people can walk to and from a road in a day it becomes part of their daily life possibilities. Using such a criteria means that an approximately 10-15 kilometer radius from any particular point can be taken as a road's "area of influence".

In terms of fundamental adaptability, animal transport traditionally handled the export of grains. The disappearance of caravans seem due as much to the limited production available for sale as anything else. What animal transport could never handle is the large scale imports into the region of the tremendous variety of goods and services such as plows, fertilizers, a myriad of assorted products like medication and service personnel such as agriculture and health agents. It is thus the need for modern inputs for both increased production and well-being that necessitates a quantum leap in motorized transportation facilities. At question is not only the problem of access per se but speed (medical evacuations) and regularity (marketing, rainy season services). In terms of replicability it should be noted that the question is not one of replicating this project in the future, but rather of replicating through this project the type of minimal rural marketing service network that already exists in other areas of the Sahel (See Annex).

To do this requires careful route layout to achieve the greatest total circulation of traffic as possible and to reach as many isolated existing or potential communities as possible. This requires a basic network of roads that link together, rather than dead end routes. The network requires ports of entry and exits via Kaedi and Gouraye and an assembling place for regional distribution and collection of goods (Selibaby).

The only way of insuring adequate vehicle traffic to remote areas is for these areas to be "on the way" to and from important centers, since, by themselves such communities will not present adequate profit potential to justify the costs to a transporter of making regular visits.

To actually quantify beneficiaries is almost impossible given changes foreseen, and the mobile nature of the population. However, in very gross terms--using a ten kilometer radius as a standard one can estimate that as of 1977 census figures the following numbers of people could be included as "affected" parties from the roads proposed.

## 2. The Question of Maintenance

The problem of maintenance requires honest assessment. A recent USAID publication "New Directions in Rural Roads," actually suggests accepting the reality that roads are not going to be maintained in

most underdeveloped countries given present governmental infrastructure and funding realities. Unfortunately, this is not acceptable alternative in the Guidimaka, since the result would not be just gradual deterioration but rapid washouts. Required is a type of repetitive, methodical upkeep very different from the types of acute community cooperative labors people are used to, and demands cleaning of drainage systems after each major rain. This conflicts with the crucial few days after a rain when a farmer must work his soil and seed it before it dries up. (Given the unpredictability of rainfall, this often has to be done several times a year.)

To be avoided is the passing on of this task to those socially weak members of the community who farm land by permission and are susceptible to being pressured to unfairly shoulder this burden. The solution proposed is to pay day laborers, who do exist during the agricultural season, the going rate (approximately 200 UM/day). The exact formula whereby this is done (contract with the community or establishment of an official job as sector maintainer) and where the revenue will come from (general regional funds, local use tax, tax on shop or market people in affected communities) cannot be established a priori since the situation differs by area and will in fact continue to change as the roads stimulate increased settlement and commerce. What is demanded is a clear commitment to work out a system with the communities as each segment as it is completed, thereto try it out, assess it after the rainy season, and then either extend it or try something new. Given the ultimate benefits to be gained, the pressure is there for everyone to work together to formulate a locally adaptive maintenance system. This, however, will take time, flexibility and adequate preparedness for dealing with failures. Some washouts will occur and have to be rebuilt (though only after the reason is determined and a new solution proposed).

#### F. Constraint versus Quantification for Projecting Change

Mauritania has shown itself over the last 20 years to be the example par excellence of a constraint model of population growth in terms of settlement location. Its highly mobile population appears capable of responding almost immediately to changes in the extent and location of four basic factors; food, earning opportunity, services and roads (which really encompass the other three as the attraction of roads is the access they provide to the others). There seems little reason to believe the Guidimaka should prove otherwise. The region's ultimate carrying capacity is a factor of available water and land, but these are highly tied to the technology available. At this moment, the best and most honest thing one can say is that access roads are a major factor that will direct the area to a rapid growth to carrying capacity limits, such as they ultimately prove to be, but which appear substantially greater than that of most other interior regions of Mauritania.

71

## VI. ADMINISTRATIVE FEASIBILITY

### 1. General

Mauritania is faced with a number of operational constraints that inhibit its ability to carry out development projects in an effective manner. These constraints include but are not limited to a lack of trained manpower, lack of institutional capacity and inadequate budgetary resources. However, while these problems exist in the transportation sector, the GIRM is committed to resolving them through other donor assistance and its own means as noted below. This is particularly true in regards to this project and it is for these reasons that the Mission does not feel there are any insurmountable administrative issues.

### 2. Institutional Capability/Role of GIRM

Interviews with GIRM officials, analysis of available GIRM reports on road improvement/maintenance and field visits have indicated similar road improvement/maintenance problems in Mauritania that exist elsewhere in West Africa. Few funds are available in the GIRM's National Budget for road improvement and maintenance, with budgeted funds for road maintenance alone representing only a fourth of country's required needs. Operating budgets for public works divisions in the different regions such as the Guidimaka where the project will take place are even worse off as a total of approximately \$4,130 was provided in 1980 to service approximately 530 km or roads and construct and maintain public buildings as well.

In addition, there is a lack of adequate technical expertise everywhere, demonstrated by inadequately maintained equipment and washed out portions of recently improved roads caused by lack of drainage structures, poorly constructed drainage structures and/or lack of periodic maintenance of the same.

Despite all of these and other problems, the PP team feels that the GIRM has the institutional capability to undertake the project. First the Department of Public Works (see organizational chart, Appendix I) within the Ministry of Equipment and Transport, is responsible for the improvement and maintenance of roads as well as that of all Public buildings and they are well aware of these and other problems and are committed to resolving them. The GIRM has provided assurances to AID that adequate budgetary resources will be provided to the Public Works Subdivision of Guidimaka throughout the duration of the project and after its termination to properly maintain completed roads and equipment. In addition they have indicated that they will provide all required counterpart personnel for the project and that they anticipate no difficulties regarding the recruitment of road building crews including equipment operators, masons, mechanics, etc. Regarding the latter, skills are available on the local job market.

Finally the GIRM has agreed that it will assign personnel for the project in such a way as to establish permanent staff capability

within the Public Works subdivision. However, to ensure that all required human and financial resources are provided for the project, USAID will include the appropriate conditions precedent in the Project Agreement to cover these matters. Furthermore, in discussions with the GIRM, USAID noted that whereas some of the required skills may be available on the local market, recruiting experienced personnel in all categories may prove to be difficult. For this reason, the PP team has recommended the establishment of a training program to cover these needs as well as to ensure the presence of an institutional capability to replicate GIRM efforts to maintain and improve roads after the project has ended.

The training will on-the-job training for the skilled people seconded to the project from Public Works. There are 24/25 positions indicated in the summary table (page 36 ) in the construction/maintenance brigade. These people will work under the supervision and guidance of the project contractor for 2½ years, with rotations from Public Works, it is expected that perhaps as many as 35 people will be so trained. They will return to other Public Works activities upon completion of the project and form the core of a pool of skilled operators, mechanics, surveyors, and foremen to enhance the effectiveness of Public Works in future force account construction/maintenance activities.

### 3. Role of UN

The UNSO and OPE have financed the first 70 kilometers of construction of the road from M'bout-Selibaby. AID is picking up the financing from that point. In spite of this being a "separate" AID-financed project from kilometer 70, there are still links with the UN as a joint venture because the OPE has financed the bulk of heavy equipment to be used and have managed the project to the point where USAID will take over. The UN has an interest in seeing the remainder of the road completed. Their experience in constructing the first tranche will be valuable. Continuing UN involvement in this activity is seen in two areas: The UN will procure the U.S. source equipment replacement and spare parts material financed by AID through this project. OPE successfully procured the initial U.S. source heavy equipment used on the first tranche of the M'bout-Selibaby road. The UN will also engage in a monitoring role to assist in the supervision of the use and care of UN-provided equipment. The UN has a field coordinator (a U.S. citizen) in Mauritania to look after UN - provided equipment for a number of other UN projects. He will be able to continue this role for this project.

### 4. The Role of USAID

USAID will provide a project manager in the Office of General Development to perform normal project monitoring functions for this activity. The USAID Mission will call on REDSO/WA engineering services for evaluation assistance. However, since USAID has no other engineering expertise in the Mission, there will be eight months of engineering consultant services provided over a three year period to assist the Mission to establish technical project monitoring parameters over the management of these activities. These services will be financed by this project.

VII. FINANCIAL PLAN

The financial plan is presented in four sections as follows:

- Summary cost estimates by FY
- Quarterly expenditure schedule
- Financial obligations Summary by FY; and
- Discussion of financial accountability and sources

A. Project Costs and Expenditures

As described in the Engineering Analysis all costs are inclusive of inflation projected to 1983, 1984 and 1985. Detailed breakdowns of monthly operating costs, capital cost, materials and miscellaneous costs are presented in the analysis. Variations in operating costs during the rainy season are taken into account. Expenditures and obligations are scheduled in a way to allow adequate lead times for procurement and deliveries. A 5% contingency and a 20% LC contingency have been added on at the end of the project to insure against possible delays caused by exceptional circumstances, but "normal" contingencies are included in the basic monthly operating costs.

SUMMARY COST ESTIMATES, LOP

(\$000 Current)

AID Contributions, combined total of resources made available from both project 682-0214 and from PL 480 Title II Section 206 program local currencies.

Personnel

TA Team	\$1,294.0
Local Personnel	628.3
Local Travel	54.0

Commodities

U.S. Procurement	\$1,326.5
Local Procurement	223.8
Third Country procurement	719.0
POL	885.5

Other Requirements

USAID short-term consultants	167.0
Evaluation	60.0
Miscellaneous (Tools, training, emergency maintenance) camp expenditures	132.0
	-----
subtotal	\$5,490.0
contingency	527.0
AID Total	<u>\$6,017.0</u>

74

UNSO Contributions

Administrative Costs \$ 200.0

GIRM Contributions

Use value of UNSO/GIRM equipment  
and salaries of TP project personnel  
(\$300,000) = \$1300.0

Total Project Cost \$7517.0

75

BREAKDOWN OF COST ESTIMATES AND FINANCIAL PLAN  
BY FY

	<u>FY 83</u>	<u>FY 84</u>	<u>FY 85</u>	<u>FX</u>	<u>LC</u>	<u>TOTAL</u>
<u>Personnel</u>						
TA Team	222.5	571.8	499.7	1113.8	180.2	1294.0
Local Labor	82.9	266.5	278.9	-	628.3	628.3
Local Travel	10.0	24.0	20.0	-	54.0	54.0
<u>Commodities</u>						
U.S. Procurement (Equipment, Tires & spares)	571.8	393.2	361.5	1326.5	-	1326.5
Local Procurement (Including local studies)	44.0	137.8	42.0	-	223.8	223.8
Third country procurement (materials & drilling)	168.5	526.5	24.0	719.0	-	719.0
POL	122.5	393.8	369.2	885.5	-	885.5
<u>Other Requirements</u>						
USAID short-term consultants Evaluation	46.7 25.0	77.5 -	42.8 35.0	167.0 60.0	- -	167.0 60.0
Miscellaneous (tools, training, emergency maintnenance, camp)	19.2	57.8	55.0	-	132.0	132.0
Contingencies			527.0	205.0	332.0	527.0
Totals (rounded)	131.1	2448.9	2255.1	4476.8	1540.3	6017.1
GIRM contribution - personnel	39.6	127.3	133.1		300	300

76

QUARTERLY ESTIMATES EXPENDITURES SCHEDULE BY FY  
 (Part I) Current \$000

ITEM	FY 83												FY 84		
	1st Q			2nd Q			3rd Q			4th Q			1st Q		
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
	-----M'bout-Selibaby-----														
Equipment	350									100					
Materials				158									165		
- FX				158									165		
- LC				30									40		
Evaluation							25								
Operating Costs							213			230			319		
- FX							213			230			319		
- LC							75			56			102		
Consultants							47								
Contingency															
- FX															
- LC															
Subtotal	350			158			285			330			484		
- FX	350			158			285			330			484		
- LC	-			30			75			56			142		
Totals	350			188			360			386			626		

77

QUARTERLY ESTIMATES EXPENDITURES SCHEDULE BY  
 FY (part II) (Current \$000)

ITEM	FY 84						FY 85						FY 86	TOTALS								
	2nd Q		3rd Q		4th Q		1st Q		2nd Q		3rd Q		4th Q		1st Q							
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	J	A	S
	Selibaby-Gouraye-----											M'bout-Kaedi-----										
Equipment																						450
Materials																						653
- FX						330																653
- LC						55																(125)
Evaluation																						35
Operating Costs																						60
-FX	339					349	229				371	382				510					2942	
-LC	152					156	60				156	162				174					(1093)	
Consultants													43								167	
Contingency :																						
-FX																			205		205	
-LC																			322		(322)	
Subtotal																						
-FX	416					349	554				371	425				510			205		35	
-LC	152					156	115				156	162				174			322		(1540)	
Totals	568					505	674				527	587				684			527		35	

8

FINANCIAL SUMMARY

Minimum Requirements (000 's \$)

	<u>FX</u>	<u>LC</u>	<u>TOTAL</u>
FY 82	350	-	350
FY 83	1334	333	1667
FY 84	1661	558	2219
FY 85	1132	649	1781
	-----	---	-----
Total	4477	1540	6017

Amount to be programmed from PL 480 Local Currency\* 1207

Total amount to be obligated under 682-0214 4810  
=====

\* \$1,207,000 to be made available to project for LC requirements by PL 480 Title II Section 206 funds.

PROPOSED OBLIGATIONS SCHEDULE

OF PROJECT 682-0214 FUNDS= \$(000's)

FY 82

FY 83

3717

1093

Proposed local currency availability from PL 480:

FY 84  
558

FY 85  
649

B. Financial Accountability and Methods

This project is a follow-on to the UNSO/OPE road construction on M'bout-Selibaby, which for the purposes of the analysis is assumed to reach 70 km by end April, 1983, or close thereafter. At that time, therefore, a number of existing accounting procedures will have been established and in the months immediately before start of project, USAID will have become familiar with UNSO/OPE's practices. In addition, procurement of equipment will have taken place during late 1982 in conjunction with the UNSO/OPE's Field Coordinator and New York procurement office. Similarly, prior to project start-up, USAID will have awarded the technical assistance contract.

During this period, all costs will be accounted for through USAID, either by direct purchases or by reimbursement of UNSO/OPE. It is understood that all UNSO/OPE costs will be financed by UNSO/OPE (i.e., about \$200,000 in personnel and administrative fees over the LOP.)

In FY 84 and FY 85, PL 480 Title II Section 206-generated local currency will be made available for local costs requirements. These will be provided through the GIRM's Rural Development Fund administered by the Ministry of Finance.

79

These funds, as well as FY 83 local currency are expected to be managed by USAID's technical assistance contractor. The Contractor will establish specific line items such as personnel, materials, repairs, local travel, local studies and miscellaneous (tools, emergency maintenance, training, camp expenditures, etc.).

Procedures for obtaining local currency funds provided through PL 480 Title II Section 206 grain sales, as well as requesting foreign currency for POL, materials, spare parts, etc., will be coordinated with the USAID Controller's Office. The UNSO/OPE field coordinator will also be kept appraised of project expenses and will similarly furnish all necessary documentation to USAID's Controller's Office regarding any direct purchases made by UNSO/OPE for the project and following prior approval by USAID.

#### Section 211 (d) Requirements

Funds for local cost financing under project 682-0214 will not be released to the cooperating government. The USAID Controller's office, in conjunction with the American contract firm on this project, will manage a revolving fund for those local cost expenditures financed through the local currency element of this project. This mechanism will be established with USAID controller's office on the arrival of the contractor and remain in place until the depletion of local currencies provided by project 682-0214. Replenishment vouchers will be submitted on a monthly basis and will be supported by submission of all supporting payment documents and examined by the USAID Controller's office. There will be no release of these funds to the cooperating government during this project.

### VIII. IMPLEMENTATION PLAN

The implementation of this project involves three distinct activities: administration, management and evaluation. These activities are composed of the following elements:

- Administration: Project Agreements between USAID and GIRM, contracting with Technical Assistance team, procurement of equipment and materials, supervision of all disbursements, coordination with UNSO/OPE.
- Management: Supervision of road construction, maintenance of equipment and roads during LOP, payroll disbursements, purchase of local items, training of brigade and GIRM supervisory staff.
- Evaluation: Pre and Post-project baseline data generation and assessment, evaluation of progress of construction.

Although there are some overlapping functions, the three activities are essentially divided between USAID/UNSO/OPE, the TA Contractor, the GIRM and REDSO/WA.

Tasks are scheduled chronologically in the following chart.

#### IMPLEMENTATION TIMETABLE

<u>DATE</u>	<u>ACTION</u>	<u>AGENT</u>
Sept. 15, 1982	Sign Project Agreement	USAID/GIRM
Sept. 30, 1982	Issue PIO/T for Technical Assistance	USAID
Nov. 1, 1982	Procure initial equipment	USAID/UN
Nov. 15, 1982	RFPs to short list from previous U.S. Contractors (UN Project)	USAID/GIRM
Dec. 1, 1982	Issue PIO/T for baseline evaluation	USAID
Mar. 15, 1983	Select technical assistance contractor	USAID
Mar. 30, 1983	Sign TA Contract	USAID
April 1, 1983	Baseline evaluation	Contractor
May 1, 1983	Begin construction at km 70	TA Team
June 1, 1983	Determine specific needs for further procurement of equipment	TA Team
June 15, 1983	Move base camp to Selibaby	TA Team
July 1, 1983	Start procurement of complementary eqpmt.	USAID/UN
July 15, 1983	Hydrology study	TA Team
Oct. 1, 1983	Procure second batch of construction materials (for Selibaby-Gouraye)	USAID/UN
Oct. 15, 1983	First availability of local currency resources from PL 480 Title II Section 206 made available for Roads Project	USAID/GIRM TA Contractor

TIMETABLE (continued...)

<u>DATE</u>	<u>ACTION</u>	<u>AGENT</u>
Nov. 1, 1983	Construction progress evaluation	REDSO
Jan. 31, 1984	Complete M'bout-Selibaby	TA Team
June 30, 1984	Procure third batch of materials (for M'bout-Kaedi)	USAID/UN
July 15, 1984	Construction progress evaluation	REDSO
Oct. 31, 1984	Complete Selibaby-Gouraye	TA Team
Nov. 15, 1982	Move base camp to Laqceiba	TA Team
1985		
July 31, 1985	Complete Rehabilitation of M'bout-Kaedi	TA Team
Aug 1, 1985	Construction progress evaluation	TA Team
Aug. 12, 1985	Issue PIO/T for follow-up baseline evaluation	USAID
Nov. 1. 1986	Baseline evaluation update	Contractor

## IX. EVALUATION PLAN

### A. Engineering

Within six months of the start of construction USAID/Mauritania will, with the help of REDSO/WA, assess construction progress and standards. At one year and three months, and again at the end of the project, similar assessments will be performed.

### B. Socio-Economic

A contractor will be selected early in FY 1983 to collect baseline socio-economic data for two months in the area to be affected by the road. The contractor will collect similar data in the same area one year after completion of road construction activity. The following sorts of information are required:

1. Traffic counts for representative parts of the year.
2. User savings effected by the road.
3. Vehicle freight and passenger fares.
4. Changes in villagers' use of transport (switch from animal to vehicle transport?)
5. Marketing behaviour of farmers, and outlets they use.
6. Transporters' margins.
7. Margins for traders of grain and consumer goods.  
(do user savings get passed on to farmers and villagers buying consumer goods?)
8. Effectiveness and accessibility of government services and extension agents.
9. Baseline data and changes in consumption patterns.
10. Baseline data and changes in geographic uses of space-- living areas; fields cultivated; grazing patterns.
11. Baseline data and changes in land ownership-including effects on rent, sales and usage of land and water rights.
12. Baseline data and changes in crop patterns: crops grown, rotation of cultivated fields, sources and use of agricultural labor.
13. Baseline data and changes in peoples basic economic strategies--both short and long term, including areas of investment, migration for jobs, mix of subsistence and cash activities.
14. Baseline and changes in the demography of concerned communities including changes in both total population and age and sex distribution.

The contractor should have proven analytical and information-gathering experience in Africa, French language capability, and expertise in agricultural economics or economic anthropology. Funds are budgetted for four person months for this evaluation.

83

X. CONDITIONS, COVENANTS, AND NEGOTIATING STATUS

USAID has worked closely with the Directorate of Public Works (formerly Directorate of Infrastructure) in the GIRM Ministry of Equipment, Transport and Communications to develop this project. Several modalities for cooperation and project implementation have been examined in the course of project development including a joint implementation with UNSO/OPE. Since the UNSO/OPE inputs into developing the Kaedi-M'bout-Selibaby-Gouraye road network were in place before AID was prepared to make its resources available, the network is being built under the guise of two separate project accords. USAID will commence its activities following the completion of the UNSO/OPE-financed section at 70 kilometers south of M'bout toward Selibaby. USAID will sign the project grant agreement with the GIRM Ministry of Transport, Equipment and Communications. The Grant Agreement is expected to be signed with the GIRM in late August or in early September 1982 upon approval of this Project Paper in AID/Washington, following a tandem review with the PL 480 Title II Section 206 Project Paper. There are two conditions precedent which will be part of the Grant Agreement: 1) the GIRM will make available to USAID all of the road construction and maintenance equipment provided to it by UNSO/OPE in the context of the construction of the first phase of the M'bout-Selibaby road. This equipment will be used for all of the USAID-financed road construction and rehabilitation activities financed under this project, and 2) the GIRM will provide all of the Public Works personnel and their salaries and compensation called for in the Project Paper to work with the technical assistance contract team on the construction brigade. There will also be two covenants included in the Agreement: 1) the GIRM will covenant to establish a maintenance plan which will include the assurance of parts and labor for the maintenance of equipment to be left with the District Public Works Engineers at Kaedi and Selibaby upon completion of the project; and 2) the GIRM will covenant to continue required road maintenance following the project through a system of Public Works contracts with local village communities.

Since this project is linked with the PL 480 Title II Section 206 roads sub-project, the PL 480 Project Grant Agreement with the GIRM (Ministry of Economy and Finance) will include provisions to make the regional local currencies for the M'bout-Kaedi and M'bout-Selibaby-Gouraye roads available as as scheduled in this project.

PROJECT DESIGN SUMMARY - LOGICAL FRAMEWORK

PROJECT TITLE & NUMBER; RURAL ROADS IMPROVEMENT (682-0214) LIFE OF PROJECT: FROM FY 82 TO FY 85

TOTAL U.S. FUNDING \$6.017 MILLION

DATE PREPARED: 5/82

NARRATIVE	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Program Goal: the broader objective to which this project contributes:</p> <p>To improve the social and economic well-being of the rural population of the Guidimaka and Gorgol Regions.</p>	<p>Measurements of Goal Achievement:</p> <ul style="list-style-type: none"> <li>- increased income as a result of improved marketing opportunities and increased availability and lower costs of inputs and technical services.</li> <li>-improved quality of life by improving access to government services in health, education and other areas.</li> </ul>	<p>National accounts and statistics indicating social and economic activity by impact area in the Guidimaka Region.</p>	<p>GIRM will provide sufficient budgetary and human resources to permit the improvement and maintenance of rural roads in the Guidimaka Region.</p> <p>GIRM will use AID, other resources to increase the availability of inputs and services in order to further the rural development of the Guidimaka Region</p>
<p>Project Purpose:</p> <p>to facilitate access to markets and the means of moving social services and agricultural inputs into potentially high food production areas</p>	<ul style="list-style-type: none"> <li>-increased number of health, education and other related governmental inputs/services delivered to area.</li> <li>- increase of commercial activities (transportation and marketing of consumer goods, local crafts) in rural areas.</li> <li>- increased agricultural production reaching national/regional markets.</li> </ul>	<p>Data collection by GIRM national and regional authorities on agricultural production, health and education.</p>	<p>Completion of all-weather transportation network will provide access to Guidimaka and will generate increased social and economic activity (increased agricultural outputs because of availability of inputs/services and marketing opportunities for farmers etc.)</p> <p>-selection and funding of rural roads will represent top priorities of GIRM national/regional authorities for road network in Guidimaka Region based on social, economic and other criteria.</p>

45

## NARRATIVE

OBJECTIVELY VERIFIABLE  
INDICATORS

## MEANS OF VERIFICATION

## IMPORTANT ASSUMPTIONS

OUTPUTSMAGNITUDE OF OUTPUTS

1. All-weather Rural Roads as follows:

- a) M'bout-Selibaby
- b) Selibaby-Gouraye
- c) Kaedi-M'bout

2. Rural Road Maintenance organization/facilities established to maintain rural roads improved under project.

3. Mobile construction brigade established for further road improvements in country.

4. Training program for counterparts and road brigade personnel completed.

1. A total of 209 km of rural roads by July, 1985:

- a. 46
- b. 45
- c. 118

2. Satisfactory maintenance of 209 km of project rural roads by end of project

3. One, by July 1985

4. Personnel trained by end of project:

- 25 Public Works personnel
- 1 mechanic/foreman
- 1 construction/foreman
- 1 CMP/COP
- 1 Surveyor
- 12 mechanics
- 8 operators
- (Storekeeper) trained

-operational records of GIRM and Project Staff

-Inspectors by GIRM Project Staff and REDSO/WA Engineers

- Project Evaluation

-standard selected for improvements of rural roads meet technical, social, and economic requirements of region.

- That GIRM Ministry of Equipment and Transport will be Technically and administratively able to undertake improvement of rural roads.

- That GIRM Ministry of Equipment and Transport will be able to carry out its responsibility of Mauritanian rural roads following their improvement.

NARRATIVE

OBJECTIVELY VERIFIABLE  
INDICATORS

MEANS OF VERIFICATION

IMPORTANT ASSUMPTIONS

INPUTS

IMPLEMENTATION TARGET  
(TYPE & QUANTITY)

1. AID (6.017 million)

- a. Technical Assistance
- b. Commodities (U.S. Third country and local) to carry out earthwork and drainage operations
- c. Training of counter-parts and road brigade personnel;
- d. Operating costs of road brigades

(see financial plan)

Budget for activities/ amounts to be financed by AID, UNSO and the GIRM.

-AID financing and procurement documents

- Financial and Operating Records of GIRM

-There will be two fully equipped earthwork/brigades and three drainage construction brigades to improve, maintain rural roads

- GIRM can recruit qualified field personnel (operators, mechanics) for brigades and can assign qualified counter-parts to work on project.

2. Other Donors (UNSO/OPE)

- a. Equipment to carry out earthwork and drainage

3. GIRM

- a. salaries for counter-parts and Public Works personnel
- b. availability of garage/workshop facilities

87

PROJECT PAPER FOR MAURITANIA  
RURAL ROADS IMPROVEMENT PROJECT

682-0214

VOLUME II-APPENDICES

- A. PID Approval Cable
- B. Legal Exhibits
  - 1. 611 (a) Certification
  - 2. GIRM Request for Assistance
- C. Engineering Annex
- D. Economic Annex
- E. Social Soundness Annex
- F. Procurement Plan
- G. I.E.E.
- H. Project Checklists
  - 1. Project
  - 2. Statutory
  - 3. Country
- I. GIRM Organization Structure: Ministry of Equipment, Transport  
and Telecommunications
- J.
  - 1. Summary of PL 480 Title II Section 206 Program
  - 2. Rural Roads Subproject Component of the PL 480 Title II Section  
206 Project

APPENDIX A - PID APPROVAL CABLE

000000

Anderson

ACTION: AID  
INFO: AMS, DCM, EF SP

STATE 24537  
6 APR 79  
AFR 6 12 10 PM '79  
AMERICAN OVERSEAS  
ASSISTANCE CORP.

At

R 050330Z APR 79  
FM SECSTATE WASHDC  
TO AMEMBASSY NOUAKHOTT 7138  
BT  
UNCLAS SECTION 01 OF 02 STATE 084537/01

AIDAC

E.O. 12065 N/A

TAGS:

SUBJECT: PID REVIEW: TRAILS AND TRACK IMPROVEMENT  
(682-0214)

1. THE TRAILS AND TRACK IMPROVEMENT PROJECT IDENTIFICATION DOCUMENT, AS MODIFIED BY THE FOLLOWING GUIDANCE RECOMMENDED BY THE COMMITTEE, IS HEREBY APPROVED BY AA/AFR. THE AA/AFR ALSO APPROVES THE COMMITTEE RECOMMENDATION THAT ENVIRONMENTAL THRESHOLD DECISION BE DEFERRED UNTIL IMPROVEMENT SITES ARE SELECTED AND IEE COMPLETED IN ACCORDANCE WITH SECTION 216.3(1) AND (2) OF REGULATION 16.

2. COMMITTEE RAISED FOLLOWING ISSUES AS AREAS OF CONCERN TO BE ADDRESSED IN PP:

A. THERE IS A NEED FOR DEFINITION OF TYPES OF ROUTE SECTIONS TO BE IMPROVED AND ANTICIPATED DESIGN STANDARDS, WHICH SHOULD BE ADEQUATE TO ENSURE ALL-WEATHER SERVICE FOR ANTICIPATED TRAFFIC BUT MODEST IN COST.

B. MINIMIZE CONSTRUCTION OF SPAN BRIDGES AND USE OVERFLOW BRIDGES AND FORDS.

C. COMMITTEE RECOMMENDED PREFERENCE BE GIVEN TO ROUTES SERVICING AREAS OF GREATEST AGRICULTURE POTENTIAL AND LARGEST SMALL FARMER POPULATION.

FYI, AID/W IS DEVELOPING A LIST OF CRITERIA AND METHODOLOGY FOR PP DESIGN TEAM USE IN SELECTING ROUTES FOR IMPROVEMENT. A COPY OF WHICH WILL BE FORWARDED TO MISSION UPON COMPLETION. END FYI.

D. PP MUST INCLUDE DETAILED PLANNING FOR MOBILIZING AND TRAINING LOCAL WORKFORCE IN LABOR INTENSIVE ASPECTS OF ROAD CONSTRUCTION AND FOR SUBSEQUENT MAINTENANCE. COMMITTEE SUGGESTS USAID CONSIDER TRAINING FORMULAS USED IN OTHER COUNTRIES; WHICH WERE DIRECTED TOWARDS ILLITERATES. PP SHOULD PRESENT DETAILED TRAINING PLAN INCLUDING ESTABLISHMENT OF INCENTIVES FOR VILLAGERS TO PROVIDE CONTINUED MAINTENANCE OF ROADS SERVING THEIR RESPECTIVE AREAS.

89

... RECOMMENDATION AND RESPONSIBILITIES OF MOBILE BRIGADE SHOULD BE DEVELOPED IN DETAIL. COMMITTEE, RECOGNIZING MISSION INTEREST IN INSTITUTION BUILDING, RECOMMENDED THAT THE MOBILE BRIGADE BE IDENTIFIED WITH APPROPRIATE GIRM MINISTRY. DESIGN TEAM SHOULD IDENTIFY U.S. ADMINISTRATIVE/ TECHNICAL ASSISTANCE REQUIRED TO DEVELOP CAPABILITY WITHIN GIRM TO ESTABLISH AND OPERATE A ROUTES IMPROVEMENT AND MAINTENANCE CAPABILITY.

F. MINISTRY MUST IDENTIFY MANAGERS AND CADRE WHO WILL WORK IN THE FIELD WITH U.S. TECHNICIANS. PP SHOULD DEVELOP DETAILED JOB DESCRIPTIONS AND QUALIFICATIONS INCLUDING TECHNICAL COMPETENCE AND LANGUAGE PROFICIENCY.

G. PP SHOULD CONTAIN AN ASSESSMENT OF IMPACT ON AGRICULTURE PRODUCTION IN AREAS OF ROUTE IMPROVEMENT. IN ADDITION, PP SHOULD EXAMINE HEALTH AND SOCIOLOGICAL IMPACT ROUTE IMPROVEMENTS.

H. HOW DOES THIS PROJECT RELATE TO CILSS STUDY "ROAD MAINTENANCE DIAGNOSTIC STUDY FOR THE SAHEL" (MAURITANIA)?

I. PP MUST INCLUDE DETAILED BUDGET THAT WILL REFLECT ADMINISTRATIVE AND SUPPORT COSTS OF PROJECT.

3. IN ADDITION, THE COMMITTEE RECOMMENDED:

A. SELECTION AND PREFEASIBILITY ANALYSIS OF CANDIDATE ROUTES DURING EARLY STAGE OF PP DESIGN. DESIGN TEAM SHOULD BE PROVIDED SUFFICIENT TIME FOR COMPLETION OF ECONOMIC, SOCIAL AND ENVIRONMENTAL IMPACT (INCLUDING COMPLETION OF ENVIRONMENTAL ASSESSMENT OR ENVIRONMENTAL IMPACT STATEMENT

IF NECESSARY) FOR INCLUSION IN PP.

B. PP CONTAIN PROVISIONS FOR ESTABLISHING BASELINE DATA AND INFORMATION RETRIEVAL SYSTEM WHICH WOULD PROVIDE DATA FOR DETERMINING PROJECT IMPACT ON SMALL FARMERS' INCOME, EMPLOYMENT, HEALTH AND SOCIAL WELFARE.

C. ANALYSIS DURING PP DESIGN WHICH WOULD INCLUDE FIELD STUDY OF AGGREGATE AND WATER AVAILABILITY.

D. ADDITION OF SOCIOLOGIST TO DESIGN TEAM.

E. USER CHARGE STUDY BE CONDUCTED BY AN ECONOMIST AND SOCIOLOGIST OVER A TWO TO THREE MONTH PERIOD AND INITIATED PRIOR TO PP DESIGN. STUDY SHOULD INCLUDE EVALUATION AND RECOMMENDATIONS FOR POSSIBLE ADJUSTMENTS IN USER CHARGES AND ESTABLISHMENT OF NATIONAL ROAD MAINTENANCE FUND. SINCE OBJECTIVE OF USER CHARGE STUDY IS TO DETERMINE MEANS OF GENERATING REVENUE FOR NATIONAL ROAD MAINTENANCE FUND AND PRESENTATION TO MINISTRY OF PLANNING, MISSION SHOULD CONFIRM GIRM'S INTEREST PRIOR TO UNDERTAKING STUDY.

BT

#4537

NNNN

UNCLAS FINAL SECTION OF 02 STATE 084537/02

AIDAC

F. PEACE CORPS VOLUNTEERS SHOULD BE USED TO INTERFACE WITH COMMUNITIES FOR BOTH RURAL CONSTRUCTION AND SUBSEQUENT ROAD MAINTENANCE.

4. PP SHOULD IDENTIFY AND ADDRESS THE ROLE OF WOMEN DURING ALL PHASES OF THE PROJECT.

5. PP TEAM MUST SATISFY REQUIREMENTS OF SECTION 611(A) AND (B) OF THE FAA. VANCE

BT

#4537

NNNN

UNCLASSIFIED

CONAKRY 1811

ACTION: AID INFO: CDA JAO ECON CERON

APPENDIX B: Legal Exhibits

1. 611 (a) Certification

OUA977DAD663

PP RUFHOK

DE RUTAAK #1811 1730933

ZNR UUUUU 22H

P 220930Z JUN 82

FM AMEMBASSY CONAKRY

TO RUFHOK/AMEMBASSY NOUAKCHOTT PRIORITY 0345

INFO RUEHAB/AMEMBASSY ABIDJAN 7859

BT

UNCLAS CONAKRY 01811

AIDAC

NOUAKCHOTT FOR PETER BENEDICT, MISSION DIRECTOR FROM  
L. ELDREDGE, REDSO/WA ENGR

ABIDJAN FOR REDSO/WA ENGR

E.O. 12065: N/A

TAGS:

SUBJECT: RURAL ROADS IMPROVEMENT PROJECT 682-0214 - 611(A)

A DRAFT COPY OF THE REVISED PROJECT PAPER FOR SUBJECT PROJECT HAS BEEN REVIEWED BY REDSO/WA CHIEF ENGINEER. IT IS DETERMINED THAT SUBSTANTIVE TECHNICAL PLANNING NECESSARY FOR CARRYING OUT THE PROJECT ASSISTANCE AND A REASONABLY FIRM ESTIMATE OF COST HAVE BEEN DEVELOPED THAT SATISFIES THE REQUIREMENTS OF SECTION 611(A). I RECOMMEND THAT A 611(A) CERTIFICATION CAN THEREFORE BE ISSUED. KILLIGN

BT

#1811

UNCLASSIFIED

CONAKRY 1811

*TDC*

22 JUN 83

TOR: 1201

CN: 00083

ACTION: AID

*92*

République Islamique de Mauritanie

شرف - اخاء - عدل  
Honneur .. Fraternité .. Justice

Ministère de l'Équipement des Transports  
et des Télécommunications

وزارة التجهيز والنقل  
والمواصلات

APPENDIX B:  
2. GIRM Letter of Request

No. 1 MEIT

رقم 1 اوت من

Nouakchott, le 14 JUN 1982 نوواكشوط

Le Ministre

الوزير

à Monsieur le DIRECTEUR de la  
MISSION de l'U.S.A.I.D.  
NOUAKCHOTT

**O B J E T : Amélioration du Réseau Routier Mauritanien.**

Monsieur le DIRECTEUR,

Suite à l'entretien que nous avons eu l'autre jour, j'ai l'honneur de vous confirmer l'intérêt constant que le Gouvernement de la République Islamique de MAURITANIE porte à l'assistance de l'USAID pour l'amélioration de notre Réseau Routier Rural.

Je vous fais savoir que nous portons la plus grande priorité pour le désenclavement de la Région du GULDIMAKHA et de celles comportant des ressources importantes telles que l'Élevage et l'Agriculture.

La Région du GULDIMAKHA ayant la production vivrière la plus élevée de la MAURITANIE il est, par conséquent, nécessaire d'avoir un accès permanent entre cette région et le reste du pays afin de faire écouler ses ressources agricoles.

