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TIGRAI REGION
PRELIMINARY PROPOSALS FOR
RURAL ROADS MAINTENANCE
UPGRADING AND CONSTRUCTION

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CHIEF ADMINISTRATORS OFFICE
MAKALLE
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PRELIMINARY PROPOSALS FOR A RURAL ROAD
MAINTENANCE UPGRADING AND CONSTRUCTION
PROGRAMME FOR TIGRAI REGION

1. Introduction

Tigray region with an area 65,900 km², an estimated total population of 1,83 million (1972) and an overall population density of 28 persons per km² is one of the more densely settled regions of Ethiopia. Local studies indicate that over much of the settled area of the region population density is about 60 persons per km². Over 95 per cent of the population are dependent on agriculture based principally on rainfed cereals, oilseeds, livestock and incense production. The main non-agricultural activity in is the production of salt from the lowland areas.

The region straddles the Ethiopian Highland massif extending from the Danakil depression in the east across wide mountainous and upland plateaux areas to the Taccaze river and lowlands in the west. The climate thus ranges from arid desert to semi arid mountain type, and has a typically short rainy season with total precipitation varying from year to year as well as within the season. The upland plateau has a rainfall ranging from 1,000 mm in the south to 550 mm in the north while the lowlands receive up to 350 mm per annum. The average rainfall of Makalle, which is typical of the central plateau, is 650 mm per annum. Much of the plateau and the lowlands are thus marginal for crop production, and the whole region suffered from bad drought over the period 1968-1973. This necessitated extensive relief operations to provide essential food supplies to the general populace. These relief operations have continued to a number of localised drought affected areas to the present time, and the pattern is expected to continue since localised drought is a feature of the region and moreover many areas are becoming heavily over populated.

Against this background of drought and its attendant relief measures several development studies and operational programmes have been mounted including the following:-

TAHADU under the IBRD;
North Eastern Rangelands Projects under the IBRD;
Central Tigray Rural Development Study under British Aid;
EPID Minimum Package Programme under SIDA and the IBBD;
SIM Community Development Programmes;
SFODA Forestry Programme.

Under these programmes various projects directed at rural development are either being undertaken at present or are under consideration for implementation in the near future. Most stress the importance of creating basic infrastructure, particularly a communications network, as a prerequisite for development.

The importance of rural roads and the extent to which priority has been given to road construction programmes in the past is reflected by the activities of the Tigray Development Organization (TDO). Over the last 12 years TDO has constructed a network of about 2800 kms of rural roads with funds raised almost entirely by local taxes. It is apparent that the existence of this road network has made possible the provision of a wide range of services including bus services, relief, agricultural extension, health, education and water supply programmes while the performance of a range of administrative functions by government or local authorities has been facilitated. The highest priority is given to the maintenance and upgrading of the existing network of roads. Proposals have also been formulated, on the basis of information supplied by awraja administrators, for new roads penetrating areas which are inaccessible at present and which have a large population, good development potential or existing economically significant activities.

1. Background to the Data Collected

The information presented in this report was prepared from data given by the eight awraja administrators to a three man team appointed by the Chief Administrator to report to the Infrastructure Sub-committee of the Tigrai Development Committee, at the request of the Rural Roads Study Team who visited Makalle on 9th June 1975. The team visited the eight awrajas between 13th and 20th June, 1975 and discussed the proposals for maintenance, upgrading and new road construction with the administrators. Little time was generally available for woreda officials to comment on the proposals. However awraja administrators are in contact with the woreda administrators on the question of roads and it is apparent that meetings have frequently been held at which possible improvement programmes have been discussed. In describing their plans the administrators have shown their obvious awareness of the varied social and economic benefits to be derived from an adequate maintenance and construction programme. Although it is recognised that the present administrators have unfortunately had relatively little time to familiarize themselves completely with their respective areas, and that they may in some cases still be developing their ideas, the broad perspective of road requirements presented is considered to be realistic.

At this stage a complete appraisal of these plans has not been feasible. However a general strategy is outlined together with specific proposals by the EPID and Ministry of Agriculture members of the Infrastructure sub-committee (See Appendices A and B).

3. Previous Road Building Activities and the Importance of Adequate Maintenance

In general first priority is given by the Awraja administrators to the maintenance and upgrading of the

existing rural road network. This reflects the comparatively developed state of the road network in the region - a network which apart from a number of old Italian roads, themselves now much degraded, was constructed by the Tigre Development Organisation (TDO). Details of the TDO activities are given in Appendices C and D and summarise as follows:-

- (a) About 2767 km of roads were constructed over the 12 year period 1962-1974. Generally these are dry weather standard.
- (b) Funds for TDO were obtained by local public contribution raised as a tax on agricultural output; relief grain was also used on a food for work basis to pay labour.
- (c) TDO was established by the Provincial Governor with a board consisting one representative from each awraja. Other staff consisted of a Director, supervisors and equipment operators.
- (d) Equipment and plant comprising 3 bulldozers, 3 graders, 3 tipper trucks, 1 traxcavator, 3 compressors and 4 vehicles were purchased new or second hand for the programme.

The drought years resulted in greatly reduced availability of funds for TDO and towards the end of 1974 their road building and maintenance activities were suspended. Staff were dismissed and equipment handed over to various organisations such as TAHADU, and the municipalities. Road maintenance during the past year has generally been taken over by the Relief and Rehabilitation Commission and undertaken on a food for work basis.

The Awraja administrators have drawn attention to the unsatisfactory nature of the present "food for work" programme, and indicate that whereas hand labour is essential, and desirable, adequate professional advice and supervision are necessary to ensure that proper standards are maintained. They have also

questioned the basic philosophy behind the "food for work" approach. It is believed that a sense of apathy may be created in the people towards "self help" type projects which should have an important role in providing labour particularly for maintenance and village level road construction.

4. The Need for New Roads in Tigrai

Although the importance of upgrading or preserving the present road network has been stressed, all the awrajas have proposals for new roads. In these plans particular importance was given to roads linking the central highlands to the eastern lowlands. Numerous new roads are also proposed for construction in the upland areas which indicates that there are still many areas in Tigrai which remain remote or inaccessible from the existing road network.

5. Planning Criteria and Proposals for Upgrading Existing and Constructing New Roads.

The proposals prepared by the awraja administrators are presented in tables 5.1 to 5.8 below, and are shown on the map accompanying this report. Each road was ranked according to its importance in upgrading or new construction programmes respectively on the basis of the economic and social criteria given below.

The criteria which were considered to be important for each road are listed in tables 5.1 to 5.8. Additional background population and administrative data are given in Appendices E and F.

(a) Social Criteria

The social criteria are mainly those concerned with the provision of social services, administration, security and general communication.

<u>Criteria</u>	<u>Abbreviation</u>	<u>Details</u>
i) Medical and health	Med	Access to hospitals, clinics and health stations for health department staff, and supply of materials.

Criteria	Abbreviation	Details
ii) Malaria eradication	Mal	Access for spraying programme, staff and equipment.
iii) Relief & Rehabilitation	Rel	Distribution of relief grain and related rehabilitation work.
iv) Education	Educ	Access for ESBU programme and supervision of schools.
v) Administration	Admin	Access for administrative staff for inspection, meetings, community development etc.
vi) Security	Sec	Access for security and police staff.
vii) Communication	Comm	General social contact and access for buses etc.

b) Economic Criteria

Access to meet the needs of agricultural, forestry and mineral production are the main primary sector requirements while in the secondary sector requirements for marketing, trading and tourism are considered to be important.

Criteria	Abbreviation	Details
i) Agricultural extension and veterinary services	Ag-serv	Transport in of production inputs and access for staff.
ii) Agricultural/Forestry marketing	Mkt	Transport out of products to market centres.
iii) Agricultural/Forestry development	Ag-devmt	Access to areas as yet undeveloped but with good potential.

<u>Criteria</u>	<u>Abbreviation</u>	<u>Details</u>
iv) Forestry management and incense production	For	Access to forest and incense producing areas for central and management purposes.
v) Mineral exploitation	Min	Transport of products and access for management purposes.
vi) Trade	Trd	Transport of traded products inter awraja, and inter and intra region.
vii) Tourism	Tour	Access to areas with tourist attractions.
viii) Land settlement	Re-sat	Access to areas either for movement inwards or outwards of people involved in settlement programmes.

