

SMALL SCALE CONSTRUCTION REPORTS  
ON  
RURAL DEVELOPMENT

- Malawi, Africa -

JR

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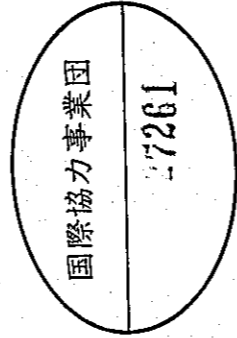
2/21/

1979-80

by H. Kanamori: Ex-Volunteer on Japan Overseas Cooperation Volunteers (JOCV),  
Japan International Cooperation Agency (JICA).

JOCV-JICA

Handwritten text in Japanese, possibly a recipient address, located in the upper portion of the envelope.



Handwritten text in Japanese, possibly a return address, located in the lower portion of the envelope.

本書は、アフリカのマラウイ国で実施された小規模構造物建築工事にかかわる、以下の2報告書を編集して1冊としたものである。

- 1) 1980 CHILUMBA DISTRICTS WATER SUPPLY PROJECT
- 2) 1979 IMPROVEMENT OF ROAD FOR WOWWE EXTENSION RICE SCHEME

"1) 1980 CHILUMBA DISTRICTS WATER SUPPLY PROJECT" には、パイプラインの配管にかかわる土工事および横断暗渠等の小規模構造物建設方法が写真で示され、また、材料表と歩掛り表が記載されている。これら材料表と歩掛り表は、日々の工事日誌を基にデータ整理したものでかなり実用的な数値が含まれている。

"2) 1979 IMPROVEMENT OF ROAD FOR WOWWE EXTENSION RICE SCHEME" も、やはり小規模構造物、特に道路関係の構造物の施工方法が写真で示され、さらに、泥壁による民家の建築方法も紹介されている。

これら2報告書は、小規模構造物にかかわる内容のため、青年海外協力隊駒ヶ根訓練所の図書室に納められ、協力隊員の活動参考とされてきた。しかし、最近農村開発の中で小規模構造物施工が扱われるようになった。そこで、広く専門家にも参考にするように、この度、新たに編集した。

平成7年4月27日

金森秀行



1980 CHILUMBA  
DISTRICTS  
WATER SUPPLY  
PROJECT

WATER BRANCH

Ref. No. 23/1/8/6.

14th March, 1981.

FROM : THE IRRIGATION ENGINEER, (J.O.C.V.), P.O. BOX 591, MALANGAWE.

TO : THE CHIEF WATER SUPPLY OFFICER, PRIVATE BAG 8, MALANGAWE.

Through: The Principal Irrigation Engineer, P.O. Box 591, MALANGAWE.

IN REGARD TO 1980 CHELONDA D.A.U.S.P. WORK

Before coming to Malawi I was working in one of the Prefectural offices of Japan as a designer. At that time, for completion of any construction work that was to be done by a contractor, the following three type of sheets should have been provided:

1. "CONSTRUCTION PHOTOGRAPHS"

To be given by the contractor to show the size of covered parts (e.g. reinforcing bars).

2. "FINAL ESTIMATION SHEETS"

To show the estimation of final design and final payment price for the constructor.


3. "ORIGINAL ESTIMATION SHEETS"

To show the estimation of original design and according to these costs the "Bid" is made.

I tried to make the above three sheets. "CONSTRUCTION PHOTOGRAPHS" were taken with my camera. In the "FINAL ESTIMATION SHEETS", the actual cost price is provided. With regard to the "ORIGINAL ESTIMATION SHEETS", they are calculated according to "EFFICIENCY AND COST WORK RATE" which has been arrived at after my experienced of work in Malawi.