Actuellement l'UNSO et le FENU ont déjà commencé la construction de la Route M'BOUT - SELIBABY. Comme le financement déjà mis en place par les Organismes du PNUD est loin de faire réaliser les travaux de la Route M'BOUT-SELIBABY, nous demandons l'assistance de l'USAID pour achever le financement de la construction de la route jusqu'à SELIBABY et pour la continuer jusqu'à GOURAYE. Nous aimerons également votre aide pour la réhabilitation de la route

...../.....

M'BOUT - KAEDI afin de garantir l'accès permanent entre ce tronçon et le reste de notre Réseau Routier National.

Tout en vous remerciant pour votre coopération, je vous prie, Monsieur le DIRECTEUR, d'agréer l'expression de ma haute considération.



Le Lt.Colonel AHMEDOU OULD ABDALLAH

9/1

APPENDIX C: ENGINEERING

Detailed Engineering Analysis

List of Annexes

- I Rainfall Data
- II Road Network Description
- III Width of Roadway on Structures ( See also Annex X)
- IV Traffic Volumes in Guidimaka
- V GIRM Standards for Road Construction
- VI Embankment and Causeway design and production criteria
- VII Runoff water retention capabilities associated with road improvements
- VIII Roadbed construction production in erodable slope areas
- IX Technical Assistance
- X Box Culvert quantities - Ford quantities
- XI Refined local labor costs
- XII Materials unit costs and origins
- XIII Quantity Estimates: Selibaby-Gouraye
- XIV Quantity estimates: Kaedi-M'bout

## APPENDIX C

## DETAILED ENGINEERING ANALYSIS

## INTRODUCTION

This analysis contains detailed costs and quantities for construction of the M'bout-Selibaby road ( starting at km 70 from M'bout, as explained in Ch. II) and the Selibaby-Gouraye road, and for the rehabilitation of the M'bout-Kaedi road.

In addition, the analysis will cover some general features common to all road elements, such as track features, terrain, maintenance requirements, and the determination of unit costs of construction for structures and earthworks and some general standards of productivity for a "Special Autonomous Brigade" similar to the one currently at work on the UNSO/OPE project.

### A. Technical Description of Track Features

#### 1. Overview of the Project Area

The Guidimaka region consists of alternating plains and minor relief features with the exception of the Assaba Plateau to the northeast which is outlined by an outstanding cliff 50 to 100 meters in height. From east to west, the following geographical features are as follows:

- the depression between the Affole plateau and the Assaba plateau. This depression is drained by the Karakoro River and is mainly an area of sand dunes which seem to be settled ( Kankossa, Sani, Ould Yenge area).
- The Assaba plateau itself which extends down to Ould Yenge.
- The transition between the Assaba plateau and the Senegalo-Mauritanian Basin. ( Immediate area of interest).

The hydrographic pattern is dense and outstanding. Due to a 400 to 700 mm per year rainfall ( see App. C, Engineering, Annex I ), and generally high runoff, the oueds are submitted to violent floods after each rain ( most of these being thunderstorms ) and soils are eroded to a large extent when the terrain slope is greater than 1.5 to 2%.

As described in Engineering Annex II, the road network of the Guidimaka area and its connection to the paved trunk road Nouakchott-Aleg-Kiffa consists mainly of ordinary tracks without drainage structures, which makes it largely impassable during the rainy season from July through October, and fairly difficult to pass during the dry season.

The lack of drainage structures blocks the possible traffic at each major oued and at each low point of the track where water accumulates on generally clayey soil, causing vehicles to get trapped in the mud. During the dry season in the sandy areas, passage is very difficult because of the very soft surface.

## 2. General Construction Characteristics

In the face of the various obstructions or transit difficulties which have been described above, the following recommendations have been devised to serve as improvement standards with minimal cost and to provide year-round passage, allowing for delays of several hours when heavy thunderstorms occur and during which time the ford crossings will be inundated.

### a) Oued crossings

Two major types of oued crossings can be encountered along the existing tracks:

- \* oueds with deep and generally narrow riverbeds ( none wider than 10mm)
- \* oueds with shallow riverbeds ( none wider than 50mm)

Very few oued crossings have deep and wide riverbeds. The main oueds on the M'bout-Selibaby road are as follows ( although the new adjustment avoids crossing them at their widest points):

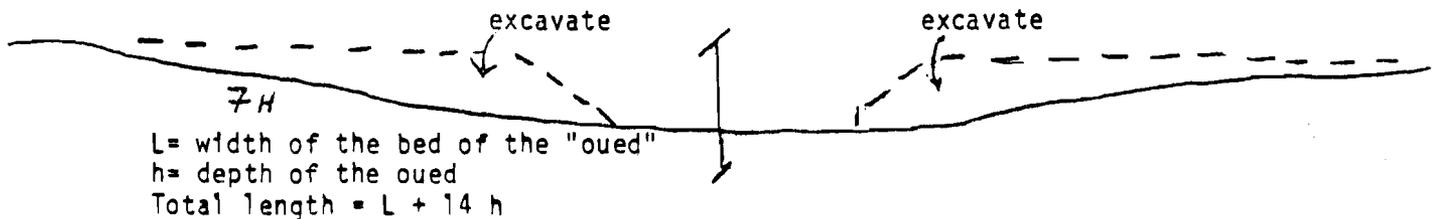
- \* Oued Haouisse ( ca km 75)
- \* Oued Nforde ( ca. km 80)
- \* Oued Tourime ( ca km 90)
- \* Oued Amague ( just north of Selibaby)

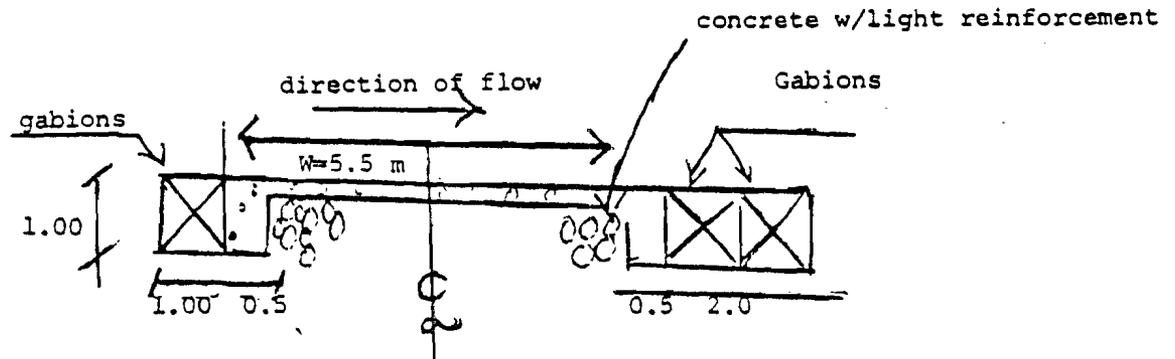
With the exception of oueds with deep and narrow riverbeds, all the crossings will be of the shallow water type. There will be no multiple box culverts required longer than 12 m on the alignments. Thus, the typical structures will be fords ( or submersible bridges) surfaced with concrete and protected upstream and downstream by gabions and riprap. Figures 1 and 2 show typical cross sections of such a ford.

The crossings of the oueds or streams with narrow and deep riverbeds could be achieved by the means of box culvert bridges having concrete abutments on spread footings and simply supported reinforced concrete slabs.

Figure 1 - Ford Crossings

Profile: ( along the roadway)





N.B. Cut off walls can be higher than 1.00 meter if the riverbed is made of a thick layer of materials subject to possible scour.

The question of width of roadway on improved sections of the existing tracks was subjected to considerable study (see Annex III) including discussions with the various GIRM officials involved. The expected traffic density (See Annex IV) would not justify anything but single lane roads with eventual provision for the passing of oncoming vehicles at reasonably close intervals

Nevertheless, a 30 cm thick and 5.5 wide roadway was selected for all improved sections of the existing tracks for the following reasons:

- i) To comply with GIRM standards for road construction (See Annex V) "Ordinary earth roads and improved tracks".
- ii) An element of uncertainty concerning effectiveness of road maintenance; a wider roadway provides greater safety against the types of deterioration such as wear at the edges of the roadway resulting from traffic and the effects of rain, and rutting of the roadway due to channelization of the traffic.
- iii) Provision for stages road improvements with traffic increase, without the necessity of coming back on already improved sections, these being considered as final with regards to their expected life span (over 20-25 years for structures and causeways).

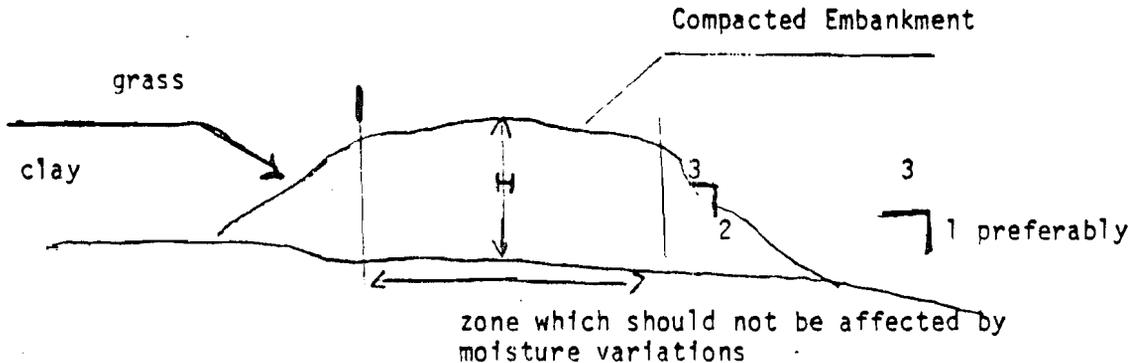
In order to establish flows and to determine specific sizes of structures and CMP locations, a study will be made at the beginning of project implementation, and most preferably during the rainy season, using both visual inspection of the crossings after heavy rains and available aerial photographs and mapping.<sup>1/</sup>

b) Low areas-flat and flooded areas

These areas are generally very flat or slightly depressed and when it rains the run-off water accumulates and soaks into the ground. As the soils in these areas consist of clay, the effect of the soaking is to raise the water content of the soil over its plasticity limit and to make the soils of these low areas very soft and sticky, therefore impassable by vehicle. /1. 1/5000 infra-red aerial photographs of the Guidimaka area --- Feb. 80 are available from Renewable Resources Project and 1/200000 maps from IGN (Institut Geographique National).

In order to remedy this type of situation, the road surface must be raised over water level by construction of embankments or causeways wide enough to prevent variations of the water content in the middle of the embankment, and high enough to not be overtopped by water.

Figure 3- Embankment cross Section



Annex VI gives information on volume of fill needed to build this type of embankment.

#### c) Soft Sand Areas

These areas are characterized by the presence of very fine eolian sand (dunes) in which the vehicles can sink more or less, depending upon the presence of grass on the surface of the terrain. The grass acts as some kind of reinforcement but it unfortunately does not withstand the passage of more than a few vehicles. These areas are dune areas, fixed or not. The availability of materials other than sand is scarce in these areas: generally nothing else but clay (either silty or sandy) can be found between two dunes in low areas.

To improve the durability of tracks in these sandy areas, a layer of selected materials suitable for road construction according to commonly accepted standards (such as materials for sub-base or base course) and 30 cm thick will be laid over a 5.5 m width after clearing the levelling the track formation. This layer of selected materials, which will most probably consist of silty or sandy clay, will be vigorously compacted (the dry density to be obtained should be at least 95% of the dry density of the Optimum Modified Proctor test). The average quantity of selected materials to be placed will be:

$$0.30 \times 5.5 = 1.65 \text{ m}^3/\text{m}$$

or

$$1650 \text{ m}^3/\text{km}$$

The equipment needed to carry out the work should consist of:

- front end loader and bulldozer
- dump trucks
- compactor
- water trucks

Figure 4 - CROSS SECTION

Earth taken from the ditches

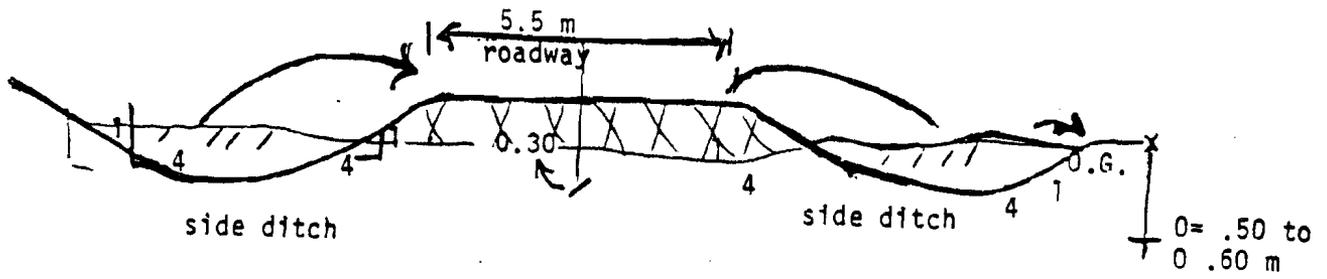
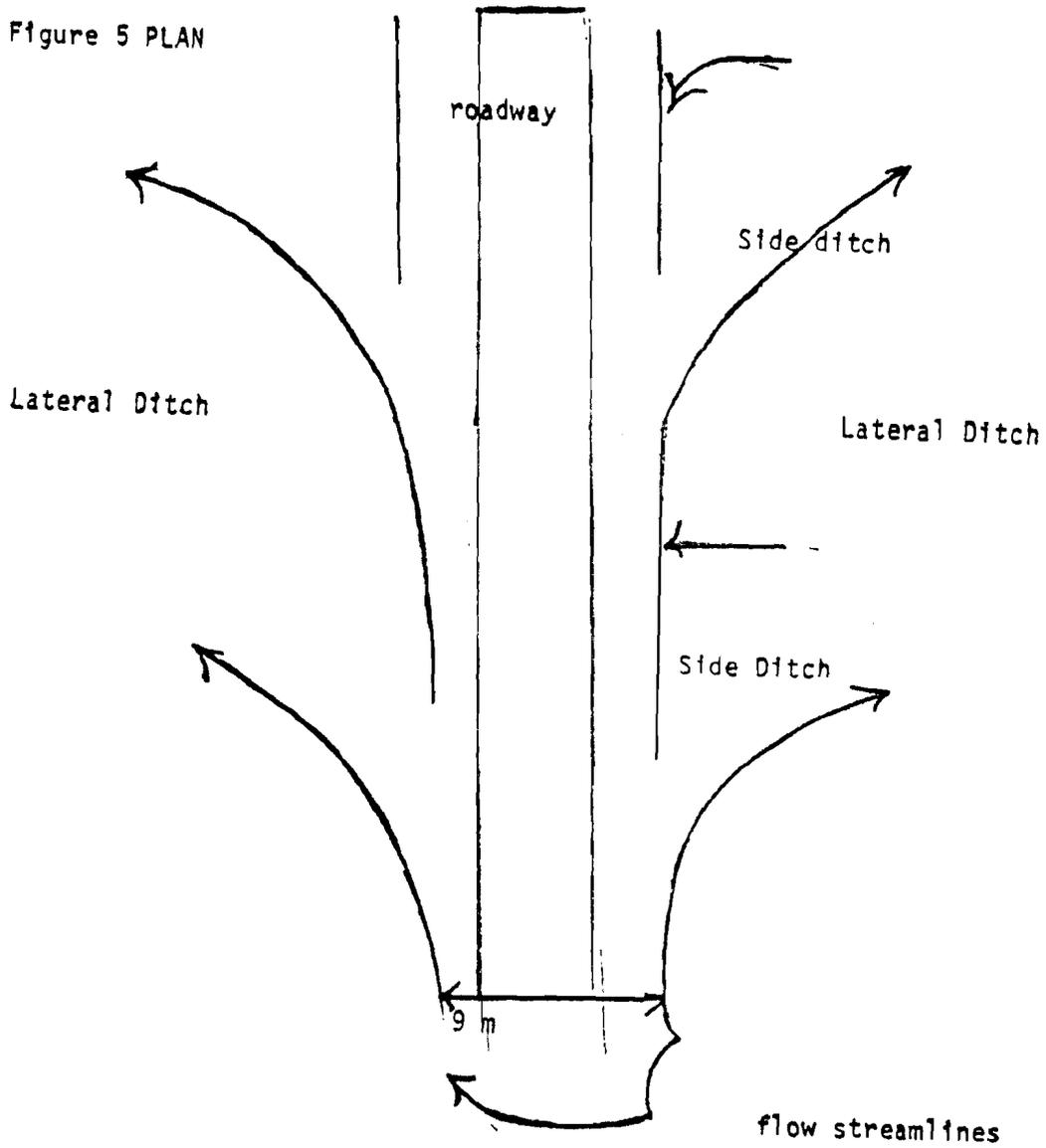


Figure 5 PLAN



100

The amount of water needed should be approximately

$$1650 \times 0.50 = 80 \text{ to } 100 \text{ m}^3/\text{km}$$

d) Erodable slope areas

These areas are characterized by a 1.5 to 2% or more slope of the terrain and the absence of vegetation to prevent water from running off. Besides the soils are generally clayey sand or silty/sandy clay, sometimes with some laterite, i.e., very fine and therefore subject to intense erosion, the fine soil particles being washed away by runoff water when the latter reaches a speed of about .50 to .75 m/sec.

To prevent the formation of deep channels in the surface of the terrain, the runoff water must be channelized and its speed kept to a minimum. In order to achieve above natural ground and with longitudinal (side) ditches and lateral ditches, as described in Fig. 4 and 5.

Longitudinal ditches will collect water from the track and adjacent surfaces; lateral ditches will divert the water away from the longitudinal ditch.

Great care should be exercised at construction time to decide on lateral ditch spacing. Some possible lining of the side ditches should be investigated as well as the terracing of the slope (see Engineering Annex VII for roadside works and water retention).

The construction of the ditches and the roadway can be done simultaneously using a motorgrader which will excavate soil from the side ditches and spread the excavated materials within the roadbed to form the 30 cm embankment (which must be compacted thoroughly and with/greatest care).

Engineering Annex VIII gives some indications of the production rate of this type of roadbed construction method.

### 3. Estimated Quantities of Each Construction Item

Several reconnaissances were carried out by various teams between May 1980 and May 1982-- with various missions but covering the same general project area. (See References 4 to 8).

Unfortunately, no actual design study has been done to date of the roads, least of all during the rainy season when rainfall phenomena need to be observed in the field. The present UNSO/OPE contractor, for example, is having to determine the road alignment, its embankments and causeways, and of course all ford and structure lengths as he goes along. The fact that annual rainfalls vary a great deal (outside of droughts) complicates the situation further, as does the periodic, though not extensive, shifting of stream beds and flood plain perimeters.

For this reason, a study team consisting of a hydrologist and a surveyor (at a minimum) is planned, within this project, to establish the final alignment and drainage geometry of M'bout-Selibaby-Gouraye during the rainy season preceding construction by USAID. The first part of the study is now planned for July to September 1983.

In the meantime, actual best estimates of quantities have been based on approximate alignments, visual field observations, and approximations derived from technicians with local experience. The figures obtained by previous reconnaissance teams were also taken into account.

In general, these estimates are on the high side, in order to maintain a realistic ceiling, at the very least, for construction estimates.

Detailed results of the field survey are contained in Appendix C, Engineering Annexes XIII and XIV.

### B. Maintenance: Facts, Description of Activities and Related Costs

#### 1. Facts.

The following facts regarding road maintenance in Mauritania have to be considered when trying to design institutional maintenance capabilities. These facts have been taken from various sources, including interviews with GIRM officials and various reports dealing with road maintenance in Mauritania. ( See Reference 1 and 3):

a) The required road maintenance budget as of 1977 was estimated at 450,000,000 UM ( US \$ 9 million) for the following road network ( See Engineering Annex II):

Paved roads	= 1130 km
City streets paved	= 85 km
Improved earth roads	= 500 km
Ordinary tracks	= 4975 km

Total = 6690 km

The maintenance costs were evaluated as follows:

Paved road	= 250,000 UM/km ( \$ 5000/km)
Improved earth road	= 280,000 UM/km ( \$ 5600/km)
Ordinary earth road	= 65,000 UM/km ( \$ 1300/km)
Improved Tracks	= 10,000 UM/km ( \$ 2000/km)

In 1977, the funds available for road maintenance were 79,000,000 UM ( \$ 1,580,000). Therefore, there was a shortfall of UM 371 million ( \$ 7.4 million) in 1977.

Since then the situation has not improved, mainly because of other urgent problems and despite the IBRD's Third Highway Project ( which did not focus entirely on road maintenance anyway).

One could say that road maintenance will remain a problem in Mauritania because of lack of funds and also lack of qualified personnel. The Fourth Highway Project due to be implemented in 1982 ( IBRD, FADES and Kuwaiti co-financing) will deal with this question to some degree. ( See Ch. II, C.4.)

b) A new organization has been devised by the Ministry of Equipment which tends toward decentralization with one District Engineer in each Region of Mauritania. In 1980, the budget to cover operating costs ( not including personnel salaries) for the Kaedi and Selibaby Districts were:

For Kaedi:	300,000 UM ( Central Government)
	25,000 UM ( Regional Government)
Total:	325,000 UM ( \$ 6500)
For Selibaby:	190,000 UM ( \$ 3,800)

(Source: District Engineers in Selibaby and Kaedi)

It should be noted that this budget is not only for roads but also for the maintenance of all official buildings ( schools, hospitals, administrative).

The District Engineer in Selibaby has a small office, one secretary, one Land Rover with a driver and not much else. The District Engineer in Kaedi has a slightly better situation with a "parc" of 1 motorgrader ( CAT 120), 1 farm tractor, a small workshop ( without tools or spare parts) and about 20 employees. This equipment is gradually being augmented.

A typical illustration is what is happening to the Kaedi-M'bout-Kiffa road where structures were built in 1965-66 along with laterite surfacing and where because of the lack of minimum maintenance ( clearing of culvert openings) the approaches to these structures have severely deteriorated and cause difficulties for vehicles even in the dry season.

c) The generally poor financial state of the Ministry and its Directorate of Public Works will not be changed at one stroke. However, the GIRM growing consciousness of the need for regular road maintenance might make it amenable to a Covenant which will encompass the plan outlined below. The UNSO maintenance funds as well as IBRD financing should also be earmarked for this project, inter alia

## 2. Description of Maintenance Activities Related to the Present Project

The specific approach which has been utilized to cope with the problem of upgrading the present " rural tracks" has led to establishing minimum design standards.

These standards should raise the condition of these "rural tracks" from "ordinary track" ( what they are at present) to an intermediate stage between "improved track" and "ordinary earth road."

All construction will aim at allowing vehicles to cross the major obstacles created by runoff water with the minimum impediment, therefore the major construction will consist of:

- \* ford crossings
- \* culverts (pipe and box)
- \* causeways for crossing low flooded areas

These various activities have been described in some detail in Section A.

The principal task will be the preservation of free flow within the culverts and ford crossings, because any kind of obstruction or impediment within such structures could cause major damages to the structures themselves as well as to the adjacent embankments.

The task requires a labor force using only hand tools (pick, shovel, machete) to take out any sand accumulation, straw, branches, trunks etc., from the openings. Given the incidence of heavy rains in the Selibaby area (Engineering Annex I), we estimate two man-days/km of road to be required 5 to 6 times a year (i.e., 10-12 man-days (km/year)).

The amount of work required each year for this task is estimated at two-man days per kilometer of road after each heavy rain.

According to Table AI.4 in Engineering Annex I, the number of days where the rainfall over a 24-hour period is greater than 20 mm is 14% to 15% of the total, i.e.,  $38 \times 0.15 = 5.7$  days in the Selibaby area.

a 20 mm rain can be considered as a moderately heavy rain, which means that 5 to 6 times within a year, two man-days would be required per kilometer of road to maintain the culverts.

These figures, 10-12 man-days/km/year, are very small but this is the goal of the design standards, which are supposed to lead to almost maintenance-free road improvements.

This type of maintenance work above should be initiated by villagers after each heavy rain, under the overall guidance of the District Engineers. The area of influence of each village could be set at mid-distance along the road to the neighboring villages. This task can be considered as preventive maintenance.

Other tasks will consist of repair maintenance on fords, culverts, embankments and/or causeways damaged by erosion or scour. This type of work will be carried out by the TP subdivision in Selibaby when needed. Similarly, light annual or bi-annual resurfacing should be programmed by the District Engineer.

### 3. Costs related to Maintenance Activities

The amount of labor required to perform the light maintenance activities is 10-12 man days/km/year.

When costed @ 25 UM/hour<sup>1/</sup> this amount represents 2400 UM/km/year or \$48/km/year.

In addition, the Selibaby District Engineer's budget (About \$4000 in 1980) should be added to the above amount and some money for vehicle operation and also for villagers' tools replacement. The amount needed is estimated at another \$8,000 for fuel, tools, maintenance and depreciation of the vehicle. The total cost of maintenance as described above is roughly \$100/km/year.

---

1/ Minimum present salary for unskilled labor in Mauritania.

104

#### 4. Maintenance During the Implementation of the Project

Light maintenance as described above will be carried out by project personnel during the rainy season, construction activities becoming slower during those months, especially after each heavy rain during the time needed to allow ground and oueds to dry up ( 24 hours). Emergency maintenance funds have been provided and will eventually allow for any type of extra protection required which would become evident after heavy rains and which would have not been foreseen before.

#### 5. Recurrent Costs for Maintenance after the Project

The type of maintenance needed after project completion includes repairs and some resurfacing. It is estimated that 2 months of operation of one earthwork and one structure sub-brigade should be more than adequate for M'bout to Gouraye. The equipment for these two sub-brigades should be left with the District Engineer in Selibaby, and a similar complement in Kaedi for the M'bout-Kaedi road.

The regular maintenance ( culvert clearing) should always be carried out. The costs for other maintenance activities will be as follows( for M'bout-Gouraye, the entire length of which falls under the Selibaby District Engineer's authority):

Earthwork Brigade -	about \$ 40,000/mo
Structure brigade -	about \$ 12,000/mo
Total -	\$ 52,000 x 2 months

Emergency maintenance materials -	\$ 5,000
Tool replacement -	\$ 1,000
Total -	\$ 6,000

Total cost:  $\$ 52,000 \times 2 + \$ 6,000 = \$ 110,000/\text{year}$   
for about 160 km

The cost/km will be  $\$ 110,000/160 = 700/\text{km}/\text{mo}$

The total cost/km will be:

Routine Maintenance ( culvert clearing)	\$ 100
Emergency Repairs and resurfacing	\$ 700
Total	\$ 800/km/year

A similar amount must be considered for M'bout-Kaedi, and has been included in the Economic Analysis.

This figure might seem slightly high, but does include improvement works as well as emergency repairs, and of course some resurfacing and the inexpensive but essential use of a tractor-pulled "Tolard" to remove corrugation effects from the roadway.

## 6. Major Maintenance/Rehabilitation

In order to protect the initial road investment, the economic analysis provides, for all roads, a major maintenance intervention 6 years after construction and amounting to \$ 4,000/km.

The chances of this actually being budgeted and done are fairly good, given the new emphasis on maintenance and also the availability of funds through the UN's Sahel Road Maintenance program. USAID's proposed collaboration with UNSO/OPE on these road segments would further ensure future availability of funds for this activity.

## 7. Training

The following GIRM ( TP) personnel are expected to receive training during the project:

- District Engineers ( 2) partial participation
- Senior TP engineer (1) counterpart to the TA project manager
- Field Superintendents (2) permanent project personnel
- Foremen, Equipment Operators and Mechanics(20-25) Permanent or rotating project personnel

These employees ( TP civil servants) will be trained on the job. They will work with their counterparts on the Technical Assistance team in close coordination and on a continuous basis in order to acquire as much experience as possible. Some should preferably be from the Guidimaka area in order to insure followup maintenance of the improved roads. It is anticipated that TP personnel will be entirely financed by the GIRM and that in this way a core force account team will be developed for future GIRM projects. The rest of the Brigade ( skilled and unskilled labor, support personnel) will also receive training as needed, but will be strictly "project" employees rather than GIRM employees.

The various people train having taken part in the achievement of the improvement works, will be the best warranty for the improved roads to be adequately maintained assuming:

- that the GIRM will be supplying adequate funding for the maintenance operation in the future, after completion of the Project; and
- that at least some of the people trained will stay in the Guidimaka region for the purpose of maintaining and improving roads.

## C. Analysis of Construction Operations by Force Account with Technical Assistance

### 1. Introduction--General Existing Inputs

The objective of the project is to construct about 90 km of road and rehabilitate 115 km of road (M'bout-Kaedi) with a "Special Autonomous Brigade" which will be entirely ( personnel, technical assistance, materials) financed by the project ( except for GIRM personnel, i.e. detached from TP). The equipment will be furnished by UNSO/OPE, with a complement from AID.

The description of the UNSO equipment is listed below:

<u>OPE/NO.</u>	<u>Description/Type of Material</u>	<u>QTY</u>
6000	IH TD 20E Crawler Tractor 210 HP	2
6001	Champion D 71-A Motor Grader 125 HP	2
6002	IH 530 Wheel Loader 150 HP, 2m <sup>3</sup>	2
6003	IH 260 A Backhoe Loader	1
6004	Mack R 685 ST Dump Truck 6 x 4, 10 m <sup>3</sup>	7
6005	Mack RT 685 ST Water tank truck, 15 m <sup>3</sup>	3
6006	Mack R685 P Fuel Tank Truck	1
6007	Mack R685ST Truck Stake Body/Crane	1
6008	Mack RM 685 Truck Mobile Field Lub. Unit	1
6009	Metcan Mobile Workshop	1
6010	Phoenix Water Tank ( Trailer Mounted)	2
6011	Phoenix Fuel Tank ( Trailer Mounted)	1
6012	Rexor Vibratory Roller 9500 kg	1
6013	Dynapac Pneumatic Roller 7 mms 10/22 t	1
6014	Towoomba Water Tank ( for living camp)	1
6015	Francap Water pump 50 m <sup>3</sup>	2
6020	Dynapac Concrete Vibrator	1
6021	Dynapac Vibrating Plate Compactor	2
6023	Wild Survey Equipment	
6022	Dynapac Hardware	
6024	Toyota/LR Pickups + 2 Land-Rovers SW	5
6025	Peugeot 305 Peugeot SW	1
	Peugeot Pick-up canvas	2
6026	Terratest Laboratory	
6027	Phoenix Low-bed Trailer ( 15/30T)	1
6028	Mack R 685 Truck Tractor	1
6029	Spillsbury/Tind Tranceiver Radio ( 4 channels)	3
	Farm tractor	1

In Section A, the various construction items were described and the equipment needed to perform these tasks are as follows:

- a) Earthworks ( embankments, causeways, surfacing). The material for earthworks could be taken from side borrow pits and, in that case, a bulldozer, a grader and compaction equipment should be sufficient. From remote borrow pits, dump trucks and front-end loader would be required in addition.

As it is not always possible to erect embankments from side borrow pits, the following minimum equipment will be needed for earthworks:

- 1 Bulldozer 150-200 HP
- 1 Motorgrader 120-160 HP
- 1 Front-end loader ( 2 m<sup>3</sup> bucket)
- 3-7 Dump trucks, preferably 10 m<sup>3</sup>
- 1 rubber-tired roller and/or vibratory roller
- 1-2 Water tank trucks ( 15 m<sup>3</sup> )
- 1 Water pump diesel engine
- 1 pickup

## b) Drainage and crossings structures

These structures will be built in reinforced concrete. The following minimum equipment will be required:

- 1 Backhoe
- 1 Concrete mixer ( 250-350 L)
- 1 Concrete vibrator
- 1 Small water tank - 1 to 1.5 m<sup>3</sup>
- 1 Service Truck to supply materials
- 1 Pickup
- 1 Vibrating plate compactor

In view of the equipment already in use by UNSO/OPE, the above-mentioned minimum equipment will enable setting up two construction "sub-brigades" for earthworks, and one "sub-brigade" for structures.

## 2. Outputs - Quantities

## a) Earthworks

According to best available data and information, the output of one earthworks "sub-brigade" such as described is between 300 and 500 m<sup>3</sup> per working day ( see Engineering ANNEX VI), according to the relative distance of borrow pits from the work site. This volume represents the fill volume; auxiliary operations such as maintenance of road under construction when needed, clearing and grubbing, over-haul, compaction of fills, corrugated metal pipes installation and excavation of ditches are considered to be by-products of the embankment construction and need not be considered separately.

Taking into account possible inefficiency ( site organization, ability of operators, etc.) remoteness breakdowns, the average production figure used for the following calculations will be 350 m<sup>3</sup> per "sub-brigade" per working day, either fill or surfacing materials.

## b) Structures

According to experience and the best available data and information, it is considered that the previously described structure construction "sub-brigade" is capable of producing 2 to 3 m<sup>3</sup> of culverts per day and 60 m of fords per month.

## 3. Project Brigades, Required Equipment, and Production

Since before construction began on the M'bout-Selibaby road, it was apparent that the UNSO/OPE equipment would not be sufficient given terrain conditions, in particular the large amount of drainage and crossing structures ( fords and culverts) required.

As an illustrative example, the UNDP study estimated that 1100 m of fords and 350 m<sup>3</sup> of concrete structures, using one "sub-brigade", would take about 22 months ( for the entire M'bout-Selibaby road); while earthworks, with two "sub-brigades", were assessed at roughly 12 months.

Therefore, and whether or not additional equipment becomes available in the interim, it is felt the USAID'S project organization must include enough equipment to create one more structure " sub-brigade."

Additional equipment is required as follows, with prices computed as of March 1981, UNSO/OPE's date of purchases of its equipment, with 25% added for inflationary adjustments projected to March 1983:

Equipment Required for Second Structures "Sub-Brigade"

<u>Item</u>	<u>No. required</u>	<u>Unit Cost (\$)</u>	<u>Total Cost (\$)</u>
Concrete mixer (400L)	2	5,000	10,000
Water Tank	2	5,500	11,000
Backhoe	1	30,500	30,500
Concrete Vibrator	1	1,200	1,200
Welding Set/generator	1	15,000	15,000
Air compressor	1	25,000	25,000
Farm Tractor	1	30,000	30,000
Service Truck/crane	1	80,000	80,000
Water pumps	2	3,000	6,000
			208,700
		+ 25% inflation	260,875
		+ 30% shipping	340,000
			*****

Another \$ 110,000 is included in the project budget for capital costs at start of construction, in anticipation of further equipment needs to be specified at that time.

For the rest of this analysis, it will be assumed that the second "sub-brigade's" equipment, in addition to existing UNSO/OPE equipment, will be available for the project.

Construction time estimates, size of crews and productivity will thus depend on assumed available equipment only, and rounded production rates based on unit estimates in Section C.2, will therefore be:

Earthworks = 2 "sub-brigades" = 16,000 m<sup>3</sup>/month  
 Structures = 2 "sub-brigades" = 120m/mo of fords, plus  
 5 m<sup>3</sup>/day of culverts

#### 4. "Special Autonomous Brigade" Organization

##### a) Earthworks-- Equipment and Personnel.

Each "sub-brigade" should be headed by a road construction foreman, although at present this position is held by the Field Superintendent of the UNSO/OPE contractor's TA team.

Full-strength equipment and personnel for both "sub-brigades" are as follows:

<u>ITEM</u>	<u>NO.</u>	<u>OPERATORS</u>	<u>DRIVERS</u>	<u>Others</u>
Bulldozer	2	2	-	-
Motorgrader	2	2	-	-
Loader	2	2	-	-
Dump Trucks	6	-	6	-
Tractors	1	-	1	-

Vib. Roller	1	1	-	-
Pneum Roller	1	1	-	-
Water Pump	2	-	-	-
Water Tank	2	-	-	-
Pickup (jeep)	2	-	-	2 lt. veh, drivers
Water Truck	3	-	3	-
Fuel Truck	1*	-	1*	-
Mobile Lub. Ut.	1*	-	1*	-
Lowboy/Tractor	1*	-	1*	-
Service Truck	1*	-	1*	-
Maintenance	-	-	-	4 mechanics
Total	-	8	14	2 drivers

\* part time only

In summary, the personnel for the two earthworks "sub-brigades" will consist of:

Construction Foreman	2
CMP Chief of Party	1
Equipment Operators	8
Truck Drivers	10-14
Light Vehicle Drivers	2
Mechanics	4

The mobile field lubricating unit, the fuel tank truck, and the service truck will be used occasionally. The Lowboy/tractor will be used only to move bulldozers.

Each earthwork "sub-brigade" should also have its own radio hook-up with the base camp. The radios can be mounted on the pick-ups.

In addition, each "sub-brigade" might have up to 10-12 unskilled workers to:

- \* help in staking
- \* placing and mounting CMP
- \* handling stones
- \* clearing and grubbing
- \* trimming ditches

The number of these laborers will vary, as will their length of employment. This is discussed in Section C.6.a. below.

#### b) Structures - Equipment and Personnel

Each "sub-brigade" for structures should also ideally be headed by an experienced construction foreman, although in the UNDP/OPE project organization this position is not filled, its functions being carried out by the Field Superintendent. For labor cost calculations (see C.6.a. below), it is assumed that these positions will be filled.

Full-strength equipment and personnel for both "sub-brigades" as follows:

<u>Item</u>	<u>NO.</u>	<u>Operators</u>	<u>Drivers</u>	<u>Others</u>
Concrete Mixer	3	2	-	-
Concrete Vibrator	2	-	-	-
Water Tank	2	-	-	-

<u>Item</u>	<u>No.</u>	<u>Operators</u>	<u>Drivers</u>	<u>Other</u>
Farm Tractor *	1	-	1	-
Pickup (jeep)	1	-	-	1
Backhoe	2	2	-	-
Dump Truck *	1	-	1	-
Service Truck*	1	-	1	-
Vibrating Plate comp	2	2**	-	-
Welding set/gen	1*	1	-	-
Air Compressor	1	1**	-	-
Water Pumps	2	2**	-	-
Maintenance	-	-	-	4 mechanics
Total	-	5	3	1 driver 4 mechanics

\* shared by both "sub-brigades"

\*\* Operators share equipment

In summary, personnel for the two structures "sub-brigades" will consist of:

Construction foremen	2
Equipment operators	5
Truck Drivers	3
Light vehicle drivers	1
Mechanics	4

The backhoe will occasionally be used to excavate for earthworks ( e.g., trenches for CMP if required.)