Table 5.1.1 ADUA AWRAJA

Priorities for maintenance and upgrading present rural road system

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
E8	1.	<u>Adua-Abi Adi</u>	65		(see Tembien Awraja Table 8.1)
E9	2.	<u>Nebelet-Feres</u> <u>Mai-Dubduto-</u> <u>(Enticho)</u>	42	Comm, trd, admin.	Main road penetrating central part of awraja. All weather standard.
E10	3.	Mai Kenete-Nebelet - Hauzien	70	Ag-serv; trd, sec.	Bridge required across Werii river. Link road with Hauzien. All weather standard.
E11	4.	Nebelet-Bizet	26	Ed, med, ag-serv.	Remote upland area, dry weather road initially.
	5.	<u>Enticho-Tsurena</u>	50	Trd, ed, med ag-serv. sec, admin.	Ultimately providing short cut to Massawa. All weather standard.
E12	6.	<u>Endamariam Shewito</u> <u>-Ahsa</u>	28	Admin, ed, med. sec, ag-serv.	Penetrating central part of awraja. All weather standard.
E13	7.	Gendefita - Feres Mai	16	Comm.	Short cut from Nebelet to Adua, dry weather road initially.

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Table 5.1.2 ADUA AWARAJA (Cont'd)

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
P12	1.	Indaba Tsahama - Alla Assa	55	Ag-devmt, trd, mkt. Comm, sec, admin.	Connecting road to provide direct route through to Makalle. All weather standard.
P13	2.	Ahsa-Adi Fitahu	15	Ag-serv, ed. med, mkt.	Penetrating rural area in northern part of awraja. Dry weather standard.
P14	3.	Asa-Hoya	25	Admin, sec, ed, med, ag-serv.	Central part of awraja presently remote from all rural services.
P15	4.	Ziban Cuyle-Wutuh			Ahsa-Ziban Guyle-Wutuh to all weather standard.

Table 5.2.1 AGAME AWRAJA

PRIORITIES FOR MAINTENANCE AND UPGRADING PRESENT RURAL ROAD SYSTEM

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
E14	1.	Hauzien-Mugalat	60	Ag-serv, mkt	Providing short cut of 40 kms from Hauzien to Mugalat-rather than using Adigrat route. All weather standard.
E15	2.	Kerseber-Asefa	25	Rel, sec.	Resettlement programme suggested (see road construction priority 2). All weather standard.
E16	3.	Kerseber-Sebeya	18	Mkt	Road constructed in 1974 but not maintained; pockets of irrigation in this area; Cash crop potential. Short cut to Sebeya from Adigrat (saving 30 kms via Zalambessa).
E17	4.	<u>Sinkata-Hauzien</u>	23	Comm, trd. ag-serv, tour.	Road presently suffers from an inadequate drainage system, badly requires side ditches and culverts to upgrade it to all weather standard.
E18	5.	Betkirkos-Adi Kiharsi	25	sec, ag-serv, comm.	Connection between roads. Dry weather standard.
E19	6.	Hauzien Verii-Nebelet	42	Trd, comm, sec.	See also Table 1.1 for Adua Awraja.

Table 5.2.2 AGAME AWRAJA (Cont'd)

Priorities for new rural road construction

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
P16	1.	<u>Idaga-Hamus-Sewna- Adi Kuaba-Dalol-Bada</u>	150	Re-set, sec, ral, min. ag-devmt, for ag-serv, tour.	Vehicle access possible now as far as Sawna. Included in new construction as sections of existing road are badly washed out by erosion and flood. (already presented to provincial government as a project). All weather standard.
P17	2.	Zalambessa-Alitena	120	Rel, min, ag-devmt, ag-serv, for.	Planned re-settlement from Asefa. N.B. Road has been constructed as far as Alitena (T.D.O. 1974) but now very degraded. Completed project from Zalambessa to Irob therefore included here as a new road construction. (N.B. Irob is a general area referring to the eastern slopes and valleys of the escarpment

Table 5.3.1 AXUM AWRAJA

PRIORITIES FOR MAINTENANCE AND UPGRADING PRESENT RURAL ROAD SYSTEM

Map reference	Priority ratings	Road	Distance (kms)	Main Criteria listed	Comments
E3	1.	<u>Afgagah-Debre Kerba</u> (Zana)	23	Admin, ag-serv, med, ed, min, tour.	All weather standard.
E4	2.	Axum-Debregenet	42	Rel, tour, min, ag-serv, med, ed.	All weather standard.
E5	3.	Asum-Maidere	27	Rel, tour, min, ag-serv, med, Ed, Mal.	All weather standard.
E6	4.	<u>Axum-Maydebay</u>	20	med, ed, ag-serv.	All weather standard
E7	5.	Axum-Wikro-Quanat	20	Rel.	Two roads serving this area at present, Wikro-Quanat appears to have better alignment. Dry weather standard.

Table 5.3.2 AXUM AWRAJA (Cont'd)

Priorities for the construction of new rural roads

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
P7	1.	<u>Maydebay-Mereb river.</u>	30	For, ag-serv, min, med, ed, tour, sec.	Penetrating northern part of awraja. All weather standard.
P8	2.	<u>Debre-Kerba-Adi Zegura</u>	20	Min, ag-serv, ed, med, agdevmt, tour.	Presently very remote areas. Could be served by roads extending east-west from Debre genet along Tekezè River. All weather standard.
P9	3.	Debre genet-Tekeze area.	20	Ag-serv, devmt, ed, med, min, tour.	
P10	4.	Naidere-Dagana	25	For, ag-serv, min	
P11	5.	Wikro-Mereb river	35	For, ag-serv.	

Table 5.4.1. ENDERTA AWRAJA

Priorities for maintenance and upgrading present road system.

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
E26 E33	1.	(i) <u>Makalle-Giba bridge</u> (ii) <u>Makelle-Samre-Yechila</u> <u>Zamra-Finarwa</u>	17 114	Admin, med Rel, ed, med, ag-devmt/serv.	See Table 8.1. Main connecting road across western plain of the awraja. All weather standard.
E34		(iii) <u>Quiha-Shiket</u>	42	Rel, med, ed, ag-devmt/serv.	Main point for relief grain distribution to Afar. All weather standard.
E35		(iv) <u>Adigudom-Debub</u> <u>-(Mahoni-Alamata)</u>	28	Ag-serv, rel, med.	Alternative route with easier gradients connecting through to Mahoni-Chercher plain. All weather standard.
E36	2.	(i) Adigudom-Hintalo - Gijet-Yechila	60	Admin, ag-serv.	Secondary link from woreda capital. Dry weather road.
E37		(ii) Wikro-Dugum - Tsigereda	48	Admin, tour, ag-devmt.	Connecting road to woreda capital.
E38		(iii) Amba Alage-Slawa	32	Admin.	
E39		(iv) Quiha-Arragūee	25	Mkt, ag-serv.ad.	
E40	3.	(v) Makalle-Chalekot -Hintalo-Dungulat.	42	Admin, Ag-serv.	

Table 5.4.2. ENDERTA AWRAJA (cont'd)

Priorities for new rural road construction

Map reference	Priority rating	Road	Distance (kms)	Main Creteria listed	Comments
P21	1.	<u>Shiket-Rorm/Afdera</u>	150	Rel, min, ag-serv, comm, med, ed.	
P22	2	Bedim-Logia	80	" " "	
P23	3.	Afdera-Assab	210	Comm, rel, mkt.	To connect with either Massawa-Assab or Sardo-Assab road, reconstruction of existing road.
P24	4.	Tsigereda-Allassa	17	Comm, mkt.	See Table 8.2
P25	5.	Hauseba-Gamra-Rehadem		Comm, med, ed,	To connect three main villages in the area.
P26	6.	Shiket-Berhale	100	Min, comm.	Following foothills along the existing track.

Note: N.E. Rangelands project proposes roads in Lowland areas.

Table 5.5.1 HULEBT AWLALO
Priorities for maintenance and upgrading present rural road system.

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
E20	1.	<u>Agula-Berhale</u>	120	Min, for, admin, comm, rel.	Upgrade to dry weather standard.
E21	2.	Wikro-Atsbi	21	Admin, Mkt, ag-serv. Tour.	Upgrade to all weather standard.
E22	3.	Wikro--Abraha Atsbaha	16	Tour. Ag-serv, edu, med. sec.	Upgrade to all weather standard.
E17	4.	Senkata-Hauzien	23	Comm, trade.	Upgrade to all weather standard.
E23	5.	Agula-Haik Meshal-Atsbi	40	Admin, sec.	Upgrade to dry weather standard.
E24	6.	Atsbi-Dera	20	Mkt, tour, admin.	Upgrade to dry weather standard.
E25	7.	Wikro-Geralta	15	Comm, Ag-serv.	Upgrade to dry weather standard

Table 5.5.2 HULET AWLALO (Cont'd)

Priorities for the construction of new rural roads.