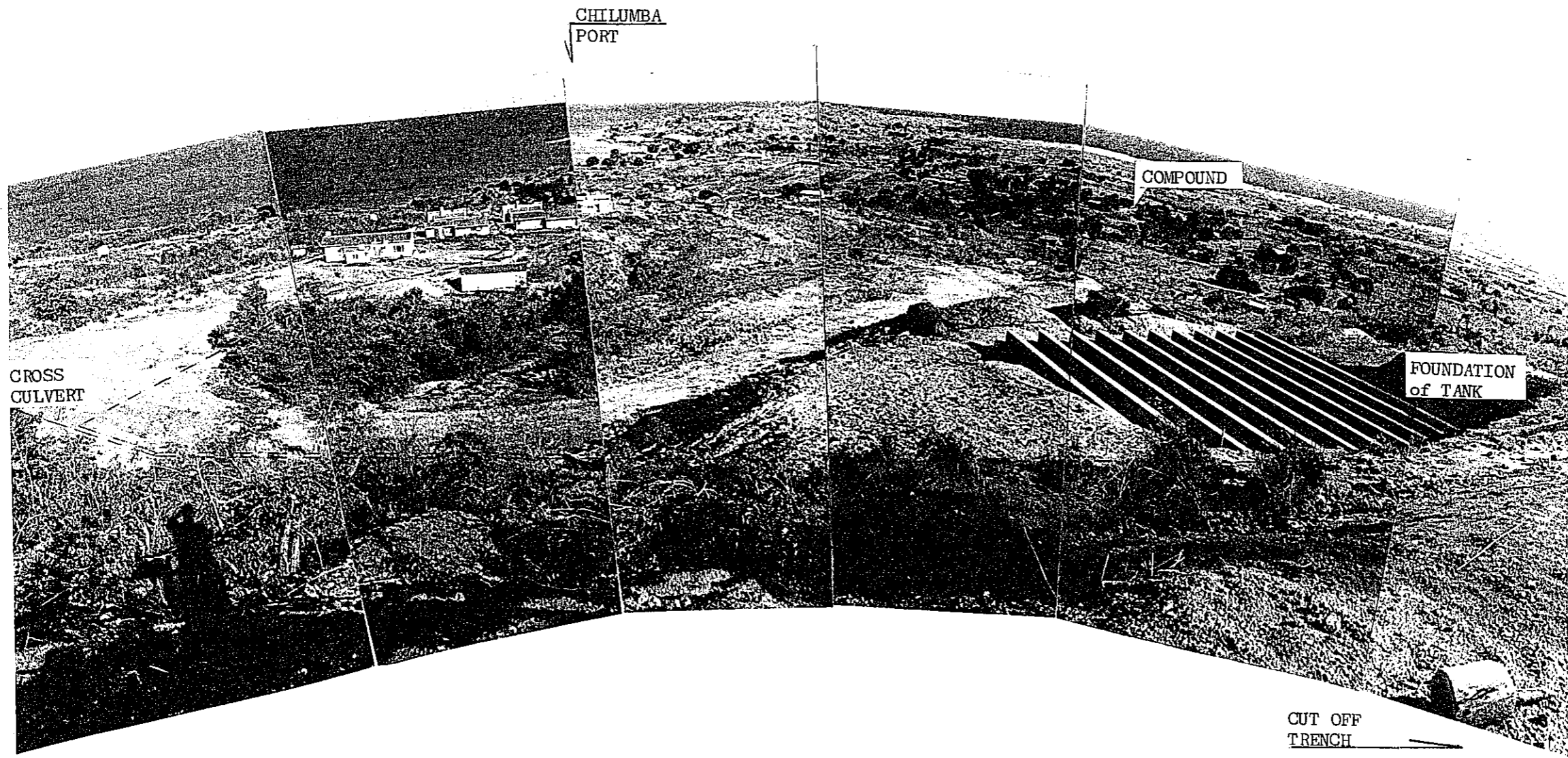
It is hoped these sheets help the estimation work of Malawi as a guide.

HK:MEEM

  
(H. KARANDI)  
IRRIGATION ENGINEER (J.O.C.V.)