The dump truck will be used to transport sand and gravel for both "sub-brigades", or if not needed, can be assigned to earthworks for hauling.

The service truck will alternate with the earthworks service truck to transport materials on site or from sources of supply ( Nouakchott, Selibaby) to the base camp.

The farm tractor will be used to pull trailers or other towed equipment.

The third concrete mixer is necessary in case of breakdown and also for continuous pours.

The water pumps, welding set and air compressor will be used as required anywhere on the site.

In addition to personnel listed above, the "sub-brigades" would require the following specialized laborers:

Masons	8-10
Carpenters	8-10
Iron workers	4-5

And unskilled workers could range from 10 to 20 depending on conditions, and would perform the following tasks;

- filling the hoppe in the mixer
- hauling conceete with wheelbarrows
- helping place concrete
- help place reinforcement bars

111

- move stones and help place gabions
- trim excavations
- help carpenters with dismantling and transport of forms

Again, most of these unskilled workers would be recruited from local villages as the road progresses, and thus their number as well as their length of employment will vary considerably.

c) Base camp - support Equipment and Personnel

A base camp is currently set up just outside of M'bout. It can be moved once or twice a year, following the work's progress. This base camp equipment consists of:

Transceiver radio	3
Mobile trailers	6
Mobile workshop	1
water tank	1
Generator ( 50 kva)	1
Generator ( 20 kva)	1
Landrovers SW	2
Peugeot Pickups (404)	2
Peugeot SW (304)	1

Technical assistance personnel is housed in the 4 larger trailers, while a smaller trailer serves as the field office and another as housing for guests, counterparts, etc.

Storage of spare parts, etc. is in the containers in which equipment was originally shipped.

Personnel assigned to the base camp consists of:

Mechanic Foreman	1
Clerk	1
Mechanics	4
Storekeeper	1
Secretary	1
Surveyor	1
Assistant Surveyor draftsman	1
Unskilled labor ( misc.)	4-6

5. Summary of Personnel and Equipment

a) Personnel Summary:

<u>Position</u>	<u>Earthworks</u>	<u>Structures</u>	<u>Support</u>	<u>Total</u>
Mechanic/foreman	-	-	1	1 *
Construction foreman	0-2	1-2	-	1-4*
CMP C.O.P.	1	-	-	1*
Surveyor	-	-	1	1*
Masons	-	8-10	-	8-10
Carpenters	-	8-10	-	8-10

<u>Position</u>	<u>Earthworks</u>	<u>Structures</u>	<u>Support</u>	<u>Total</u>
Iron workers	-	4-5	-	4-5
Mechanics	4	4	4	12*
Operators	8	5	-	13*
Truck Drivers	10-14	3	-	13-17
Lt. vehicle drivers	2	1	-	3
Clerk	-	-	1	1
Storekeeper	-	-	1	1*
Secretary	-	-	1	1
Asst. Surveyor/draftsman	-	-	1	1
Unskilled labor	20-24	10-20	4-6	34-50
-----				
Total:	47- 55	46-60	12-19	103-131

\* Personnel detached from TP/Nouakchott, except for 5 "local" operators.

Thus, 24-25 employees will comprise the basic "face account" element of the project, financed by the GIRM.

#### b) Equipment Summary

<u>Item</u>	<u>Earthworks</u>	<u>Structures</u>	<u>Support</u>	<u>Total</u> (1)	<u>Req.</u> (2)
Bulldozer	2			2	-
Motorgrader	2			2	-
Loader	2			2	-
Dump Truck	6	1		7	-
Farm Tractor	1	1		2	1
Vibratory roller	1			1	-
Pneumatic roller	1			1	-
Water Pump	2	2		4	2
Water tank	2	2		4	2
Pickup (toyota jeep)	2	1		3	-
Water truck	3			3	-
Fuel truck			1	1	-
Mobile lub. Unit			1	1	-
Lowboy/tractor			2	2	1
Service truck/crane			2	2	1
Concrete Mixer ( 400L)		3		3	2
Concrete vibrator		2		2	1
Water tank, towed		2		2	-
Backhoe		2		2	1
Vibrating plate compactor		1		1	-
Welding set/generator		1		1	-
Air compressor		1		1	1
Mobile trailers			6	6	-
Mobile workshops			1	1	-
Water tank			1	1	-
Generator ( 50 kva)			1	1	-
Generator ( 20 kva)			1	1	-
Land Rover SW			2	2	-
Pickup (Peugeot 404)			2	2	-
Peugeot SW ( 305)			1	1	-
Transceiver radio			3	3	-

Additional existing equipment includes hardware, survey equipment, and soils testing laboratory materials. There is also a year's supply of spare parts.

-----

Notes to Equipment Summary listing;

(1) Total is the equipment considered as required for the two earthworks "sub-brigades" and the two structures "sub-brigades" on which all subsequent cost and productivity analyses are based.

(2) "Required" corresponds to equipment necessary to field the second structure "sub-brigade." This would comprise the \$ 340,000 USAID initial equipment component.

D. Detailed Operating Costs

1. Labor Costs

Labor costs have been computed largely on the basis of the existing UNSO/OPE "Special Autonomous Brigade" and the contractor's anticipated "full strength" hiring requirements in the future. The second structures "sub-brigade" is also included.

Precise actual costs can only be determined after the fact, of course, but the following analysis attempts to establish the limits of the likely range of costs. An average monthly figure, weighted for inflation and contingencies will be arrived at. It should be kept in mind that labor costs in this type of project ( i.e., mechanized) account for approximately 20% of operating costs so that the total's sensitivity to variations in labor costs is not very great.

Labor classifications in the following table are standard Mauritanian classifications. Hourly salaries are as of May 1982. Indemnities refer to displacement benefits ascribable to detached TP personnel. Monthly salaries are based on 190 hours plus benefits as described in Engineering Annex XI.

( See Table 3.1.)

Notes to Table III 3.1.

1) No construction foremen are currently employed by the contractor, though with the size of crews envisaged, there could be up to 4. However, indenities were calculated for only 1 ( in the MIN case), and 4 basic salaries were calculated without bonuses, in the MAX case.

2) Indemnities calculated for only 8 of the operators. Rest are local hire.

3) Unskilled labor is all local and hired intermittently. Therefore, only 6 months/yr hire were calculated for both MIN and MAX cases.

-----  
With the above conditions in mind, labor costs will range from:

MIN: \$ 26,700/month

to

MAX: \$ 31,300

in 1982 prices.

Assuming basic wage and benefit increases of 10% per year, we have monthly labor costs:

for mid-1983 to mid-1984: \$ 29,370 - \$ 34,430 , and

for mid-1984 to mid-1985: 32,310 - 37,870

114

Note that the unskilled labor, which varies from \$2,800 to \$4,000 per month (always assuming full employment only half the year), and the TP construction foreman positions, at \$900/month each, are the most variable items. Other positions in the brigade are largely determined by the equipment in use. Given the extent of mechanization of the brigade, it is doubtful whether the total maximum of projected costs would ever be reached. (By the way of example, current UNSO/OPE costs are at \$20,000/month, and the contractor does not anticipate ever going beyond \$25,000/month and only in peak months for relatively short periods.)

In order to select a working number which will reflect reality and at the same time offer a margin of safety, we compute an average between minimum and maximum to which we add a contingency factor composed of:

- Variation in number of employees 5%
- Miscellaneous contingencies,  
emergencies, labor-associated costs, overtime, etc. 5%
- 10%

Therefore, for the purpose of this project as defined, the average labor costs will be:

During Calendar 1983:	\$35,000/month
1984:	\$38,500/month
1985:	\$42,400/month

(Of which approximately 30% will be TP personnel).

## 2. Technical Assistance

In order to insure the project implementation, a US Technical Assistance contractor will be hired for the duration of the project. The main missions of this team will be to:

- \* organize construction work in order to achieve production objectives ;
- \* train on-the-job, all categories of personnel;
- \* insure coordination with local authorities and donors (UNSO/AID);
- \* supervise disbursements; and
- \* prepare the detailed design and plans prior to construction for the various structures

The team will comprise:

- one chief of party, highway engineer
- one chief mechanic
- one field superintendent
- one mechanic

A more detailed position description and task schedule is provided in Annex IX.

The cost of Technical Assistance is based on the assumption that the team will be provided by a private U.S. Consulting firm under contract with USAID, under current cost & fee conditions.

COSTS OF TECHNICAL ASSISTANCE TEAM

	<u>Est. 1982 Salary (\$)</u>	<u>Fees/yr (\$ x 2.45)</u>	<u>Monthly Fees (\$)</u>
Highway Engr. Chief of Party	48,000	117,600	9,800
Field Superin- tendent	36,000	88,200	7,350
Chief Mechanic	34,000	83,300	6,940
Mechanic	30,000	73,500	6,125
		Rounded Total	30,200/month

On the basis of 11 months in the field for each member of the TA team, per diem will be:

\$5,500/month

Travel expenses are assumed at 2 trips/year/person + 4 trips for possible dependents = 12 trips:

\$2,000/month

Extra luggage, personal effects, shipping and miscellaneous expenses are assumed at: \$1000 per month

Total = \$38,700/month  
=====

For 1983-1985, an inflation factor of 10% is factored in, per year.

Summary of Monthly TA Costs

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Fees	\$30,200			
Per Diem	\$ 5,500			
Travel & Expenses	\$ 3,000			
	-----	-----	-----	-----
	\$38,700	\$42,500	\$46,700	\$51,400
	=====	=====	=====	=====

119

In addition to the permanent TA team the project requires the services of a hydrologist. Some specific studies are necessary to evaluate the necessary culverts or bridge openings, based on studies of aerial photographs (1/50,000), maps (1/200,000) and visual inspection of the sites.

It is estimated that 3 man-months in two visits should be required for these studies.

Salary	:	\$40,000 x 2.45 x 3 x 1/12	=	\$24,500
Per Diem	:	\$1,500 x 3	=	4,500
Travel	:	2 trips x \$2,000	=	4,000
				-----
				\$33,000

Over the 18-month<sup>1)</sup> life of project (+ 10% infl.) = \$2,000/month.

### 3. Equipment Operating Costs

The equipment operating costs consist of:

- provision for tire replacements
- provision for tire replacements
- provision for spare parts
- cost for fuel and lubricants
- provision for repairs outside the project facilities
- miscellaneous

Percentages for contingencies have been added to the provisions for tire replacement and for spare parts as well as for the cost of fuel and lubricants, as explained in the corresponding paragraphs.

#### a) Provision for tire replacement

Estimated number of tires for the total brigade equipment is about 290, including:

- 12 motorgrader tires
- 8 wheel loader tires
- 6 + 6 Farm tractor tires
- 140 Truck tires (1200 x 20)
- 14 tires for pneumatic rollers (1200 x 20)
- 12 tires for tank trailers (1200 x 20)
- 12 tires for 4 WD pick-up
- 20 tires for car and light pick-up
- 32 tires for camp trailer

The cost of tires on a monthly basis has been evaluated as follows:

- \* the average tire is a 1200 x 20 truck tire
- \* the cost of such a tire without tax is \$540
- \* assuming renewal of tires every 3000 hours, and taking into account the fact that the equipment comes with an extra set of tires, the provision for tires renewal will be spread over 36 months, therefore:

---

<sup>1)</sup> It is assumed no TA hydrologist will be required for M'bout-Kaedi.

290 x 540 x 1/36 = \$4,350/month  
 + contingency (10%) = 435  
 -----  
 Total \$4,800 (First year)  
 + 15% \$5,500 (Second year)

b) Cost of spare parts

Generally, the cost of spare parts for road construction equipment can be estimated at 10% per year of the value of the equipment.

Note that equipment generally comes with one year's supply of spares and that, in addition, UNSO/OPE purchased \$200,000 worth of parts in 1981, for a total of \$2.4 million in equipment and spares.

Nevertheless, it is always good to estimate costs of spares on the high side, thus:

- cost of UN equipment : \$2.20 million  
 - cost of USAID equipment: \$0.34 million  
 Total value: \$2.54 million  
 - annual cost of spares : \$0.254 million  
 - rounded cost of spares : \$21,200/month  
 + freight (30%): \$27,600/month  
 + contingency (10%): \$30,000/month  
 =====

And for 2 year, add 10% for inflation for: \$33,000/month

c) Fuel Consumption and costs

The following listing indicates diesel fuel consumption for the equipment based on 190 hours a month and a rate of efficiency of 75%. These factors are accurate according to the UNSO/OPE contractor and the GIRM engineers familiar with site conditions in Mauritania.

FUEL CONSUMPTION SUMMARY

ITEM	No.	Unit Hourly (liters)	Unit 8-hrs. days (liters)	Total monthly (liters)
----	---	-----	-----	-----
Bulldozer	2	28	224	8400
Motorgrader	2	17	136	4850
Loader	2	17	136	4850
Dump Truck <sup>1</sup>	7	-	70	8800
Farm Tractor	2	10	80	2850

118

Vibrator roller	1	17	136	2450
Pneumatic roller	1	10	80	1400
Water pump	4	2	16	1150
Water truck <sup>2</sup>	3	-	40	2200
Fuel truck <sup>2</sup>	1	-	20	400
Mobile lub, unit <sup>2</sup>	1	-	20	400
Lowboy/tractor <sup>2</sup>	1	-	20	400
Service truck/crane <sup>2</sup>	2	-	20	800
Concrete mixer	3	3	24	1300
Concrete vibrator	2	2	16	600
Backhoe	2	10	80	2850
Vibr. plate comp.	1	2	16	300
Welding set	1	3	24	450
Air compressor	1	5	40	700
Generator <sup>3</sup>	1	5	-	3600
Vehicles <sup>4</sup>	8	-	35	6700
Workshop	1	5	40	700
				-----
			Monthly total:	56,150 liters
			+ contingency (5%)	60,000 liters
				=====

## Notes to Fuel Consumption Summary:

- 1) Dump trucks are assumed to average 200 km/day and consume 1lit/100 km.
- 2) Water trucks are assumed to average 100-125 km/day @ 40 lit/day. All other trucks are used part-time only and thus are estimated to consume 20 lit/day.
- 3) Generator assumed to function 24 hr/day and 30 days/month. Consumption of second generator is based on emergency use only and is covered by contingency.

\*\*\*\*\*

Lubricants are generally estimated at 5% of fuel consumption.

$$\text{Lubricants: } .05 \times 62,000 = 3,100 \text{ lit/mo}$$

Fuel and Lubes Summary Costs per Month

Diesel @ 18 UM/lt + 5 UM Tspt./lt x 60,000	=	1,380,000 UM
Lubricants @ 14,000/200 lt drum x 15 drums	=	210,000 UM
		-----

Total Monthly: 1,590,000 UM

monthly rounded cost: \$ 31,800

In the last two years, the price of fuel has gone up about 2/UM/year a roughly 10%. Assuming the same level of price increases for

1983 - 1984, we obtain:

For 1983: \$35,000/month

and for 1984: \$38,500/month

d) Cost of Repairs

There is no single rule of thumb for this item, but as a reserve contingency for repairs outside of the site (e.g., vehicle repair in Nouakchott or purchase of spare parts in Mauritania) there can be allocated 5% of the spare parts budget.

Thus, for 1983: \$1,500/month

and, for 1984: \$1,600/month

e) Miscellaneous

This item can be allocated \$1,000/month for the duration of the project as reserve on operating costs.

4. Subcontracts

Some allocations needs to be made for local studies done by Mauritanian firms. There will probably be a need for some soils studies and perhaps also hydrological studies beyond the 3 man-months provided for under Technical Assistance.

The studies item should not exceed \$1,500/month over the life of the project.

Concerning the need for water, a detailed study of water supply by SNIM's Geological Research Division (Reference 7) puts the cost of necessary well drilling along this road at roughly 10 to 14 million UM, or \$200,000 to \$280,000. This would cover about 700 m of drilling and PVC pipe installation. A slightly less costly option (mixing some boring with well construction) would come to about \$150,000.

While several studies (Reference 5, 6 and 7) have pointed to the lack of water in the area, the current contractor's experience seems to indicate

no shortages at all. Alluvial aquifers are plentiful at a depth of about 2 m and can be got at with bulldozers. In addition, small retention dams built up before rainy seasons can also retain some water, thus diminishing the need for borings, and at low cost.

Given the above, it is estimated that a budget of \$50,000 would be sufficient for this item.

The monthly allocation for well drilling expenses can be set at \$3,000 for the life of the project.

#### 5. Miscellaneous items

Monthly costs for miscellaneous items are as follows:

\* Tools replacement; the amount (\$500 per month) is provided for covering the cost of unskilled labor hand tools (pick, shovel, axes, wheelbarrows), as well as mechanics' hand tools.

\* Local travel, transport and charter: this amount (\$2,000/month) is provided to cover the cost of truck rental to transport materials and commodities from Nouakchott to Selibaby when need be, to pay for air costs for construction materials are included in materials prices.

\* Emergency maintenance (\$2,000) is intended to provide funds for hiring people in case of emergency repairs to be carried out on the completed road sections after heavy rains and to allow for specific protection devices.

\* Training material and activities (\$1,000/mo.) are intended to support the training components of this T.A. team.

\* Miscellaneous materials for camp and brigade operation: \$2,000 is intended to cover all expenses arising from supplies, camp site moving and reinstallation, etc.

### MONTHLY OPERATING COSTS

#### SUMMARY

<u>ITEM</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
1. Local Labor	\$35,000	\$38,500	\$42,400
2. Technical Asst.	42,500	46,700	51,400
- Hydrology	2,000	2,000	-
3. Equipment Oper. Costs			
Tires	4,800	5,500	6,100
Spare parts	30,000	33,000	36,300
fuel	35,000	38,500	42,350
misc.	1,000	1,000	1,000
4. Subcontracts			
local studies	1,500	1,500	1,500
well drilling	3,000	3,000	3,000

5. Miscellaneous			
tools	\$ 500	\$ 500	\$ 500
local travel/transpt.	2,000	2,000	2,000
emergency maint	2,000	2,000	2,000
training	1,000	1,000	1,000
Misc. camp exp.	2,000	2,000	6,000 1)
	-----	-----	-----
	\$163,800	\$178,800	\$196,000

Of which, payable in local currency:

	<u>1983</u>	<u>1984</u>
Local Labor:	35,000	38,500
Technical Assistance		
- per diems	6,200	6,800
Equipment oper.:		
- fuel & lubes	(35,000)	(38,500)
- repairs	1,500	1,600
- misc.	1,000	1,000
Subcontracts:		
- local studies	1,500	1,500
Miscellaneous		
- all items	7,500	7,500
	-----	-----
	87,700	95,400
As percent of total	53.5%	53.3%

Note that if fuel costs are considered as a hard currency item, which may well be a contractual condition, the percentage local currency drops to 35%. It is this approximate figure which will be used in the financial plan for disbursement schedules.

#### 6. Cost of materials

Materials to be used for drainage, fords and structures consist of:

- cement
- steel reinforcement bars
- wood
- gabions
- corrugated metal pipe (CMP Ø 80)

Unit costs, projected to mid-1983, are as follows:

* Cement	\$215/ton
* Steel	1400/ton
* Wood	500/m <sup>3</sup>
* Gabions	25/each (2m <sup>2</sup> )
* CMP	125/m

1) Includes demobilisation expenses.

Quantities of materials for drainage structures for each road are estimated below, based on previous studies as field investigations. The smaller quantities ascribed here to the M'bout-Selibaby segment are based on the new (Marchant) alignment and not on the existing M'bout-Selibaby track. Note that from km 70, the new alignment takes 46 km to reach Selibaby. Similarly on the 1-2-1 alignment (see Sheet 1A and 2A), Selibaby-Gouraye is 45 km.

- a) Materials Cost and Construction Time  
 i) M'bout (km 70) - Selibaby (46 km)  
 - Structure and Pipe

PK	<u>Fords</u>	<u>Culverts</u>	<u>CMP</u>
70-76	4 x 10 m	2 x (4 x 1.5)	5
	3 x 5 m	(Oued Haouisse)	
36-80	2 x 10 m	4 x 1.5	10
(Tassota)	4 x 5 m		
80-92	3 x 10 m	2 x (4 x 1.5)	8
	6 x 5 m	(Oued Tourime)	
92-95	2 x 5 m		6
95-116	3 x 10 m	6 x 3	20
	4 x 5 m	(oued Amague)	
	-----	-----	---
Total 5:	215 m	5 culverts	49

Fords: 215 m (= 1.8 months)

Culvert Vol: (5 x 49) + 93 = 338 m<sup>3</sup> (= 3 months)

CMP = 49

Thus, structures work should take 4.8 months, round off to 5 months and add 1 month for difficulties of terrain, contingencies and possible extra work. Structure time: 6 months

- materials:

- \* fords - 215 m
  - Cement: x 0.84 = 180.6 tons
  - Steel : x 28.7 = 6.2 tons
  - Gabions: x 3 = 645 m<sup>2</sup>
  - Stones & Gravel: x 5 = 1075 m<sup>3</sup>
  - Wood: x 0.5 = 107.5 m<sup>3</sup>
- \* Culverts - 5 x (4 x 1.5) + 1 x (6 x 3)
  - Cement: 5 x (17.5) + 33.2 = 120.7 tons
  - Steel : 5 x (1.9) + 3.4 = 12.9 tons
  - Wood: 5 x (2.00) + 4.8 = 14.8 m<sup>3</sup>
- \* CMP - 49 x 7 m = 343 m (Ø 80 cm)

- Materials:

- Summary Quantities and Costs:

<u>Item</u>	<u>Cost/Unit</u> <sup>1/</sup>	<u>QTY</u>	<u>Total</u> <sup>2/</sup>
Cement	\$215/ton	301.3	\$65,000
Steel	1400/ton	19.1	27,000
Wood	500/m <sup>3</sup>	122.3	61,000
Gabions	25/each	323	8,000
CMP	125/m	343	43,000
			-----
			\$204,000

1) 1982 prices + 15%

2) Rounded

For contingency and possible price variations, add  
5%: Total = \$214,000  
\*\*\*\*\*

ii) Selibaby and Gouraye (45 km)

	<u>Fords</u>	<u>Culverts</u>	<u>Bridge</u>	<u>CMP</u>
PK				
0-8	2 x 20 m 1 x 15 m	2 x 1	-	2 (1 repl)
8-15	1 x 10 m 3 x 20 m		-	2 4
15-27	2 x 25 m 1 x 20 2 x 15		-	8
27-45	3 x 20 m	2 (4 x 1.5)		8
	-----	-----		---
Totals:	285 m	3 culverts		24

Fords : 285 m (= 2.4 months)

Culvert vol. 2 (49) + 24 = 122 m<sup>3</sup> (= 1 month)

The repair of the three bridges is estimated at 2 months, and thus total structures time should be 5.4 months, plus 0.5 month for contingencies, etc. Structures time: 6 months  
\*\*\*\*\*

- materials:

* Cement: x 0.84 =	201.6 tons
* Steel : x 28.7 =	6.9 tons
* Gabions: x 3	720 m <sup>3</sup>
* Stones & Gravel x 5 =	1200 m <sup>3</sup>
* Wood x 0.5 =	120 m <sup>3</sup>

124

- \* Culverts - 2 (4 x 1.5) + 2 x 1  
 Cement: (2 x 17.5) + 11.5 = 46.5 tons  
 Steel : (2 x 1.9) + 1.0 = 4.8 tons  
 Wood : (2 x 2.0) + 0.9 + 0.9 = 4.9 m<sup>3</sup>
- \* CMP - 25 x 7 m = 175 m (Ø 30 cm)
- \* Bridge Repair - 3 decks, L = 6 m each  
 Cement 3 x 11.2 x 0.4 = 13.4 tons  
 Steel 3 x 11.2 x 0.08 = 2.7 tons  
 Wood: 3 x 33 x 0. = 2.2 m<sup>3</sup>

- Materials

- Summary Quantities and Costs:

<u>ITEM</u>	<u>COST/UNIT</u> <sup>1</sup>	<u>QTY</u>	<u>TOTAL</u> <sup>2</sup>
Cement	\$215/ton	261.5	\$56,000
Steel	1400/ton	14.5	20,300
Wood	500/m <sup>3</sup>	127	63,500
Gabions	25/ea	360	9,000
CMP	125/m	175	22,000
			-----
			\$170,800

1) 1982 prices + 15%

2) Rounded

(For contingency and 1984 prices, add 20%):  
 Total = \$205,000  
 =====

7. Final Summary and Conclusions

Total Construction Time and Costs

Although previous estimates split costs between earthworks, structures, and support components, and then finally into just structures and earthworks for purposes of final scheduling and costs, it is felt that the continuity of the Special Autonomous Brigade renders such a split unnecessary. The concept of the brigade will make major layoffs undesirable, and thus time elapsed on the project will be considered for the entire brigade.

It is assumed that the earthworks brigades will be able to produce 7.5 km/month. Given the relatively small amount of causeways (elevated to 1.5 - 2 m above original ground), and the ability of the structures sub-brigades to stay ahead of earthworks the 7.5 km/month goal is considered to be realistically attainable.

This would give:

- for km 70 - Selibaby (46 km): 6 months
- and for Selibaby-Gouraye (45 km): 6 months

125

However, this time does not fully account for the rainy season (July-October), during which time operations can take place but at an extremely reduced pace. It would thus be necessary to adjust the schedule to take in leave time and other aspects reducing brigade efficiency and output. On the other hand, equipment operating cost would be reduced during this period also, and these represent 45% of monthly operational costs.

Assuming that USAID involvement would begin around May-June 1983 (which appear now to be a likely date for UNSO/OPE's completion of 70 km), we would then expect the first leg to take up to 9 months (from June 1983 to February 1984) but to cost no more than 7.5 months in operating costs. The same would apply for the second leg, from March 1984 to December 1984.

The following table summarizes all costs and also derives the overall cost/km, excluding depreciation of equipment. This item, however, is factored into the economic analysis, reflecting the use value of combined UNSO/OPE and USAID equipment costs during the life of the project. (See Ch IV, Economic Analysis, Section 8).

SUMMARY TABLE

PROJECT CONSTRUCTION COSTS

	<u>M'bout-Selibaby</u>	<u>Selibaby-Gouraye</u>
KM	46	45
Full Oper. Months	7.5	7.5
Chronological months	9	9
Total Oper. Costs	\$1,228,500	\$1,341,000
Materials	\$ 214,000	\$ 205,000
Total Costs	\$1,442,500	\$1,546,000
Cost/km	\$ 31,360	\$ 34,400

E. Kaedi-M'bout Road

1. Description

This road is a section of the RN 2 trunk road which links Rosso to Kiffa. It lies totally in the Gorgol Region. This road must be considered as an essential link of the all-weather Nouakchott-Selibaby route, through Boutilimit, Aleg, Boghe, Kaedi and M'bout.

Two main sections can be identified along the existing road:

KAEDI to LEQCEIBA

LEQCEIBA to M'BOUT

The first section, Kaedi-Leqceiba is a 7 meter wide earth road with generally a laterite surfacing except in the vicinity of Kaedi where there is no surfacing at all, only sand. The road runs eastward on the high

ground next to the Gorgol River. The terrain can be considered as gently rolling and the vegetation is mostly brush and small trees. No existing drainage structures exist on this first 45 km, despite the fact that several shallow but wide "oueds" are crossed by the existing alignment.

The second section, Leqceiba to M'bout, has little surfacing but about 25 multiple-cell box culverts were built in 1965-1966. The terrain is generally flat except for the crossing of the Oua Oua Ridge, about 15 to 20 km from M'bout, with steep slopes and rock outcrops.

The soils are generally hard brown clay which provides a fairly good ride for the vehicles and is not subject to rutting. The Gorgol river is crossed by two single land bridges just after Leqceiba.

Due to the lack of drainage structures in the first section and the embankments washed away in the second section, the Kaedi to M'bout road is impassable for many days at a time during the rainy season, from July to September each year.

## 2. Projected Improvements

The projected improvements will consist of:

- construction of ford crossing where no structures exist now. The fords or "raidiers" are the most suitable type of oued or stream crossing structure in the area because of the shallow river beds which are predominant along this road.
- repair of existing structures and embankments/causeways including the raising of the level of these embankments to prevent overtopping by runoff water.
- addition of a few corrugated metal pipes, 80 cm in diameter to match the required culvert openings.
- construction of protective works such as dykes for oued draining, gabions, etc.
- road resurfacing wherever it will be deemed necessary and in particular in the vicinity of Kaedi.

## 3. Estimate of rehabilitation costs for the Kaedi-M'bout Road.

This cost estimate has been devised based on the assumption that work will be performed by the Special Autonomous Brigade with all the equipment available for M'bout-Selibaby-Gouraye.

Quantities of the various work items can be estimated as follows:<sup>1/</sup>

- 360 meters of ford construction (11 fords)
- 10-15 existing structures to receive protection works (ditches, dykes, etc.)
- extensive repairs needed on 5 structures
- volume of fill to be placed estimated at 140,000 m<sup>3</sup>

When comparing these quantities to the average estimated monthly production of the brigade,

- \* fords at 120 m/month = 3 months
- \* repairs on structures = 3 months
- \* embankments at 15,000 m<sup>3</sup>/month = 9 months

<sup>1/</sup> See Annex XIV for detailed inventory.

121

The brigade should be able to perform the work in 9 full operating months. The road itself is in fair shape for most of its length, is studded with borrow pits, and all but two structures are easily passable. Were the road to be entirely reconstructed, the quantities (especially earthwork) would change considerably. But in the context of an all-weather rehabilitation, the following cost quantities are judged to be fair estimates:

- Materials:

\* Fords - 360 m

Cement:  $x 0.84 = 302.4$  tons

Steel:  $x 28.7 = 10.3$  tons

Gabions:  $x 3 = 1080$  m<sup>2</sup>

Stones and Gravel:  $x 5 = 1800$  m<sup>3</sup>

Wood:  $0.5 = 180$  m

\* Culverts - Estimated reconstruction of 10 cells of 2 m length (10 x 2 x 1.5) and 1 bridge (20 x 2 x 1.5) for an equivalent total of 15 (4 x 1.5)

Cement:  $15 x 7.5 = 112.5$  tons

Steel :  $15 x 1.9 = 28.5$  tons

Wood :  $15 x 2.0 = 30.0$  m<sup>3</sup>

\* CMP - 35 x 7 m = 245 m (Ø 80 cm)

- Materials:

- Summary Quantities and Costs:

<u>ITEM</u>	<u>COST/UNIT</u> <sup>1</sup>	<u>QTY</u>	<u>TOTAL</u> <sup>2</sup>
Cement	\$215/ton	415	\$ 90,000
Steel	1400/ton	38.8	55,000
Wood	500/m <sup>3</sup>	210	105,000
CMP	125/m	245	31,000
			-----
			\$281,000

1) 1982 prices + 15%

2) Rounded

For 1985 prices, add 30%:

\$365,000

SUMMARY TABLE

PROJECT CONSTRUCTION COSTS

KAEDI-M'BOUT

KMS	118
Months	9
Operating Costs	\$1,765,000 (\$196,000/month)
Materials	\$ 365,000
Total Costs	\$2,130,000
Cost/km	\$ 18,050

128

F. References

1. Programme de remise en etat d'entretien et de construction du reseau routier Mauritanien.  
- Ministere de l'Equipment et des Transports, Direction de l'Infrastructure, Mars, 1980.
2. Road User Charges Study - Mauritania  
Charles Vandervoort, USDOT, January, 1980.
3. Programme d'Entretien Routier  
- BCEOM/Lamarre Valois, Juin, 1978.
4. Report on the Evaluation of Alternate Routes for the Rural Roads Development Project - Mauritania  
Dr. Harold T. Rib, USDOT, September, 1981
5. Report on Aggregate and Water Surveys for the RRDP, Mauritania  
Dr. Harold T. Rib, USDOT, June, 1980
6. Report on Aggregate and Water Surveys for the RRDP, Mauritania  
Louis Berger International, May, 1980
7. Etude Hydrogeologique pour l'alimentation en eau des troncons M'bout-Selibaby-Gouraye et Dafort-N'dieo  
S. Okensengom and P. Moliere, SNIM, January, 1981.
8. Rapport Geotechnique concernant la Recherche de Gites a Materiaux dans la Region du Guidimaka - Laboratoire National des Travaux Publics (LNTP), February, 1981

129

ANNEX 1

RAINFALL DATA

Table AI      Average number of days of rain and rainfall in Selibaby area

Table AI-2    Rains characteristics in Selibaby

Table AI-3    Rainfall characteristics - Guidimaka Region

Table AI-4    Daily Rainfall Frequency

Comments

TABLE AI.1 Average number of days of rain and rainfall for Selibaby

<u>MONTH</u>	<u>NO. OF DAYS</u>	<u>RAINFALL</u>
January	0	
February	0	1
March	0	
April	0	3
May	1	10
June	5	50
July	8	150
August	11	200
September	8	120
October	3	30
November	1	3
December	0	3
	-----	-----
Total	37	570 mm

These figures are just average and therefore only indicative of the rainfall pattern in the Selibaby area.

131

TABLE AI.2      RAINS CHARACTERISTICS IN SELIBABY

<u>RAINS RAINFALL RANGE (MM)</u>	<u>NO. OF RAINS PER YEAR IN OPPOSITE RANGE</u>	<u>NO. OF RAINS/ NO. OF YEARS</u>	<u>TOTAL NO. OF RAINS IN OPPOSITE RANGE</u>
10-20	10.2		235
20-30	5.6		129
30-40	2.6		61
40-50	1.8		42
50-60	0.8	1/1.2	19
60-70	0.4	1/2.5	9
70-80	0.26	1/4	6
80-90	0.13	1/7.6	3
90-100	0.09	1/11.1	2
100-110	0.09	1/11.1	2
110-120	0.04	1/25	1
-----	-----	-----	-----
180-190	0.04	1/25	1
		Total	510

Notes:

- (i) - Above table based on 23 years of observation
- (ii) - Total number of rains observed is 851, 60% of which (510) had a rainfall greater than 10 mm
- (iii) - A rain of 183 mm which lasted 9:30 hours has been observed on August 6, 1936.  
This rain is unique so far
- (iv) - Maximum rain intensity observed is 125 mm/hour

SOURCE: HYDROLOGIE DU CERCLE DE GUIDIMAKA - A. Lermuzeaux - BURGEAP, Dec. 1958

132

TABLE AI.3 RAINFALL CHARACTERISTICS: GUIDIMAKA REGION

STATION	Average annual rainfall (mm)	No. of days with rain (average)	Maximum rainfall (mm)	Minimum rainfall (mm)	% of rains greater 20 mm	% of rains greater 50 mm	% of rains with intensity greater than 50 mm/h	Maximum rain fall in 24 h (mm)
KAEDI	412	27	762	193	70	5	5	162
KIFFA	353	28	620	142	70	4	3	98
M'BOUT	430	20	611	226	70	3	6	132
SELIBABY	635	38	1110	350	75	4	3	207
KANKOSSA	436	28	538	237	65	4	5	(142)

Source: Carte de Reconnaissance - Hydrogeologique de la Mauritanie  
 Notice explicative - Bureau Hydrogeologique - Ministere de l'Equipement  
 Sources des Eaux Souterraines. Jan. 58.

TABLE AI.4 DAILY RAINFALL FREQUENCY

Number of days where the rainfall over a 24 h period has been:

mm	0.1	1	5	10	20	50	100		Total No. of observations
	0.9	4.9	9.9	19.9	49.9	99.9	and over		
KIFFA	No.	180	175	111	95	48	9	1	619
	%	29.5	28.5	18	15	8	1	>1	
SELIBABY	No.	185	206	165	164	113	13	1	
	%	22	24	20	20	13	1	>1	

122

It should be noted from the above tables that:

- \* Table AI.3= Going northward, the rains are shorter and more violent
- \* A 10 mm/hour rain generally generates runoff water, otherwise there is only infiltration and/or evaporation
- \* In Selibaby 70% of the rains are of the thunderstorm type (percentage of the total number of rains recorded)
- \* In Kiffa only 67% of the rains are thunderstorm
- \* The average yearly rainfall over the period 1931-1960 has been 649 mm in Selibaby, 350 mm in Kiffa and 410 mm in Kaedi
- \* Percentage of rainfall between day and night in August from 1951 through 1960

	<u>Day (08 AM - 6 PM)</u>	<u>Night (6 PM - 08 AM)</u>
KIFFA	44%	56%
SELIBABY	28%	72%

This pattern is favorable because it has a tendency to reduce evaporation. August is among the hottest months of the year.

Other reference: "Sedentarisation des Nomades en Mauritanie Centrale Sahelienne"  
Charles Toupet 1977

134

ANNEX IIROAD NETWORKA. The National Road Network

## 1. Administrative Classification

The Mauritanian road network has been officially classified by decree No. 68.288/PR in October, 1968.

This classified road network totalling 7090 km in March 1980 (Ref 10) is reflected in Table A II.1 below.

The GIRM has defined the following three road categories:

(i) - Routes Nationales - RN (National Roads) which, link main "Chef-Lieux de Departement" towns together and with neighboring countries;

(ii) - Routes Regionales - RR (Regional Roads) which, within a Region, link main regional activity centers and the "Chef-Lieux de Departement" towns to the National Road" network;

(iii) - Routes Secondaires - RS (Secondary Roads) which, link secondary production centers to the "Regional and/or National Roads" networks.

TABLE A II.1

National Roads	KM 4705
Regional Roads	1730
Secondary Roads	655 -----
Total	7090

Not included in the above count are the numerous unclassified trails which might add up to another 1000 km or so. These are generally camel and donkey trails over flatlands, which may be followed by four-wheel drive vehicles during the dry season.

The road density in Mauritania therefore averages 5.5 km/1000 km<sup>2</sup> or 0.00855 mi/sq.mi.