Map reference	Priority rating	Road	Distance (kms)	Main Criteria Listed	Comments
P18	1.	Atsbi-Enshet	40	Agr. devmt, for, re-set.	T.D.O. started but abandoned this project. It forms a possible resettlement area. Dry weather standard.
P19	2.	Berhale-Enshet		Admin, sec, for.	Priority 1 and 2 serve an area with the best forest potential in Tigrai.
P20	3.	Atsbi-Endaselassie-Michael Amba Church	17	Tour.	

Table 5.6.1 RAYA AND AZEBO

Priorities for maintenance and upgrading present road system

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
E40	1.	<u>Maychew-Mahoni-Chercher</u> <u>Didigsaala</u>	150	Agr-devmt, rel,min. agr-serv, admin, med.	Access to Didigsaala may be easier via Alamata.
E41	2.	Adi Shuhu-Chelena	28	Agr-serv, med, mkt, tour.	
E38	3.	Amba Alage - (Dela)		" " "	
E42	4.	Chercher-(Alamata)	40	Ag-devmt,mkt,trd.	Short cut to the main Dessie-Asmara highway.
E35	5.	(Alamata)- <u>Mahoni-</u> <u>Adigudom</u>)	100	Ag-serv, mkt,trd.	This alignment was surveyed by E.H.A. for possible highway alignment.
E43	6.	Charcher-Macharie	20	Ag-devmt, med, ed, rel.	

Table 5.6.2 RAYA AND AZEBO: (Cont'd)
Priorities for new rural road construction

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
P30	1.	Chelena-Shamhek	80	Ag-serv. Ed, med. Comm.	Dry weather standard
P31	2.	Maychew-Chelena	60	Ag-serv, ed, med. Comm.	All weather standard.
P32	3.	Maiswat-Kukufto-Chercher	80	Ag-serv. Ed. Med. Comm.	Dry weather standard.

Table 5.7.1 SHIRE AWRAJA

Priorities for maintenance and upgrading present rural road system.

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
E1	1.	<u>Endasselassie-Dedebit</u> <u>- Debie</u>	40	Mkt, ag-serv, for.	High potential in this area for incense, agriculture, livestock.
E2	2.	Adiawala-Yirga	17	Trd, sec.	Falls within TAHADU project area but presently out of their road improvement programme.

N.B. TAHADU have started upgrading the western lowland Shire rural roads as part of their development programme. These roads will be maintained in all weather condition. In general the Awraja administration have limited their priorities to roads to the east (except Yirga-Adiawala see above). The TAHADU programme includes Enda Selassie-Adi-Dairo-Adi Awala-Adi Hagerai-Shiraro-Tekeze (Humera); Shiraro-Yirga-Mereb Shambugus-(Asmara).

Table 5.7.2 SHIRE AWRAJA

Priorities for construction of new rural roads

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
P1	1.	Enda Selassie-Semena	22	Rel, admin, med.	Included as new construction, existing road crudely constructed under food for work programme.
P2	2.	Belas-Kelakil	30	Ag-serv, mkt	
P3	3.	Selekleka-Semema	45	Mkt. trd.	Grain movements made more efficient to Asmara mkts.
P4	4.	Endabaguna-Mailli	40)	Mkt, admin, se	
P5	5.	Mailli-Abunatomas	10)	sec.	Presently very remote area with high potential for agricultural development. Incense, gum arabic etc.
P6	6.	Selekleka-Tselimbet	35	Admin, rel.	Possible connection later with Axum.

Table 5.8.1 TEMBIEN AWRAJA

PRIORITIES FOR MAINTENANCE AND UPGRADING PRESENT RURAL ROAD SYSTEM.

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
E26	1.	<u>Makalle-Abi</u> (via Giba bridge)	74	Admin, trd, comm, mal.	Particular sections currently being upgraded, essential Makal to all weather standard.
	2.	<u>Adua-Abi Adi-Finarwa</u>	171	Trd, admin, mkt, comm. Tour.	Study by E.H.A. for World Bank project in hand covering longterm development of this major route.
E27	3.	Abi Adi-Guaya	25	Med, ed, mkt, mal, ag-serv.	Dry weather road at present requires improvement and upgrading to all weather road in longterm.
E28	4.	Tsetsera-Hauzien	35	Trd, agr-serv, mkt, tour, comm.	Present road in poor condition, required to provide link with Hauzien-Adigrat. Several small irrigated areas would be linked to markets.
E29	5.	Abi Adi-Shumera-Metaka	38	Ag-serv, med, ed.	Health clinic planned for 1975.
E30	6.	Agbe-Hagare Selam	30	Comm, mal, mkt.	Main route to Abi Adi now via northern road from Hagere Selam, irrigated crops produced in area could be marketed in Makalle

Table 5.8.1. TEMBIEN AWRAJA (Cont'd)

Priorities for maintenance and upgrading present rural road system.

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
P31	7.	Shoatenegum(10 km south of Giba river)-Digigket	40	Med, ag-serv, mkt, admin, ed.	Digigket was previously the capital of Abergele woreda. Plan to re-instate this village if served with adequate road facilities.
E32	8.	Yechila-Gijet	45	Ag-serv, ed, mal,	10 kms. within Tembien built by food for work labour and student campaigners this year. Requires dry weather standard initially.

Table 5.8.2. TEMBIEN AWRAJA (Cont'd)

Priorities for new rural road construction

Map reference	Priority rating	Road	Distance (kms)	Main Criteria listed	Comments
P27	1.	<u>Access to Abergele woreda</u>	30-40	Ag-serv, med, ed, mkt, admin.	Area of good agricultural potential, (oilseeds, incense gum arabic, livestock etc.) Presently with no rural services. Dry weather initially upgraded to all weather later.
P24	2.	Alla-Assa-Tsigereda	17	Mkt, comm, ag-serv, tour.	To connect with Dugum area, Dry weather road initially until proven.
P28	3.	Guaya-Tecazze	15-18	Ag-ser, mkt, mal, med.	Agricultural potential near Tecazze high but road difficult to construct. Dry weather standard.
P29	4.	Digigket-Tecazze river	15	Mal, mkt, ag-serv, ed, med.	Area along Tecazze valley with good potential presently without access. Dry weather standard.

The proposals put forward by the awraja administrators are framed primarily around the need to provide links between awraja capitals and from woredas to awrajas. This stems partly from the importance assigned to administrative criteria by the awraja administrators, and also from the fact that the woreda is generally regarded as the basic planning unit by the ministries and organizations involved in providing rural services. Thus first priority is given to upgrading the inter awraja and inter woreda network to all weather status. However it is recognised that the requirements for such a programme must involve a complete appraisal of the existing network. Similarly proposals to upgrade existing roads and to construct new roads penetrating rural areas, and the priorities assigned to them, reflect the relative importance of certain areas and the limitations of the existing road system and require further careful study.

6. Overall Regional Priorities and Requirements

From the data presented in the preceding sections the Infrastructure Sub-committee developed proposals for a regional upgrading and new construction programme. The roads included in these proposals were selected on the following basis:-

- a) Roads which form part of the network of roads connecting the main centres within the region and which provide links to the major roads traversing the region.
- b) Provision of connecting roads between the highland areas and the eastern lowlands to ensure adequate links for the Afar people to the main administrative and commercial centres.
- c) Roads which provide access to areas which are remote at present and which have large populations or good agricultural potential.
- d) Routes which are either better than those followed by existing roads or provide an alternative to an existing, but difficult, route.