CONSTRUCTION

PHOTOGRAPHS

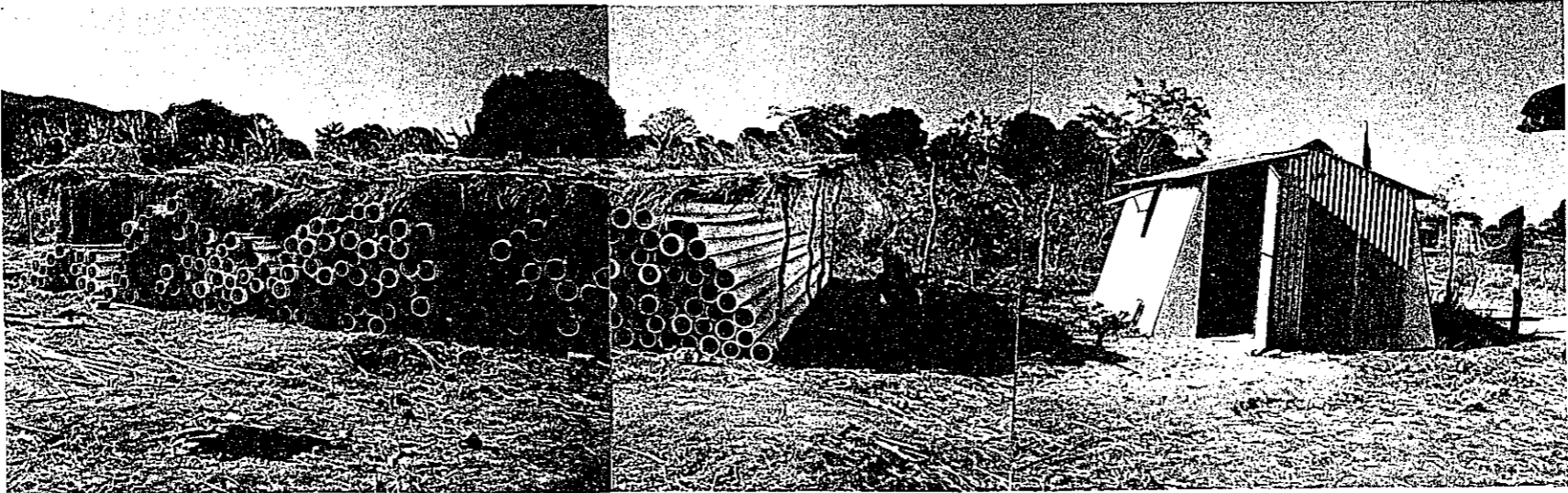


CHILUMBA SITE

NOTE :  
----- PIPE LINE

COMPOUND

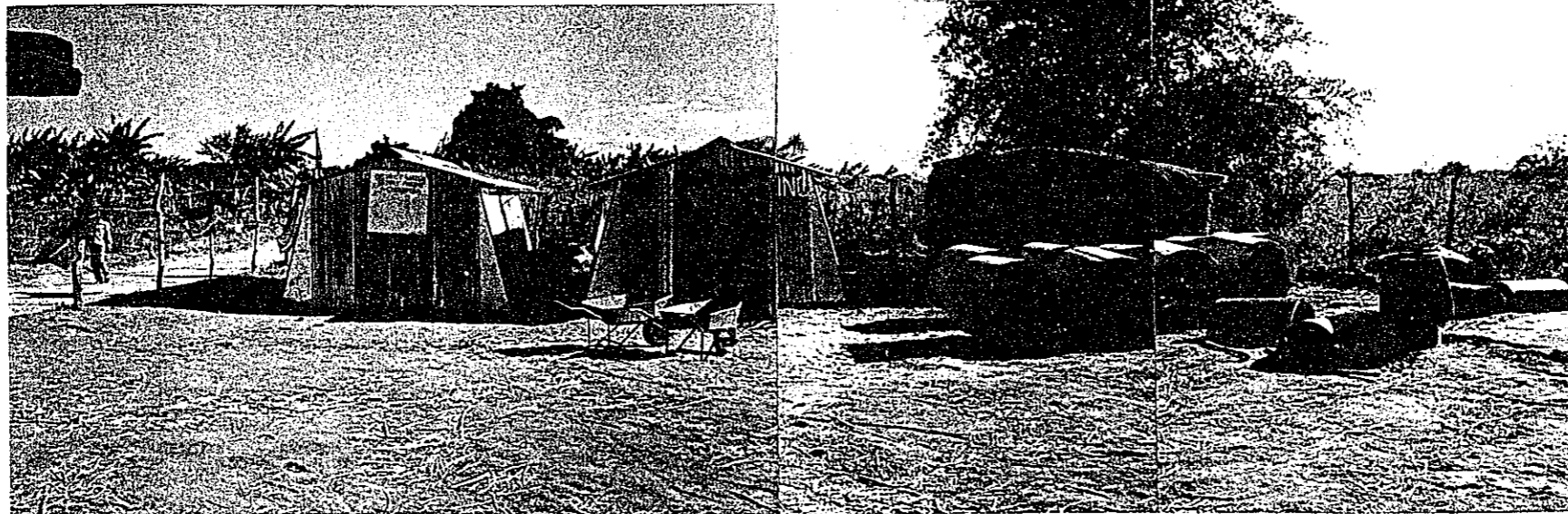
PIT LATRINE



PIPE HOUSE

SITE OFFICE

COMPOUND



STORES

WORK SHOP for Carpenter

PIPE LAYING

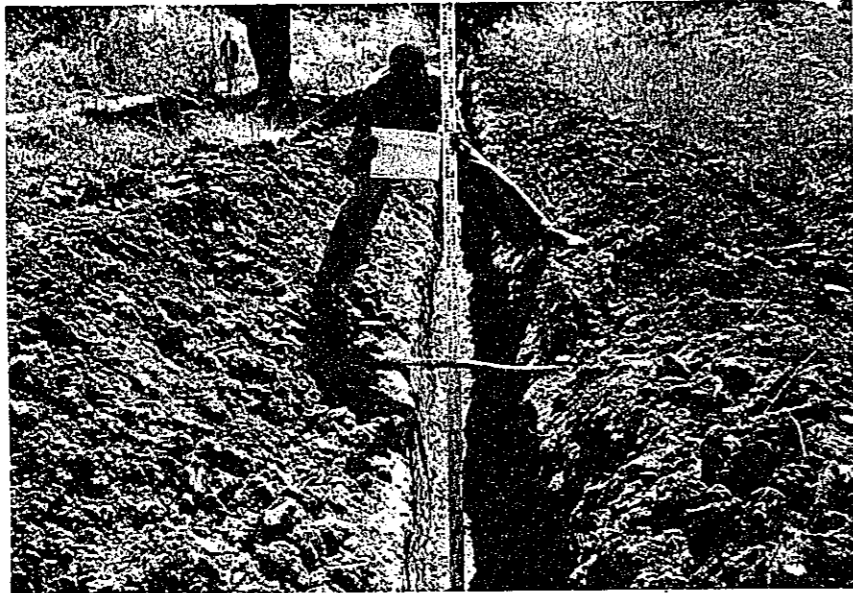