2. Mauritanian Road Network: Technical Classification

The classified road network can be distributed into several types of road according to their construction and design standards; these various road types are as follows:

(i) - "Ordinary track" :

This type of road corresponds to the lowest level of classification: no construction has ever been undertaken on the alignment, which has been created only by the repeated passage of vehicles over the same tracks. This type of road is generally impassable during the rainy season (no drainage and no crossing at all).

(ii) - "Improved track" :

This type of road has had some spot improvements but to a low degree and non-systematical. This is, generally speaking, an existing track which has been cleared, on which a few fords have been built and some very difficult sections have been improved. The alignment and profile have not been studied at all and is not guaranteed all year round.

(iii) - "Ordinary Earth Road" :

This type of road has been subject to geometric and soil studies. The alignment is final where important construction works are required. The profile is generally above the water level and a minimum pavement (0.14 m thick over a 5 m width) has been laid down in low bearing capacity areas. The pavement consists of materials taken along the alignment which have an average quality for road construction standards. The crossing structures can be flooded (submersible).

(iv) - "Improved earth road"

This type of road has a definite alignment and its profile is always above water level. The pavement is made of selected materials and is designed to carry projected traffic (0.20 to 0.25 m thick over a 6 to 7 m width); the structures are dimensioned such as to withstand 10 year floods and are built as permanent structures.

(v) - "Asphalted road"

This is the highest level of classification and therefore the ultimate step in road design and construction. This type of road, carefully studied and built, comprises generally a two-lane asphalted roadway over an adequately designed pavement, in relation to the traffic forecasts.

Table A II.2 below indicates the composition of the Mauritanian road network according to the various techniques of construction:

TABLE A II.2

Situation as of March 1980 (Ref 10)

Asphalted Roads	:	1283 km	)	
Improved Earth Roads	:	570 km	)	
Tracks	:	5555 km	)	
		-----	)	
			)	
Total	:	7408 km	)	See Table AII.3 for route details

136

Situation as of 1977 (Ref. 12)

Asphalted Roads	: 615 km	
Improved earth roads	: 433 km	6042 km
Ordinary earth road	: 2066 km	) (classified as "track", no work ever being carried out on these roads)
Improved track	: 1085 km	
Ordinary track	: 2891 km	
	-----	
Total	: 7090 km	

TABLE A II.3MAURITANIAN ROAD NETWORK

<u>1. Asphalted Roads</u>		<u>Length (km)</u>	<u>Observations</u>
<u>*National Roads</u>			
Nouakchott-Rosso	RN 2	204	
Nouakchott-Akjoujt	RN 1	256	
Nouakchott-Boutilimit	RN 3	154	
Boutilimit-Aleg	RN 3	109	
Aleg-Sangarafa	RN 3	344	
Sangarafa-Kiffa	RN 3		
Kiffa-Aioun el Atrous	RN 2	210	just completed
	bis		
Wharf-Nouakchott	RN 2	6	
		----	
	Subtotal	1283	
<u>*Unclassified Roads</u>			
Zouerate-Fderick		34	
Nouadhibou-Point Central		12	
Nouakchott-Beach		15	
		---	
	Subtotal	61	
Grand Total Asphalted Roads		1344	
		====	

2. Improved Earth Roads

Akjoujt-Atar	RN 1	180	
Atar-Choum	RN 1	120	
Boghe-Kaedi	RN 2	100	drainage structures not built
Kaedi (via M'bout)-Kiffa	RN 2	305	(partial)
	Total:	705	

3. TracksNational Roads

Atar-Algerian Border	RN 1	1215	
Rosso-Boghe	RN 2	200	Studied as paved road
Aioun-Nema	RN 2	295	under constr.
Sangarafa-Moudjerra	RN ?	60	
Moudjerra-Tidjikja	RM ?	130	
Tidjikja-Kiffa	RN 4	240	
M'bout-Selibaby-Gouraye	RN 5	165	candidate road
Aioun-Mali (border)	RN 6	150	
Nema-Mali (border)	RN 7	150	
		----	
	Subtotal	3005	

Regional Roads

Atar-Chinqueti	RR 1	120	
Rosso-Mederdra	RR 2	65	
Rosso-Boutilimit	RR 3	195	
Podor-Aleg	RR 6	115	
Kaedi-Maghama	RR 7	110	
Selibaby-Kankossa	RR 8	140	
Kankossa-Kiffa	RR 8	100	
Kiffa-Tamchekett	RR 9	120	
Tamchekett-Aioun	RR 9	160	
Nema-Oulata	RR 10	100	
Nema-Bassikounou	RR 11	200	
		----	
	Subtotal	1425	

Secondary Roads

Nouadhibou-Boulanouar	RS 1	95
Ouadane-Chingetti	RS 2	140
Nouakchott-Jreida-Bou Lanouar	RS 3	405
Aleg-Kaedi	RS 4	150
Tidjikja-Tichit	RS 5	200
		---
	Total:	990
	Grand Total Tracks:	5420
		====

The Mauritanian Road network in 1980 is as follows:

	Unclassified Roads	National Roads	Regional Roads	Secondary Roads	Total
	-----	-----	-----	-----	-----
Asphalted Roads	61	1283	-	-	1344
Improved earth roads	-	705	-	-	705
Other earth roads and tracks	-	3005	1425	990	5420
	-----	-----	-----	-----	-----
Total	61	4993	1425	990	7469

Since 1977 more than 600 km of roads have been asphalted which represents essentially the Boutilimit-Aioun el Atrous Road (665 km). The other variations cannot be detailed because of the lack of a detailed road listing for 1977. However, the only other works carried out so far have been on the Boghe-Kaedi Road (100 km) and on the Kouroundjel-Kiffa section of the RN 2 (50 km) which could account for the variation between the 1977 and 1980 values of the length of improved earth roads (157 km).

There exist some discrepancies between the various references and the latest issue of the Mauritanian Road Map (IGN Edition 1-1980).

## B. The Guidimaka Region Road Network

### 1. Main roads and linkages to the Mauritanian road network

The main roads of the Guidimaka region as well as the roads linking the region with the trunk roads of the Mauritanian road network are as follows:

#### a) National Roads (Classified as such)

RM 5 M'bout-Selibaby-Gouraye

M'bout-Selibaby: 120 km ordinary track

Selibaby-Gouraye: 45 km improved track

RN 2	Boghe-Kaedi-M'bout-Soufa-Kiffa
	Boghe-Kaedi : 105 km <u>earth road</u> *
	Kaedi-M'bout : 115 km <u>earth road</u> /improved track
	M'bout-Kouroudjel: 135 km <u>earth road</u> /improved track
	Kouroudjel-Kiffa : 45 km <u>earth road</u> **

The link Boghe-Aleg linking finally the Guidimaka region to the paved road to Nouakchott by the shortest route does not appear on our classification. This link at present is an ordinary track about 65 km in length and its construction as paved road is to begin in October, 1981.

b) Regional Roads (Classified as such)

RR 7	Kaedi-Sive-Maghama-Harr-Selibaby
	Kaedi-Sive 70 km
	Sive-Maghama 50 km
	Maghama-Harr-Selibaby 110 km
RR 8	Selibaby-Bouly-Ould Yenge-Kankossa-Louroudjel
	Selibaby-Bouly 50 km ordinary track
	Bouly-Ould Yenge 26 km ordinary track
	Ould Yenge-Kankossa 64 km
	Kankossa-Kouroudhel 45 km

\* improvements not completed at date; drainage structures still to be built

\*\* just completed

No secondary road is recorded as such in the Guidimaka Region. All other routes are just unclassified ordinary track whose existence and alignment depend on the amount of vehicles using it every week or every month during the dry season, none being consistently passable during the rainy season, i.e., from the beginning of July up to the middle of October (3-4 months overall).

The routes which have been surveyed are:

(i) Selibaby-Hassi Chagar-M'bedia Achar-Dafort-N'Dieo-Soufa.

This route lies in a north-south direction and links Selibaby directly to the M'bout-Soufa-Kiffa road. The approximate length is as follows:

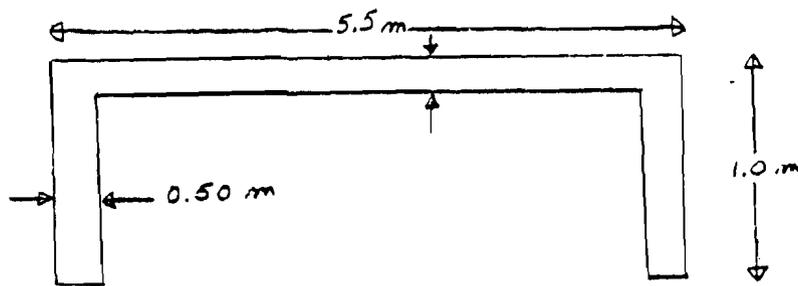
Selibaby-Hassi Chagar	26 km
Hassi-Chagar-M'bedia Achar	18 km
M'bedia Achar-Dafort	16 km
Dafort-N'Dieo	26 km (this section is almost never used by other than 4-WD vehicle)
N'Dieo-Soufa	11 km
	-----
	97 km

(ii)	Se11baby-Guemou	33.5 km
	Guemou-Soulou	9.5 km
		-----
		43 km
(iii)	Khabou-Solou	10 km
	Solou-Djougountourou	10 km
	Djougountourou-Gouraye	26.5 km
		-----
		46.5 km
(iv)	Ould Yenge-Sanbangoma	25 km
	Sanbangoma-Dafort	24 km
	Dafort-Bouanze	20.5 km
	Bouanze-Oudelemgu11	12 km
		-----
		82 km

ANNEX IIIWIDTH OF ROADWAY ON STRUCTURES

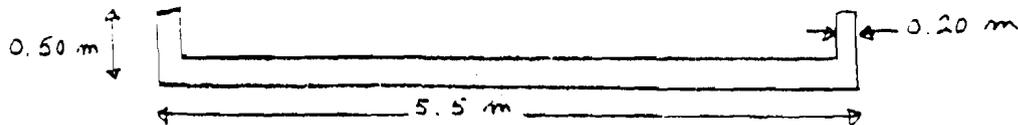
## A. Fords

As indicated in Ch. III, Section A, fords will generally have the following cross-section:



## B. Culverts

The height of culverts might vary, but the top slab remains 5.5 m wide with a small curb.



Detailed computations of quantities for both fords and culverts are given in Annex X.

ANNEX IVTRAFFIC VOLUMES IN GUIDIMAKATABLE A. IV.1

ESTIMATED AVERAGE DAILY TRAFFIC ON SELECTED  
ROADS DURING THE DRY SEASON <sup>1/</sup>  
(1981)

ROUTE	CURRENT TRAFFIC
M'bout-Selibaby	4-5 VPD <sup>2/</sup> comprised of ten-ton trucks and landrovers
Selibaby-Ould Yenge	7-8 VPD, consisting of ten-ton trucks and land rovers
Selibaby-Gouraye	1-2 trucks (ten-ton) per day plus 5-6 land rovers
Gouraye-Khabou	1-2 vehicles per week

1/ Data from LNTP and field surveys, March, 1981

2/ VPD; vehicles per day

143

Traffic in the Guidimaka Region

1. Selibaby-Ould Yenge-Kiffa-Nouakchott

- SONIMEX sends an average of 45 vehicles per month totalling 540 vehicles per year
- Commissariat sends 545 trucks of 12-13 MT per year
- Total GIRM trucks: 1085 per year
- A maximum of five private vehicles per day presently travel on this road, of which one is a taxi-bus from Kiffa to Selibaby

2. Selibaby-Gouraye

Daily from 2 to 3 private vehicles make this trip

3. Kaedi-M'bout-Selibaby

Traffic 1 truck per week

The section, Selibaby-Boule-Ould Yenge-Kankossa-Kiffa, the main artery connecting Guidimaka with its markets, presently carries a traffic of 8 vehicles per day throughout the year, with interruptions of several days during the period June to October. Traffic on the M'bout-Selibaby road is currently four vehicles per day during the dry season and declines to zero in the wet season when the oueds become impassable barriers.

ANNEX VGIRM STANDARDS FOR ROAD CONSTRUCTION

(Note: These standards are among the most commonly used all over western Francophone Africa)

TABLE A.V.1MINISTRY OF EQUIPMENT AND TRANSPORT HIGHWAY DESIGN STANDARDS

	<u>ASPHALTED ROAD</u>	<u>IMPROVED EARTH ROAD</u>	<u>ORDINARY EARTH ROAD</u>	<u>IMPROVED TRACKS</u>	<u>ORDINARY TRACKS</u>
Design Speed (km/h)	100	100	60-80	60	n/a
Width of Formation (m)	9	9	7-8	n/a	none
Width of base Course	7	7	5-6	5	none
Pavement thickness (cm)	20-25	20-25	15-20	15	none
Width of surfacing (m)	6	none	none	none	none
Minimum radius (m)	500	500	200	100	n/a
Maximum Gradient (%)	6	6	10	n/a	n/a
Expected Lifespan (years)	10	10	5	n/a	n/a
Minimum sag Radius curvature (m)	3000	3000	1000	n/a	n/a
Minimum horizontal radius of curvature (m)	6000	6000	500/1000	n/a	n/a

n/a - either "Not applicable" or "not defined"

Source: Ministère de l'Équipement et des Transports - Direction de l'Infrastructure

145

STANDARDS AND SPECIFICATIONS IN  
UNSO/GIRM AGREEMENT FOR M'BOUT-SELIBABY

The following indicates agreed-on Standards and Specifications:

- All-weather use except for minor interruption of traffic at fords at highest water flow;
- Width of roadway 5,5 m;
- Roadway width of fords and bridges: 5,5 m (roadway width of fords and bridges on feeder roads will be 4.2 meters except that fords over 35 meters long will have a roadway width of 5,5 meters);
- Horizontal and vertical alignment sufficient for eventual 80 km/hr maximum; designed operating speed where economically feasible;
- No shoulders
- Maximum center line gradient of 5 percent;
- Crown slope (camber) 3 percent;
- Superelevation (as per GIRM standards)

(1) Embankment, causeways: in floodwater areas, embankment will be constructed to an elevation of at least 75 centimeters above the high water level. In erodable slope areas (those characterized by a 1.5 to 2 percent or greater slope of terrain and without vegetation to prevent water from running off), a minimum of 30 cm depth embankment over the original ground will be accomplished simultaneously with a motor-grader which will excavate material to form the side ditches and spread it to form the 30 cm embankment which will be compacted. Suitable side ditches and lateral drainage will be constructed, as required.

(2) Where in situ material is considered unsatisfactory for embankment construction, select materials will be hauled to the jobsite for this purpose. Where acceptable select materials are available, select materials will be used in lieu of in situ materials. This decision will be the responsibility of the engineer in charge of construction. The objective is to construct the most substantial road within available funding.

No surfacing: none except that roadways to be constructed with select materials will be compacted. While no surfacing material is specified for the roadway, to the extent that a suitable gravel or granular surfacing material is readily available from borrow pits within "quote free-haul" distance, such surfacing (select) material will be taken and incorporated in the final road levels. Final surfacing and embankment shall support the design axle load of 13 MT.

(3) Drainage structures; fords: With the exception of oueds typically characterized by deep and narrow beds; all oued crossings will be by ford. Fords will be paved with concrete and will be protected upstream and downstream by gabions. On the M'bout-Selibaby road, oued crossings shall be by fords constructed above culverts (overflow bridges) where financially justifiable.

On the M'bout-Selibaby road and other similar roads, the paved ford roadway width will be 5,5 m. On feeder roads, the normal paved ford roadway width will be 4 m but fords over 35 m long will all be 5,5 m width. Edge markers will be constructed of a durable material and painted to identify the edges of road paving. Markers will be high enough to enable drivers to see the limits of ford roadway widths during design high water flows.

(4) Culverts: will be 80 centimeters or 1 meter (in diameter) corrugated metal pipe with masonry or concrete headwalls. Some masonry box culverts may be constructed.

(5) Small bridges: Some bridges (up to 10 meters in length) may be constructed to cross deep and narrow oueds. They will have masonry abutments on spread footings with reinforced concrete deck slabs. On the M'bout-Selibaby road, bridge roadway widths will be 5,5 meters. On other roads, the normal width of bridges will be 4 m, with directional prioritization signposts. No bridges over 10 m long are foreseen.

(6) Existing structures will be rehabilitated, enlarged or reinforced according to identified needs and requirements.

147

ANNEX VIEMBANKMENT AND CAUSEWAY DESIGNAND PRODUCTION CRITERIA1. Embankments

Equipment and Production:

1 dozer, 150-180 to 200 HP (150-160 should be sufficient)

1 front end loader, 2m<sup>3</sup> bucketwater trucks (15 m<sup>3</sup>)

a) Front-end loader production (compacted roadbed):

 $2 \times 0.75 \times 0.75 \times 0.85 = 1.28\text{m}^3$  compacted/cycle

Cycle time average 30 sec (120 cycles/h)

Efficiency = 50 mn/h = 5/6 (approximately 80%)

Therefore:  $1.28 \times 120 \times 5/6 = 127 \text{ m}^3/\text{hour}$ Note: the loader should not be the production bottleneck (it can produce approximately 1000 m<sup>3</sup>/day)b) Trucks: payload = 6 m<sup>3</sup>, compactedaverage speed, rough terrain - 15 km/h to 12/km/h  
1 km/4 or 5 mnIf haul is 2 km: 4 km = 16 to 20 mn/round trip

Loading and unloading = 5 mn

Total time is 21 to 25 mn/full cycle

Should have 2 to 3 cycles/hour which is 16-24 cycles per day

or 96 to 144 m<sup>3</sup> compacted per day/truckIf haul is 1 km: 2 km = 8-10 mn/round trip

Loading and unloading stay the same = 5 mn

Total time is 13-15 mn

Should have 3-4 cycles/hour which is 24 to 32 cycles per day

or 144 or 192 m<sup>3</sup> compacted per day.

148

## c) Production criteria, embankments:

There are two key factors in maintaining production levels: haul distance and number of trucks. Output decreases geometrically with distance; to obtain 350 m<sup>3</sup>/day, for example:

28 cycles: 1 truck, 1 km haul = 170 m<sup>3</sup>/day

28 cycles: 2 trucks, 1 km haul = 340 m<sup>3</sup>/day

Need 2 trucks

20 cycles: 1 truck, 2 km haul = 130 m<sup>3</sup>/day

20 cycles: 2 trucks, 2 km haul = 260 m<sup>3</sup>/day

Need 3 trucks

But:

8 cycles: 1 truck, 5 km haul = 50 m<sup>3</sup>/day

8 cycles: 2 trucks, 5 km haul = 100 m<sup>3</sup>/day

... etc: Need 7 trucks

And:

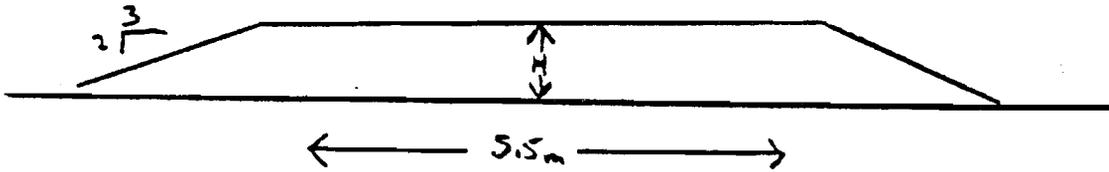
4 cycles: 1 truck, 10 km haul = 25 m<sup>3</sup>/day

... etc: Need 14 trucks

If the production goal is about 350 m<sup>3</sup> compacted per day, then with existing fleet no borrow pit can be more than 5 km from the construction site and reach average production.

2. Embankments - Causeways

Formation width has to be 5.5 meters



$$\text{End area: } A = \frac{1}{2} (5.5 + 5.5 + \frac{H \times 3}{2} \times 2) \times H = \frac{H}{2} (11 + 3H)$$

Table: area values

<u>H (m)</u>	<u>A(m<sup>3</sup>/L) (m)</u>
1	7.5
1.5	11.6
2	17.0
2.5	23.1
3	30.0

Table: If Haul is 1 km (+) @ 28 cycles/day

<u>H(m)</u>	<u>A(m<sup>3</sup>/1m)</u>	<u>2 Trucks (34)</u>	<u>Length/ Day</u>	<u>3 Trucks (510)</u>	<u>Length/ Day</u>
1	7.5		45 m		68 m
1.5	11.6		29 m		44 m
2	17.0		20 m		30 m
1.5	23.1		14.5 m		22 m
3	30.0		11 m		17 m

Note that if haul distance is 5 km, one would need 10 trucks to obtain 500 m<sup>3</sup> of fill.

ANNEX VIIRUNOFF WATER RETENTION CAPABILITIES ASSOCIATED WITH  
ROAD IMPROVEMENTS

With an average 50 mm rainfall each year each hectare (10,000 m<sup>2</sup>) of the Guidimaka Region receives:

$$10,000 \times 0.5 = 5,000 \text{ m}^3$$

of rain water within a three-month period.

Most of this water goes to the Senegal River through runoff and oueds: besides, it washes out fertile topsoil from cultivated lands.

The idea of preventing some of this water from running off came to the members of the tracks reconnaissance team and it was thought that very simple earthworks could be devised to prevent runoff water from washing off the improved tracks, by retaining rain water and thus allowing this water to infiltrate into the ground instead of running off.

These simple earthworks should be built along the road and at the same time. They would consist eventually in small dykes following the contour lines of the terrain, about 30 to 40 cm in height, or in benched slopes.

These structures should be built in areas where the terrain is adequate--top of small catchment basins, if possible next to villages--and after a ground survey of the terrain which would allow staking of contour lines every one to five meters in elevation, according to the gradient of the slopes that will be dealt with.

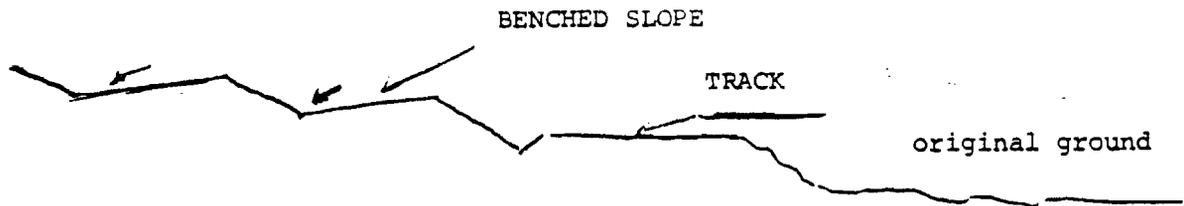
If these structures are carefully built in well-chosen areas, one can expect some positive impacts on the environment:

- o prevention of soil erosion
- o better alimentation through infiltration of the alluvial aquifers
- o through higher moisture content of the soils behind the dykes, provide land suitable for agriculture

The height and the density of these dykes should be carefully designed to prevent any overtopping of the dykes even during maximum rainfall.

151

Another way to accomplish the objectives set forth would be to bench the slopes according to the drawing below.



This design, though leading to similar results as the dykes, will require more maintenance.

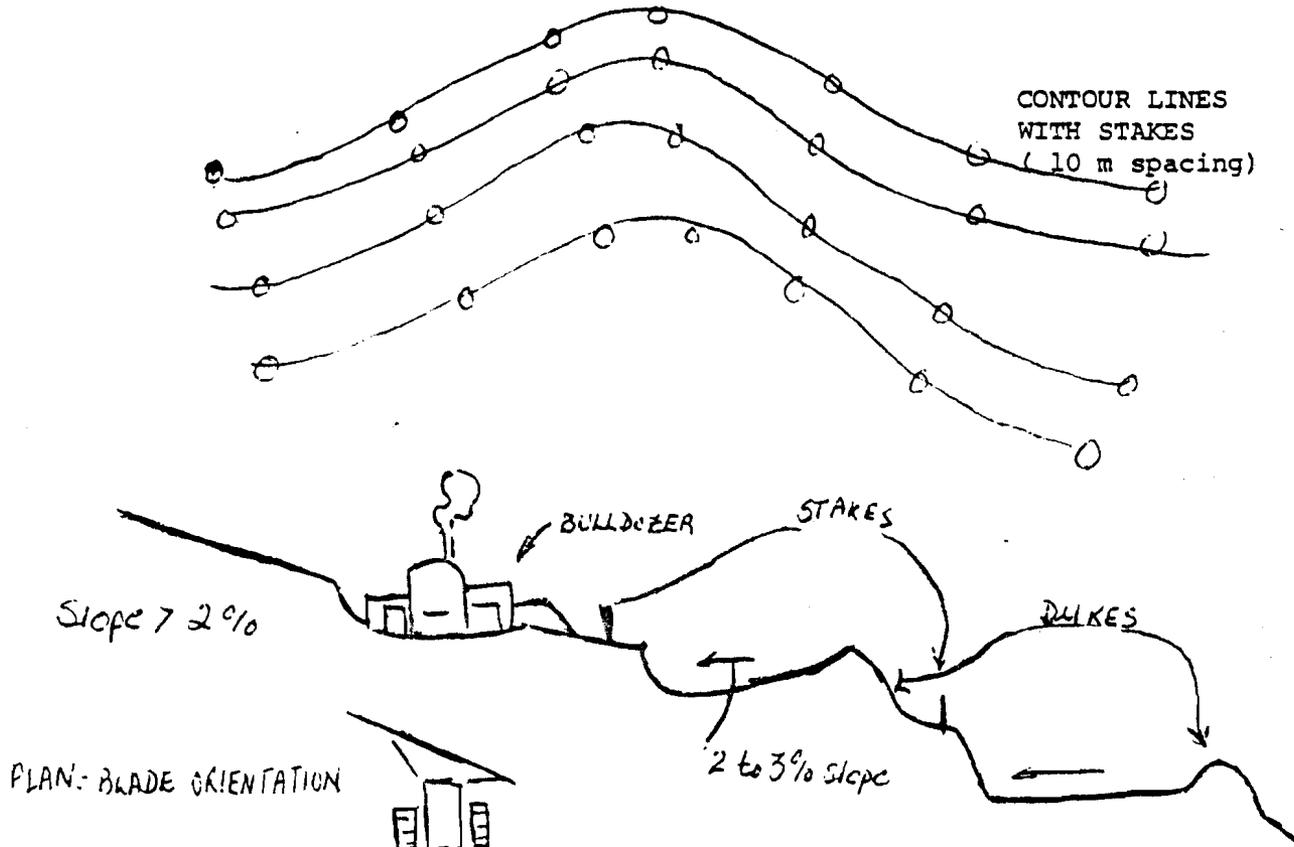
Some spots where these structures could be profitably used have been identified during reconnaissance. These are found mainly where the road is next to the crest line of the terrain.

We recommend that this type of area development being implemented along with track improvements as a pilot action which could be easily extended and replicated in other areas.

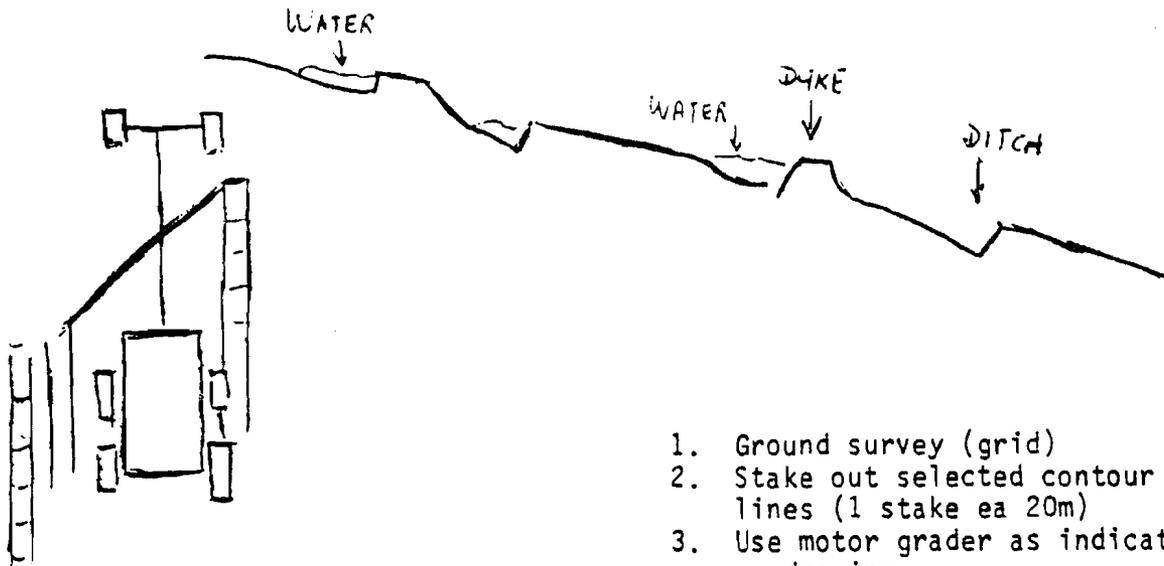
Construction of the small structures can be done partially by the heavy equipment of the brigade, partially by the villagers when the area to be developed is located next to a village. Local participation should be a requirement for initiating such development.

Another way to retain water would be to create submersible dams instead of ford crossings whenever the road or track alignment crosses a small flow.

Again this could be done only in the upper areas of the catchment basins.

TERRACE CONSTRUCTION

This work can also be performed with a motorgrader as indicated below.



1. Ground survey (grid)
2. Stake out selected contour lines (1 stake ea 20m)
3. Use motor grader as indicated on drawing
4. Hand labor will compact and level the small dyke 80 to 40 cm in height

ANNEX VIIIROADBED CONSTRUCTION PRODUCTION IN ERODABLE SLOPE AREAS

## 1. Longitudinal drainage

width of formation = w

thickness of fill = h

$$\text{average volume } V = W + \frac{(W + 8h)}{2} \times h = wh + 4h^2$$

(per metre of  
road length)

$$v = h (w + 4h)$$

ditch - depth = d

$$\text{ditched volume } D = 2 \frac{(8d \times d)}{2} = 8d^2$$

(per meter of road length)

Compaction factor - .9

$$\text{Hence: } D = 0.9V \text{ -----> } 8 d^2 = 0.9 h (w + 4h)$$

Minimum desirable value for d - 0.4 to 0.5 m, say 0.5 m -

0.6 m, therefore:

$$\frac{8 \times 0.5^2}{2} = h (w + 4h) = 2.22 \text{ m}^3 = Qi$$

$$\text{or } \frac{8 \times 0.6^2}{0.9} = h (w + 4h) = 3.20 \text{ m}^3 = Qi$$

This can be written:  $Qi - hw + 4 h^2$  or  $4h^2 + hw - Qi = 0$ 

$$h = \frac{-w \pm \sqrt{w^2 + 16 Qi}}{8}$$

W being 4, 5 or 6 meters, necessary height of fill is:

<u>W</u>	<u>h (d=0.5)</u>	<u>h (d=0.6)</u>
4	0.40	0.52
5	0.35	0.47
6	0.31	0.42

## 2. Quantities

according to previous calculations average excavation quantities are:

$$2.25 \text{ to } 3.5 \text{ m}^3 / \text{m}$$

equipment and estimated production

one may consider this work (see figure in Annex VII) being undertaken either by a heavy grader (150 HP) or by a bulldozer 150-60 to 200 HP

The grader will need as many as 20-24 passes over 100 M to complete this work.

Assuming a 100 m long section, 2 hours should be required to complete this work.

$$24 \times 100 \times 2 = 5 \text{ km first gear + positioning 2 hours}$$

One grader should be able to do 400 to maybe 500 m of road per day. Say 400m.

$$\text{No of working days/year: } 24 \times 10 \text{ mo.} \times 0.75 = 180$$

$$0.4 \times 180 = 72 \text{ km/year}$$

155

ANNEX IXTECHNICAL ASSISTANCE: DETAILED POSITION DESCRIPTION AND TASKS SCHEDULE

## 1. Highway Engineer - Project Manager

This engineer will be responsible for the effective management of field operations. He will take, after consultation with Government officials, all necessary steps to assure the proper execution of all activities of the project outlined in the work plan. He will be responsible for the administrative, technical and financial aspects of the operations of the entire brigade or construction unit. He will provide on-the-job training for his national counterpart, i.e., the District Engineer in Selibaby.

He should have a degree in Civil Engineering and be highly experienced in management of road construction operations. He should be totally fluent in French (spoken and written). His experience in management of road construction should have been acquired through 10 years of successful operations with a contractor in Francophone Africa.

## 2. Mechanics

Two mechanics with extensive experience in maintenance and repairs of road construction equipment will be assigned for the duration of the project to the rural roads construction unit.

The chief mechanic will be assigned to the base camp and will be responsible for the heavy repairs to be made on the equipment of the rural roads construction unit; he will also be responsible for maintaining an up-to-date stock of spare parts and for the proper management of this stock.

The other mechanic will be responsible for all preventive maintenance and light repairs of the equipment when used in the field.

Both mechanics will do on-the-job training of the national staff assigned as their counterparts (1 mechanic foreman and seven mechanics).

Both should have at least 10 years of experience in the maintenance and repairs of road construction equipment, if possible in Africa. They should be fluent in French and Arabic. An experience acquired with a manufacturer of heavy construction equipment or with a contractor in road construction, should be considered a must.

## 3. Field Superintendant

The superintendant should have extensive experience in earth roads construction in Sahelian countries.

He will be in charge of the earth work and structure brigades. He will work in coordination with the mechanics for equipment problems and with the project manager for logistics as well as work plans.

He will be assisted by the Chief Surveyor in the setting up of the alignment and structures. He should organize the work brigade and control the labor force as to achieve the project objectives in terms of kms built per month. He will also see to on-the-job training of the national foremen and chiefs of party assigned to the various brigades.

He should have a solid background in road construction activities and at least 5 years of experience in the management of road construction in Africa, preferably acquired with a road contractor in Africa. He should be fluent in French and possibly Arabic, with a good knowledge of all problems related to soils utilization in road construction.

4. There is the need for hydrological studies early in the project. The services of an experienced hydrologist are required to undertake the following tasks:

- conduct a hydrological survey of the project area during rainy seasons
- gather pluviometric data as available in Mauritania
- establish rainfall measurement devices in the project area
- train a local hydrologist to follow up on data gathering
- estimate flow at alignment oued crossings and recommend structure and pipe sizes
- advise on optimum alignment after field survey with Public Works project surveyor

The hydrologist should have appropriate degree training and experience. He should be fluent in French and should have 5-10 years experience, preferably in the Sahel.

ANNEX XBOX CULVERTS AND FORDS: QUANTITIES1. Box culvert quantities

$$\text{Top slab} = 0.30 \times L' \times 5.5 = 1.65 \times (L + 0.80)$$

$$\text{Bottom slab} = 0.30 \times L' \times 5.5 = 1.65 \times (L + 1.00)$$

$$\text{Walls} = (N + 1) 0.45 \times H \times 5.5 = 2.48 \times H \times (N+1)$$

$$\text{Wing walls} = H \left(1 - \frac{1}{2\sqrt{2}}\right) \times 0.30 \times \left(\frac{L+1}{2}\right) \times 4 = 0.388 (L+1)H$$

$$\text{Cut off wall} = 2 \times 0.40 \times 1.00 \times (L+1.00 + \left(\frac{L+1.00}{2} - 0.40\right) 2) = 0.80 (2L+1.2)$$

$$\text{Apron} = 2 \times \frac{3}{2} (L+1.00) \times \left(\frac{L+1.00}{2}\right) \times 0.30 = (L+1.00)^2 \times 0.45$$

Total

$$\text{slabs} = 1.65 \times (2L+1.80) = 1.65 (L+0.80) + 1.65(L+1.00)$$

$$\text{walls} = (N+1) \times 2.48 \times H$$

$$\text{wingwalls \& apron} = (L+1.00) [0.388H + 1.45 \times (L+1.00)]$$

$$\text{cut off wall} = 0.80 (2L+1.2)$$

$$\text{Concrete 400 kg} = 1.65 (L + 0.80) \times 0.40 \quad (\text{top slab only})$$

$$\begin{aligned} \text{Concrete 350 kg} &= (L+1.00) [1.65 + 0.388H + 0.45(L+1.00)] \times 0.35 \\ &+ 2.48H (N+1) + 0.80 (2L+1.2) \times 0.35 \end{aligned}$$

L = width of the culvert (inside)

N = number of cells

H = height of the culvert (inside)

All dimensions refer to figures appearing in Chapter I.