Table 6.1 Provisional overall priorities for maintenance and upgrading programme

Map reference	Priority	Road	Awraja	Sections 5 reference table
E26	1	Makalle-Abi Adi	Enderta/Tembien	5.8.1
E20	2	Agula-Berhale	Hulet Awlalo	5.5.1
E8	3	Adu-Abi Adi	Adua/Tembien	5.8.1
E17	4	Senkata-Hauzien	Agame	5.2.1
E40	5	Maychew-Mahone-Chercher-Didigwa saala	Raya Azebo	5.6.1
	6	Adigudom-Debub-Makoni	Enderta/Raya Axebo	5.4.1
E34	7	Quiha-Shiket	Enderta	5.4.1
E33	8	Makalle-Samre-Finarwa	Enderta	5.4.1
E1	9	Enda Selassie-Dedebit-Debre	Shire	5.7.1
E12	10	Enda Mariam Shew-ito-Ahsa	Adua	5.1.1.
E11	11	Enticho-Tzurena	Adua	5.1.1
E9	12	Nebelet-Feres Mai-Enticho	Adua	5.1.1
E3	13	Afgagah-Debre Kerba(Zana)	Axum	5.3.1
E6	14	Axum-Maydebay	Axum	5.3.1

Table 6,2 Provisional overall priorities for new construction

Map reference	Priority	Road	Awraja	Sections 5 reference table
P21	1	Shiket-Afdera	Enderta	5.4.1
P16	2	Edaga Hamus-Dallol-Bada	Agame	5.2.2
E35	3	Adigudom-Debub-Mahoni-Alamata(1)	Enderta	5.4.1
P27	4	Abergele Woreda feeder road project	Tembien	5.8.2
P23	5	Afdera-Rorom-Sardo/Assab	Enderta	5.4.2
P8	6	Debre Kerba-Adi Zegura	Axum	5.3.2
P7	7	Maydebay-Mereb river	Axum	5.3.2

Note: (1) Included here since escarpment sections are badly degraded.

7. Conclusions

No detailed appraisal of Tigrai's rural road system has yet been carried out to allow the preparation of a final maintenance and construction programme. In section 5 a preliminary list of existing roads requiring upgrading and possible new construction projects for the future is presented (some omissions are bound to have occurred due to the short time allowed for the collection of data on which this report is based). Nevertheless these proposals form the basis for a much more detailed assessment in respect of both socio-economic and engineering considerations to be carried out by the Rural Roads Study Team.

An indication of overall priorities as seen from the regional viewpoint was assessed by the Infrastructure Sub-committee and is presented in section 6. Although two Ministries have presented provisional lists of their priorities for maintenance and construction, it was not feasible to include the road requirements or proposed programmes of TAHADU and the North Eastern Rangelands Project. These projects should however be considered in arriving at the final regional programme.

Makalle
June, 1975.

APPENDIX A
MINISTRY OF AGRICULTURE PROPOSALS FOR RURAL ROAD UPGRADING
AND CONSTRUCTION

The main considerations in the Ministry of Agriculture proposals are concerned with: disease and pest control of agricultural crops; forestry extension and protection and future timber exploitation; the incense industry; and veterinary services. Roads of particular importance to the veterinary department are listed below. The general view of the Ministry is that all existing dry weather roads require proper maintenance, particularly post wet season repairs.

Table A.1 Ministry of Agriculture Proposals for rural roads

<u>Existing roads for upgrading</u>	<u>New roads</u>
1. Adua - Tembien - Makalde	1. Atsbi - Berhale
2. Enda Selassie - Adihagaray- Shembake	2. Shiket - Didigsaala
3. Enda Selassie - Debre aby road	
4. Enda Selassie - Sheraro- Humera	
5. Selekleka-Mereb River link (North)	
6. Agula - Dalol - (via Desa forest)	
7. Wikro - Atsbi - Horogona - Berhale	
8. Maychew - Mahone - Shiket	
9. Abi Adi - Yechila - Finarwa	
10. Bada - Sardo (Assab Road)	

APPENDIX B
EPID PROPOSALS FOR RURAL ROAD UPGRADING
AND CONSTRUCTION

EPID have 36 Minimum Package Programme (MPP) extension centres in Tigray at present and propose to establish a further 33 centres under Phase II of this programme. The proposals outlined below reflect the need to support the planned and existing centres with adequate road access.

Table B.1 EPID Rural Road Proposals

Awraja	Road	Kms.	Work required	Notes
Axum	Axum - Medebay	70	New road	Open up new agricultural area.
Adua	Adua - Maikenetal	34	Repair bridges	Old Italian road. Good base
Agame	Mugulat - Azeba	18	New road	Open up good agricultural potential.
	Fatsi - Debredamo	18	New road	Crop extraction.
	Adaga Hamus Sawne	40	Improvement	
	Edaga Hamus Seheta	20	Improvement	Irrigation
	Beitcherkoa Adidekiharsi	10	Improvement	possibilities.
	Adigrat - Asefe	30	Improvement	
	Edaga Hamus Tahtaiziban	18	New Road	
Hulet Awlale	Wikro - Atsbi	25	Improvement	Crop extraction
	Wikro - Dugum	40	Improvement	" "
	Dugum - Tsegereda	20	Improvement	" "
	Tsegareda - Wikro	62	Improvement	" "
Enderta Quiha Tembien Wersega	- Aragure - Adi Aha		Improvement	Irrigation & crop extraction.

Awraja	Road	kms.	Work required	Notes
Raya & Azebo	Mahoni - Chercher	42	New alignment	Flat country
	Maychew - Mahoni	18	Improvement	Black soils
	Chercher - Gugubdo	30	Improvement	Drainage
	Chercher - Alamata	32	Improvement	Culverts, bridge
	Adi Shuhu - Bora	33	Improvement	Crop extra- ction.
	Adi Shuhu - Maheo	15	Improvement	Open up
	Dela - Ambalage	35	Improvement	good agricul- tural areas.
Shire	Endaselassie - Semema	22	Improvement	
	Endabaguna - Adimohamedo		New Road.	

Notes: Roads are listed in order of priority under awrajas.

APPENDIX C

The Experience with Rural Road Construction in Tigre Province

I. Introduction

In an earlier series of papers we examined in considerable detail the experience in constructing a specific rural road in various parts of Ethiopia. With this paper and a previous one we are examining an entire provincial effort to construct a network of rural roads. Such an effort is made up of a number of specific projects, and the larger issues of provincial institutions for planning, financing, constructing and maintaining the roads will be addressed. These issues will be contained in the background on section of the report. This will then be followed by a section will attempt to point out the important lessons that can be derived from the experience.

II. Background

Tigre province has been and still is the site of considerable activity in the area of rural road construction. Although it was one of the areas hardest hit by the drought, the relief program was successful because of the availability of a good network of rural roads which enabled food, medical supplies, and relief teams to arrive to the remotest area in the province.

Credit for the accomplishment of the construction work of the 2,767 kms... of rural roads in Tigre Province should go to the Tigre Development Organization (hence referred to as T.D.O.) a self-help organization set up by B.H. Leul Ras Mangesha Seyoum, governor of Tigre Province, Twelve years ago.

'See "The Experience with Rural Road Construction in the Chilalo Agricultural Development Area", 22 Nov. 1973, "The Experience with Labor Intensive Rural Road Construction in the Bako-Jere-Shembu Area of Wellega Province", 10 Dec. 1973, and "The Experience with Labor Intensive Rural Road Construction in the Bichena-Yeduha Area of Gojjam Province". 8 Jan.1974.

" 'See "The Current Experience with Rural Road Construction in Wello Province". April 1, 1974.

"Refer to attached tables I, II, III of Rural Road Projects in Tigre Province.

Rural Roads Constructed Through Food for
Work Programme
in Tigre Province

No.	A w r a j a	Road Project	Length in Kms	Year Project was completed (E.C.)
1.	Inderta	Ambalega-Deala	32	1963
		Makale-Giba Bridge	17	1964
		Makale - Samre	51	1964
2.	Raye & Azebo	Adi Shehu-Bore	29	1963
3.	Adwa	Woree-Nebelet	12	1964
4.	Tembien	Yechila-Samre	39	1966
		Adi Adi-Ambera	29	1966
5.	Agame	Senkata-Hawzien	23	1964
		Hawzien-Worse	17	1964
		Zalambassa-Sebeya	20	1964
		Mengelalo-Alitena	16	1964
		Zalambassa-Alitena	5	1964
		Sebeya-Kerseber	16	1964
6.	Ralet Awlailo	Axeba-Kerseber	32	1964
		Atebi-Wahdyes	52	1966
		Total	390	

Source: Tigre Development Organization

Rural Roads Constructed by T.D.O.