BEFORE TRENCHING



UNDER TRENCHING

PIPE LAYING



AFTER TRENCHING



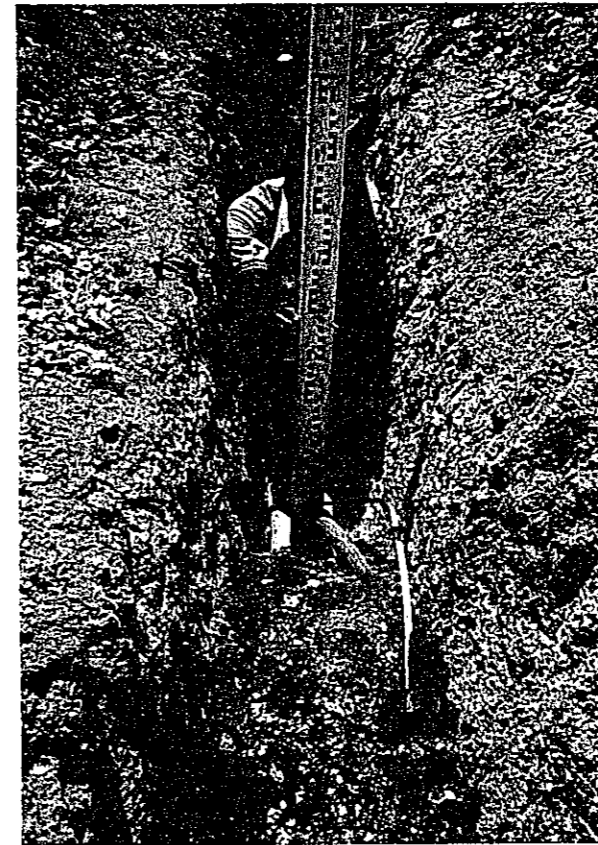
TRIMMING BED



PIPE LAYING



BED SAND



COVERING SAND

PIPE LAYING

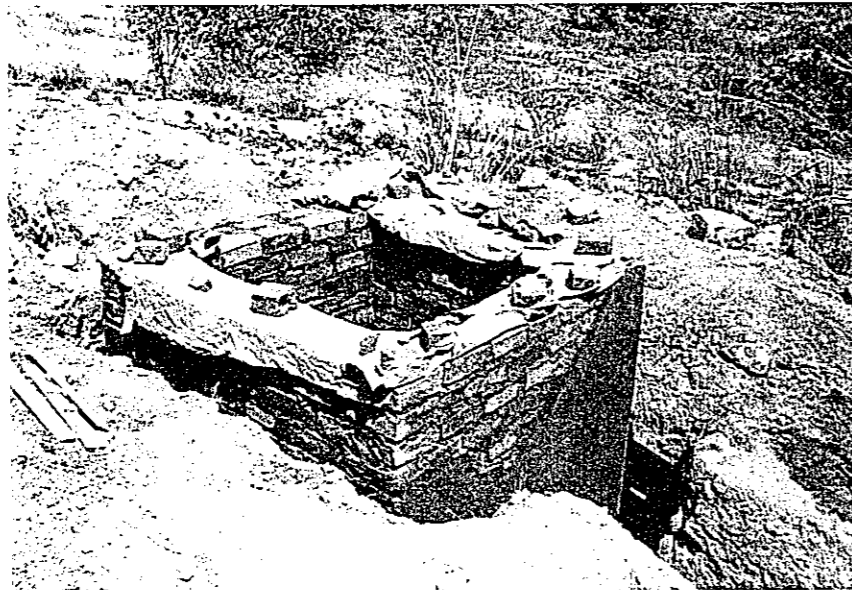


BACK FILLING

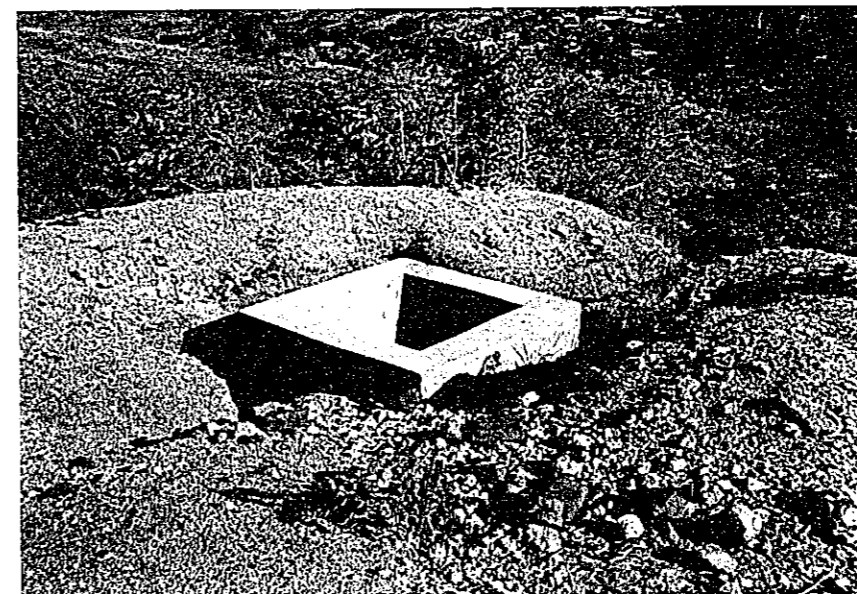


TESTING PIPE