C.64

1.1 Concrete volume as function of culvert size

(Top slab and Total other)

H	L	N	Top slab (m <sup>3</sup> )	B.S	W	WW	COF	A	TOTAL Other (m <sup>3</sup> )
1.5	3	2	6.3	6.6	11.16	2.33	5.76	7.2	33.05
2	4	2	7.9	8.2	14.88	3.88	7.36	11.25	45.59
2	5	3	9.5	9.9	19.84	4.66	8.96	16.20	59.58
4	4	2	7.9	8.2	29.76	7.76	7.36	11.25	64.33
3	6	3	11.2	11.5	29.76	8.15	10.56	22.05	82.02
1	2	1	4.6	4.9	4.96	1.16	4.16	4.05	19.23
1.5	4	2	7.9	8.2	11.16	2.91	7.36	11.25	40.88

1.2 Quantities for each Type of Culvert = concrete and steel

LxH	Cement (m <sup>3</sup> )	Steel (Tons)	
		0.08 x	0.03 x
3 x 1.5	6.3x0.4+33.05x0.35 = 14.1	$\frac{0.08}{6.3}$	$\frac{0.03}{33.05}$ = 1.5
4 x 2	7.9x0.4+45.59x0.35 = 19.1	7.9	45.59 = 2.0
5 x 2	9.5x0.4+59.58x0.35 = 24.7	9.5	59.58 = 2.5
4 x 4	7.9x0.4+64.33x0.35 = 25.7	7.9	64.33 = 2.6
6 x 3	11.2x0.4+82.02x0.35 = 33.2	11.2	82.02 = 3.4
2 x 1	4.6x0.4+19.22x0.35 = 11.5	4.6	19.23 = 1.0
4 x 1.5	7.9x0.4+40.88x0.35 = 17.5	7.9	40.88 = 1.9

159

## 1.3 Wood Quantities

$$\text{Soffit} = L \times 5 = L \times 5.5$$

$$\text{Walls} = H \times 5.5 \times (N+1) \times 2 = H \times 11 \times (N+1)$$

$$\text{Wing walls} = H \left(1 - \frac{1}{2\sqrt{2}}\right) \times \left(\frac{L+1}{2}\right) \times 8 = H(L+1.00) \times 2.586$$

Assume reuse forms 3 times, wood thickness = 6.5 cm

<u>H</u>	<u>L</u>	<u>N</u>	<u>Soffit</u>	<u>Walls</u>	<u>wingwalls</u>	<u>TOTAL (m<sup>2</sup>)</u>	<u>0.022 V</u>
1.5	3	2	16.5	49.5	15.5	81.5	1.79
2	4	2	22.0	66.6	25.9	113.9	2.51
2	5	3	27.5	88.0	31.03	146.53	3.22
4	4	2	22.0	132.0	51.7	205.7	4.52
3	6	3	33.0	132.0	54.3	219.3	4.82
1	2	1	11.0	22.0	7.8	40.8	0.90
1.5	4	2	22.0	49.5	19.4	90.9	2.00

2. Quantities for standard ford crossing = (per linear meter)

Width = 5.5 m

## 1/ Concrete

slabs: 0.25 x 5.5 =	1.38 m <sup>3</sup>
cut off walls: 0.50 x 1.00 x 2 =	1.00 m <sup>3</sup>
	-----
TOTAL	2.38 m <sup>3</sup>

## 2/ Steel (Fe E 24) = mild steel

wire mesh 5.5m <sup>2</sup> / m x 1.372 kg =	7.546 kg
∅ 12 (lengthwise)= 4m x 0.882 kg =	3.528 kg
( 1=2.50 @ 33 cm) 5m x 4 x 0.882 kg=	17.640 kg
	-----
TOTAL	28.714 kg/m

3/ Gabions 3 m<sup>2</sup>/ m4/ Stone + gravels (foundation) 5 m<sup>3</sup>/m

## 5/ Joints (as required) minimum 12 meters

2.1 SUMMARY of quantities per linear Meter of ford

Concrete = 2.38m <sup>3</sup>	Say 2.4 m <sup>3</sup>
	Aggregates
	Sand
	Water
Steel = 28.7 kg	Cement 2.4 x 0.350 = 0.84 T
Gabions = 3 m <sup>2</sup>	
Stone & gravel = 5 m <sup>3</sup>	
Wood = 0.5 m <sup>3</sup>	

161

3. SUMMARY Quantities

a) Culverts (Max. 3 N), 5.5 m wide

<u>L x H(m)</u>	<u>Cement (T)</u>	<u>Steel (T)</u>	<u>Wood (m<sup>3</sup>)</u>
3 x 1.5	14.1	1.5	1.8
4 x 2.0	19.1	2.0	2.5
5 x 2.0	24.7	2.5	3.2
4 x 4.0	25.7	2.6	4.5
6 x 3.0	33.2	3.4	4.8
2 x 1.0	11.5	1.0	0.9
4 x 1.5	17.5	1.9	2.0

b) Fords, 5.5 m wide

Per linear meter:

- cement	:	0.84 T
- steel	:	28.7 kg (0.03T)
- Gabions	:	3 m <sup>2</sup>
- stones & gravel	:	5 m <sup>3</sup>
- wood	:	0.5 m <sup>3</sup>

162

ANNEX XIREFINED CALCULATIONSOF LOCAL LABOR COSTS

Personnel shall work 42 hours/week at the basic rate. Overtime will be computed as follows, but is expected only of operators and drivers, and no more than 6 hours/week. Climate does not permit excessive use of overtime.

42 hours	=	42
42 - 48 = 6 x 1.1	=	6.6
		----
		48.6

Various paid leaves should be accounted for in the total cost of labor; these are:

vacations	=	24/days/year*
legal holidays	=	9 days/year
other paid leave	=	5 days/year
Total	=	38 days/year

When dismissing employees, some compensation has to be paid, which amounts to 25% of the monthly salary, besides there is a one month notice which has also to be paid (1/12th of the annual salary). The total to be paid is then  $1/12th + 0.25 \times 1/12 = 5/48$  of the annual salary.

The annual salary will depend on the number of working days per year. From 365 days have to be deducted

52	Sundays
9	Legal Holidays
24	Vacation days
	----
85	days

This leaves exactly 280 days of work per year.

The paid leaves represent :  $38 / 280 = 0.136$

The dismissal compensation is :  $5/48 = 0.104$

Therefore these costs account for 24% of the employee salary.

---

\* But only after a full year of employment.

Employers have to pay Social Security in Mauritania; the amount which has to be paid represents 13% of the salary and benefits paid to the employee.

Table 1	<u>COST OF LABOR IN MAURITANIA</u>	
1. Employee Salary	=	S x 1.013*
2. Paid Leaves = Line 1 x 1.24	=	S x 1.256
3. Social Security = Line 2 x 1.13	=	S x 1.419
		=====

The following Table 2 gives the present official basic hourly salary for the various categories of personnel in the construction field in Mauritania. Categories go from 1 up to 6, then the following categories are foremen. (1 through M6)

HC means "Highly Qualified Labor".

---

\* Overtime rate included.

Table 2

## CONVENTION COLLECTIVE GENERALE DU 13.02.74 -

## ANNEX II

## BATIMENT ET TP

<u>Categorie</u>	<u>HOURLY RATE</u> <u>Taux horaire</u>
1A	24.47
1B	28.5
2	27.7
3A	28.0
3B	28.3
4A )	
)	
4B )	32.0
5A )	
)	
5B )	37.0
6A )	
)	
6B )	45.3
HC	47.5
M1	55.1
M2	65.7
M3	77.6
M4	84.6
M5	89.4
M6	95.4

For employees detached from TP/Nouakchott wage is 1.75 x basic S.

ANNEX XIIMATERIALS UNIT COSTS

Cost and Possible Sources (1982 prices, delivered on site)

	<u>UNIT</u>	<u>COST UM</u>	<u>SOURCE</u>
Cement	Metric tons	9,500	imported from Spain or Senegal
Reinforcement bars	Metric tons	60,000	imported from (Europe?)
Corrugated metal pipes	linear meter	5,500	imported from US or Europe
Gabion brackets	No.	1,000	imported from US or Europe
Wood	m <sup>3</sup>	21,000	imported (Senegal)?
Diesel	liter	18 (+5 TSPT)	local

166

ANNEX XIII - QUANTITY ESTIMATES: SELIBABY - GOURAYE  
Selibaby-Gouraye Inventory

PK	DRAINAGE	G	F	S	COMMENTS
0					Governor's res.
1.9	ex.CMP x 1			x	50 cm fill x 2.4km
2.1	Bridge (DAM)				3.5 m wide
3.3	RC8 culvert	x			OK condition
5.0	BC				replace
5.5	R				2 x 20 m
6.2	R				15 m
6.5	Ex.CMP x 1				
8.2	CMP x 2		x		required fill
8.4				x	
9.0	R	x			20m
9.6	R				20 m
10.0			x		50 cm fill x 500 m
10.2	R				10 m
10.6	Ex CMP x 1	x			
10.9	ex CMP x 2				damaged
11.0	ex CMP x 1				
11.7	R				20 m
12.3			x		Dyke (1 m fill) x 500 m
13.2	CMP x 1	x			
13.6	ex CMP x 1				
14.4	CMP x 3 (DAM)				
15.3	RCP culvert				OK conditon
15.4	R				2 x 25 m
18.4	CMP x 2			x	for 2.5 km
18.9			x	x	High fill/sand
19.9	Bridge (dam)				
20.3	R				20 m
22.4	Bridge (dam)			x	
24.7	CMP x 2		x		
25.3	R				2 x 15 m
26.4	CMP x 2		x		80 m dyke
27.5		x			SANBA KANDJI
27.7	CMP x 2				
27.8	BC x 2N	x			Damaged
28.6	R				20 m
29.1			x		50 cm fill x 2 km
31.3	R	x			20 m
32.4	R +CMPx 2				20 m
35.4	CMP x 2				
36.8	CMP x 2				
37.0					Mountainous
39.0			x		Begin Hood plain/change alignment
45.0					Gouraye

167

Quantities:

Repair: 3 bridges

Piers: 15

Total length: 295 m

CMP: 20 + 5 replacement = 25

Emb. and causeway:

50 cm: 8000 m = 32,000 m<sup>3</sup>

1 m: 600 m = 3,600 m<sup>3</sup>

Sand: 2000 m

Best Available Document

168

## Notes:

PK = kilometers, adjusted = Station  
EX. = existing  
CMP = Pipe  
RCP = Reinforced concrete pipe culvert  
R = Radier (ford or submersible bridge)  
G = Grading only  
F = Fill section (flood zone)  
Dyke = Fill of 1 m or more (high flood)  
S = Sand  
DAM. = Damaged  
BC = Box culvert  
BC x N: N = Number of cells

ANNEX IV - QUANTITY ESTIMATES: KAEDI - M'BOUT  
KAEDI - M'BOUT INVENTORY

PK	DRAINAGE	G	F	S	COMMENTS
0					Governor's res.
2		x			Exit urban zone
2.7			x		50 cm fill x 2 km
4.7		x			
6.5	CMP x 2		x		50 cm fill x 1 km
7.2	R			x	30 m
7.5	R		x		20 m + Fill x 500 m
8.0	CMP x 1	x			
10.8			x		50 cm fill x 4 km
13.9	CMP x 1				
14.4	R				40 m
14.7	CMP x 2	x			
16.7	CMP x 1				Borrow pit
17.1	CMP x 1				
18.8	CMP x 1				Erodable zone x 1 km
19.5					Seyene village
20.0					4 Borrow pits
20.3	CMP x 2				
21.4					Laterite borrow pit
22.0			x		50 cm fill x 1 km
23.6	R				30 m
26.4	R				80 m
27.3				x	300 m
27.5	R		x		50 m + (fill x 1 km)
27.7	R				20 m
28.7	R	x			20 m
31.7	CMP x 1				
36.3	R			x	50 m
38.1	CMP x 1	x			
38.4	CMP x 1				
40.0	R				10 m
44.5					Leqceiba village
45.7	Bridge		x		Gorgol Blanc
45.9	BRIDGE		x		Gorgol Noir
51.9	CMP x 2				Borrow
52.6	CMP x 1				
54.5	CMP x 2				
54.9			x		50 cm fill x 2 km
56.6					Rock - 200 m
57.3		x		x	Borrow
57.6	CMP x 1				
58.3	BC x 4 N (5m)				OK condition
59.7	CMP x 1				
60.3	BC x 5N				Borrow - OIL
61.3	CMP x 1				
63.6	BC x 4 N				CK condition
63.7	CMP x 1				
64.2	CMP x 1				
67.0					village
68.2	BC x 8N (5m)		x		OK condition. Protection
68.6	EX. CMP x 2	x			
70.0	R				10m
71.6					Village
72.1	3BC x 9 (5m)		x		Oued Rami
72.9	EX. CMP x 3		x		Dyke x 100 m x 1.5 m
73.0	EX. CMP x 1	x			

170

PK	DRAINAGE	G	F	S	COMMENTS
76.9					300 m
78.6	BC x 4N (5m)				OK condition
81.2	BC x 8N (6m)		x		OK Bad approaches
81.3	BC x 8N (6m)		x		OK. 100 m dyke
83.8	R				30 m
83.9	EK.CMP x 2				
84.3	BC x 8 N (6m)				OK
84.4	EK.CMP x 6				OK
84.5	BC x 8N (6m)		x		ok. 100 m dyke
87.3			x		High fill: 1.5 m x 2 km
89.4	BC x 6N (6m)	x			CK
89.9	BC x 9N (5m)				OK
90.0	BC x 9N (5m)				
91.7	BC x 8N (5m)				
93.6	BC x 8N (5m)				Damaged
93.8	BC x 12N (5m)				Seriously damaged (2N)
95.8	EK.CMP x 2				
97.9	BC BRIDGES				5 m wide. One broken. Approaches
	BC x 20 N				
97.9	BC x 12 N (5m)				Oued Kow .OKcond.
			x		800 m dyke 1.5 m H
99.0					Kow village
101.6				x	400 m
102.4	CMP x 3				Ma Wa mountains
102.7	CMP x 3				+ side ditches 300 m
103.0	EK.CMP x 2				OK cond.
104.8	Ex.CMP x 2				OK cond.
				x	Sand - 1 km
106.9	CMP x 2				
108.1	BC x 9N (5m)		x		Flood zone - 2.5 km
					fill at 1.5 m H
110.5	BC x 10N (6m)	x			Damaged (2 decks)
111.6	CMP x 2				
112.6	BC x 8N (6m)				OK cond.
112.8	BC x 12N (5m)				Damaged
				x	Sand 1.5 km
115.3	CMP x 2				
116.3	About bridge				Protection walls
118.3					Prefecture.

Quantities:

Repair: 5 structures

Fords: 11

Total length: 360 m

CMP: 36

Embankment  
and causeway: 95,000 m<sup>3</sup>

Fill at grade: 55,000 m<sup>3</sup>

Total fill: 140,000 m<sup>3</sup>

172

## Appendix D. Economic Analysis

### I Inter-Regional Road Network

An understanding of the benefits from the M'bout-Selibaby-Gouraye road can come only from analyzing the road in its regional context. The northerly east-west paved road has been completed from Nouakchott well past Kiffa to a point some 115 kilometers short of Nema. Connections between this paved road and the productive Guidimaka and Gorgol regions are frequently impassable during the four or five month rainy season. This situation reduces the export of grain surpluses to food deficit regions, discourages trade and commerce generally and impedes the effectiveness of input supply, including agricultural research and extension.

Construction has begun on paving the first link in the network from Aleg to Boghe, with European financing. Restoration of the Boghe to Kaedi road is to begin later this year under the World Bank's Fourth Highway Plan. These costs can therefore be considered sunk costs. Restoration of the Kaedi-M'bout link is being proposed for financing under the PL 480 section 206 project paper and the associated costs are included in the IRR calculations.

The computed benefits comprise a) road user savings from existing and generated traffic on the three road links, M'bout-Selibaby, Selibaby-Gouraye and M'bout-Kaedi; b) road user savings on traffic diverted from the Nouakchott-Kiffa-Ould Yenge-Selibaby road to the all-weather Nouakchott-Kaedi-Selibaby road; c) savings in storage and inventory costs on goods formerly stockpiled before the onset of the rainy season; and d) the value added from additional crop production induced because of higher farmer incomes realized through the reduction in transport costs and from guaranteed input supplies and the facilitation of agricultural research and extension activities.

#### A. Costs

One of the key conditions for USAID participation in this project is for continued use of the equipment procured by UNSO to complete the M'bout-Gouraye road. The UNSO budget for doing the road stretch from M'bout to a point 70 kilometers south is \$4.3 million; to the extent these funds are insufficient, the remainder can be drawn from the overall \$15 million UNSO project, including the Moudjeria-Tidjika road (140 kilometers) and the Kiffa-Tamchakett road (112 kilometers). The cost of the UNSO equipment was \$2.4 million. Assuming that the life of the equipment is five years and that the duration of USAID use is no more than eighteen months then the USAID depreciation thereon would be  $\$2,400,000 \div 5 \times 1.5$  or \$720,000. Per kilometer, this would equal  $\$720,000 \div 91$  or about \$8,000.

173

For the M'bout-Selibaby road completion (46 kilometers), the USAID use value of UNSO equipment would be \$320,000 during the first year. This use value on the Selibaby-Gouraye road (45 kilometers) would be \$400,000 during the second year. The use value of that fraction of the equipment used on the M'bout-Kaedi road is approximately \$200,000. The construction costs for the M'bout-Selibaby-Gouraye road are calculated at \$30,800/km in constant dollars. (See Ch. III, Engineering Analysis). The construction costs on the first road segment would thus be about \$1.42 million and on the second road segment about \$1.39 million, in constant dollars.

Additional equipment, replacements and spare parts need to be ordered, costing about \$450,000 with \$225,000 residual value in year 3. Evaluation costs for baseline data collection and for follow-up impacts totalling \$50,000 are included. Annual maintenance costs are projected at \$800 per kilometer and a refurbishing several years out at \$4,000 per kilometer. Finally, the costs of restoring some structures and their approaches on the M'bout-Kaedi road are estimated at \$2.15 million, not including the use-value of UNSO equipment, calculated in the preceding paragraph. All these costs are tabulated in the attached table.

B. Benefits - Road User Savings From Existing and Generated Traffic on M'bout-Selibaby, Selibaby-Gouraye and M'bout-Kaedi Roads

Estimates of existing traffic levels were made based on 1981 project design team counts, discussion with local people and on examination of customs and police records by the 1982 design team. Without the project, traffic is assumed to grow by 1.5% per year, exclusive of commodity traffic by state agencies and of projected cereal traffic from the Fom Gleita irrigation project for which user savings are separately calculated.

With the road project, traffic is assumed to triple immediately and increase by 3% per year thereafter or an additional 1.5% per year in comparison to the situation without the road project. (This is in line with experience after the St. Louis to Matam road in Senegal was completed.) Valuing the benefit from traffic generated by an improved road is difficult since such traffic involves costs as well as benefits. A rule of thumb in transport economics is to value the benefit at one half of the generated traffic's road user savings. The rationale for this division is that the 50% of road user savings for generated traffic is a "road users' surplus". This surplus, a benefit of road improvement, is that part of road user savings which could be taken away without reducing road use by the generated traffic.

The following chart presents a graphic explanation. Without the project, high road costs (RC) lead to limited use of the road at traffic volume (TV<sub>1</sub>). Following the project, road costs will be greatly reduced to RC<sub>2</sub> providing an incentive for traffic volume to expand to TV<sub>2</sub>. The benefit for the generated traffic (i.e. the "road users' surplus") is thus the triangle ABC under the demand curve, and is equivalent to 50% of total savings for generated

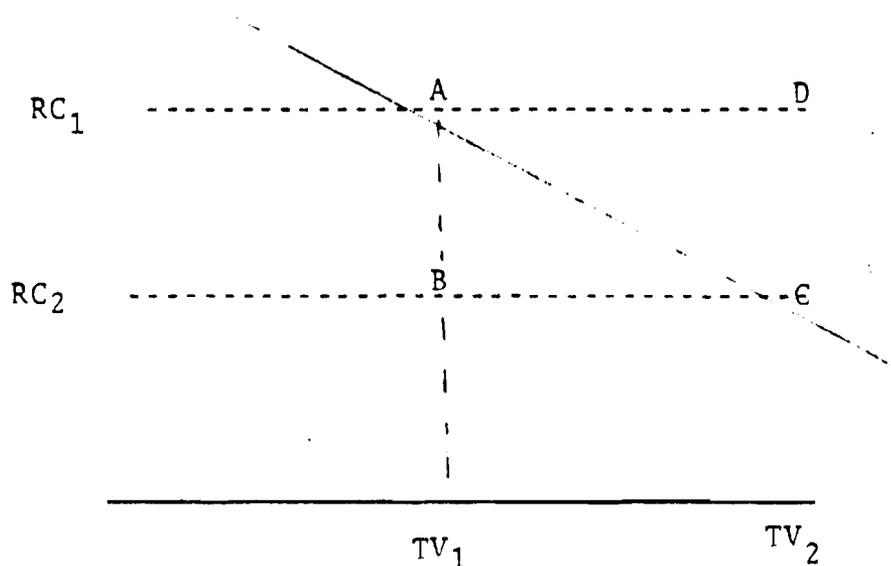
174

TABLE D.1  
COSTS (\$000)

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A. Fixed Costs														
1. Equipment	450		-225											
2. Evaluation	25	0	25											
3. Total	475	0	-200											
B. M'bout-Selibaby (46 km)														
1. Use value of UNSO OPE Equipment	320													
2. Construction @ 30,800/km	1420													
3. Maintenance (116 km)	0	90	90	90	90	90	464	90	90	90	90	90	90	90
4. Total (1+2+3)	1740	90	-110	90	90	90	464	90	90	90	90	90	90	90
C. Selibaby-Gouraye (45 kms)														
1. Use value of UN equipment	0	400												
2. 30,800/km	0	1386												
3. Maintenance	0	0	36	36	36	36	36	180	36	36	36	36	36	36
4. Total (1+2+3)	0	1786	36	36	36	36	36	180	36	36	36	36	36	36
D. M'bout-Kaedi														
1. Use value of UN equipment		200												
2. Total including equipment and Technical Asst.		2150												
3. Maintenance	0	0	92	92	92	92	92	92	660	92	92	92	92	92
4. Total (1+2+3)	0	2350	92	92	92	92	92	92	660	92	92	92	92	92
E. Total Costs	2215	4226	8	218	218	218	590	362	786	218	218	218	218	218

D.3

175



traffic is equivalent to the user savings from existing traffic during the first year after project completion).

The cost savings per kilometer using different road surfaces have been calculated on the basis of figures appearing in 1978 BCEOM/GIRM report\*. These estimates after being multiplied by 1.61 to represent five years of intervening inflation at 10% per year appear below (in UM):

	asphalt	earth			
		excellent	good	mediocre	bad
taxis	10.85	12.01	14.54	16.49	18.45
trucks	34.57	45.63	56.0	67.41	82.28

The user savings on each road per journey is derived by subtracting costs on excellent road surfaces from cost on bad road surfaces as follows:

M'bout-Selibaby

Without project - With = Savings

\* BCEOM Mission report to the GIRM, Flux et Transport en Mauritanie (Paris, Lamarre Valois International Ltd. June 1978). The carrying capacity of the taxi or pick-up is 500 kilograms; truck about 10 tons.

176

			<u>UM</u>	
taxis	112 x 18.45 = 2066	x 12.91 = 1446	620	\$12
trucks	112 x 82.28 = 9215	x 45.63 = 511	4104	\$82

Selibaby - Gouraye

taxis	45 x 18.45 = 830	x 12.91 = 581	249	\$ 5
trucks	45 x 82.28 = 3703	x 45.63 = 2053	1650	\$33

Kaedi - M'bout

taxis	115 x 18.45 = 2122	x 12.91 = 1485	637	\$13
trucks	115 x 82.28 = 9462	x 45.63 = 5248	4214	\$84

The user savings on existing and generated traffic by road segment can now be calculated as follows:

<u>M'bout-Selibaby</u>	<u>(\$000)</u>
2 taxis x 270 days/year x \$12=	7
2 trucks (10 ton) x 270 days/year x \$82=	44
	-----
	51
 <u>Selibaby - Gouraye</u>	
3 taxis x 65 days/year x \$5=	5
1/3 truck x 365 days/year x \$33=	4
	-----
	9
 <u>M'bout-Kaedi*</u>	
6 taxis x 270 days/year x \$13=	91
4 trucks x 270 days/year x \$84=	21
	-----
	112

These total figures are used in the attached road user savings benefit tables for existing and generated traffic with one exception, that for the existing traffic on the M'bout-Selibaby road. Here, the savings are calculated for the the USAID constructed portion alone (42 kilometers):

\* Impressionistic evidence, no road count available. Road is

177

42/112 x 51 = 19. The savings on the generated traffic remains at 51 since no traffic generation takes place until the entire road network is completed.

Three additional categories of road user savings on these road segments remain to be treated. Dryland, small dam and small-scale irrigated production, when marketed, will be transported in small pick-up vehicles or "taxis", whose traffic growth without the road and generation with the road have already been picked up in the growth rates discussed earlier. But transport of SONADER imports to the Fom Gleita irrigation project and the transport of large-scale production from the irrigation project need to be included in the benefit stream. The BCEOM and IBRD reports assert that each hectare of irrigated production requires 800 kilograms of agricultural inputs (including fuel for pumps) per year. The Fom Gleita project operating to full capacity will bring 3,600 hectares of land into production. This may be reached in stages as follows:

Year 2: 600 ha. Year 3: 1200 ha. Year 4 1800 ha.

Year 5: 2400 ha. Year 6 3000 ha. Year 7 3600 ha.

With a savings of \$84 per journey by a 10-ton truck each way, the benefits starting in year 3 with road completion are as follows (in \$000):

16, 24, 32, 40 for years 3-6; and 48 for year 7 and thereafter.

The Fom Gleita project will eventually produce about 16,000 tons of milled rice per year, of which assume 70% will be marketed. Assume 1/3 of the marketings move from M'bout to Kaedi and 1/6 from M'bout to Selibaby. Then the peak deliveries, reached by year 7, will be as follows:

$16,000 \times .70 = 11,200 \times 1/3 = 3696$  for Kaedi

$\times 1/6 = 1848$  for Selibaby\*

The benefits would be calculated using the user savings of \$84 and \$82 per trip respectively and multiplying by 1.5 (assuming that half of the trucks will receive full return loads on the average). The benefits would then be as follows:

-----

\* There is some disagreement within the design team and with the OMVS economist as to the likelihood of this traffic to Selibaby in view of the surplus production planned at Gouraye. The total calculations are not affected by this disagreement since otherwise the additional sixth of Fom Gleita production can be presumed to go to Kaedi.

178

D.7

	<u>M'bout-Kaedi</u>	<u>M'bout-Selibaby</u>
Year 3	1232--15	616--8
Year 4	1848 23	924 12
Year 5	2464 30	1232 15
Year 6	3078 38	1540 19
Year 7	3696 45	1848 23

(and subsequently)

The figures 15 to 45 and 8 to 23 appear in the attached table on lines C5 and 4 respectively.

179

## ROAD USER SAVINGS (\$000)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A. M'bout-Selibaby														
1. Existing traffic (1.5% growth p.a.)			19	19	20	20	21	21	22	22	23	23	24	24
2. Generated traffic (1.5% growth p.a.)			51	52	53	53	54	55	56	57	58	58	59	60
3. Total 1 and 2			70	71	73	73	75	76	78	79	81	81	83	84
4. Gorgol rice to Selibaby			8	12	15	19	23	23	23	23	23	23	23	23
5. Total 3 and 4			78	83	88	92	98	99	101	102	104	104	106	107
B. Selibaby-Gouraye														
1. Existing traffic (1.5% growth p.a.)				9	9	9	10	10	10	11	11	11	12	12
2. Generated traffic (1.5% growth p.a.)				9	9	9	10	10	10	11	11	11	12	12
3. Total 1 and 2				18	18	18	20	20	20	22	22	22	24	24
C. M'bout-Kaedi														
1. Existing traffic (1.5% growth p.a.)			112	114	115	117	119	120	122	124	126	128	129	131
2. Generated traffic (1.5% growth p.a.)			112	114	115	117	119	120	122	124	126	128	129	131
3. Total 1 and 2			224	228	230	234	238	240	244	248	252	256	258	262
4. SONADER inputs to Gorgol			16	24	32	40	48	48	48	48	48	48	48	48
5. Gorgol Rice to Kaedi			15	23	30	38	45	45	45	45	45	45	45	45
6. Total 3,4 & 5			255	275	292	312	331	333	337	341	345	349	351	355

180

iii) Benefits from Diverted Traffic

Much of the present traffic to Selibaby and Gouraye, especially during the rainy season, now goes via Kiffa. The route from Aleg through Kiffa and Ould Yenge is a distance of 574 kilometers compared to a distance of 407 kilometers from Aleg through Boghe, Kaedi and M'bout. The third route presently utilized is through Kiffa and M'bout, a distance of 671 kilometers. Though the longest route, it has presently the best road surface and is passable to M'bout except after the heaviest rains. An alternative on the Kaedi-Selibaby segment via M'bout is via Maghama instead. With the road improvements planned under this project some of the present traffic Nouakchott-Selibaby via Kiffa would be diverted to the road network through Kaedi. The user savings through traffic diversion can be calculated as follows:

1. General Traffic

Without Project ( in UM )

Aleg-Kiffa (paved)	- 344 kilometers
Taxi 10.85	3,732
Truck 34.57	11,892
Kiffa-Kourandjel (good)	45 kilometers
Taxi 14.54	645
Truck 56	2,520
Kourandjel - Ould Yenge (mediocre)	109 kilometers
Taxi 16.49	1,797
Truck 67.41	7,348
Ould Yenge - Selibaby (bad)	76 kilometers
Taxi 18.45	1,402
Truck 82.28	6,253
Total taxi	7,585
truck	28,013

With Project ( in UM )

Aleg - Boghe (paved)	70 kilometers
Taxi 10.85	760
Truck 34.57	2,410
Boghe - Kaedi - M'bout - Selibaby (excellent)	
	110 + 115 + 112 = 337 kilometers
Taxi 12.91	4,350
Truck 45.63	15,377
Total taxi	5,110
truck	17,796

181

User savings (without less with) are thus equal to 2,475 UM (\$50) for taxis and 10,217 UM (\$204) for trucks.

We can now calculate the user savings on the diverted traffic for cereal imports, agricultural inputs and for other traffic.

## 2. Cereal Imports

Cereal imports currently brought into Selibaby by the CAA and OMC total about 870 tons and by SONIMEX about 1200 tons. This traffic representing 207 trucks would progressively be eliminated over the next six years with the large increase expected in local agricultural production. The user savings would be as follows: ( In \$000 thousand)

Year 1	207 x 2 (return trip) x \$204
Year 2	170 x 2 x 204

(no diversion savings since road network not yet completed)

Year 3	135 x 2 x 204 = 55
Year 4	100 x 2 x 204 = 41
Year 5	70 x 2 x 204 = 29
Year 6	35 x 2 x 204 = 14

## 3. Agricultural inputs

Gouraye presently has over 300 hectares in production, with plans to increase to about 1,500 hectares in five years and to 3,000 hectares in ten years. Assuming as before for Foug Gleita that agricultural inputs are about 800 kilograms per hectare per year, then the diversion savings on this trade with 10-ton trucks are as follows:

Year 1	300 x 800 x 2 (return trip) x \$204
Year 2	600 x 800 x 2 x 204

(no diversion savings since road network not completed)

Year 3	900 x 800 x 2 x 204 =29
Year 4	1200 x 800 x 2 x 204 =39
Year 5	1500 x 800 x 2 x 204 =49
Year 6	1800 x 800 x 2 x 204 =59
Year 7	2100 x 800 x 2 x 204 =69
Year 8	2400 x 800 x 2 x 204 =78
Year 9	2700 x 800 x 2 x 204 =88
Year 10	3000 x 800 x 2 x 204 =98

The user savings from the projected road improvements on the Selibaby-Gouraye road are \$33 per trip so that starting in year 4, this savings on this trade can be added to the above figures as follows ( in \$000):

182

Year 4-6, year 5-8, year 6-10, year 7-11, year 8-13, year 9-14, and year 10 and subsequently 16.

#### 4. Other traffic

Traffic additional to grains imports which might be diverted with the projected road improvements might be evaluated as follows (in \$000):

1/2 trucks x 100 days/yr x \$204	= 10
1 taxi x 100 days/year x \$50	= 5
Total	15

The 100 days above represent rainy season traffic which currently must go by way of Kiffa in the rainy season, since the M'bout-Selibaby road is flooded. During the dry season, traffic routes chosen depend upon intermediate cargoes as well as perceived differences on road qualities and lengths. Thus the extent of diversion during the dry season for other traffic is difficult to estimate. An alternative scenario was constructed, for calculation of a second IRR, based on an optimistic assessment of traffic diversion during the dry season. This scenario assumes that 100% of year-round private Nouakchott-Kiffa-Selibaby traffic would be diverted to the Nouakchott-M'bout-Selibaby road. This traffic is comprised of:

1.5 trucks x 365 days/year x \$204	= \$111.7
2 taxis x 365 days/year x \$ 50	= 36.5

Total: \$148

It was also assumed for this alternative scenario that Nouakchott-Selibaby traffic, would triple, following road network completion and grow 3% p.a. (rather than 1.5% p.a. without the project). The savings for this generated traffic would add an additional \$148,000 to benefits in year 3.

183

TABLE D.3

## ROAD USER SAVINGS FROM DIVERTED TRAFFIC (\$000)

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14
II. Nouakchott-Selibaby														
1. Cereal imports	0	0	55	41	29	14	0	0	0	0	0	0	0	0
2. SONADER inputs for Gouraye	0	0	29	45	57	69	80	101	102	114	114	114	114	114
3. Other diverted traffic	0	0	15	15	16	16	17	17	18	18	19	19	20	20
4. Total 1 & 2 & 3	0	0	99	101	102	99	97	118	120	132	133	133	134	134
5. Total Road User savings (4+ all previous benefit tables)	0	0	432	477	500	521	546	570	578	597	604	608	615	620
6. Alternative scenario: private traffic savings from diverted and generated Nouakchott-Selibaby traffic = \$296,000 in year 3, rather than \$15,000 in item 3 above														
a) diverted traffic savings for non-state-agency traffic			296	302	306	310	314	318	324	328	334	340	345	350
b) total user savings			713	764	790	815	843	871	884	907	919	929	940	950

128

D. Savings in storage and inventory costs.

Because M'bout and Selibaby are inaccessible during much of the rainy season, state agencies and presumably private traders must stock materials to last until roads become passable at the end of the rains. Based on knowledge of state agency stocks, estimates were made of storage costs and inventory carrying costs (at 7% capital cost) which will not be incurred once an all-season road network is in place.

A 400 m<sup>2</sup> warehouse in Selibaby rents for approximately 2000 UM/month. Total - 8000 UM = \$160 = \$0.40/ton/month. Due to progressive in-flows and outflows from May to November, assume average storage is 3.5 months.  $\$0.40 \times 3.5 \text{ mo.} = \$1.40/\text{ton}$ . SONIMEX currently stores 3000 T in rainy season.  $3000 \text{ T} \times \$1.40 = \$4,200$ .

Assume SONIMEX represents half the rainy season storage by all traders and agencies in Selibaby. Total storage savings in Selibaby due to the road would then be  $4200 \times 2 = \$8,400$ .

Assume the average value of capital tied up in a ton of material is \$200, and that the opportunity cost of capital is 7%/year, the opportunity cost of capital for the 3.5 month storage period is  $3.5 \div 12 \times .07 = .02$ .  $3,000 \text{ T} \times \$200/\text{T} \times .02 = 12,250$ . Double this for stocks carried by other agencies and traders - \$24,500.

Total Selibaby inventory and storage savings (beginning in year 4 with completion of full road network) =  $\$24,500 + 8,400 = \$32,900$ .

M'bout

Assume that storage and inventory costs are  $\frac{1}{2}$  those in Selibaby = \$16,450:

$$12,250 + 4,200 = \$16,450$$

Gouraye

Plenty of idle storage space appears to exist and anyway access from Senegal is possible during the winter. We have therefore decided to omit any calculation of storage and inventory savings in Gouraye.

The storage and inventory savings are portrayed in the attached table.

185

SAVINGS IN STORAGE & INVENTORY

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Kaedi-M'bout Road														
1. M'bout storage			4.2	4	4	4	4	4	4	4	4	4	4	4
2. M'bout Inventory			12.3	12.3	12	12	12	12	12	12	12	12	12	12
3. Total (1+2)			17	17	17	17	17	17	17	17	17	17	17	17
Kaedi-M'bout-Selibaby Road														
1. Selibaby storage			8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
2. Selibaby inventory			24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5
3. Total (1+2)			33	33	33	33	33	33	33	33	33	33	33	33
Total			50	50	50	50	50	50	50	50	50	50	50	50

D.14

1/25

### E. Production Incentives

The main purpose of most USAID activities in Mauritania is to help bring about substantial increases in the production of foods. The existence of an all-weather road network into Guidimaka would guarantee the timely receipt of needed seeds, tools, fertilizer, and other inputs and make much more possible agricultural extension activities throughout the year. Road user savings for inputs and on roads toward such food deficit areas as Kiffa would raise the effective price received by farmers for their crops and hence enlarge the farmer's purchasing power. This enhanced purchasing power combined with more dependable delivery of inputs and greater contacts with agricultural extension workers should constitute substantial incentives for increased food production.

Although there is no satisfactory way to quantify this essential benefit of production incentives, some suggestive orders of magnitude can be given. The present and future market for Guidimaka food surpluses is primarily the Kiffa area. Exports from Guidimaka can be considered to center around Selibaby; exports from Gouraye will be further away, but from around M'bout much nearer. The present transport cost from Selibaby to Kiffa is approximately 1.5 UM per kilogram over a distance of 307 kilometers. The first section of the Kiffa-M'bout road of approximately 40 kilometers was restored by the GIRM in 1980 pursuant to an explicit undertaking to the World Bank in connection with the Bank's approval of financing for the Fom Gleita project; we understand that the remaining 155 kilometers will be completed by the GIRM during the next three years. This restoration work combined with the completion of the M'bout-Gouraye road should lower average marketing transport costs by some 0.6 UM per kilogram. A similar savings might be calculated as possible for Gorgol production through the restoration works on the Kaedi-M'bout road.

GIRM statistics on present food production are notoriously understated; the actual production in reasonably good recent years in Guidimaka and Gorgol might have been 15,000 and 20,000 tons respectively. Our surveys of prices received by producers in the Guidimaka region indicate that the low received from merchants just after the harvest is 8 or 9 ouguiyas per kilogram and the high about 15 or 16. The OMC purchase price covering only a small portion of the harvest is 13. The average year-round producer price is thus probably 12 ouguiyas per kilogram. According to the 1982 PL 480 Section 206 project paper, the economic producer price in Mauritanian surplus producing areas is UM 15.5 per kilo and the agreed GIRM/USG policy is moving in that direction. It is expected that before 1984 15.5 UM will be the price farmers receive at farmgate. The PL 480 project paper also calculated that the value added of crop production under improved technology net of the opportunity cost of labor, other production costs, and transportation costs is about 35%. Making the heroic assumption that the road network affects half the production areas in the Guidimaka and Gorgol regions, that road user savings are passed on in their entirety to crop producers, and that the producer supply elasticity is one, we have the following calculation for the value of the production incentive due to the lower costs of marketing surplus produce:

187

$$35,000 \text{ tons} \times \frac{1}{2} \times 15,500 \text{ UM} \times \frac{0.6 \text{ UM}}{15.5} \times 0.35 = 3,675,000 \text{ UM}$$

or \$73,500

This calculation captures only a small portion of the production incentives attributable to the completion of the road network. Omitted entirely in the reduction in costs of agricultural inputs and consumer goods which raises the farmers' purchasing power with perhaps as great an effect as the savings on marketing costs. The improved roads may also make the trucking industry so competitive as to shave trucking margins and further increase transport savings passed on to farmers. The combined supply response on both the input and output sides to these two additional factors as well as to the factor analyzed earlier might be worth twice \$73,500 per year, or \$147,000.