In Tigre Province

No.	Awraja	Road Project	Length in Kms	Year Project was completed (E.C.)
1.	Indarta	Makelle-Mai-Mokden	17	1955
		Quiha-Shikhet	42	1958
		Adi Gudom-Debub	28	1958
		Makalle-Chelekot-Sokota	36	1961
		Makalle-Giba River	17	1964
2.	Raya & Azebo	Korbeta(Mersa)-Raya Kara	115	1960
		Maichew-Dididigaala	149	1957
		Debub-Korbeta (Mersa)	51	1961
		Shikhet-Hadealga(Raya)	100	1962
3.	Shire	Enda Selassie-Adi Awala-Shembakel	141	1963
		Enda Selassie-Debre Abbai	10	1959
		Adi Hagerai-Haylee Imni	15	1963
		Adi Hagerai-Sheraro	26	1963
		Sheraro-Yirga	40	1963
		Chin Meda-Tekazze River Bank	80	1963
		Adi Nebrud-Adi Awala	25	1963
		Sheraro-Tekazzo	52	1963
		Tekazze-Maiteno	7	1963
		Mentabted-Maiquhli	14	1963
		Sheraro-Ziban Jodana	18	1963
		Sheraro-Game Reserve	32	1963

Rural Roads Constructed by T.D.O.

In Tigre Province

Nö.	Awraja	Road Project	Length in Kms	Year Project was completed (E.C.)
		Tekezze-Humera	130	1964
4.	Adwa	Adwa-Melihai Awalo	5	1956
		Dedbo-Feresmai	15	1958
		Nebelet-Endabatsahma	18	1963
		Nebelet-Entichew	42	1963
		Endamariamshwito-Ahsa	28	1964
5.	Hulet Awlailo	Agula-Berahle	120	1958
		Ayniala-Dalol	94	1958
		Wukro-Abraha Atsbaha	21	1959
		Afalo-Afdera-Assab	210	1961
		Rorom-Artale	23	1965
		Wukro-Abrha Atsbaha (new road)	16	1965
		Wukro-Hawzien	35	1965
		Wukro-Atsbi	21	1965
		Wukro-Wahdyes	52	1966
		Berahle-Ayni Ala	-	-
6.	Axum	Axum-Atse Kaleb	3	1957
		Axum-Mhberdugwa	12	1957
		Axum-Zena	23	1957
		Axum-Maiedme	7	1957
7.	Tembien	Giba Bridge-Hageresalam	30	1964
		Hageresalam-Abi Adi	27	1960
8.	Agame	Edagahamus-Dalol-Adekuba	65	1961
		Senkata-Hawzien	23	1964
		Total	1935	

Source: Tigre Development Organization

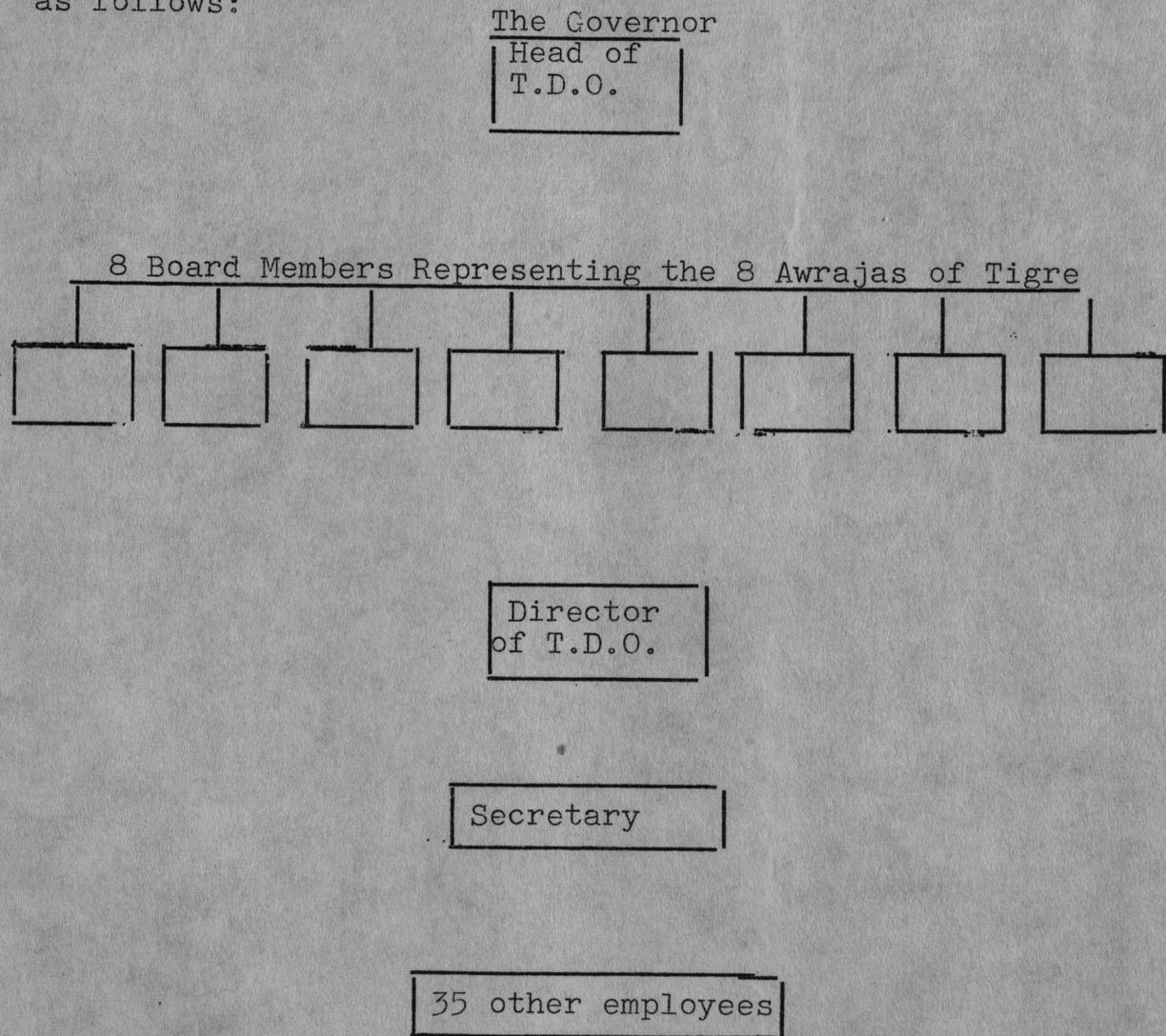
Rural Roads Constructed by the Italians and Improved
by T.D.O. in Tigre Province

No.	Awraja	Road Project	Length in Kms	Year Project was completed (E.C.)
1.	Raya & Azebo	Maichew - Korbeta Mersa)	18	-
2.	Inderta	Adigudom - Samre	60	
		Makalle - Hageresalam	59	
		Adigudom-Gijet	40	
3.	Hulet Awlailo	Agula-Atsbi	27	
4.	Adwa	Ribagered-Endabatsahma	17	
		Bizet-Debredamo	15	
		Adwa-Abi Adi	98	
5.	Axum	Axum-Adiet	35	
6.	Tembien	Abi Adi-Feenarwa	73	
		Total	442	
		Food for Work Programme	390	
		T.D.O. (New Const- ruction)	1,935	
		T.D.O. (Reclamation)	442	
		Grand Total	2,767	

Source : Tigre Development Organization

The activities of the T.D.O. initially varied from road building and water resource projects to afforestation. Rural Road building currently comprises the major activity of T.D.O.

A simple organizational chart of T.D.O. would appear as follows:



The head and chairman of T.D.O. is the Provincial Governor, and the director of the T.D.O. is appointed by him.

There are also eight board members representing the eight awrajas of Tigre. These persons are elected every six years.

T.D.O. obtains its revenues through voluntary annual public contributions collected during the harvest season. These contributions initially represented 10% of the agricultural farm output but were later reduced to 5% due to the bad harvests caused by erratic rainfall. Last year, because of the drought in some of the awrajas in Tigre province, T.D.O. was unable to collect any funds.

The expenses of T.D.O. are mainly in the form of wages and salaries for its 35 employees excluding the chairman and the director who are paid from the Central Government Budget, through the Ministry of Interior.

To realize its rural road development program, T.D.O. initially purchased the following equipment:

- 3. Tippers
- 3. Graders
- 1 Traxcavator
- 2 D-7 Bulldozers
- 3 Compressors
- 1 Toyota
- 3 Land Rovers-
- Dynamiting equipment

Most pieces of the above equipment have surpassed their useful economic life because they are 10 to 12 years old.