PIPE LINE STRUCTURES  
VALVE CHAMBER



· UNDER BUILDING ·



· COMPLETION ·

PIPE LINE  
STRUCTURES



CONCRETE SLAB  
for Road Cross



ANCHOR BLOCK

STRUCTURES  
CROSS CULVERT



BEFORE CONSTRUCTION



AFTER CONSTRUCTION

CROSS CULVERT  
SOIL WORK



CUTTING A SLOPE



DIGGING CUT OFF SILL

CROSS CULVERT

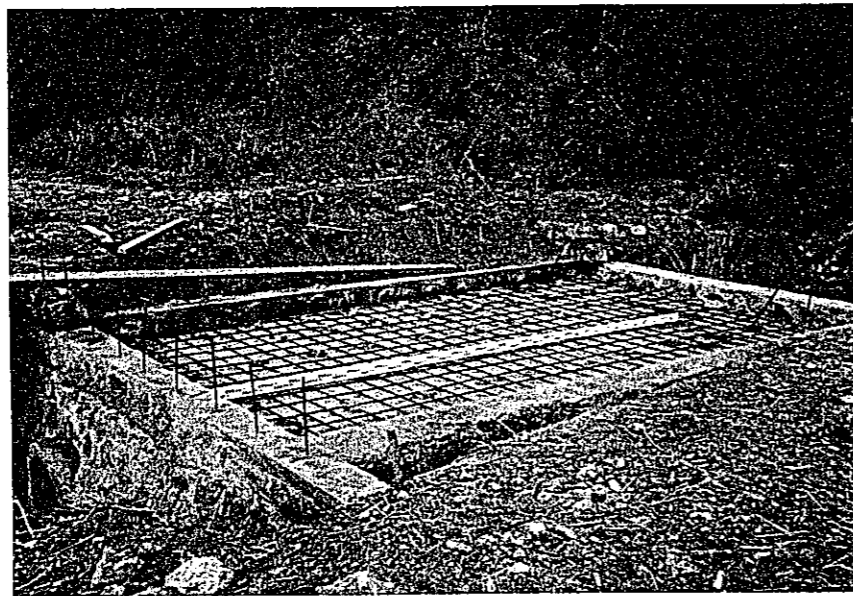


INSTALLING CONCRETE RINGS

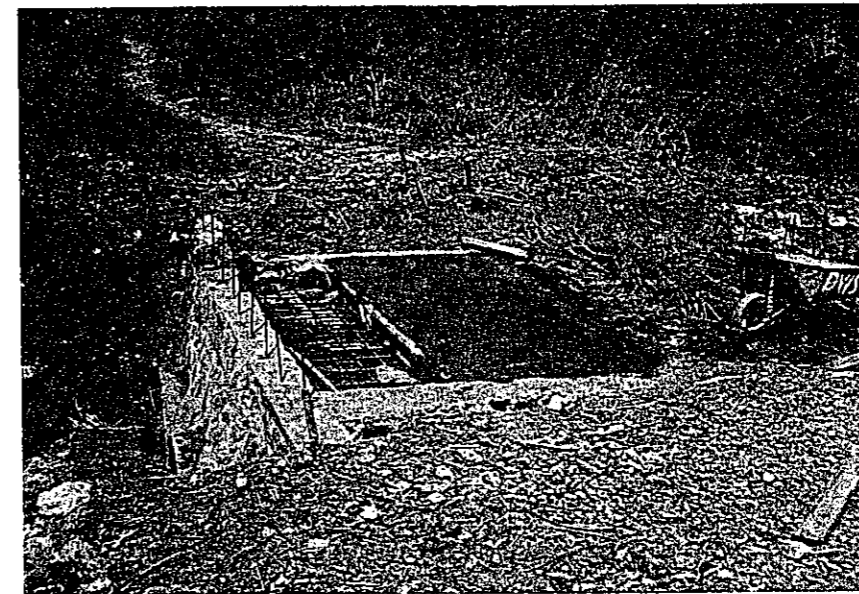


FILLING CONCRETE

CROSS CULVERT  
REINFORCEMENT CONCRETE SLAB



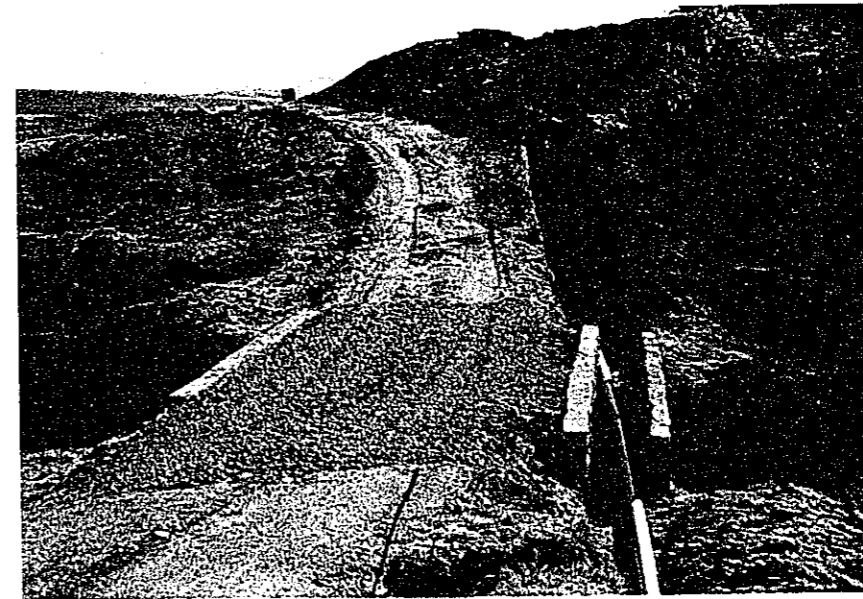
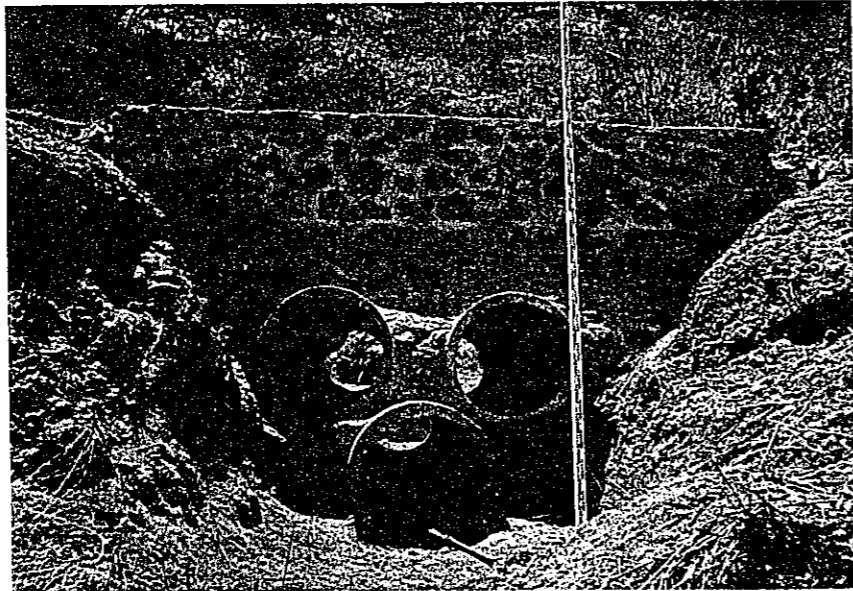
PLACING REINFORCEMENT BARS