What is still omitted is the effect of guarantees of timely arrival of input supplies whenever needed and the facilitation of agricultural research and extension activities. The price of certain inputs such as seeds and spare parts for pumps is not a hindrance to their use in continuing an agricultural production chain; rather long delays in arrival because of the impassability of roads during the rainy season are often the key constraint in meeting production targets. Some good agricultural research has been undertaken at Kaedi and the Integrated rural development project at Selibaby. Yields could rise significantly throughout the Gorgol and Guidimaka if these research results could be disseminated widely. Such dissemination through more frequent visits by agricultural extension agents will be facilitated through improved roads. Also aiding production increases will be more dependable access to social and administrative services such as clinics and schools. Quantification of this production incentive arising from dependability of receipts of inputs and from the facilitation of agricultural extension activities is difficult, but neglecting to do so might omit the most important benefit of all. Within the next dozen years, the Fom Gleita and Gouraye perimeter will be producing about 33,000 tons of cereals (3,600 x 5 + 3,000 x 5). GIRM and donor efforts may succeed in raising the current production of the drylands parts of the Gorgol and Guidimaka regions from 35,000 to 60,000 tons during the same period. By far the greater factors in these increases will be the investments in agricultural facilities and in the higher producer prices received (both as a result of GIRM/USAID policy\* and from the effect of road user savings already captured). A small factor behind the increases will be the effect of improved roads on guaranteed input supply and better extension. Another way to visualize the benefit is to assume that the production increases planned for certain years might actually be delayed by a year or two for lack of all-weather roads. If we award this factor 10% of the benefits (a certainly conservative enough assumption but taking into account also that the improved roads may only impact on half of the drylands production), then

\* In 1981, the GIRM took the dramatic step of increasing producer prices from 8 to 13 UM per kilogram and further smaller increases are planned on a gradual basis to achieve a farmgate price of 15.5 UM based on import parity.

188

the peak benefit from this factor will be as follows:

$$58,000 \text{ tons} \times .10 \times 15,500 \text{ UM} \times 0.35 =$$

$$\text{UM } 31,465,000 = \$629,000$$

This peak benefit from the benefits of guaranteed input supply and better extension may be staggered gradually as follows from years 3-14 (in \$000): 50,90,130,175,220,270,320,375,430,490,545 and 620. We can now add to these figures the annual figure previously calculated as that part of production incentives attributable to supplier response to user savings on inputs and marketing costs (\$147,000): 173\*\*, 237, 277, 322, 367, 417, 467,522, 637, 692, and 776.

Assuming that the proportion of the production incentive attributable to the individual road link is roughly equivalent to the road length we can distribute the benefit stream as follows (total length - 272 kilometers):

M'bout-Selibaby ( $\frac{112}{272}$ ): 85,98,114,133,151,172,192,215,238,262,285 and 320.

Selibaby-Gouraye ( $\frac{45}{272}$ ): 0,39,46,53,61,69,77,86,95,105,114, and 128.

M'bout-Kaedi ( $\frac{115}{272}$ ): 88,100,117,136,155,176,198,221,244,270,293, and 328.

These calculations are entered on the attached sheet titled Production Incentives. The benefit streams for road user savings from existing, generated and diverted traffic, for savings in storage and inventory costs and for crop production incentives are combined in the page following. This page also contains the net benefits after deducting the cost data from table D.1. The IRR for this road network project is .5%

Due to the somewhat speculative nature of attempts to quantify the effect of a better road network on increases in production, a second scenario was constructed for increased production. This scenario quantifies only the supply response to increased farmgate price, ignoring the response to more effective extension, timely input supply, and increased purchasing power of rural producers (due to reduced costs of inputs and consumer goods). A slightly higher financial transport savings/kg is calculated, .8 um/kg (based on an average transport distance of 45 km, savings/vehicle trip = 400 UM, spread over 500 kg per vehicle). This scenario uses a RAMS small-scale rice production budget, (RAMS #552, p.59) with labor valued at 80/UM/days to assess increased production. Again, an average farmgate price of 15.5 UM/kg is assumed to rise by the full amount of the price. With supply elasticity of unity, and half the production area in Guidimaka and Gorgol affected, supply would increase  $.052 \times 35,000 \times \frac{1}{2} = 910 \text{ T}$ .

---

\*\* Supplier response on Selibaby-Gouraye road only begins during year 4.

In this alternative scenario, the increased production is valued at cereal import parity price plus internal distribution to a deficit area, less transport from Guidimaka or Gorgol, less production costs. Enger's 1981 PL 480 report calculates import parity plus internal distribution costs at 22903 UM/T. Transport costs from Guidimaka or Gorgol to deficit areas might average 45 km over the regions' new good roads plus an additional 100 km over tracks and bad roads. Transport costs would thus be  $(45 \text{ km} \times 12.91 \text{ UM/km} \times 2)$  (since each small vehicle would carry approximately  $\frac{1}{2}$ T)) plus  $(100 \text{ km} \times 16.49 \text{ UM/km} \times 2) = 4460 \text{ UM}$ . Production costs for 5 T paddy (=3.25 T milled rice) = 37126.  $37126 \div 3.25 = 11423 \text{ UM/T}$ . Total value of 1 ton increased production =  $22903 - 11423 = 7020 \text{ UM/T}$   $\div 50 = \$140/\text{T}$ . So total benefit is  $140 \times 910 = \text{Approx. } \$126,000$ . This alternative scenario's benefits were combined with the "optimistic" scenario for diverted traffic and road user savings. A second IRR was calculated, also 5%.

PRODUCTION INCENTIVES TABLE D.5.  
(\$000)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
G. Increased Production														
1. M'bout-Selibaby	0	0	85	98	114	133	151	172	142	215	238	262	285	320
2. Selibaby-Gouraye	0	0	0	39	46	53	61	69	77	86	95	105	114	128
3. M'bout-Kaedi	0	0	88	100	117	136	155	176	198	221	244	270	293	328
Total (1+2+3)	0	0	173	237	277	322	367	417	467	522	577	637	692	776

COSTS AND BENEFITS (SCENARIO 1)

Table D.6.

(\$000)

<u>Year</u>	<u>Costs</u>	<u>Benefits</u>	<u>Net Benefits</u>
1	2215	0	2215
2	4226	0	-4226
3	8	655	647
4	218	764	546
5	18	827	609
6	218	893	675
7	590	963	373
8	362	1037	675
9	786	1095	309
10	218	1169	951
11	218	1231	1013
12	218	1295	1077
13	218	1357	1139
14	218	1446	1228

IRR= .5%

192

APPENDIX E: SOCIAL SOUNDNESS ANNEX

J. Grayzel, USAID Behavioral  
Science Advisor

	<u>CONTENTS</u>	<u>Page</u>
I.	Introduction	E.1
	A. The Guidimaka as a Development Anomaly	1
	B. Background to Social Analysis	1
	C. The Problem of Quantification versus Constraints	2
II.	The Basic Social Landscape:	3
	A. The Guidimaka's Potential Vis-a-Vis the Rest of Mauritania	3
	B. The Soninke (Sorakolle) Culture as Mauritania's Most Productive Agricultural System	4
	C. The Distribution of Power, Rights and Duties Within the Community	4
	D. The Tremendous Attachment of the Soninke to Their Region and Culture	5
	E. Male Outmigration and Labor Availability	6
	F. Women and Children as Predominant Labor and the Threat of Increasing Female Outmigration	8
	G. Other Groups of the Guidimaka: The Bidan, Fulbe, Toucouleur and Haratin	9
	H. Projecting Forward by Looking Backwards and Around	11
III.	Regional Social Structure and the Distribution of Power	12

193

IV. Roads in Particular	E.13
A. The Present Transportation Situation	
1. Vehicle Traffic	
2. Animal Traffic	
3. Pedestrian Traffic	
4. Boat Traffic	
B. The Question of Construction	1 5
C. The Question of Maintenance	1 6
V. Summation:	1 6
A. Scenario I - If Project Is Done	1 7
B. Scenario II - If Project Isn't Done	

194

## I. Introduction:

### A. The Guidimaka as a Development Anomaly

In a land of minimal rainfall, the Guidimaka is Mauritania's wettest area; in a nation dominated by pastoralists who generally view agricultural labor as degrading, the majority of its population of both sexes and all ages are reared to see agricultural labor as the sine qua non of family unity and survival. It is also a region whose sons are taught to equate willingness to travel with manhood; who have amassed centuries of cumulative experience as workers in the cities of France, and who send home appreciable amounts of earnings to support family and community. Yet, at the same time, it is an area of stagnant agricultural production, no systematic regional marketing structure and annual isolation between its parts and from other regions due to the lack of minimal all-weather transportation facilities.

One can simply view the region as an underdeveloped region of the Third World. Given such a view, one sees a localized system that operates with established internal consistency but whose productivity is insufficient to meet new needs and aspirations and therefore needs amelioration. A more accurate view, however, is to realize that the region's population contains a highly productive and, in many cases, fairly skilled labor force well adapted to and already intermeshed with modern industrial civilization. The problem is that the region's most productive labor is not its own, but is in other countries and overseas. As a result, the home communities are deprived both of much of the productive labors of their men as well as the secondary inputs such as roads, health facilities and commercial outlets that service the areas where they work. In the end, the greatest sufferers are the women and children who wait at home. In this respect, the situation is akin to areas of southern Africa or Appalachia - areas of "isolation poverty" - where improvement in both basic living standards and productivity is largely dependent on more egalitarian two-way links being developed between the hinterlands and the greater political entity they serve, and with areas receiving an adequate share of inputs in terms of services and development as part of the compensation for the expatriate labor they supply.

In the case of the Guidimaka, this isolation, as with any hinterland, is geographic as well as social and economic. Paved roads are not necessary, but minimal year round access is. Such access alone will not solve the area's problems, but such access is a condition precedent to any other inputs flowing in adequate quantity, with regularity, and at the appropriate time. It is a first step that must be followed by others if a final goal is to be reached, but it is the first step, and by definition must precede the others.

### B. Basis of this Analysis

The Guidimaka has been a long-ignored area not only developmentally, but in terms of basic interest and research per se. With the exception of St. Pierre's 1925 book "The Sarakolle of the Guidimaka," there is no significant work of original research. In 1977, the British Voluntary

Service "War on Want" published an excellent review of the situation and thereafter established a project along the river directed by Luce Ferrier, who had studied Soninke workers in France and who has, as part of the present project, begun meticulous production studies which, unfortunately, are not yet ready for analysis except on an ad hoc basis. The same is true of the USAID Integrated Rural Development Project, whose Chief of Party, Max Goldensohn, is an anthropologist who did his dissertation in Mauritania. The PID Social Analysis for the immediate project in question was done by Steve Reyna, the REDSO/Anthropologist, who was chosen because of previous investigations he had done in the region. The USAID Rural Assessment and Manpower Study has also provided preliminary data on the present day demography and economics of the area. I have drawn heavily on all the above to supplement my own experience gained from four trips over the last two years to the area. None of these sources bear any responsibility for any mistakes I may be shown to have made, but they do deserve credit for any insights. To the best of my assessment, they are in harmony with the situation as I shall present it. Steve Reyna's report, in particular, so well sums up the basic background, that it should be consulted in addition to this present analysis for greater background. As a result, my own efforts are directed to providing summary background data and otherwise to concentrate on specific questions that seem of direct relevance in the design of the proposed project.

### C. Quantification Versus Constraints

Prior to its independence in 1960, Nouakchott, Mauritania's present capital, was a village of approximately 500 people. After careful analysis, assessment and projection, a city that could adequately house an eventually estimated population of 8,000 by 1970, 16,000 by 1982, was established between the sea and a series of moving dunes that placed limits on its capacity to grow. Today its estimated population is around 200,000 and people inhabit potential flood areas along the coast, shifting sand dunes, and are expanding south and east along its national highway, as a testimony not only to the foibles but also the social irresponsibility of unjustifiable attempts to quantify the unknown.

"Demographers usually group models of population growth under two headings: mathematical models and component models.... further subdivided according to whether the growth is conceived of as unconstrained or constrained. Models of unconstrained growth are simplest, almost of definition, since it is not necessary to build the constraints into the model. They tend to be based on exponential curves depending only on the initial population size, time and the "intrinsic" rate of growth. Cultural ecologists and ecologically-minded human biologists have generally rejected this model.... Human ecologists... generally recognize that population growth is constrained; this is expressed in various ways, but the phrase which most often epitomizes these constraints is carrying capacity.... Carrying capacity is not a simple constant, but a function of environmental, technological, and social variables, each of which is subject to change."

H. Schacht, "Two Models of  
Population Growth"  
AA vol. 82 No. 4, 1981

196

Mauritania has shown itself over the last 20 years to be the example par excellence of a constraint model of population growth in terms of settlement location. Its highly mobile population appears capable of responding almost immediately to changes in the extent and location of four basic factors; food, earning opportunity, services and roads (which really encompass the other three as the attraction of roads is the access they provide to the others). There seems little reason to believe the Guidimaka should prove otherwise. The region's ultimate carrying capacity is a factor of available water and land, but these are highly tied to the technology available. At this moment in time, the best and most honest thing one can say is that access roads are a major factor that will direct the area to a rapid growth to carrying capacity limits, such as they ultimately prove to be, but which appear substantially greater than that of most other interior regions of Mauritania.

Because of the above situation, the following analysis stresses extrapolating in gross terms from recognizable germane factors. This is not to deny the importance of quantification, but only its inapplicability and impossibility at this time. Steve Reyna proposed in his PID Social Analysis that along with the project, a relatively inexpensive effort, through the use of one or two graduate students, be funded to begin to gather the type of specific longitudinal data that could lead to meaningful quantifiable correlations between road construction and development in the area. Such an intervention has been incorporated in this project.

## II. The Basic Social Landscape:

The following is intended as a brief outlining of the most salient points regarding the socio-economic situation in the Guidimaka that are of immediate concern to the design of a Rural Roads Project. Steve Reyna's PID Social Analysis should be consulted for greater but more generalized background data if desired.

### A. The Guidimaka's Potential Vis-a-Vis the Rest of Mauritania

The Guidimaka has the highest annual rainfall in Mauritania of between 450-600 mm a year. In this sense, it is environmentally and culturally a northern fringe of productive systems found in Mali and Senegal, rather than other parts of Mauritania. In fact, the "Guidimaka" traditionally represents an established area of Soninke domination that extends into these other countries and of which the Mauritanian portion is presently about a third of the total area. In the past, it exported both cereals and animals, especially donkeys and horses, and during the height of French colonial exploitation of the river was a major cross-roads. In comparison with the rest of Mauritania it has the combination of both future river irrigation and rainfall agriculture. Water is the single most important factor limiting increased production throughout Mauritania. The same would seem true of the Guidimaka, but in this case the problem rests in the loss of potential water through runoff and a geological situation that provides only limited areas of easily available ground water collection. Given the rain per se, these problems would appear technologically solvable over time with the proper combination of incentives and, in fact, one can predict that many interventions

1971

now being developed in much harsher area of the country, such as retention dams, reforestation, and new water lifting system will eventually find their most profitable application in the Guidimaka area. The fact that they, with the exception of the present ongoing USAID IRD Project, have not been tried, is an outstanding example of how the area has suffered from development neglect due largely to its isolation. In a poor country with very limited prospects for rapid improvement, the dryland agricultural potential of the area is something that neither the GIRM nor foreign donors can afford to continually neglect.

B. The Soninke (Sarakolle) Culture as Mauritania's Most Productive Agricultural System

As a northern fringe of Mande agricultural civilization, Soninke civilization and social structure has evolved as one primarily adapted to agricultural production in contrast to Moor social organization which is basically an arid land pastoral adaptation with an agricultural appendage. The fact that the Soninke are found in the extreme fringes of the ecological zone conducive to major agricultural production has forced them to evolve additional survival mechanisms in the form of migratory commerce and labor. However, even while working in the factories of France, they continue to maintain their basic social unity and organization.

The major characteristic of the system is extremely strong patriarchal group control, with an emphasis on group unity and self-help coupled with a strong tinge of xenophobia. The major production unit is the extended family compound, dominated by the eldest male of the family who controls younger brothers, sons and sometimes cousins. Production centers on the family field, though younger males and women have small individual fields as well. On the family field labor is cooperative and its production under the authority of the patriarch. Primary responsibility is for the head male to assure adequate food for the family. Given the precarious rains of the Sahel, this requires maintaining a reserve for hard times (usually a two-year stock). Much to do is often made of this fact, as if it means the Soninke are not market-oriented, but this is not true. The stock, if not used, is recycled, older grain being sold as there is new grain to replace it. Thus, except for the two-year startup time, the only loss is that encountered by poor storage (improvement of which could be an important extension activity). Recent years have, in fact, seen somewhat of a breakdown of this system because people have discovered they can reduce their reserve and buy donor grain, especially rice, to replace it when necessary.

C. The Distribution of Power, Rights and Duties Within the Community

The patriarchal system is replicated on the village level where control rest with the oldest male of the founding family assisted by a council of males from other important families. This group controls other newer or socially lower families, mainly by being recognized as the controllers of the village land. Others are seen as having land by

198

permission of the controlling group. Given the strong emphasis on community unity, it is not easy for any community member to be denied or deprived of land as long as they fulfill their community responsibilities. However, as it is the controlling group that determines rights and responsibilities, the distribution is not completely equal.

Control and distribution of rights and duties is also effected by the highly stratified social classes that extended from nobles through commoners to artisans and slaves. These distinctions no longer have legal significance but are important in terms of the facts of community power. This is especially true as concerns slave status. Because labor has long been a major production constraint, the Soninke, as with similar groups such as the Bambara in Mali, sought to obtain the maximum number of slaves, in contrast to the Moors who, in fact, traditionally had only small numbers for mainly household tasks. However, unlike among the Moors, slaves were highly integrated into the family unit to the extent that if there was no older male from the noble family, an older male slave could become de facto family patriarch. A major factor permitting this was and continues to be the fact that neither agricultural nor other manual labor per se is seen as degrading. To the contrary, everyone is pressured to work. There is, however, unequal distribution of rights and duties when there is insufficient benefits for all, or when there is too little or too much to do. Thus the best land generally goes to the higher status people. Likewise, if a manual task has to be done requiring only a few people, the village authorities will tend to delegate it to those most easily dominated. Ironically, it is probably communities with the largest slave status populations (often over 50%) that can be the most de facto egalitarian, while it is the low rank family in the minority among others that can be the most exploited and dominated.

Given that this system even replicates itself in migrant factory communities in France (where, for example, everyone works together on the assembly line but the lower class members do the cooking at night), there is little an outsider can do other than be careful not to make unreasonable demands or use undue pressure on communities, for these will only be deflected on to those least able to resist. Above all, it should be remembered that the system has its own internal regulating mechanism in the ultimate value placed on continued group solidarity.

#### D. The Tremendous Attachment of the Soninke to Their Region and Culture

Generally all of Mauritania's people demonstrate a fierce loyalty and strong attachment to their home areas despite their problems and poverty. This is certainly true of the Soninke who, despite years abroad in centers of modernization both in Africa and Europe, not only continue to send large sums of money home, but maintain their families there and retire to their home communities at around 40-45 years of age, while they could still be active elsewhere. (Among other things, this is the age when the prophet Mohammed received the call and therefore is seen as a time to assume patriarchal responsibilities, as well as the time when the still older generation has likely passed away and power opportunities open; and,

finally, a time when a younger generation of males 15 years and older arises to take up the responsibility of migrant labor.) Money is not only sent home to support the family, but the community and Soninke culture. Large and expensive mosques dot the Guidimaka landscape like small medieval cathedrals. Often characterized as "non-economic" or "non-productive" investments, they are, in fact, among the most crucial investments toward maintaining the unity of community on which the productive system rests. Likewise, many communities evidence a renaissance of traditional architecture and decoration to an extent that bespeaks an effort to compensate for the threatened disintegration due to modernization and urbanization occurring elsewhere but not there. It can therefore be said that as a group they have already evidenced strong positive actions to maintain their home area as a vital community and would be willing to do so in the future if the opportunity is offered.

#### E. Male Outmigration and Labor Availability Among the Soninke

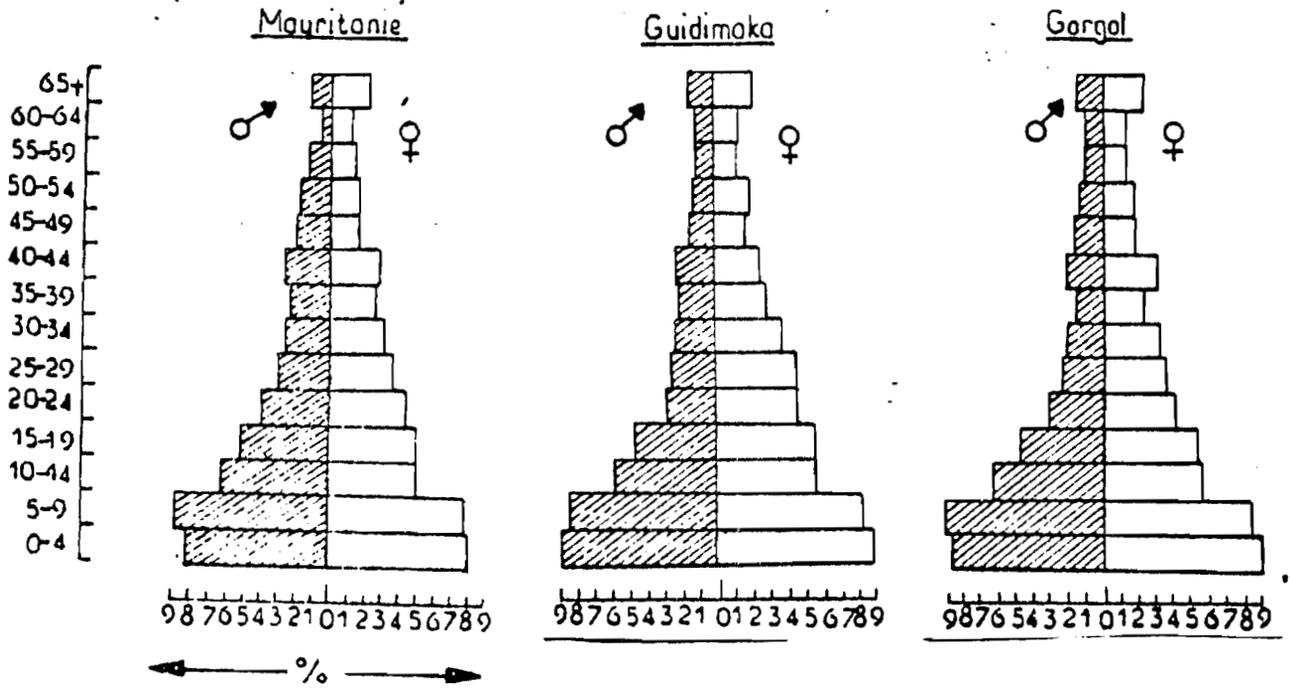
Chart One, attached, represents comparative estimations of population broken down by age and sex, in Mauritania's regions. Quick perusal makes evident the preponderance of females over males during the most productive ages of 15-40. These figures are composites of both sedentary and nomadic groups. Since the nomadic groups travel as a family, their sex distribution is more even, which means for the sedentary communities, which would be both the major agricultural producers and providers of labor for road work, the situation is even more skewed than shown. Moreover, not only are 20-30% of the male work force out of the region, but those who go and succeed in foreign work markets are almost by definition the most energetic, ambitious and capable.

The situation vis-a-vis Soninke male outmigration frames the entire picture as concerns labor availability in the area. This outmigration is actually an ancient phenomena and is virtually an inherent part of Soninke manhood. At circumcision age young boys are expected to go to other communities or Selibaby to earn the money to pay for their special dress. A young man who has not participated in the hardships of overseas work often encounters difficulty making a good marriage. This situation existed in past times when the Soninke specialized as traders into Black Africa (known as "Marka" in Mali and Senegal). During the colonial period they specialized as boat workers both along the river, to Europe, and even worldwide. The latest major alteration came around the years of independence in 1960 when, as a result of the end of the Algerian war, France began to replace Algerian workers with manpower from her former African colonies.

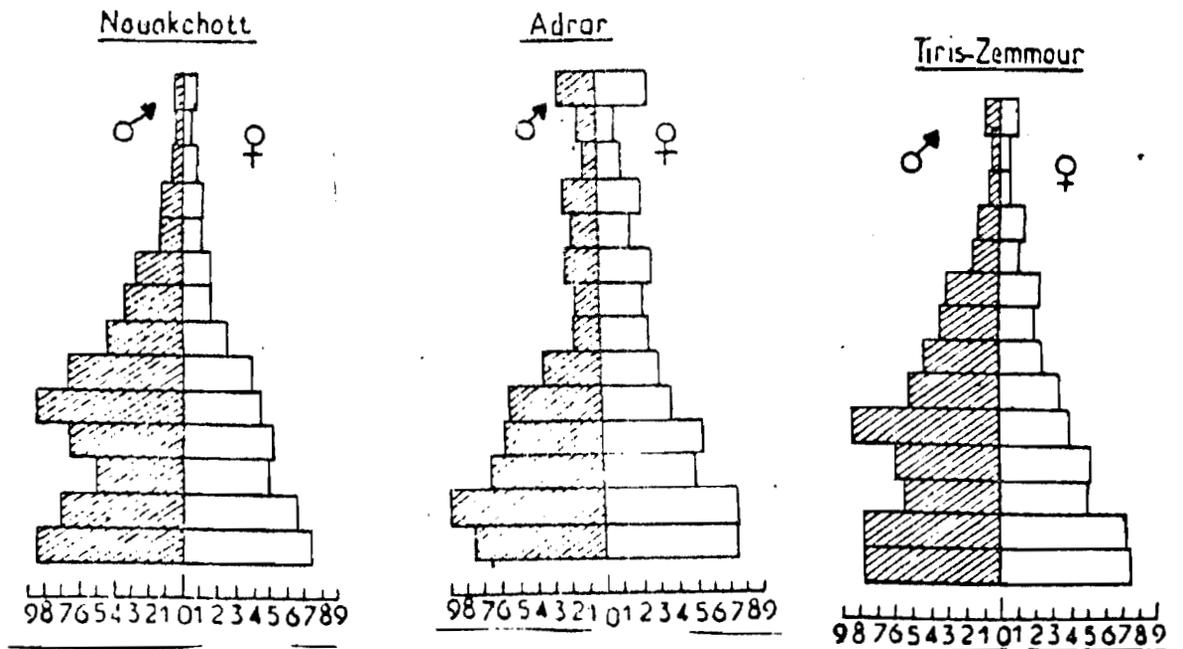
The drought of the last few years therefore is not the cause of male migration but has had a serious effect by threatening the viability of the home communities to which they have almost always returned. To counteract this threat requires inputs of money and labor, especially in terms of labor assisting devices, whether plows for weeding or machines for retention dam construction, to assist what is a relatively weak labor force of women, children and older men. In many cases, due to their employment overseas, there is significant investment capital that goes into other areas such as mosque construction or to hiring replacement labor during the rainy season (either Haratin or Bambara from neighboring

COMPARATIVE POPULATION PYRAMIDS BY AGE AND SEX

- The entire country and the two regions of the project:



- The capital and two northern regions (for comparison):



Source: USAID RAMS Project (682-0211) Report.  
Annotated Statistical Compendium Vol. 1, AE-43,  
July 1981.

201

Mali). Other more modern investment potentials, such as those already mentioned, seem frozen due to the area's isolation. (People have, for example, bought plows in Mali or Senegal but despite promises they have never received any instruction from local agricultural agents. When asked why, local service personnel cite the transportation problem.)

Meanwhile, the labor shortage puts good labor on a competitive basis with salaries available elsewhere. During the rainy season, day laborers earn 200-300 UM a day. A minimal monthly salary is approximately 3700 UM (\$80). While these look high, the figures represent necessary earnings to support a family in light of the high cost of imported goods including food. Preliminary studies indicate the region's population has the highest dependency on outside remittances of anywhere else in Mauritania.

The situation has important ramifications vis-a-vis the myth of voluntary labor. Labor in general, and especially during the rainy season, has a definite value of about 200 UM a day. To the extent people volunteer their labor, they are contributing 200 UM a day. To the extent they are being required to do so, they are being taxed 200 UM a day. To the extent not everyone contributes labor, the tax is discriminatory. To the extent it is the poor who provide most labor, it is they who are discriminated against.

This labor shortage situation has at least two immediate ramifications, one potentially quite positive, the other positive or negative depending on project implementation plans. First, because of the labor bottleneck but the area's strong emphasis on agriculture and its fair amount of investment capital, one can predict that if effective extension work was introduced, especially in the area of labor assisting devices, the response could be good. On the other hand, in terms of community labor either to construct or maintain roads, labor, meaning the people who actually do the work, must be paid. It would be far more equitable to evolve a new local revenue system that would demand equal contribution from all than insist on direct contributions of free labor. Community responsibility should be sought in terms of their assuring the paid labor is available and the work done.

#### F. Women and Children as Predominant Labor and the Threat of Increasing Female Outmigration

USAID has supported the investigation of the situation of women in Mauritania, including those in the Guidimaka. The findings of Melinda Smale who wrote the report was that the combination of male outmigration and drought has been to dramatically increase the burden on Soninke women. Traditionally, women and children were expected to contribute labor to the family field, but this still remain the primary responsibility of the men. Women had fields of their own on which

202

secondary crops such as peanuts, indigo, etc. were raised as a side income. Today, due to the combination of labor shortage and poor production, the women's fields are being used to provide the basic family grains. Thus, women are laboring more but have experienced a significant drop in their discretionary income. This greatly increases the already burdensome responsibilities of the women in other areas such as house construction, and their primary responsibility for providing clothing, education and medical care of the children.

As a first step, therefore, one can say that women and children would actually be the majority of beneficiaries if the general welfare of the area increased. In terms of productive labor, revitalization through labor assisting devices would directly assist them, not necessarily in terms only of they themselves using them, but in re-establishing the productivity of the family fields under male control. This would relieve women of this burden and free them to return to earning a secondary income of which they are the primary beneficiaries.

There is also an important corollary to the situation concerning women. The burdens are becoming so great that evidence of female outmigration to join men is beginning to appear. This phenomena, if it develops substantially, will be the death knell of the traditional communities and with it the area's basic and most valuable hope for improvement. To prevent this system's collapse requires fairly quick improvement in the quality of life per se, improvements that must reach the remote villages and which cannot reach them given present means of access.

G. Other Groups of the Guidimaka: The Bidan, Fulbe, the Toucouleur and Haratin

As already noted, population figures in Mauritania are subject to sudden fluctuation given the high mobility of its people. Up to now, the major focus has been on the socio-cultural situation of the Soninke. In straight proportional terms, the Soninke comprise about 55% of the region's total population (1979 figures). Of the remaining, approximately 25% are Toucouleur and Peul (Fulbe) and 20% Moor (both Bidan and Haratin).

Given the preceding, plus the fact that the Soninke are the major agricultural producers; that their production system appears the most promising in terms of increasing yield; and finally, that they have the most solid traditional claims on productive lands in the region, it seems that the regeneration of the region's economic vitality will benefit them the most and that they will be the most active direct participants in related action.

This does not mean that other groups will not profit, but only that the Soninke social situation and production system is the major cultural determinant at this time. In fact, many other groups, specifically herders, could substantially benefit from new marketing possibilities but easily escape responsibilities for care or tax because of their mobility. Basically, the other germane groups are as follows:

The Moors: (approximately 25%). The Moors are basically represented by three sub-groups, the noble warrior Bidan (white Moors), the Zenaga (white Moor tributary herders), and the Haratin (freed slaves). In the past, Bidan groups or their tributary Zenaga, used the Guidimaka as seasonal pasture land. Important groups established tributary slave villages that engaged in agriculture

207

and provided the ruling groups with a share of the crop. Today the majority of Moor villages are former slave communities or newly settled areas of Zenaga. There are even some noble Bidan who, having lost their herds during the drought, are attempting to establish new sedentary mixed farming - small herding communities. These villages, especially those of the Haratin, are among the poorest in the area. Because they are generally small in size, it is unlikely that they will in the foreseeable future be provided major infrastructure, and therefore access to health and education facilities is closely tied to commuting to the nearest large settlement.

The Haratin, especially, provide the major day-laboring population of the region, in terms of working for others, and are generally not part of the well-developed network that allows the Soninke and some Toucouleurs to readily exploit overseas opportunities. At the same time, because they often do not possess the best lands, they must by necessity supplement their own agricultural earnings. More than any other group they are dependent on the existence of manual labor jobs that come with transport infrastructure development, whether road maintenance, truck loading and unloading and especially for women, small detail market operations such as bread and daily condiment selling. As a group, therefore, they would be the most direct beneficiaries of any newly created labor jobs that resulted from the new roads.

On the other end of the social scale are the Bidan traders who tend to dominate the mid-level commercial sector (one and two-room stores that sell the variety of imported food and materials needed on a daily basis, such as canned milk, sugar, cloth, etc.). This group prospers on the availability of transport for goods and mid-level market opportunities. As such, they are the major suppliers of goods to remote areas and in this sense their prosperity is directly related to the increase in provisionment of business to isolated communities. Interesting is the general absence from all but a few of the largest settlements of the Guidimaka, of the small Bidan stores found elsewhere in the country. Reasonable local taxation of such shops occurs in administrative centers such as Selibaby and is one potential method of raising revenue for maintenance, were one potential method of raising revenue for maintenance, were more to exist.

The Toucouleur and Fulbe (Peul): These people represent a common linguistic group but are strung along a cultural spectrum the ends of which differ enormously in terms of production and community organization. The prototype of the Toucouleur community is found along the river where they represent substantial sized communities whose economic existence is traditionally based on river recession agriculture, supplemented by dryland agriculture on nearby lands, fishing, and some livestock (either sheep or goats, or cattle which are generally cared for by Fulbe herders). Like the Soninke, they receive substantial inputs from men working out of the community, in this case somewhat less in Europe and more in Nouakchott and other African countries. Social organization of production is generally on the nuclear family level and the communities do not have the strong patriarchal control of the Soninke. Most of the major settlements are in the southern, especially southwest, area towards Maghama and Kaedi. In many cases, these southwest communities are far better serviced in terms of available supplies and in and out access because of the proximity to the river, though except for those on the river, access after rains is a problem.

The Fulbe (Fr. Peul) are at their cultural epitome on the other end of the spectrum, living in small seasonal hamlets of a few families, in houses of grass or banko, with straw roofs, devoted to their livestock and engaging in agriculture only as a secondary, mainly subsistence, activity. The small size, isolation and seasonal nature of their settlements put them on the lowest end in terms of either public or private services being directed to them. These communities will generally only be served if they are along the access route to larger settlements and, as will be further explained, argues why major circuits of commerce must be developed rather than single-focused, one-way routes to select major settlements.

In between the prototype large Toucouleur river agriculture settlement and the small temporary Fulbe hamlet lies a growing number of intermediate communities where sedentary agriculture is combined with transhumant cattle raising (only selected family members travel with animals). Such communities offer potentially expanding models of the type of highly adaptive mixed farming-herding units that would spring up with proper inputs.

#### H. Projecting Forward by Looking Backward (and Around):

As was pointed out in the introduction to this analysis, present day circumstances do not provide simple indications of future development, and myopic analysis will serve little except to reveal the myopia of much past and current development planning. The Guidimaka region has historically been a borderland between the Sudanic civilizations to the south and the desert civilizations to the north. At different times, depending on historical, political and economic circumstances, this border area through to the eastern border of Mali has been of fluctuating economic significance. A thousand years ago the capital of the Empire of Ghana was in southern Mauritania and the Soninke as commercial intermediaries rose to power. During French colonial rule and when river commerce was of major importance, the Guidimaka became an important area of activity. With the division of the French colonies into nations, the northern fringe of the Guidimaka became an isolated backland tied to a nomadic system with few permanent settlements and few material needs. Today that system is undergoing major changes. For example, along the Mali-Mauritanian border to the east, a series of weekly markets south of Koboni, Djigueni and at Adel Bagrou have been established by the authorities. Weekly markets provide a mechanism whereby traders, trucks and other services such as molyette, plow and tool repairers gather at an appointed time and serve the economic needs of a surrounding area, usually within a 15 kilometer radius. Such a system prevails throughout the agricultural production areas of the Sahel, providing an input of goods and services as well as establishing regularized grain and livestock marketing opportunities. As weekly gathering points, they offer potential opportunities for the extension of government services. They also create in the central market towns new economic activities as well as new potentials for revenue raising through modest market fees. Such a system depends on access of surrounding areas to the central point as well as the creation of transport circuits that permit trucks through daily progression from one center to another along the route to service significant numbers of the population at reduced costs.

The above scenario does not presently exist in the Guidimaka but there is good reason to believe it could, especially with government encouragement, once all-year access routes were opened. If it did, the possibility would arise that the market towns, because of their special advantage and weekly special reliance on the roads being opened, would be prone to assume more responsibility for minor maintenance. More important that the precise scenario, however, is the

basic pattern of progress that can be foreseen, namely, that in this instance (as it not always is the case) agricultural production and population increase should follow road construction, precisely because of the increase in general life activity and not vice versa. The fact is that profit from agricultural production is generally not sufficiently profitable to engender the settlement of backwater areas. Rather, people decide for many other reasons where to settle and thereafter they engage in such agricultural activity as possible. In many cases, therefore, the effect on the potential for production should be the major criteria for route selection rather than present population or production should be the major criteria for route selection rather than present population or production the purpose being to use roads, among other things, to engender new productivity, not just reach productivity already existant.