Lack of equipment coupled with the shortage in revenues of T.D.O. pushed the emphasis from a capital-intensive salary operation to a labour-intensive food-for-work approach for road building. For example, the first project of T.D.O. which was Mekele-Asmara road was totally capital-intensive, whereas most new T.D.O. projects carried out at present are labor-intensive.

Almost all the labourers now involved in rural road construction projects of T.D.O. are paid in grain obtained from the food-for-work program and for drought relief purposes. The supervisors and foremen, who by now have years of practical experience, are paid monthly wages by the T.D.O.

For maintaining the roads, T.D.O. organizes a road repair holiday every September after the rainy season. The local people come out and in two days make a major effort to repair the roads. In addition, awraja governors are responsible for having roads examined after every heavy rain to see if washouts have occurred and if so to repair them. Finally, T.D.O. maintains some roads in sparsely settled areas with their own machinery.

The A.H.A. assists the T.D.O. in maintaining the available T.D.O. equipment by making their excellent and greatly underutilized repair facilities available at cost. They used to provide tax-free fuel, and have provided engineers and technicians to help design difficult jobs such as the 54 metre bridge over the Giba river linking the Embien and Inderta awrajas of the Tigre Province. The E.H.E. also helped train people in blasting.

It is important to note that people in the various awrajas of Tigre province suggest rural road projects to be undertaken by T.D.O. The awraja board members convey these suggestions to the board of T.D.O. which then decides when and how to undertake the projects.

III. Engineering and Construction

The attached map of Tigre province and the list of projects in Tables I, II, and III indicate the extent of the rural road construction program in Tigre Province. The major network objective is to connect all outlying regions of the province with the provincial, awraja and

wereda capitals of Tigre. Furthermore, the aim of the network is to facilitate labor mobility and to provide links between the province of Tigre and other centres of economic activities within Tigre and other parts of the country such as the Humera regions. Another important objective of the network is to promote social and cultural cohesion within Tigre and between Tigre and the other provinces of the country.

Some of the network has been completed to minimal standard using equipment in labor deficient areas and workers in thickly populated areas. Important lessons have been and are being learned from the experiences. Many projects have been completed by T.D.O. The following projects were recently examined and seem to be representative of what has been accomplished.

Adi Gudom-Dubub-Mersa-Chercher 105 kms

This rural road project was constructed between 1958 and 1961 E.C.Y.'s. Initially the whole project was constructed with equipment and some labor, Now, however, the road is being improved with labor.

The first portion i.e. up to Dubub has been washed away in places and the road is not very impressive. The terrain is flat and the alignment needs to be altered in some areas.

Passing Dubub the road climbs uphill and becomes a circuitous side hill cut. Here, work is progressing fairly well. The work is mainly reducing steep gradients, soling and widening. The soling work seems to be very satisfactory and if continued as is planned up to the junction of this rural road to Adi Gudom on the main road, there is no reason why this road would not develop into an all-weather road.

Before approaching the Inderta-Raya & Axebe border the road deteriorates again and certain sections of it have been washed away because of recent torrential rains and the presence of several large streams which need to be bridged. Another factor for this deterioration on the road is the type of soil and the poor drainage in the area. The soil is mainly black cotton soil and there are few select materials and rock sites nearby which could be used for road construction.

Despite these difficulties workers were doing their best to upgrade the road by widening.

The road then goes uphill through a thickly-forested rolling land. The forest is mainly of acacia trees and the area is principally reserved for cattle grazing. The area is also noted for its sparse population. This terrain is fed by several streams which descend down the mountains on the eastern side of the road.

In this areas the quality of the road deteriorates further and maintenance is poor. Maintenance gets worse once one gets into the broad plain of Raya & Azebo. About eighteen kilometres before reaching Mersa (Korbeta) the road is at its worst simply because it passes through a rich agricultural valley. There is little or no embankment and farmers have cut the road with ditches to obtain water for their fields. This pattern continues until a few kilometres away from Mersa, where one encounters a large stream which poses a serious problem during the rainy season.

Up to Mersa (Korbeta) the road is not very identifiable and it is continuously dissected by ditches dug across it. In some places these ditches have grown wider and are difficult to cross except by a four-wheel drive vehicle, tractor, or a large truck. There is a danger of the road being obliterated by these ditches.

From Mersa on the way to Chercher the road continues to pass through the rich agricultural valley and it is in a very poor state. In some sections the road embankment has more elevation than the surrounding fields, and here it could be salvaged. On the other sections the road appears to be hopeless unless select materials and rocks are brought in. Unfortunately these select materials and rocks have to be transported a long distance, (between 25-30 kms) because of their non-availability in the neighbourhood.

Before reaching Chercher (about 15 kms) the road climbs up again, becomes a side hill cut and is in better condition because of the rocky terrain it passes through. It continues in that state until it reaches Chercher.

It is noteworthy to mention that the two last segments of the road are maintained by equipment because it is difficult to recruit labourers.

Chercher-Shikhet 100 kms

This road which was built in 1962 E.C.Y. is very interesting in the sense that it combines both good and bad working conditions, flat, rolling and hilly terrain, black, clay and rocky soils, hot and cool climates, forests and grasslands thickly and scantily populated areas. It also presents social contrasts because it passes through a region inhabited by settled agriculturalists who find it easier to acquire the skills of road building, and nomads who are not interested in road building activities.

This road was initially constructed by equipment and is presently maintained both by labor and equipment

The first few kilometres from Chercher pass through an agricultural and a grazing area. Here ditches dug along the width of the road pose a serious difficulty to smooth

driving along the road. All the work here has been done by equipment. Washout of the road is very common near the small streams descending down the escarpment. Some of the streams, especially along the segment of the road in the Adal area which is forested and rolling are very wide and need structures to bridge them. The largest stream is the Megalo. This is a very wide stream that poses a serious bridging problem because the stream is subdivided into three channels. All along the length of this road, labor intensive methods have not been used because of the non-availability of select materials and stone, and the difficulty of recruiting large gangs of workers.

Beyond the Megale stream crossing, the road passes through a plain and the soil is sandy. Numerous streams are passed but generally drainage is not a problem. Heaps of basalt could easily be collected and labor could be used for small maintenance work.

The road from the junction to Afdera to Shikhet which is 22 kms long is dominated by a big mountain. Here the cuts have been efficiently done and substantial amounts of select materials have also been placed.

On passing the mountain the road goes through a flat plain interrupted by few streams until it arrives at Shikhet at the foot of the hills. This section of the road is made up of clay soil. Labor intensive methods could only be successful if select materials are made available from the hills, otherwise machinery seems indispensable for maintenance and further upgrading of this road.

Junction-Afdera 70 kms

This road which is being currently constructed using labour, offers the opportunity to observe which method of road construction i.e. labour intensive vs capital intensive

should be selected and under what terrain conditions one is more appropriate than the other. It also provides the unique opportunity to see how different cultural groups can work together. Here, the lowland nomad Adals are taking part in the construction work in collaboration with people from the highland agricultural areas of Tigre.

This road is also interesting because working conditions for highlanders are very difficult, yet labor productivity is surprisingly high compared to what was observed in Wello.* The standard of the road going to Afera is very satisfactory and valuable techniques in rural road building such as terracing, burning large rocks in order to facilitate their breaking, and construction of paved fords are being successfully utilized.

The most encouraging thing that comes out of this project is to see competent Ethiopian foremen running a large labor force composed of about 1,000 laborers without facing any frictions and using their common sense to undertake engineering tasks, despite their lack of formal training in the subject.

The junction to Afdera is located at 78 kms from Chercher and 22 kms from Shikhet.

On the junction of Afdera the soil is red clay. This portion of the road presents a problem for labor but could easily be served by equipment. The road then climbs uphill and once again, in the hills the work accomplished is labor intensive and quite satisfactory. The road is wide and paved with carefully laid soling. The gradients are not steep. The work on the way to Afdera is progressing very satisfactorily. The work gangs which vary between 50 and 60 appear to be working well.

* With almost 1000 laborers broken up into gangs of 50, some 900 meters of side hill cut with rubble stone facing were being completed each day.

Shikhet-Quiha 42 kms

This road which was constructed in 1958 E.C. passes through a hilly and mountainous terrain where road construction materials could easily be obtained.

From Shikhet to Quiha the road first crosses a big stream which needs to be bridged. The road then steadily climbs uphill and once one climbs up one could see the interesting job that has been carried out. Good terracing in places has been carried out and substantial amounts of selected materials have been placed along the road. What is needed, is however some compacting and re-alignments at certain intervals on the approaches to Quiha. The road is now used by heavy trucks as well as other vehicles.