FILLING CONCRETE



CROSS CULVERT



COMPLETION

ACCESS ROAD



BEFORE EXCAVATION



AFTER EXCAVATION

CUT OFF TRENCH



TRENCHING



DIGGING CUT OFF SILL

CUT OFF TRENCH



BASE SLAB SETTING OUT



SIDE WALL SETTING OUT

CUT OFF TRENCH



AFTER STONE WORK



COMPLETION

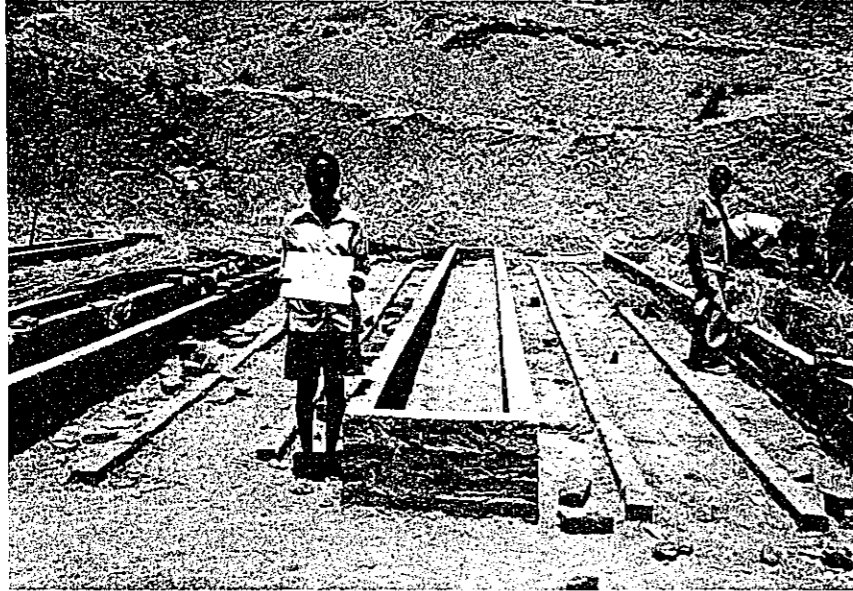
FOUNDATION OF STEEL TANK



UNDER EXCAVATION