To do this requires careful route layout to achieve the greatest total circulation of traffic as possible and to reach as many isolated existing or potential communities as possible. This requires a basic network of roads that link together, rather than dead end routes. The network requires ports of entry and exits via Kaedi and Gouraye; and an assembling place for regional distribution and collection of goods (Selibaby).

This means that if insufficient funds exist to do the entire network, emphasis should be on a functioning subsection. Such a subsystem would provide year-round access to at least two of the three ports of entry/exit (Kaedi, Kiffa, Gouraye) and at least one completely closed northern loop (Selibaby-Ould Yenge-Dafort-Selibaby or Selibaby-Ould Yenge-Dafort-Bouanze-M'bout Road-Selibaby or Selibaby-Dafort-Bouanze-M'bout Road-Selibaby). If a choice has to be made between these possibilities, one will have to weigh costs versus present use/future potential, this being done on economic and agricultural assessment grounds. It will have to be recognized that such choices are not clearcut but require judicious weighing. (For example, present traffic favors giving preference to Kiffa over Kaedi, but future inputs that would increase production are much more likely to come from Kaedi than Kiffa, given development along the river, the Kaedi School, and the new project on the Gorgol.).

### III. Regional Social Structure and the Distribution of Power

Basically, two systems exist concomitantly in the Selibaby area. The modern system administratively consists of a regional governor, department prefets and heads of governmental services such as agriculture, health and public works, who are representative of their respective ministries in Nouakchott but under the immediate authority of the governor. Personally it consists of individuals and groups in largely modern economic classes: traders, chauffers, mechanics, salaried laborers and families in non-traditional settings such as Selibaby. Juxtaposed to this is the already described social landscape of the various traditional communities and ethnic groups and their heirarchically class structure. The two tend to overlap in many quasi-official situations and committees such as the Red Crescent, the Volunteer Movement, and Regional Advisory Committee, where traditional leaders or aspiring politicians often try to reinforce existant powers or gain new ones by acting as brokers between the populace and the government, in the distribution of goods and services in return for cooperation and support as needed.

The operation of these different systems will be the medium for effecting the proposed project and the designing of the implementation plan to correspond to the realities of how they behave is indispensable both for project success and a fair distribution of benefits and obligations.

206

First it must be realized that units have definite spatial boundaries that define the limits of their jurisdiction and concern. On the modern administrative level this is the region and to the extent the project extends into another region, it will have to organize a separate effort and realize that each region will respond based almost entirely on its perceptions of its own needs. Thus, for example, if only a small link extends into the Kaedi region and equipment is given them to maintain it, experience indicates that the equipment will be used for whatever regional purpose they feel is most important. As far as the traditional communities are concerned, the problem on their level will be in creating some system that establishes a clear identity on a self-interest level between specific communities and specific stretches of road. At this moment, the best that can be provided are several hypothetical possibilities such as: 1) give specifically identified communities maintenance contracts so that they, or at least some members, have an economic interest that corresponds with maintaining a specific number of kilometers; 2) redefine community boundaries in terms of exclusive rights to settlement and cultivation which correspond to the length of road they help maintain; or 3) create a new system of weekly market and service centers (as exists elsewhere in West Africa and now is beginning to be established in the eastern area of the country) and thereby create for such communities a special interest (and obligation) vis-a-vis the surrounding road system that leads to them. As noted, these are but possibilities and eventually locally adaptive mechanisms will have to be worked out over time.

The next question then becomes who can and who will work out the solutions. In this regard there is a major distinction to be made as to who will make decisions and who will carry them out. On the administrative level it is the regional governor and prefects who are the final authorities, but the job of actually organizing and working with the community, checking up on their work and supporting them will probably fall to the public works engineer. This type of community organizing job is not one for which they are trained or provided equipment, and the project should include a project maintenance liaison officer to assist in creating this capacity and to provide necessary inputs such as tools that can be given to communities to enable them to participate as agreed upon. Steve Reyna's analysis proposes the use of Peace Corps Volunteers in such a capacity. If these are not available, a contractor with former Peace Corps community organizing experience would seem appropriate.

On the community level, the decision-making authority generally lies with the recognized community head and a djamaa council of community elders. However, much as the governor passes the job on to his regional staff, they will pass the job on to others. What is to be avoided is the passing on of this task to those socially weak members of the community who farm land by permission and are susceptible to being pressured to unfairly shoulder this burden. The way to avoid this is through paying those who actually do the work.

#### IV. Roads in Particular

##### A. The Present Transportation Situation

At present, movement in the Guidimaka is effected in one of four ways, vehicles, animals, foot and by boat. None of these is always possible at all times throughout the years, since when the gullies are flooded after a rain even food traffic between villages is hampered. In this sense, the value of roads should be seen as more inclusive than the measure of motorized transport use that can

207

be envisioned, for in fact the creation of all-weather passages will enhance the ease and regularity of pedestrian and animal traffic as well as trucks and cars.

1) Vehicle traffic of a commercial nature is mainly by trucks which transport goods such as sugar, tea, rice, milk, cloth and other manufactured goods into the area. These include both private commercial vehicles and those of SONIMEX, the governmental import agency. Vehicles generally come into the area loaded and leave empty except for some seasonal trade in sorghum that generally exists north toward Kiffa, and seasonal trade in mangoes and special grasses for mats that come from Mali. During the rainy season traffic is irregular depending on rainfall. During the dry season the main routes between M'bout-Selibaby and Selibaby-Kiffa see several vehicles a day. Larger interior communities such as Hassi Chaggar and Dafort report vehicles every few days to once a week. Smaller but important communities such as Ndeio report single visits every three weeks to once a month. Less important interior villages, especially seasonal Fulbe hamlets, never receive vehicles and must travel out to other locations for rides or goods. Most vehicles take passengers for a negotiated rate (for example, \$6 to \$11 from an interior community to Selibaby or Ould Yenge). This passenger trade compensates for the lack of two-way traffic in goods. Thus trucks often come with supplies via the paved road to Kiffa and then Selibaby but return to Nouakchott via M'bout and the river because they are not permitted to carry passengers on the paved road but can on the dirt road in the south.

2) Animal traffic is traditional and continues to be an important means of moving goods and people. Camels and donkeys are the main carriers of goods, mainly food stuff, in addition to horses and steers which carry people. They have the advantage of flexibility in that they are available as the individual needs them, and when he needs them, for small quantities. While donkeys are generally available to all, either as property or free loan, camels are expensive animals (a good male being easily worth \$600) and are rented on a trip by trip basis. (For example, for a three-day trip between Ndeio and Selibaby a camel rents for 1000 UM (\$22). Since a camel can carry approximately 400 kilos, this comes to at best 2.5 UM a kilo, which is the same as the price by truck to Kiffa. The renter loses in time but gains by being able to transport goods back to the village for no additional price. However, since people often don't have a full load to sell but must pay the full rental price, the cost per kilo can exceed that by truck. In all, it seems to be the irregularity of vehicle traffic that continues to make animal transport desirable, not economics, and in fact, if motor transport increases, as can be projected with new roads, it will probably replace all but very local animal transport precisely because it proves cheaper in time and money.

In terms of fundamental adaptability to the region's needs, animal transport could probably handle any increases in grain production. The disappearance of large caravans seems due as much, if not more, to the limited production available for sale as anything else. What animal transport will never handle is the large scale imports into the region of the tremendous variety of goods and services such as plows, fertilizers, a myriad of assorted products like medication and service personnel such as agriculture and health agents. It is thus the need for modern inputs for both increased production and well-being that necessitates a quantum leap in motorized transportation facilities.

202

3) Pedestrian traffic exists as both a need to be served by improved roads and one type of limitation on their use. People in discussion stressed the value of roads to facilitate pedestrian movements which are also hampered by flooded passages. In terms of a limitation on travel, the average person can cover 20-30 kilometers a day, though some hardy souls are capable of more with strenuous effort. In terms of a one-day round trip, giving time for business to be enacted, 20 kilometers seems a fair standard for defining that area proximate to a road where daily life can be assumed to be affected by the road's existence. As such, it would also seem the logical maximum area that a community take responsibility for, all else being equal.

4) Boat traffic, mainly in the form of both small and fairly large dugouts, exists on the river for several months after the rainy season, providing transport both along the bank to the interior via flooded areas, and across to Senegal. Kilometer for kilometer, the transport of goods is cheaper by this means. However, this advantage disappears if the point of origin or final destination is inland because of substantial costs in time and fees for unloading and reloading from boat to truck.

#### B. The Question of Construction

Three major opinions were expressed in regard to the construction of the roads. One was that the major problem was access over the difficult areas, either gullies or deep areas of soft sand. The second was the hope that local labor would be employed to build the roads. The third, by a few people with some experience, was that the need for water for surface construction would deplete very limited local resources.

The first and third opinions supported the idea of concentrating on overcoming as many obstacles as possible and ignoring whenever possible surfacing any areas now passable year round. Thus, while some people, mainly transporters, noted that the poor surface added to wear and tear, none felt it prevented travel per se. The second opinion, regarding using local labor for construction raises important questions as to community identification with the road, benefits gained, and the realities of labor availability as already noted.

The use of the labor of community members living along the particular segment being built would create from the start identification of each segment with those immediately being served by it. It would also result in immediate training of local people in road construction tasks. Therefore it would seem appropriate to establish this as a policy even if it created inconveniences by increasing the turnover of personnel and the speed of construction. It is important to note, however, that at the same time communities expressed the desire to provide the labor for the roads, they noted that they would generally need advance notice to "call back young men now elsewhere". This caveat is crucial because it reveals the underlying desire of the heads of communities to bring back their youth at the same time as their being aware that this can only be done by having alternative employment to offer. The idea that labor will be available without pay is just not realistic, except for very short acute types of community cooperation that can be scheduled at people's convenience. (Thus, for example, after roads are built, one might get local help to assist in a one or two day repair of a washed out area. However, even in the several cases in the area where people were asked by the government to do this, they ended up being given gifts of money, grain and clothes that added

up to a value of 93 UM (\$2.05 a day in wages for each of the days they contributed).

### C. The Question of Maintenance

The problem of maintenance requires some very hard analysis and honest assessment. It might be noted that a recent USAID publication "New Directions in Rural Roads," actually suggests accepting the reality that roads are not going to be maintained in most underdeveloped countries given present governmental infrastructure and funding realities. Unfortunately, this is not an acceptable alternative in the Guidimaka, since the result would not be just gradual deterioration but rapid washouts. Moreover, since the road represents an interdependent system, all areas must be kept up if the system is to be operational. This requires a type of repetitive, methodical upkeep very different from the types of acute community cooperative labors people are used to. Even more unfortunate is the fact that the type of maintenance required apparently demands cleaning of drainage systems after each major rain. This conflicts with the crucial few days after a rain when a farmer must work his soil and seed it before it dries up. (Given the unpredictability of rainfall, this often has to be done several times a year). The only solution would seem to be to pay day laborers, who do exist during the agricultural season, the going rate (approximately 200 UM a day). The exact formula whereby this is done (contract with the community, establishment of an official job as sector maintainer) and where the revenue will come from (general regional funds, local use tax, tax on shop or market people in affected communities) cannot be established a priori since the situation differs by area and will in fact continue to change as the roads stimulate increased settlement and commerce. What is demanded is a clear commitment to work out a system with the communities along each segment as it is completed, try it out, assess it after the rainy season, and then either extend it or try something new. Given the ultimate benefits to be gained, the pressure is there for everyone to work together to formulate a locally adaptive maintenance system. This, however, will take time, flexibility and adequate preparedness for dealing with failures. No doubt some washouts will occur and have to be rebuilt (though only after reason is determined and a new solution proposed). What must be avoided at all costs is a modern bureaucratic form of corvee (colonial forced) labor and this means accepting the increased time and uncertainty of final results that accompany a democratic decision-making process.

### V. Summation

The purpose of the preceding analysis has been to outline the sociological processes in the Guidimaka Region of Mauritania that are of immediate relevance to understanding the need for access roads to the region; the probable consequences of providing such access; and the requisite actions called for in order to plan and implement an adaptive, practical and maximally meaningful project capable of being not only maintained but even expanded in the future. In the end, the bottom line is whether or not to act on this proposal and the probable consequences of the decision taken. From the sociological perspective, I believe the following alternative scenarios present themselves as real possibilities:

Scenario IAll-Weather Access is Provided to the Guidimaka  
and to the Areas Along the River :

There will be gradual rise in the commercial and productive activities of the region that will become increasingly pronounced as the Senegal River traffic and irrigation activities increase, given proposed OMVS development plans. The situation of traditional Soninke communities will stabilize and, provided adequate production inputs are provided, witness a revitalization as semi-skilled members return from migrant labor overseas and have knowledge. There will be an increase in the influx of outsiders seeking land tempered eventually by limits of available water and land resources and the prior claim of present communities. Together with the Assaba region to the north, the area could become the eventual hub of a revitalized, meaningful interior economy extending east to the Hodh, west to the Brakna, and north to the Tagant, with the Guidimaka reassuming its past historical importance as a link between Mauritania, Mali and Senegal - in contrast to its present isolation from all three.

Scenario II.All-Weather Access is not Provided

The present male migrants will be joined by an increasing number of females and the fundamental solidarity of existing Soninke communities will begin to undergo irreparable fission. Returning skilled and semi-skilled males will return to urban areas that offer outlets for their skills and opportunities for investment of their earnings. There will be an increased influx of the poorest segment of Mauritania's population, those forced to seek any opportunity available. They will come mainly from other interior areas (but also from the river) as some lower class people are pushed out by returning migrants with stronger traditional rights along the Senegal who seek to take advantage of the development of irrigated perimeters. With neither modern skills nor personal capital and with no meaningful government inputs or outside commercial investments due to the area's continuing isolation, it will become an increasingly depressed cheap labor reserve for temporary river employment needs, and a reservoir of poor women, children, and the elderly.

Unfortunately, it is almost impossible to meaningfully quantify this process but the relative positive and negative directions would seem to provide significant direction for the decisions that must be made now.

## RURAL ROADS ANALYSIS

## CHART II

Comparison by Region of Percentage of School Population by Age  
and Sex Receiving Primary Education.

<u>Region</u>	<u>Boys</u>	<u>Girls</u>	<u>Both</u>
1. Hodh Oriental	20%	11%	16%
2. Assaba	21%	10%	16%
3. Tagant	22%	15%	18%
4. Guidimaka	24%	11%	18%
5. Gorgol	27%	14%	21%
6. Trarza	27%	16%	22%
7. Hodh Occidental	28%	12%	17%
8. Brakna	28%	15%	22%
9. Tiris Zemour	38%	31%	35%
10. Inchiri	38%	31%	35%
11. Adrar	42%	28%	36%
12. Nouakchott	68%	67%	67%
13. Baie de Levier	88%	69%	79%
National Average	30%	19%	25%

Listing on scale is by male percentage since this is more directly related to access to facilities, while female education is more heavily influenced by socio-cultural criteria.

APPENDIX F - PROCUREMENT PLAN

A. Responsibilities

The GIRM's Ministry of Equipment, Transport, and Telecommunications, through its Directorate of Public Works, is the responsible agency for this project. AID will provide approximately \$6,017,000, of which \$3,290,000 has been set aside for commodities. A co-management system has been devised with UNSO/OPE (United Nations Sahelian Office/Office of Project Execution) which purchased \$2,400,000 in equipment in 1981 and has provided approximately \$3,000,000 in operating financing to build 70 kilometers of road from M'bout toward Selibaby in 1982 and early 1983. A description of the existing equipment is included in the Engineering Analysis.

A list of equipment, materials and supplies which will be AID-financed is shown below. Capital equipment will all be of U.S. source and origin. Local procurement of eligible items will be in accordance with good commercial practices and procedures as outlined in Section E below (imported shelf-item procurement). The UN's Office of Project Execution (OPE) will serve as the Procurement Services Agent (PSA).

B. Commodity List

List of Items to be purchased with AID funds

1. Equipment

<u>Description</u>	<u>Quantity</u>	<u>Unit cost</u>	<u>Total Cost</u>
Concrete Mixer (400 L)	2	\$5,000	\$ 10,000
Water Tank	2	5,500	11,000
Backhoe	1	30,500	30,500
Concrete Vibrator	1	1,200	1,200
Welding set/generator	1	15,000	15,000
Air Compressor	1	25,000	25,000
Farm Tractor	1	30,000	30,000
Service Truck/crane	1	80,000	80,000
Water pumps	2	3,000	6,000
			<u>\$(208,700)</u>
		+ 25% for inflation	(260,875)
		+ 30% for shipping	(340,000)

Total capital investment is thus \$340,000 before the start of the project and \$110,000 has been set aside after startup for equipment contingency:

capital equipment investment total: \$450,000

Additional items include:

2. Spare parts for all equipment during LOP:	803,000
3. Construction materials (cement, wood, gabions, rebar, CMP):	778,000
4. P.O.L. (petroleum, oil, lubricants):	885,500
5. Subcontract/local studies:	108,000
6. Tires and tubes:	131,000
7. Miscellaneous (tools, camp expenses, office supplies, etc.):	132,000

TOTAL: \$ 3,287,500

C. Source/Origin

The authorized source/origin code is 000 and the host country.

D. Imported Shelf-item Procurement - Local Cost Financing

1. The Rural Roads Improvement Project will require approximately \$355,800 for local cost procurement of such items as spare parts, construction materials, tools, tires, and other commodities. Procurement of these commodities will be in accordance with procedures described in AID Handbook I, Supplement "B", Chapter 18.

2. Imported shelf-items from Code 000(U.S.) sources can be financed in quantities limited to the amount of local currency authorized in the project (\$333,000). Shelf-item procurement for Mauritania includes shelf-item procurement in Senegal. Commodities from Code 941 sources (U.S. and Less Developed Countries) can also be financed in quantities limited to \$333,000 in local currency. Shelf items imported from Code 935 sources can be procured if the price per unit does not exceed \$5,000. The total amount of these project purchases cannot exceed \$25,000 or 10% of the total project local cost financing, whichever is higher. For the D.A.-funded element of this project, purchases of shelf items imported from Code 935 sources cannot exceed \$33,300 without first obtaining a specific geographic source waiver.

3. In addition to local currency resources, which total \$333,000 in the D.A.-funded element of this project, there will be \$1,207,000 of locally-generated funds available from the PL480 Title II Section 206 program of this project. The local cost restriction does not apply to the PL480 funds, which, by its nature, will only be spent locally.

APPENDIX G

INITIAL ENVIRONMENTAL EXAMINATION

OR

CATEGORICAL EXCLUSION

Project Country: Mauritania

Project Title and Number: Rural Roads Improvement, Project 682-0214

Funding: FYs 82-85 \$4,810,000

IEE/CE Prepared by: USAID/Nouakchott, Barry MacDonald

Environmental Section Recommended:

Positive Determination \_\_\_\_\_  
Negative Determination X  
or  
Categorical Exclusion \_\_\_\_\_

Action Requested by: [Signature] Date July 2, 1982  
Mission Director

Concurrence:  
Bureau Environmental Officer

APPROVED  
DISAPPROVED  
DATE

[Signature]  
AUG 30 1982

Clearance: GC/AFR [Signature] Date 8/31/82

215

## I. Examination of Nature, Scope and Magnitude of Environmental Impacts

### A. Description of Project

The Guidimaka Region of south-central Mauritania, with its capital at the town of Selibaby, has the highest potential for the expansion of agricultural production of all the regions of Mauritania. This potential is linked to the relatively high level of precipitation in the region, judged by Sahelian standards (between 400-600 mm annually) and the proximity of the Senegal River along the southern border. Development of this potential is hampered by difficulties of access of agricultural inputs, markets and extension services caused by the lack of an improved road network. This condition also limits access to health and educational services. The situation is particularly acute in the rainy season when heavy precipitation and periodic flash flooding render most roads in the region impassable. Even in dry periods, large areas of soft sand make the transit of certain routes difficult.

The objective of the proposed project is to upgrade some 209 kms. of roads in the Guidimaka and Gorgol Regions to all-weather status. This effort will be carried out in cooperation with the GIRM and will be related to other road building projects in Mauritania designed to eventually link the country's major concentrations of population and production in a cohesive network.

Improvements to the existing road network will be made as follows. In those areas where rains produce flash flooding which destroys road surfaces and makes passage difficult or impossible, ford surfaced with concrete will be constructed protected upstream by gabion structures. In a few cases where the road alignment crosses narrow, deep channels, simple masonry and reinforced concrete bridges will be constructed. In low areas where rains turn the soil into mud making passage difficult, the roadbed will be raised by the construction of embankments and causeways. Particularly sandy stretches will first be graded and covered with a surface material such as silty or sandy clay which will be compacted to create a firmer road surface. Roads will be designed to a width of 5.5 meters.

Tracks to be improved by the project are: M'bout-Selibaby (46 kms, starting from km 70 from M'bout), Selibaby-Gouraye (45 km) and M'bout-Kaedi (118 kms). Associated components of the project are the training of Mauritians in the planning and execution of rural roads improvements and the development and support of an improved road maintenance system.

Technical assistance for the project will consist of a group of individuals to supervise road construction and oversee the maintenance of road building equipment. Actual construction will be carried out by a locally-hired mobile construction brigade and GIRM public works personnel.

Through the project, it is expected that the volume of agricultural production and other goods reaching regional and national markets from the Guidimaka and Gorgol Regions will be increased. The volume of health and educational inputs and services provided to the area is also expected

to increase. Such improvements are seen as vital to contributing to the overall goals of increasing the incomes and quality of life of the rural population in the Guidimaka and Gorgol Regions.

#### B. Identification and Evaluation of Environmental Impacts

Environmental impacts of the rural roads project can generally be divided into two types. In the first instance, there are a series of immediate impacts involving land use, water use, atmospheric conditions and the effect on natural resources caused by the actual construction activities themselves. Secondly, there are the longer-range impacts of the project related to socio-economic and cultural variables and the health status of the region.

While excavation and grading activities will be fairly extensive during the construction process, all such procedures are designed to improve existing tracks in the area. Thus, no currently productive land or existing village populations will be impinged upon by the physical process of road construction. In fact, in areas where a series of tracks exist between two given points, a more precise alignment will reduce the amount of land currently devoted to transport uses.

Despite the relatively high levels of rainfall in the Guidimaka Region when compared to other regions of Mauritania, water remains a scarce commodity in the region. Survey work has indicated that village wells produce an insufficient volume of water to meet both domestic needs and the requirements for road construction. Therefore, water needs for road construction will be met from sources identified specifically for the project. Further, the road improvements contemplated have been planned to make use of dry-compaction and other road building techniques designed to reduce water use. Thus, it is anticipated that the draw-down on local aquifers will not be so great as to disrupt local village water supplies.

From a socio-economic perspective, environmental changes can be expected to a greater and of a more long-lasting nature than the relatively short-term impacts of the construction process itself. Physical mobility will increase considerably. Land values, particularly for land near the road alignment, will most likely increase raising questions of tenure and ownership. The demand for health and educational services is expected to rise as access to those services improves. Marketing and transportation patterns will be altered significantly.

As a whole, these changes are expected to produce beneficial consequences for the population of the region. Improved access to markets and improved transportation services should lead to improved incomes as freight costs are reduced, losses due to spoilage minimized and the general ability to move production to sales points is upgraded. Access to the benefits of dispensaries, clinics and hospitals as well as educational facilities should lead to improvements in the quality of life of the Rural Guidimaka population. Demand for such services however, can be expected to increase the economic burden on institutions charged with their supply.

217

Problems of land tenure and ownership are endemic to development efforts throughout Mauritania reflecting the complex social and legal framework which encompasses these issues: USAID/Nouakchott is currently implementing an AIP project which will address these problems on a nationwide basis (Land Tenure AIP, 625-0937).

Discussions of Attached Impact Identification and Evaluation Form Ratings

The following comments explain the evaluation charted on the accompanying form. All notations under the heading N exert no project impacts and will require no explanations. All other columns (L-little, M-moderate, H-high, and U-unknown), where checked will be commented on below.

LAND USE - the potential for increased erosion exists on embankments in areas where the roadway is to be raised above the existing surface. However, design criteria, involving plantings of grasses and other materials on the embankments, have been incorporated in the project to lessen the possibility of erosion. Excavation of local materials; clay in particular, and grading will be of moderate scope in the areas affected by the project. This excavation is not expected to have a detrimental effect on the general character of the land or the local population. Grading will take place on existing tracks and is designed to improve already existing transportation routes. While some increase in the population density along the improved alignments can be expected, the population is generally already concentrated in areas of agricultural production and market centers served by the existing system of tracks to be improved by the project.

Water Related Impacts - Some limited impact on drainage and flood patterns is anticipated from the road construction activities. In most areas however, culverts and bridges will be built to allow the rainy season waters to follow their usual course without destroying the road surface. Some diminution of the water table may occur during the course of construction. This effect will be temporary in nature and will be minimized to the fullest extent possible by not drawing water from existing wells used for domestic purposes. Sedimentation levels in water runoff from the roadway surface and embankments may exhibit a minimal increase. This impact is of limited importance since no permanent bodies of standing water exist in the Guidimaka Region. The Senegal River will not be affected by sedimentation from project construction activities.

Atmospheric - Pollution from dust raised during the construction will be high but of limited duration. Vehicle generated air and noise pollution will increase over time on project roadways, but the relatively low volume of traffic in this primarily rural region will limit the effects of this impact.

Natural Resources - The utilization of water and soil resources in the construction process will have a limited environmental impact on the project area. In the case of water, the effects will be temporary in nature, earthmoving and excavation activities are not expected to alter significantly the natural resource base of the region.

210

Cultural - Mobility and transportation patterns will be altered by the project as the volume of vehicular traffic increases. While there may be some modification of traditional values as a result, it must be remembered that traditional Mauritanian societies have been generally highly mobile in character. Thus, while the form of that mobility may be altered, the general cultural fabric of the society is not expected to be greatly disturbed.

Socio-Economic - Socio-economic patterns in those areas of the Guidimaka Region affected by the project will probably alter significantly over time as a consequence of this project. These changes are discussed in earlier sections of this evaluation and are expected to produce beneficial results in terms of higher incomes and a higher quality of life. One negative consequence will be the probability of increased disputes regarding land tenure and ownership in the vicinity of the improved tracks. USAID is attempting to address this difficult problem through the mechanism of an AIP devoted to working with the GIRM on the development of possible solutions to land tenure and ownership issues.

Health - Some minor dietary changes and a limited increase in the volume of traffic accidents are anticipated as a result of the project. These minor negative consequences will be offset by the highly positive benefit of the rural populations increased access to medical services.

General - An improved road network in the Guidimaka Region may facilitate an increased volume of trade with neighboring Senegal. All-weather roads currently exist connecting Dakar with the town of Bakel, on the opposite bank of the Senegal River from the Guidimaka town of Gouraye. However, this trade flow can be expected to remain at fairly minimal levels unless an improved transport service across the river itself is established. In terms of larger program impacts, the roads project is expected to have a highly beneficial impact on the GIRM's program to support rural development in Mauritania through improved access to services and the development of the country's agricultural potential. The same positive impact will accrue to the activities of foreign donors working in the Guidimaka as improved access reduces the cost of transporting commodities to the region and facilitates travel by technical assistance teams to the Guidimaka.

## II. Recommendation for Environmental Action: Negative Determination.

The overall negative consequences of the project on the natural resource base are limited in terms of scope and duration. On the other hand, highly positive socio-economic benefits are expected to accrue from the transportation improvements brought about by the project.

## INITIAL ENVIRONMENTAL EXAMINATION

Impact Areas and Sub-areas - See Explanatory Notes for this form.

Impact Identification and Evaluation - Use the following symbols:

- N - No environmental impact  
 L - Little environmental impact  
 M - Moderate environmental impact  
 H - High environmental impact  
 U - Unknown environmental impact

A. LAND USE

	N	L	M	H	U
1. Does the project change the character of the land through:					
a. Erosion _____		X			
b. Excavation and/or grading _____			X		
c. Change in animal or plant habitats _____		X			
d. Modification of land use _____			X		
e. Increasing concentration/population _____			X		
2. Potential natural disasters _____		X			
3. Unplanned roadside activity (e.g. overgrazing) _____		X			
4. Other factors _____					

B. WATER RELATED IMPACTS

1. Does the project change the quality of water resources through:					
a. Drainage pattern _____		X			
b. Modification of flood patterns _____			X		
c. Water table change _____			X		
d. Salinity modification _____		X			
e. Pollution of adjacent waters _____		X			
f. Induce sedimentation of adjacent waters _____			X		
g. Ecological balance _____		X			
h. Other factors _____					

C. ATMOSPHERIC

1. Does the project induce atmospheric changes through:					
a. Pollution (during construction e.g. dust) _____					X
b. Pollution (vehicle generated e.g. dust, exhaust) _____			X		
c. Air pollution (cargo generated e.g. chemical asbestos, phosphates, etc.) _____			X		
d. Noise pollution _____			X		
e. Other factors _____					

D. NATURAL RESOURCES

1. Does the project change the natural resource balance through:					
a. Planned and unplanned exploitation _____				X	
b. Utilization of limited resources for construction _____			X		
c. Other factors _____					

		N	L	M	H	U
<b>E. CULTURAL</b>						
1.	Does the project affect the culture through:					
a.	Changes in traditional cultural values _____		X			
b.	Alter physical symbols _____	X				
c.	Alter traditional modes of transportation _____			X		
d.	Alter traditional living patterns through increased mobility changes in family structure _____	X				
e.	Other factors _____					
<b>F. SOCIOECONOMIC</b>						
1.	Does the project affect socioeconomic conditions through:					
a.	Changes in ownership/land values/tenure _____			X		
b.	Changes in market patterns (local, natural), regional _____				X	
c.	Increase demand of services (e.g. public and private automotive, water supplies, health, etc.) _____				X	
d.	Change in transportation pattern (cost; cargo) _____				X	
e.	Changes in economic/employment patterns _____			X		
f.	Other factors _____					
<b>G. HEALTH</b>						
1.	Does the project affect health standards through:					
a.	The creation of stagnant water which may result in increased disease vectors _____		X			
b.	Increased carrier mobility (human and/or animal) _____		X			
c.	Dietary changes (introduction of new food products) _____			X		
d.	Increased traffic accidents (human and animal) _____			X		
e.	Other factors _____					
<b>H. GENERAL</b>						
1.	Does the project have:					
a.	International impacts _____		X			
b.	Controversial impacts _____		X			
c.	Larger program impacts _____				X	
d.	Other factors _____					
<b>I. OTHER POSSIBLE IMPACTS (not listed above)</b>						
_____						
_____						
_____						

APPENDIX H - PROJECT CHECKLISTS

5 C (1) - COUNTRY CHECKLIST

Listed below, are first, statutory criteria applicable generally to FAA funds, and then criteria applicable to individual fund sources: Development Assistance and Economic Support Fund.

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

- No. 1. FAA Sec. 116. Has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, can it be demonstrated that contemplated assistance will directly benefit the needy?
- Yes 2. FAA Sec. 113. Has particular attention been given those programs, projects, and activities which tend to integrate women into the national economies of developing countries, thus improving their status and assisting the total development effort?
- No. 3. FAA Sec. 481. Has it been determined that the government of the recipient country has failed to take adequate steps to prevent narcotics 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?
- Yes 4. FAA Sec. 620 (b). If assistance is to a government, has the Secretary of State determined that it is not dominated or controlled by the International Communist movement?
- No. 5. 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) the debt is not denied or contested by such government?
- No. 6. 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?

222

- No 7. FAA Sec. 620(a), 620(f), 620D; FY 80 App. Act. Secs. 511, 512 and 513; ISCA of 1980 Secs. 717 and 721. Is recipient country a Communist country? Will assistance be provided to Angola, Cambodia, Cuba, Laos or Vietnam? (Food and humanitarian assistance distributed directly to the people of Cambodia are excepted). Will assistance be provided to Afghanistan or Mozambique without a waiver? Are funds for El Salvador to be used for planning for compensation, or for the purpose of compensation, for the confiscation nationalization, acquisition or expropriation of any agricultural or banking enterprise, or property or stock thereof?
- No 8. 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?
- No 9. 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?
- No 10. FAA Sec. 620(k). Does the program exceed the \$100,000,000 limit?
- N/A 11. 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?
- No 12. FAA Sec. 620(m). Is the country an economically developed nation capable of sustaining its own defense burden and economic growth and, if so, does it meet any of the exceptions to FAA Section 620(m)?
- N/A 13. 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?

- No 14. FAA Sec. 620(q); FY 80 App. Act Sec. 518. (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 the country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds?
- N/A 15. 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, taken into account by the Administrator at time of approval of Agency OYB." This approval by the Administrator of the Operational Year Budget can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)
- Yes\* 16. 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?
- Mauritania 17. 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?  
regularly meets its UN obligations.
- No 18. FAA Sec. 620A, FY 80 App. Act, Sec. 521. Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism? Has the country granted sanctuary from prosecution to any individual or group which has committed a war crime?
- No 19. 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. who is present in such country to carry out economic development programs under the FAA?

\* Diplomatic relations have been resumed and a bilateral assistance agreement currently is being negotiated.

204

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?

B. FUNDING SOURCE CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria.

Yes a. FAA Sec. 102(b)(4). Have criteria been established and taken into account to assess commitment progress of the 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.

N/A b. FAA Sec. 104(d)(1); IDC Act of 1979. If appropriate, is this development (including Sahel) activity designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families in programs such as education in and out of school, nutrition, disease control, maternal and child health services, agricultural production, rural development, assistance to urban poor and through community-based development programs which give recognition to people motivated to limit the size of their families?

2. Economic Support Fund Country Criteria.

No a. FAA Sec. 502B. Has the country (a) engaged in a consistent pattern of gross violations of internationally recognized human rights or (b) made such significant improvements in its human rights record that furnishing such assistance is in the national interest?

No b. FAA Sec. 532(f). Will ESF assistance be provided to Syria? If so, has President waived prohibition against the assistance by determining that such assistance will further U.S. foreign policy interests?

c. FAA Sec. 609. If commodities are to be granted so that sales proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?

This project is linked with a sub-project activity financed through the local currency generated by the PL 480 Title II, Section 206 project. The 206 project requires that a Special Account arrangement be established.

d. FY 80 App. Act Sec. 510. Will assistance be provided for the purpose of aiding 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? No.

e. FAA Sec. 620B. Will ESF be furnished to Argentina? No.

5C (2) - Project Checklist

Listed below are statutory criteria applicable generally to project with FAA funds and project criteria applicable to individual funding sources: Development Assistance (with a subcategory for criteria applicable only to laons); and Economic Support Fund.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE?  
HAS STANDARD ITEM CHECKLIST BEEN  
REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT

1. FY 80 App. Act Unnumbered; FAA Sec. 634 A; Sec. 653 (b);.

(a) Describe how authorizing and appropriations Committees of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than \$1 million over that figure)?

(a) Advice of program change will be submitted  
(b) Yes.

2. FAA Sec. 611 (a) (1). Prior to obligation in excess of \$100,000, will there be (a) engineering, financial other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance. 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. N/A.

724

4. FAA Sec. 611 (b); FY 80 App. Sec. 501. If for water or water-related land resource construction, has project met standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 1973? N/A.

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? 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. No.

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; and (c) encourage development and use of cooperatives, and 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.

(a) The project will encourage the flow of international trade between Senegal and Mauritania by improving the roads from the Senegal River Basin area into the interior of Mauritania; (b) private initiative to engage in increased agricultural and food production should be stimulated as a result of improved transportation links and subsequent reduced transport costs; (e) the technical efficiency of agriculture in the Guidimaka Region should be improved as a result of increased technical advice and improved agricultural inputs from the extension services which will be better able to reach rural farmers on the improved roads.

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).

The project will finance technical assistance services and project commodities from private firms in the U.S.

9. FAA Sec. 612 (b); Sec. 636 (h); FY 80 App. Act Sec. 508. 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 in lieu of dollars.

221

Mauritania's contribution represents the maximum that it can manage, given that it is one of the poorest countries in Africa.

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? 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? Yes.

12. FY 80 App. Act Sec. 522. 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? N/A

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102 (b); 111;113;281 (a). Extent to which activity will (a) effectively involve the poor in development, 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) The project will encourage local small farmers to increase agricultural production because of the greater availability of agricultural inputs and the greater accessibility to markets provided by transportation improvements; (c) the project will encourage local communities to engage in rural road maintenance, to assure that the improved road network continues to function; (d) road improvements made by the project will improve the position of women in the Project area since they are often engaged in farming activities which will benefit from improved transportation links noted in (a) above; (e) the road network to be improved by the project will be of direct benefit to the regional development activities financed under the auspices of the OMVS by assuring improved transport links between the Senegal River Basin and the rest of Mauritania's national road network.

228

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.) N/A (Sahel funds used)

(1) (103) for agriculture, rural development or nutrition; if so (a) extent to which activity is specifically designed to increase productivity and income of rural poor; 103 A if for agricultural research, full account shall be taken of the needs of small farmers, and extensive use of field testing to adapt basic research to local conditions shall be made; (b) extent to which assistance is used in coordination with programs carried out under Sec. 104 to help improve nutrition of the people of developing countries through encouragement of increased production of crops with greater nutritional value, improvement of planning, research, and education with respect to nutrition, particularly with reference to improvement and expanded use of indigenously produced foodstuffs; and the undertaking of pilot or demonstration of programs explicitly addressing the problem of malnutrition of poor and vulnerable people; and (c) extent to which activity increases national food security by improving food policies and management and by strengthening national food reserves, with particular concern for the needs of the poor, through measures encouraging domestic production, building national food reserves, expanding available storage facilities, reducing post harvest food losses, and improving food distribution.

(2) (104) for population planning under sec. 104 (b) or health under sec. 104 (c); if so, (i) 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.

(4) (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; and (ii) extent to which assistance provides advanced education and training of people in developing countries in such disciplines as are required for planning and implementation of public and private development activities.