Makale-Samre 51 kms

This road which goes in a south-westerly direction from Makale is not very much different from what was carried out elsewhere. The road crosses hilly agricultural countryside interrupted by valleys. In general the quality of the road is good except along the valleys where it deteriorates.

There is some labor intensive improvement work going on along the road. This work took the form of widening and terracing and if it is completed the standard of the road is going to be raised substantially.

Here drainage is not a serious problem, although in places culverts may be needed to cross small streams. To offset the need for culverts large rocks have been piled up to serve as Irish fords.

Giba-River Bridge

This is the largest of eight bridges constructed by the T.D.O. Location - 17 kms to the west of Mekele linking

the Provincial capital of Tigre and Inderta awraja with Abi Adi the capital of Tembien awraja.

It is a 54 metre reinforced concrete bridge with a center span of 24 feet and two end spans of 15 feet resting on Masonry piers. These two awrajas contributed Eth.\$30,000 each and the remaining 6 awrajas of Tigre contirbuted Eth. \$10,000 each. The total contribution amounted to Eth.\$120,000.

500 workers were involved in the work which took two months i.e. 17th Guenbot 1964 E.C. up to 16th Hamle 1964 E.C. The design for the bridge was carried out by H. E. Luel Ras Mangesha, Governor of Tigre Province and Engineer Mekonnen of E.H.A. the bridge cost Eth\$160,000 to construct.

Other Roads in Tigre

From the attached tables and map it is easy to observe that many rural roads have been built in Tigre Province. As was mentioned earlier most of the present work is carried out by labor-intensive methods. Capital-intensive methods are being presently used in Shire awraja where the road system is being prepared in advance for a comprehensive agricultural development program for that area.

IV Conclusions:

The Tigre experience has indicated what can be done with local resources if a program has local support, good leadership, and the occasional cooperation of an institution like the EHA. The roads are generally primitive and are subject to frequent washouts during the rains. Nevertheless, the alignments and much of the embankment remain, and the people come forth each year to repair them. Keeping the road system intact is a continuing task. As resources become available the chronically bad sections are being upgraded. Even though many engineers would not favor these facilities with the term road, the local people value them, and their existence has saved many lives. Vehicles use them, and commerce

and administration are possible. The alternative of doing nothing for the past twelve years has not been acceptable.

The most valuable generalization that can be made regarding labor intensive vs. capital intensive operations appears to be that labor works well in the hills where a circuitous side hill cut is utilized. The rubble stone terrace faces or retaining walls can only be constructed by hand, and the excavation of the side hill as the terrace rises is generally easily done by labor since the earth and fractured stone need not be carried any distance. Stone is almost always readily available for soling difficult or steep sections, and for paving the road to let small streams across the embankment.

In the lowlands, labor can only be effectively utilized in excavating the ditches and throwing the material on the embankment. Where embankments need to be heightened and select material utilized, machinery of some type is almost certainly called for.

Two interesting techniques deserve comment. The first is the practice of burning brush piles around large stones, that makes it easier to fracture the stone with hand tools. The second is the practice in the hills of defining, not the centre line of the road, but the foot of the embankment. Rubble stone retaining walls are started at the foot and the earth dug from the side hill behind the retaining wall. As the wall rises at an inward slope the excavation continues. The wall serves not so much to retain the earth and stone as to pave the downhill slope of the embankment, to stabilize it, and prevent erosion. Walls several meters high were inspected, and have been in place for several years. The technique is particularly effective at stream crossings where washouts are a constant danger. This technique is uniquely suited to hand excavation. Bulldozing a side hill cut does not allow for this sort of terracing. The

material is simply pushed down the mountain and it is hoped that the downhill slope will eventually stabilize.

Perhaps the most impressive aspect of the TDO operation is their lack of dogma concerning engineering and construction techniques and their extreme flexibility. They have constructed and maintained roads using fully mechanized and fully labor intensive methods, tailoring certain aspects of the work to whatever resources they have available. In addition, they find no conflict between famine relief food-for-work programs and getting roads built. They do not have the single minded objective of getting roads built on a once and for all basis. The objectives of building roads, providing employment, providing for maintenance, and involving the local populace have all been reconciled to a remarkable degree. The communal ownership of land in the area does explain much of the enthusiasm of the local populace, but not all of it.

Finally, it is remarkable that not a single foreign expert is involved in the program. It has been going on quietly for 12 years staffed wholly by Ethiopians.

APPENDIX D

Review of Rural Road Development Activities in Tigre/
Wollo Area

Rural road construction in the famine areas of Wollo and Tigre is receiving attention from a number of different interested parties. An attempt is made herein to list these parties and describe the nature of their interest. A section on conclusions and recommendations is added in an attempt to indicate how these interests might be coordinated.

At present, at least 12 different groups have an interest in rural road construction Tigre/Wollo. They are:

1. Tigre Development Organization(TDO) Activities
2. EPID Proposal for Tigre
3. Ministry of Agriculture Proposal for Wollo
4. British Army Engineers
5. British ODA Proposal for Wollo
6. IBRD
7. UNDP
8. German Assistance
9. ESBU
10. LNB
11. HSIU Relief Committee
12. Planning Commission Office.

1. Tigre Development Organization (TDO) Activities

The Province of Tigre is in a much better position than Wollo in terms of a rural road network largely because of the TDO self-help organization that has been operating in Tigre for the past 12 years. At last count, 2,767 km of penetration roads had been built or reconstructed by the TDO.* Originally the construction was done by machinery and some 35 paid employees of the TDO, financed by a tax

* See: "The Experience with Rural Road Construction in Tigre Province", 20 April 1974, Planning Commission Office, (Mimeograph).

on agricultural production. Maintenance was largely accomplished by volunteer labour in what is basically a communal land tenure area. With the failure of crops for several years running, revenues have ceased. The U.S. Food-for-Work programme has been financing most of the current effort through the TDO, which has shifted to labor intensive methods. Of the 2767 km. constructed to date, 390 km has been done under the Food-for-Work program.

Since TDO exists, it has some experienced employees, and has used and continues to use both machine and hand labor methods of construction. Much more could be done immediately by simply providing the TDO with money, food, or equipment.

2. EPID Proposal for Tigre

EPID Report No. XIV Jan. 1974 has been recently combined with discussions with the Governor of Tigre into a detailed proposal for rural road construction.*

The essence of the proposal is to construct in one year 300 km of road at a cost of E\$10,000 per km. Another 600km is to be constructed in the two subsequent years. The budget for the first phase is estimated at E\$3.16 million. It is proposed that foreign assistance covers E\$2.55 million including E\$1.25 million for local labor payments. Both machinery and hand labour are to be employed.

The intention is to utilize the existing TDO, supplemented with some expatriate staff to implement the program. The source of foreign assistance has not yet been determined. The proposed IBRD and UNDP assistance mentioned below is however a potential source.

The 900 km. program is broken down into 17 separate projects, some of which are improvements of existing roads. Others are entirely new links.

3. Ministry of Agriculture Proposal for Wollo:

In October 1973, the Planning and Programming Department of the Ministry of Agriculture produced a report of Wollo

* See: "Analysis of Construction for Low Cost Roads in Tigre Province". Feb. 1974.

similar to the EPID report for Tigre. The proposal was revised in Dec. 1973 and included an engineering appendix and cost estimate prepared by the Ethiopian Highway Authority (EHA).**

The proposal calls for 9 separate projects in phase one for a total of 358 km. to be constructed over a period of 3 years. The cost estimated by the EHA comes to a total of E\$8.8 million, 24.7 thousand dollars per km., to be contrasted with the ten thousand dollar per km. cost for the Tigre proposal. Some equipment would be usable after phase one.

Since the equipment would have to be purchased at the outset, a three year outlay of E\$10.8 million would be required. At the end of Phase one, the Machinery would be valued at E\$2.0 million, thus the E\$8.8 million cost of phase one.

The Ministry of Agriculture envisages a second phase of 290 additional km. spread over four projects. If the unit cost for the second phase is the same as the first phase it entails an additional investment of E\$7.2 million.

Some of the projects proposed have already been undertaken by the British Army Engineers. Others will be included in the British ODA proposal for Wollo. The details of these two proposals are given below.