(5) (106; ISCA of 1980, Sec. 304) for energy, private voluntary organizations, and selected development activities; if so, extent to which activity is: (i) (a) concerned with data collection and analysis, the training of skilled personnel, research on and development of suitable energy sources, and pilot projects to test new

methods of energy production; (b) facilitative of geological and geophysical survey work to locate potential oil, natural gas, and coal reserves and to encourage exploration for potential oil, natural gas, and coal reserves; and (c) a cooperative program in energy production and conservation through research and development and use of small scale, decentralized, renewable energy sources for rural areas;

(ii) Technical cooperation and development, especially with U.S. private and voluntary or regional and international development, organizations;

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

(iv) reconstruction after natural or manmade disaster;

(v) for special development problems, 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.

c. (107) is appropriate effort placed on use of appropriate technology? (relatively smaller, cost-saving, labor using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor). YES.

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)?

Strict adherence to the 25% rule is not required of SDP-funded projects.

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"? N/A.

230

(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 civil education and training in skills required for effective participation in governmental processes essential to self-government. \*see below

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? YES.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122 (b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest. N/A.

b. FAA Sec. 620 (D). If assistance is for any productive enterprise which will compete with U.S. enterprises, 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?

3. Project Criteria Solely for Economic Support Fund

a. FAA Sec. 531 (a). Will this assistance promote economic or political stability? To the extent possible, does it reflect the policy directions of FAA Section 102. N/A.

b. FAA Sec. 531 (c). Will assistance under this chapter be used for military, or paramilitary activities?

5C (3) - STANDARD ITEM CHECKLIST

Listed below are the statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

\*The project responds to the wishes of the people to have year-round transportation access between the Guidimaka Region, potentially Mauritania's most productive area, and the rest of the country.

231

A. Procurement

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed? YES
2. FAA Sec. 604 (a). Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him? YES.
3. FAA Sec. 604 (d). If the cooperating country discriminates against U.S. marine insurance companies, will commodities be insured in the United States against marine risk with a company or companies authorized to do a marine insurance business in the U.S. N/A.
4. FAA Sec. 604 (e); ISCA of 1980 Sec. 705 (a). 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? (Exception where commodity financed could not reasonably be procured in U.S.) N/A.
5. FAA Sec. 608 (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. YES.
7. FAA Sec. 621. If technical assistance is financed, to the fullest extent practicable will such assistance, goods and professional and other services from private enterprise, be furnished 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? YES.
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? YES.

9. FY 80 App. Act Sec. 505. Does the contract for procurement contain a provision authorizing the termination of such contract for the convenience of the United States? YES.

B. Construction

1. FAA Sec. 601 (d). If 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 interests? 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? 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? YES.

C. Other Restrictions

1. FAA Sec. 122 (B). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter? N/A.

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? N/A.

3. FAA Sec. 620 (h). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries? YES.

4. Will arrangements preclude use of financing:

a. FAA Sec. 104 (f). To pay for performance of abortions as a method of family planning or to, motivate or coerce persons to practice abortions; to pay for performance of involuntary sterilization as a method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization? YES.

- b. FAA Sec. 620 (g). To compensate owners for expropriated nationalized property? YES.
- c. FAA Sec. 660. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? YES.
- d. FAA Sec. 662. For CIA activities? YES.
- e. FAA Sec. 626 (i). For purchase, sale, long-term lease, exchange or guaranty of motor vehicles manufactured outside U.S., unless a waiver is obtained. YES.
- f. FY 80 App. Act Sec. 504. To pay pensions, annuities retirement pay, or adjusted service compensation for military personnel. YES.
- g. FY 80 App. Act Sec. 506. To pay U.N assessments, arrearages or dues. YES.
- h. FY 80 App. Act Sec. 507. To carry out provisions of FAA section 209 (d) (Transfer of FAA funds to multi-lateral organizations for lending.) YES.
- i. FY 80 App. Act Sec. 509. To finance the export of nuclear equipment fuel, or technology or to train foreign nationals in nuclear fields? YES.
- j. FY 80 App. Act Sec. 516. To be used for publicity or propaganda purposes within U.S. not authorized by Congress. YES.

REPUBLIQUE ISLAMIQUE DE MAURITANIE

Honneur - Fraternité - Justice

PRESIDENCE DU GOUVERNEMENT

VISAS : LEGISLATION :

DBC      CF

APPENDIX I:

GIRM Organization Structure:  
Ministry of Equipment, Transport and Telecommunications

DÉCRET N° 09.12  
Fixant les attributions du Ministre  
de l'Équipement, des Transports et  
des Télécommunications et l'organisation  
de l'Administration Centrale de  
son Département.

LE PREMIER MINISTRE

- VU la Charte Constitutionnelle du Comité Militaire de Salut National du 25 Avril 1981,
- VU le Décret N° 40.81 du 27 Avril 1981 portant nomination du Premier Ministre,
- VU le Décret N° 42.81 du 29 Avril 1981 fixant la composition du Gouvernement,
- VU le Décret N° 133.80 du 17 Décembre 1980 portant règlement organique relatif aux attributions des Ministres,
- VU le Décret N° 62.81 du 1er Juin 1981 portant nomination d'un membre du Gouvernement,
- VU le Décret N° 36.80 du 12 Avril 1981 fixant les attributions du Ministre de l'Équipement et des Transports et l'organisation de l'Administration Centrale de son Département.

D E C R E T :

ARTICLE 1er : Le Ministre de l'Équipement, des Transports et des Télécommunications est chargé des questions relatives :

I - aux Travaux Publics et notamment :

- des études de la construction et de l'entretien des routes, ponts et ouvrages d'art,
- des études, de la construction et de l'entretien des aérodrômes,
- des études de la construction et de l'entretien des voies ferrées des Ets maritimes et fluviaux et des wharfs,
- de la construction des routes,
- les études de la construction, de l'entretien et du fonctionnement des phares et balises,
- de l'exploitation des ports maritimes et fluviaux et des wharfs,

- de l'étude et de l'aménagement des voies navigables,
- du contrôle, de l'exploitation et de l'entretien des bacs,
- de la gestion des subdivisions des travaux publics,
- des études, de l'exécution et du contrôle des travaux de voiries,
- de la gestion du domaine public,
- de l'étude de la réalisation et du contrôle des travaux et l'axe routier NOUAKHOTT - NEMA,
- des travaux géographiques et notamment
- de la géodésie, de la cartographie et de la topographie, télé-détection.

II - Aux Transports et à l'Aviation Civile et notamment :

- des transports aériens, routiers, ferroviaires et fluviaux,
- de l'organisation, la réglementation, la planification et la coordination de l'ensemble de ces transports et du contrôle de l'application de la législation les régissant,
- de la fixation et l'application des tarifs de transports publics aériens et des tarifs des services connexes,
- de la délivrance des autorisations de survol dans l'espace aérien mauritanien et d'atterrissage sur les Aéroports nationaux par les avions étrangers,
- des rapports avec l'Agence pour la Sécurité de la Navigation Aérienne en Afrique et à MADAGASCAR (ASECNA) et du contrôle de la dite Agence dans les conditions fixées par les statuts et la convention régissant les rapports entre les Etats signataires et l'ASECNA et par les contrats particuliers ultérieurs,
- des rapports avec la Compagnie Multinationale AIR AFRIQUE, du contrôle de la dite Compagnie dans les conditions prévues par les statuts et le traité de YAOUNDE régissant les rapports entre les Etats signataires de ce traité,
- de la classification et de l'homologation des aéroports.

III - Aux Postes et Télécommunications et notamment :

- à l'exploitation des services postaux,
- à la construction, au contrôle et à l'exploitation des réseaux de télécommunications.

IV - Aux relations avec l'organisation pour la Mise en Valeur du Fleuve SAHARA et à toutes les questions relatives à l'étude, l'exécution et au contrôle des projets de développement réalisés dans le cadre de cette organisation.

ARTICLE 2 : sont soumis à la tutelle administrative du Ministère de l'Équipement, des Transports et des Télécommunications, les Établissements Publics suivants :

- l'Office des Postes et Télécommunications,

- des études, de la construction, de l'entretien et du fonctionnement des phares et balises maritimes et fluviaux,
- de l'étude et de l'aménagement des voies navigables,
- de l'exploitation des ports maritimes et fluviaux,
- du contrôle de l'exploitation et de l'entretien des bacs,
- des études, de l'exécution et du contrôle des travaux de voirie,
- de la gestion du domaine public,
- de la gestion des subdivisions des travaux publics,
- de l'étude, de la réalisation et du contrôle des travaux de la Route NOUAKHOUTT - NEMA.

La Direction des Travaux Publics comprend quatre services et une division :

- le Service des Ports et Voies Navigables chargé des bacs,
- le Service des Travaux Publics,
- le Service de l'Entretien du Matériel et de l'Entretien Routier,
- le Service des Etudes et du Contrôle Routier,
- la Division de la Documentation et des Archives.

Le Directeur des Travaux Publics est assisté dans sa tâche par un Directeur Adjoint.

ARTICLE 7 : La Direction de la Topographie et de la Cartographie est chargée :

- de l'exécution des travaux topographiques intéressant les divers départements ministériels,
- de l'agrément des géomètres privés,
- de l'établissement des cartes et toutes opérations s'y rapportant (géodésie, astronomie, photogrammétrie, télédétection etc...)
- de l'implantation et du contrôle des lotissements.

La Direction de la Topographie et de la Cartographie comprend deux services :

- le Service de la Topographie,
- le Service de la Cartographie.

ARTICLE 8 : La Direction des Transports est chargée :

- des études économiques et techniques relatives à l'exploitation et au développement des transports routiers, ferroviaires et fluviaux et de la tenue des statistiques et de la documentation requises,
- de rassembler tous les éléments d'étude utiles à l'actualisation des accords bilatéraux et multilatéraux en matière de transports routiers, ferroviaires et fluviaux et de la mise en œuvre des plans et budgets approuvés,

..../....

237

- l'Établissement Maritime de NOUAKCHOTT,
- le Port Autonome de NOUAKCHOTT,
- le Laboratoire National des Travaux Publics.

Le Ministre de l'Équipement, des Transports et des Télécommunications exerce les pouvoirs de tutelle et de contrôle fixés par les lois et règlements en vigueur sur les Sociétés d'Économie Mixte suivantes :

- la Société AIR MAURITANIE,
- la Société des Transports Publics de NOUAKCHOTT (S.T.P.N.)

**ARTICLE 3 :** L'Administration Centrale du Ministère de l'Équipement des Transports et des Télécommunications comprend :

- le Secrétariat Général,
- les Conseillers Techniques, dont un est chargé des questions relatives à la tutelle du Ministère sur les Établissements Publics et les Sociétés Nationales,
- la Direction des Travaux Publics,
- la Direction de la Topographie et de la Cartographie,
- la Direction des Transports,
- la Direction de l'Aviation Civile,
- la Direction Administrative et Financière,
- le Service de la Production,
- le Service des Études et Contrôle des Travaux de l'OMVS,
- la Division de la Documentation et des Archives.

**ARTICLE 4 :** Le Secrétaire Général est chargé de l'Administration des services centraux et notamment de la gestion du personnel, de l'engagement et de la gestion des crédits prévus au budget du Ministère.

**ARTICLE 5 :** Les Conseillers Techniques sont chargés de traiter les affaires qui leur sont confiées par le Ministre et de donner leur avis sur les divers projets pour lesquels ils sont consultés.

**ARTICLE 6 :** La Direction des Travaux Publics est chargée :

- de l'étude, de la construction et de l'entretien des routes, ponts et ouvrages d'art,
- de l'étude, de la construction et de l'entretien des aérodrômes et de l'infrastructure aéronautique,
- de l'étude, de la construction et de l'entretien des voies ferrées,
- de la classification des routes,
- de l'étude de la construction et de l'entretien des ports maritimes et fluviaux et des wharfs,

..../....

- de la préparation des projets de textes législatifs et réglementaires relatifs aux transports routiers, ferroviaires et fluviaux et du contrôle de l'application de la législation et de la réglementation en vigueur,
- des études, du point de vue de l'exploitation, des projets de construction d'infrastructure routière, ferroviaire et fluviale,
- de l'application de la réglementation relative au contrôle économique et technique des entreprises effectuant des transports routiers, et fluviaux à titre public et contre rémunération ainsi que les entreprises créées aux fins de la vente, de la réparation et de l'entretien des véhicules routiers,
- du contrôle technique des véhicules routiers, de la tenue du registre d'immatriculation des véhicules et de la délivrance des cartes grises,
- de la délivrance des permis de conduire, de l'organisation des examens et épreuves requis pour la délivrance et le renouvellement des dits permis,
- de la participation à la prévention des accidents routiers, ferroviaires et fluviaux,

La Direction des Transports comprend deux services et deux divisions :

- le Service des Transports Routiers qui comprend deux divisions :
  - . la Division des Etudes et de la Réglementation,
  - . la Division de l'Immatriculation et du Contrôle Technique
- le Service des Transports Ferroviaires et Fluviaux.

**ARTICLE 9** : La Direction de l'Aviation Civile est chargée :

- des questions relatives au transport aérien,
- des liaisons avec l'organisation de l'Aviation Civile des Etats Arabes, la Commission Africaine de l'Aviation Civile et l'Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar,
- de l'instruction sur le plan économique et technique des demandes d'agrément d'entreprises mauritaniennes de transport et de travail aérien, des agences de voyage aérien, des entreprises de vente, d'entretien et de réparation des aéronefs, de la tenue du registre de ces entreprises et de leur contrôle technique et économique,
- de la délivrance des autorisations de survols non réguliers dans l'espace aérien de la République Islamique de MAURITANIE,
- de l'approbation des horaires des services de transport aérien régulier et des études préalables à l'approbation des tarifs de transport aérien régulier et à la demande, de travail aérien, de vente, de réparation et d'entretien d'aéronefs,
- de la recherche, de la mise en oeuvre et de la coordination des mesures de toute nature propres à faciliter le transport aérien,

.... / ....

- de l'homologation des cours d'instruction pour la formation du personnel de l'aviation civile, de la préparation de projets d'actes réglementaires portant organisation des examens et épreuves préalables à la délivrance et au renouvellement des diverses licences et qualification et la tenue du registre de ce personnel,
- de la délivrance de certificats d'immatriculation d'aéronefs civils et de la tenue du registre de ces aéronefs,
- de la liaison avec les sociétés ou organismes chargés du contrôle de la navigabilité,
- de l'approbation des manuels d'exploitation des entreprises de transport et de travail aérien, ainsi que des manuels de vol et des manuels d'entretien des aéronefs inscrits au registre mauritanien,
- de la prévention des accidents d'aviation et de la conduite des enquêtes sur les accidents et incidents d'aviation,
- de l'instruction des demandes d'ouvertures d'aérodromes privés de la tenue du registre de ces aérodromes et du contrôle de leur exploitation.

La Direction de l'Aviation Civile comprend deux services :

- le Service des Transports Aériens et de la Sécurité des Vois,
- le Service des Etudes et de la Formation.

ARTICLE 10 : La Direction Administrative et Financière est chargée sous la responsabilité du Secrétaire Général :

- de la gestion de tout le personnel et de la formation professionnelle à tous les niveaux du Ministère,
- de la comptabilité et de la gestion financière, notamment de la préparation et de l'exécution du Budget du Ministère, du suivi des financements extérieurs, et de la comptabilité ministérielle du Ministère,
- des dossiers comptables des marchés d'études, de fournitures et de travaux passés par le Ministère.

La Direction Administrative et Financière comprend deux services :

- le Service du Personnel,
- le Service de la Comptabilité.

ARTICLE 11 : Le Service de la Traduction est chargé sous l'autorité directe du Secrétaire Général de la traduction de tous les documents du Ministère.

ARTICLE 12 : Le Service des Etudes et Contrôle des Travaux de l'OMVS est chargé de toutes les questions relatives à l'étude, à l'exécution et au contrôle des projets de développement réalisés dans le cadre de cette organisation.

...../.....  
ARTICLE 13 : Le Service des Etudes et Contrôle des Travaux de l'OMVS est chargé de toutes les questions relatives à l'étude, à l'exécution et au contrôle des projets de développement réalisés dans le cadre de cette organisation.

ARTICLE 13 : La Division de la Documentation et des Archives est chargée de la conservation et du classement des archives et de la documentation du Ministère, ainsi que de la reproduction et de la diffusion des documents intéressant le Ministère.

ARTICLE 14 : L'Organisation des Directions, Services et Divisions en Subdivisions, Bureaux et Sections sera définie par Arrêté du Ministre de l'Équipement, des Transports et des Télécommunications.

ARTICLE 15 : Sont abrogées toutes dispositions antérieures contraires et notamment le décret n° 36.80 du 14 Avril 1980 fixant les attributions du Ministre de l'Équipement et des Transports et l'organisation de l'Administration Centrale de son Département.

ARTICLE 16 : Le présent décret sera publié au Journal Officiel.

Ampliations :

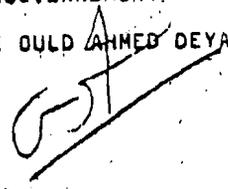
- PG.....5
- Ts M.....20
- PCMSN.....3
- LEG.....3
- DT.....14
- Régions.....14
- CGE.....2
- J.O.....3
- Arch.....3

NOUAKCHOTT, le 5 février 1982

Le Colonel MAAOUYA OULD SID'AHMED TAYA

P.C.C.C. LE SECRETAIRE GENERAL DU  
GOUVERNEMENT.

SIDI OULD AHMED DEYA



SUMMARY OF PL 480 TITLE II SECTION 206 PROGRAM

Prior to the 1970s, Mauritania was self-reliant in meeting its food needs; what it could not produce, it was capable of importing on commercial terms. During the 1970s, the economy experienced a succession of shocks -- the Sahelian drought, the costly Western Sahara War and the stagnation of world prices for iron ore, Mauritania's major source of revenue and foreign exchange. Food production declined, the pace of rural-urban migration quickened, and Mauritania's commercial import capacity eroded due to the cost of the war and reduced iron ore earnings. Imbalance in food supply and demand resulted in wide fluctuations in food prices ranging from 8 UM/KG to 40 UM/KG causing emergency food aid to become essential. Since 1978, food aid has averaged 62,000 MT or 33 % of total requirements.

The USG has responded to Mauritania's food needs to date through emergency relief programming on a year-to-year basis. In contrast, this Title II Section 206 initiative proposes a multi-year Food for Development program in which sales proceeds are used to both alleviate the causes of the need for the assistance and support programs and projects to increase the availability of food commodities to the neediest. The program will provide up to 60,000 MT of food aid to the Government of the Islamic Republic of Mauritania (GIRM) over a three year period, FY 1983-85. Local currency drawdowns to support sub-projects, in effect, extend the program an additional two years to FY 1987.

Sales proceeds will generate about 640 UM million or a \$ 12.8 million equivalent. Over a longer run, it is envisioned that Mauritania will become a Title I or Title II recipient. Ultimately, the objective is to reestablish food self-reliance such that Mauritania no longer depends upon concessional food assistance.

This Food for Development program is timely and consistent with the GIRM and USAID/Mauritania's development strategies. The GIRM's Fourth Five-Year National Development Plan recognizes the need to retard rural-urban development. Almost all planned projects in the rural sector aim directly at increasing food production. By the year 2000, the GIRM aims to achieve food self-sufficiency.

The USAID/Mauritania country development strategy is supportive of this national effort. A key objective of the CDSS is to increase food availability and food production. Potentials in both dryland and irrigated agriculture are targeted.

242

Consistent with these GIRM/USAID objectives, the purpose of this Section 206 program is two-fold: (1) to increase domestic marketed food production; and (2) to strengthen the food pricing, marketing, and distribution system. At the end of the project in 1987, the Office of Mauritania Cereals (OMC) will have more than doubled its purchases of locally produced grains from 2,000 MT to 4,500 MT annually; OMC handling capacity will have increased from 20,000 MT to 64,500 MT with stocks turning over annually; and the OMC will be operating as a financially self-sustaining institution.

The outputs of the program constitute an integrated package of interventions directly impacting upon the achievement of the project purposes. A key feature -- and the major one justifying this multi-year commitment -- is the support this program gives to USAID/Mauritania's food price policy reform program. Under this program, OMC wholesale prices will be raised to import parity plus internal transport and handling by 1987. Through adjustments are expected to put upward pressures on producer prices. Through policy dialogue, USAID/Mauritania will concomitantly urge the National Committee for Food Security to increase producer prices.

While adjusting prices toward parity, a food price stabilization program component will aim to stabilize market prices within a range of fluctuation not to exceed 20 percent by 1987. Training and warehouse construction will be provided to increase the OMC's handling capacity and thereby its influence on market prices.

As efforts to increase and stabilize prices proceed, a food crop extension program will directly support GIRM efforts to increase local cereal production. This extension effort draws upon the successful experience gained through an AID-supported integrated rural development project scheduled to end in December, 1982. The proposed activity is in the most productive rainfed region of Mauritania and employs an animal traction technology package which has already proven acceptable to farmers. The extension effort will aim to increase domestic production an additional 670 MT/year by 1985.

The 206 program will also directly support local food production through the reinforcement of the GIRM's crop protection service. This intervention supplements an on-going USAID project and will expand the operational capacity of the service unit by an additional 8,400 hectares per year by 1987.

Section 206 support to the rehabilitation of the Kaedi-M'bout road will have a favorable impact on food production by improving extension agents' access to farmers and by reducing transport costs of marketed inputs and outputs. The road traverses and provides access to some of the most potentially intervention is linked with construction of the DA-financed, M'bout-Selibaby road. The M'bout-Selibaby road crosses through the heart of the Guidimaka region where the above noted crop segment is essential to providing year-round access to the M'bout-Selibaby segment.

242

Also facilitating the timely distribution of food aid will be the construction of a bulk handling facility at the Nouakchott port. The facility will significantly reduce excessive demurrage charges now incurred due to poor offloading capabilities. These savings will reduce OMC transport costs and will significantly reduce the extent to which upward price adjustments under the food price policy reform program must be made.

In addition to the policy reform and development project activities to be funded, the GIRM is prepared to carry out a series of self-help activities designed to strengthen its commitment to development and to increase the transfer of resources to the rural sector. The GIRM will:

- annually increase GIRM recurrent and capital budget allocations to the rural development sector in real terms;
- in keeping with the Grain Market Stabilization Program objectives, announce domestic foodstain production purchase prices by May 1, prior to the planting season;
- initiate a series of pricing policy studies to examine the feasibility of price reforms for sugar, tea, and rice imports to establish domestic wholesale market prices at import parity plus internal handling costs;
- improve the planning, analysis, and coordinating capabilities of the GIRM to provide more comprehensive planning in the food and rural development sectors.

The GIRM and USAID are prepared to negotiate and implement a program management plan which incorporating respective rules, regulations, and guidelines which meet acceptable standards of performance for project implementation and evaluation.

The Section 206 program will be under the joint management of an Executive Steering Committee co-chaired by the GIRM Minister of Finance and Economy and the Director, USAID/Mauritania. The development activities will be co-supervised by the GIRM and USAID appointed project officers. Program operations will be examined quarterly with corrective action implemented as needed. Annual evaluations will justify program modification, continuation, or termination.

244

## Appendix J.1

### Rural Roads Sub-project Component of the PL 480 Title II Section 206 Project

#### I. Project Description

##### A. Background

One of the basic constraints inhibiting the movement of production input packages and of domestically produced crops from surplus production areas to markets are high transportation costs, due in large measure to the poor condition of existent rural roads and lack of access by vehicles to many productive areas. This situation increases the effective isolation of producing areas, which are completely inaccessible during and immediately after the rainy season, roughly July to October. This prevents the OMC grain purchasing campaign from reaching many farmers who produce marketable surpluses. Collection costs are significantly greater in less accessible zones. Storage and inventory carrying costs of agricultural inputs are also increased since these items must be transported and stockpiled at the place of use prior to the rains. In addition, agricultural research and extension are made difficult.

##### B. Project Activities

This project proposes the use of local currencies generated by the Title II-206 project to extend the number of kilometers improved under the proposed Rural Roads Improvement Project 682-0214. This dollar-funded project is a collaborative effort between USAID/Mauritania and the United Nations Sahel Operations (UNSO). The Section 206 local currency will make it possible to upgrade additional road surface than would be possible under the 682-0214 project alone. Construction will be undertaken by teams formed as part of the USAID/UNSO project and technical assistance will be provided by three experts funded by the Development Assistance Project. The funds will be used to provide local currency costs needed to make two major arteries passable year round. A major improvement effort will be undertaken on the 45 kilometers connecting Selibaby and Gouraye while a less extensive rehabilitation effort will be made on the stretch between M'Bout and Kaedi (118 Km.).

The M'Bout-Kaedi link is estimated to cost \$2.25 million of which \$649,000 is local currency costs to be covered by the Section 206 Program. The Selibaby-Gouraye link is estimated at \$2.373 million of which the Title II, 206 Program will cover \$558 of local currency costs.

This project should be reviewed in tandem with the Rural Roads Improvement Project (682-0214) which was originally proposed to improve the M'Bout-Selibaby-Gouraye road. The Title II Section 206 sub-project for road improvement originally proposed to upgrade the M'Bout-Kaedi road. Since these roads together are part of the same road network and are both vital links in the transportation system, their financing should be considered together. The M'Bout-Kaedi road requires foreign exchange inputs unavailable through the PL 480 Title II Section 206 local grain sales proceeds. The M'Bout-Selibaby-Gouraye road also has requirements for the use of local currencies. Thus, present project proposal, Rural Roads Improvement, 682-0214, includes the provision of foreign exchange required for rehabilitating the M'Bout-Kaedi road. Likewise, local currency

245

requirements for the M'Bout-Selibaby-Gouraye road will be primarily met with PL 480 sales proceeds as indicated in the financial section of this Project Paper. However, since PL 480 local currency will not be available until FY 1984, there is also a local currency element to the Rural Roads Improvement Project (to cover requirements prior to FY 1984.

### C. Project Goals

The proposed route passes through the Gorgol Region recessional agriculture zone. It will also provide all-weather access to the 3600 HA irrigated agriculture project on the Gorgol Noir (Black Gorgol) river. The proposed road will provide a year-round route for the supply of essential inputs and evacuation of production towards urban market areas for this major GIRM and international multi-donor project (World Bank, Kuwaiti Fund, et. al.). Finally, the completion of the M'Bout-Kaedi section will connect the regional roads being constructed by the USAID/UNSO project to link the Guidimaka Region with the Kaedi market and provide access to northern cereal deficit areas, both rural and urban. Completion of this road network will allow surplus cereals from the Guidimak cereals production areas to be transported and marketed at a much more competitive price than is now possible. Most important, it will assure timely delivery of agricultural inputs to the Guidimaka and Gorgol Regions and facilitate a much more vigorous agricultural extension effort. This should encourage rapid increases in crop production than would be possible without completion of the road network.

### D. Linkage to Country Development Strategy

A major objective of USAID/Mauritania's country development strategy is increased food availability and production. Rehabilitation of the M'Bout-Kaedi road will contribute to this objective by improving marketing access to food producing areas, particularly the dryland regions in which USAID food production activities will be implemented. The improved road will also promote rural development in a broader sense by permitting greater access for the delivery of other economic and social services.

USAID/Mauritania also proposes to fund construction of a major segment of the Selibaby-M'Bout road. Rehabilitation of the M'Bout-Kaedi link is essential to realizing the benefits of the Selibaby-M'Bout link.

### E. Linkage to Policy Reform

USAID/Mauritania policy reform initiatives center on the upward adjustment of food prices to stimulate increased domestic marketed production. The economic viability of the entire road improvement effort is linked to this price policy reform. Additionally, the reform in prices will permit the Mauritanian Cereals Office to function independently of GIRM and donor subsidies. The improvement in the road system will reduce transport costs and will lower OMC costs and thereby contribute to developing the OMC as a financially self-sustaining institution. These savings can also lower producer input costs and reduce the level to which OMC wholesale prices must be raised under the price reform program criteria.

246

## F. Beneficiaries

USAID is concentrating its financial resources on two economic groups--small agriculturalists who are engaged in some associated animal raising, and herders who also farm. These groups have substantial needs, with fair to good potential to become increasingly productive under favorable circumstances. These groups suffer severely from the periodic Sahelian droughts.

Beneficiaries will largely be those working in food production. As this sector absorbs the vast bulk of Guidimaka's productive labor, the project has the potential of reaching up to 64,000 people (68 percent of the region's population, representing rural farmers). If roads open markets for agricultural products, they can also impact positively on women. Women have their own fields in the Guidimaka on which they grow crops for sale. Roads have the potential of raising women's incomes by providing them with greater access to markets, a direct production incentive.

The direct beneficiaries, as described in more detail in the 682-0214 Project Paper (p. 7), are local workers, workers on the roads themselves, private transporters, farmers, and private merchants.

## G. Impact on Development Constraints

### High transport costs and isolated production and consumption regions.

As previously mentioned, a major constraint on the development of the agriculturally productive Gorgol and Guidimaka Regions is the rudimentary quality and seasonal utility of the road system. The Title II-206 resources will permit improvement of additional kilometers of the rural road network being constructed by the USAID/UNSO Rural Road Improvement Project. As a whole, this network will address the predominant constraints of high transport costs and lack of all-weather access for key inputs and for agricultural extension services.

## II. Analysis

### A. Current Status

The 118 kilometer M'Bout-Kaedi segment proposed for improvement with Title II-206 resources is part of the National Highway #2. The road surface itself is graded laterite of acceptable quality and is capable of supporting year-round traffic. Problems are caused, however, by the route which the road follows through the Gorgol Valley. By paralleling the course of the Gorgol River,

241

the road section is bisected by many small and medium-sized watercourses which during the rainy season becomes swift-flowing streams feeding the Gorgol River and its tributaries. Some of these channels are not controlled by drainage structures at points of intersection with the National Highway, although two major bridges and about 50 structures do exist. Passage is frequently impossible during the rainy season for several days at a time, and difficult and expensive even during the dry season because of the deteriorated condition of the roadway, originally constructed in 1963-64.

B. Outputs

M'Bout-Kaedi

The proposal calls for the rehabilitation of drainage structures and bridge approaches to adequate design standards and appropriate for future as well as present traffic levels. The required new structures will be permanent and will not need to be replaced in the event of further improvements to the road surface itself. The drainage structures will provide year-round service at minimum cost, allowing delays only in the event of flash-flooding which follows only the heaviest rains. In this way primary damage to the roadbed by the watercourses and secondary damage from the passage of vehicles over privously inundated or washed-out sections will be held to a minimum.

The projected improvements will consist of:

- construction of ford crossings where no structure exist now. The fords or "raidiers" are the most suitable type of oued or stream crossing structure in the area because of the shallow river beds which are predominant along this road.
- repair of existing structures and embankments/causeways including the raising of the level of these embankments to prevent overtopping by runoff water.
- addition to a few corrugated metal pipes, 80 cm in diameter to match the required culvert openings.
- road resurfacing wherever it will be deemed necessary and in particular in the vicinity of Kaedi.

Selibaby-Gouraye

In view of the various impediments to the all-weather flow traffic on the Selibaby-Gouraye link, as well as the whole system, improvements will be made to accomplish the following objectives.

248

- i) Provide year-round service at minimum cost, although allowing for delays of up to one or two days when heavy thunderstorms occur (i.e., fords rather than bridges).
- ii) Reflect the presently low traffic volumes which will gradually increase over time.
- iii) Build drainage structure to adequate design standards which are appropriate for the present as well as future traffic levels and will not require upgrading when traffic will warrant a better roadway (i.e, ultimately, widening and/or paving). This means that the roadbed as well as the structures will be built to a width of 5.5m according to the standards being used in the UNSO construction.

On the 45 km Selibaby-Gouraye section, specific outputs will include repair of three bridges, improvement of fords (265m) and culverts (122m<sup>3</sup> by volume), as well as improvement of the 45 km of roadbed.

For precise technical information on this road link, please refer to the 682-0214 Project Paper--both the main text and annexes.

The cost estimate of rehabilitation for the Kaedi-M'Bout road has been devised based on the assumption that work will be performed by the Special Autonomous Brigade with all the equipment available for M'Bout-Selibaby-Gouraye.

#### C. Economic Rationale

The proposed road rehabilitation will reduce the costs and increase the efficiency of both agricultural input delivery and food marketing. It will also increase the general level of commercial activity in the area and result in higher private farm-gate prices, which will provide an incentive for increased production. Finally, the road will increase the effectiveness of the agricultural research and training institutes based in Kaedi, and encourage more frequent visits throughout the region by extension agents.

The computed benefits comprise a) road user savings from existing and generated traffic on the three road links, M'Bout-Selibaby, Selibaby-Gouraye and M'Bout-Kaedi; b) road user savings on traffic diverted from the Nouakchott-Kiffa-Ould Yenge-Selibaby road to the completed Nouakchott-Kaedi-Selibaby road; c) savings in storage and inventory costs on goods formerly stockpiled in M'Bout and Selibaby before the onset of the rainy season and the value added from additional crop production induced or made possible through the reduction in transport costs and from guaranteed input supplies at a lower cost and in a timely manner and the facilitation of agricultural research and extension.

249

### IRR's

The IRR calculated for the basic scenario of traffic growth and production increase is 5 percent. A second scenario, with more optimistic diverted traffic estimates, but more conservative estimates of increased production, also yields an IRR of 5 percent.

For a more detailed economic analyses, see Project Paper 682-0214, Economic Section (page ) as well as the Economic Annex.

### D. Social Impact

Two political systems exist in the Selibaby area. The modern system administratively consists of a regional governor, department prefets and the head of governmental services such as agriculture, health, and public works who are representatives of their respective ministries in Nouakchott but under the immediate authority of the governor. Juxtaposed to this are the traditional communities and ethnic groups and their hierarchical class structure.

The area's population is comprised of several sub-groups. However, because of their strong attachment to the region and to agriculture, and in general their possion of the best land, the social dynamics of the Soninke clearly dominate the situation. In reality, it is almost impossible to predict the exat effects of a road, since the role itself creates a new, dynamic and continuously changing situation. It is precisely because of this that socio-economic monitoring of communities along the road should occur during the life of the project. However, it is possible to at least outline the socio-economic pressures that mape up the situation. As will be seen, these pressures--somewhat unique given the region's historic adjustment to male outmigration --seem to indicate no clearly discernable negative effects from the introduction of new all-weather transportation but to the contrary seem to be overwhelmingly positive in nature.

For a detailed analysis of the various ethnic groups in the region and the effects of the road effort on outmigration of work-age males and the women and children that remain, refer to the Project Paper 628-0214, pp. 51-56.

### III. Implementation Schedule

The activities to be financed by Title II-206 resources will be completely integrated into the USAID Rural Roads Improvement Project 682-0214. Implementation will therefore depend on the rate of completion of precedent road sections and the availability of construction teams. A complete implementation schedule is included in the 682-0214 project paper.

250

In summary, this schedule is as follows:

<u>ROAD</u>	<u>DISTANCE (KMS)</u>	<u>EXTERNAL FINANCING</u>	<u>TIMETABLE</u>
1. M'Bount-70 Kms towards Selibaby	70	UNSO/OPE	3/82 - 5/83
2. 70 kms from M'Bount-Selibaby	46	AID-682-0214/ PL 480	5/83 - 2/84
3. Selibaby-Gouraye	45	" "	2-11/84
4. M'Bount-Kaedi	118	" "	11/84 - 8/85

IV. Management

Supervision of construction activity and financial accountability will be assured by the USAID Project Manager, the Comptroller's Office and engineering consulting services. Oversight responsibilities will be assumed by the USAID/Office of General Development. Disbursement of funds will be determined by the PL 480, Section 206 Management Committee.

V. Budget/Financial Plan

Total costs of the road improvement effort to be met by USG contributions are \$6,017,000. Four million eight hundred and ten thousand dollars (\$4,810,000) will be financed under the Rural Roads Improvement Project (682-0214) and \$1,207,000 in local currencies under Section 206.

FINANCIAL SUMMARY  
(000's \$)

	<u>FX</u>	<u>LC</u>	<u>TOTAL</u>
FY 82	350	-	350
FY 83	1,334	333	1,667
FY 84	1,661	558	2,219
FY 85	<u>1,132</u>	<u>649</u>	<u>1,781</u>
Total	4,477	1,540	6,017

Amount to be programmed from PL 480 Local Currency**	1,207 -----
---------------------------------------------------------	----------------

Total amount to be obligated under 682-0214	4,810 ----- -----
------------------------------------------------	-------------------------

\* 330,000 in local currency provided by Project 682-0214.

\*\* \$1,207,000 to be made available to project for LC requirements by PL 480 Title II Section 206 funds.

251

In FY 84 and FY 85, PL 480 Title II Section 206-generated local currency will be made available for local costs requirements. These will be provided through the FIRM's Rural Development Fund administered by the Ministry of Finance.

252

QUARTERLY ESTIMATES EXPENDITURES SCHEDULE BY FISCAL YEAR  
(Current \$000)

---

	FY 84				FY 85																			
	2nd Q		3rd Q		4th Q		1st Q		2nd Q		3rd Q		4th Q											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S

---

Selibaby-Gouraye-----M'Bout-Kaedi-----

Equipment																									
Materials																									
- FX					165								330												
- LC					40								55												
Evaluation																									
Operating Costs																								35	
- FX					319	339		349	229				371	382	510										
- LC					102	152		156	60				156	162	174										
Consultants														43											
Contingency																									
- FX																								205	
- LC																								322	
Subtotal																									
- FX					484	416		349	554				371	425	510									240	
- LC					626	152		156	115				156	162	174									292	
TOTALS					626	568		505	674				527	587	684									562	

TOTAL LC (for 206 funding) 558 649

@ 50UM = \$1.00 UM UM

20

Evaluation

In accordance with the Section 206 evaluation procedures, the Management Steering Committee will receive and analyze reports from the contract technical and evaluation consultants funded by project 682-0219 to determine progress on the road links funded by Section 206 local currencies. A formal evaluation will be conducted jointly by the USAID and GIRM at the end of FY 1985.

254.