4. British Army Engineers in Wollo

In Feb., Mar., and April of 1974, a squadron of British Army Engineers came to Wollo for a three month operation designed to construct almost 100 km of badly needed penetration roads,

** See: "Proposed Program of Rural Road Construction in Wollo" Ministry of Agriculture, Planning & Programming Dept. Dec. 1973. (Mimeographed).

largely with local hand labor. At one point almost 5000 laborers were employed on a food-for-work basis.

The Royal Engineers are planning a similar 3 month operation to build a major bridge on the Dessie-Wegel Tena Road. It is programmed for the first quarter of 1976.

An EHA engineer has been sent to Wollo to keep the British Army projects going until the ODA Team arrives.

5. British ODA Proposal for Wollo

The British Government through their Overseas Development Administration (ODA) have proposed a comprehensive package of rural roads for Wollo. ** The package includes:

- a. A British management team of 6 men for a period of three years.
- b. Basic mechanical construction units and maintenance units
- c. The preparation of a programme of rural roads for Wollo with priorities assigned.
- d. Construction of a system of 412 km. of road at a unit cost of E\$14,000 per km.
- e. The development of permanent domestic institutions in Wollo to construct and maintain such roads.
- f. The training of Ethiopian labor, managers, and supervisors in techniques of construction and maintaining such roads.
- g. Finance of E\$8.0 million through the British credit which is 40% grant and 60% interest free loan. Of the total sum estimated, only the taxes on fuel and imported equipment of E\$426,000 need be covered by EG funds.

** See: "The Current Experience with Rural Road Construction Wollo Province", 1 April 1974, Planning Commission Office (Mimeograph).

See: "A Memorandum on the British Proposal for Construction of Low Cost Rural Roads in Wollo Province", 17 April 1974, Planning Commission Office. (Mimeograph).

For this project, the PCO has completed all the preliminary work. All that is lacking is the approval of the Council of Ministers. Work could begin as early as July 1974.

6. I.B.R.D. Drought Relief Credit

In March 1974, the IBRD proposed a US\$10 million drought relief credit to be used exclusively in Wollo and Tigre. Of this US\$10 million, 1.5 million is earmarked for the construction of rural penetration/access roads for Wollo and Tigre. The money is to be spent for the purchase and operation of basic mechanical road construction units. A basic condition for this loan is that the long discussed task force for a nation-wide rural roads program be officially instituted.

7. UNDP Drought Rehabilitation Programme

In May 1974, the Administrator of the UNDP recommended to the Governing Council an allocation of US\$2.0 million beyond the normal IFF allocation, for drought relief purposes. Of this US\$2.0 million, US\$150,000 is allocated for two man years of technical assistance and ancillary equipment for assistance in coordinating rural roads programme in drought stricken areas. Unlike the IBRD credit it appears that the use of the technical assistance need not be restricted to the Tigre/Wollo area.

8. German Assistance

Private German famine assistance in Wollo organized by "Der Stern" magazine has been restricted mainly to health facilities and distribution centres. Some D.M. 12 million has been collected for Wollo. For some inaccessible areas the Germans appear to be willing to construct or improve roads serving such facilities. Dr. Trapp the principal contractor of the Awash-Tendaho road has been contacted to explore the possibility of equipment from the completed road being used in Wollo. The status of this initiative is as yet unknown.

9. ESBU

The Elementary School Building Unit has done some road construction in Wollo between Dessie and Were Ilu. The first 5 km of the road is particularly interesting because of the variety of imaginative approaches to cross-drainage that have been incorporated into the road.

10. LMB

The Livestock and Meat Board has done some road construction in Wollo in the lowlands north and south of the Kombolcha-Assab road. It isn't clear what their plans are for the future. Clarification from the LMB should be sought.

11. HSIU Relief Committee

Students from the university have recently taken over the work begun by the British Army Engineers on the Kobo-Zobel mountain road in Wollo. Reconsitruction and clearing of the road is being done partly on a food-for-work basis.

12. Planning Commission Office

The Planning Commission Office (PCO) has been keeping abreast of low cost road building activities in the famine areas not only because of their obvious relevance for drought relief, but also because of the relevance of the experience for a nation-wide rural roads program. The experience from two provinces as different as Wollo and Tigre should provide lessons that are transferable to other areas of the country.

Conclusions and Recommendations:

For Wollo province the key operation is the proposed British ODA effort. As a comprehensive program with management and financing, it is absolutely essential before any other

aid can be absorbed in that area. Unless the ODA project is expedited it is unlikely that the IBRD resources can be used effectively or the Ministry of Agriculture program implemented.

For Tigre Province, the existing TDO should serve as the basis organization to work with. Work can be accomplished immediately by making, money, food grain, or machinery available. The IBRD credit can be used immediately here. It is also possible that the UNDP technical assistance funds could be used here to strengthen the TDO.

It is important not to lose sight of the fundamental differences between the two provinces and the different approach required for each. With all of the preliminary work done on the ODA project for Wollo, and the existence of the TDO in Tigre, there is no reason why things should not move rapidly in both provinces.

APPENDIX E

POPULATION DATA FOR AWRAJAS IN TIGRAI REGION

Awraja (Capital)	Rural Popula- tion (1) thousand	Total Area thousand km ²	Upland settled area thousand km ²	Nomadic eastern lowland area kms	Rural pop. density over up- land settled areas, persons per km ²	Urban popula- tion (2) thousand
Adua (Adua)	332.2	3.2	3.2	-	104	34.0
Agame (Adigrat)	229.7	4.8	2.6	2.2	88	20.0
Axum (Axum)	201.3	3.2	3.2	-	63	34.0
Enderta (Makelle)	214.9	21.8	6.0	15.8	36	53.5
Hulet Awlalo (Wikro)	144.9	13.8	1.9	11.9	76	14.5
Raya and Azebo (Maychew)	78.9	7.9	3.0	4.9	25	22.5
Shire (Enda- Selassie)	174.5	8.5	8.5	-	21	19.0
Tembien (Abi Adi)	188.7	4.3	4.3	-	44	10.0
Total	1565.1	67.5	32.7	34.8	48	207.5

Notes: (1) 1970 C.S.O. Population data shown (Exclude the lowland nomadic population. No attempt has been made to update this data)

(2) Latest Urban Population Data obtained from local municipal authorities. (They can only be regarded as general approximations) The rural and urban population estimates are not directly comparable.

APPENDIX F
AWRAJAS, WOREDAS AND WOREDA CAPITALS OF TIGRAI REGION.

AWRAJA	WOREDA	WOREDA CAPITAL
Adua	Adi Abeto	Adi Abien
	Adi Arbaite	Rama
	Adua	Adua
	Ahsa	Ahsa
	Bizet	Bizet
	Emba Seneiti	Nebelet
	Enticho	Enticho
	Igela	Gerahousemay
	Inda Abatshm	Amist Zufan
	Hahaile	Feres Mai
	Maikinietal	Maikinistal
Agame	Dalol	Dalol
	Ganta Afeshum	Adigrat
	Gulo Mekeda	Zalambessa
	Hulet Belesa	Hauzien
	Sibuh Sasie	Idaga Hamus
Axum	Adet	Debregenet
	Lai Maychew	Axum
	Narai	Wikro
	Na'dier	Mahberddiego
	Zana	Debrekerbe
Enderta	Dega Haloa	Dela
	Didiba & Dergajen	Quiha
	Enderta	Makalle
	Geralta	Tsigereda
	Hintalo	Hintalo
	Saharti	Gijet
	Shiket	Shiket
	Waereb	Samre
	Wajirat	Debub

AWRAJA	WOREDA	WOREDA CAPITAL
Hulet Awlalo	Atsbi	Atsbi
	Berhale	Berhale
	Tsada Amba	Sinkata
	Tsirae	Agula
Raya & Azebo	Amba Alage	Adi Shuhu
	Bora	Chelena
	Chercher	Weyra Wuha
	Didigsa	Didigssala
	Inda Mahoni	Maychew
	Mahoni	Marsa
Shire	Asgede	Maydimu
	Gult Wedaj	Seleklaka
	Hadegti	Shiraro
	Koraro	Indasselassie
	Lai Adiabo	Adi Dairo
	Medebay Taber	Semema
	Seyint/Adiabo	Adi Aw-Ala
	Tach Adiabo	Yirga
	Tsibla	Inda Abaguna
Tembien	Abergele	Yechila
	Dega Tembien	Hagere Selam
	Layna Tach Tsetsera	Kachamo
	Metekana Ambera	Abi Adi
	Tankwa Milash	Agbe