AFTER EXCAVATION

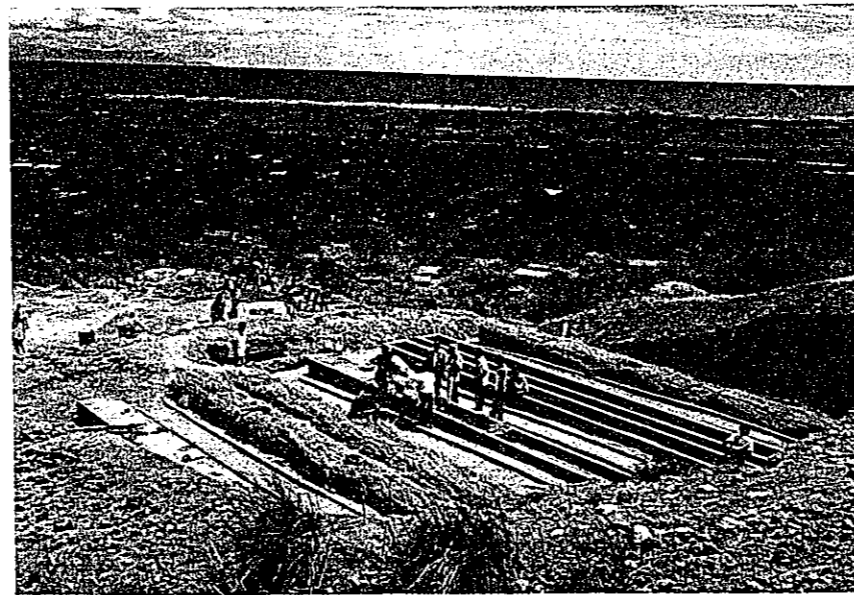


FOOTING



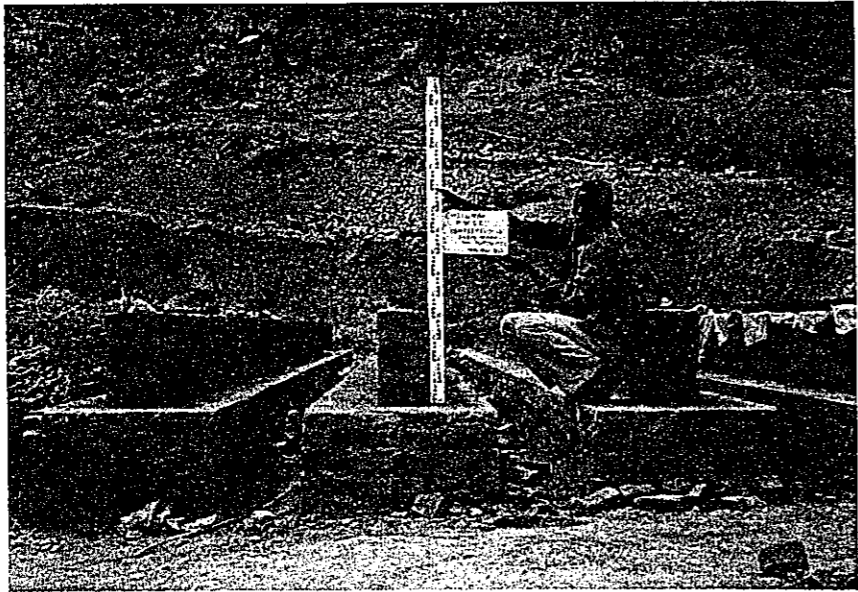
COMPLETION

BUILDING SHUTTER

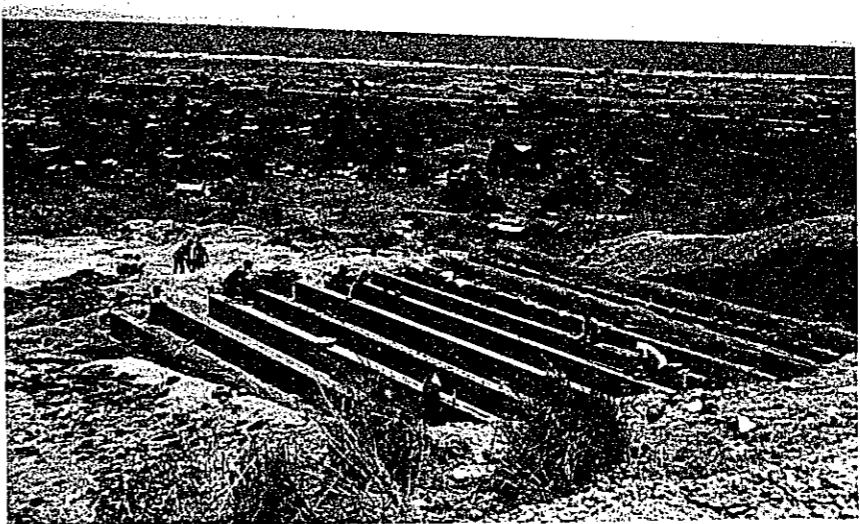


CONCRETE FILLING

FOUNDATION OF STEEL TANK  
SUPPORTS



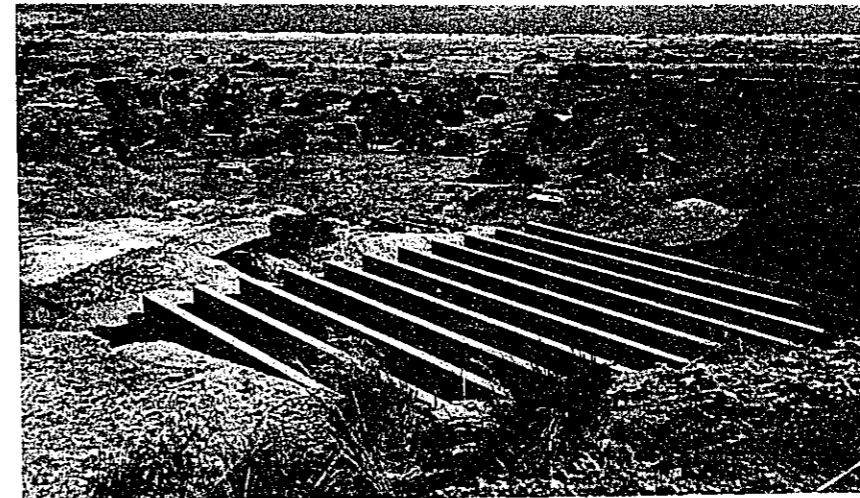
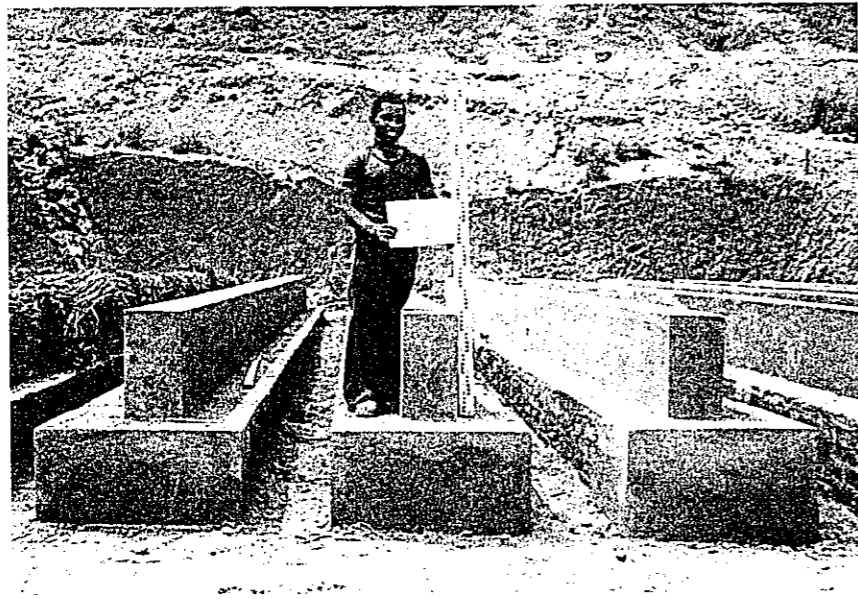
BUILDING BRICKS



MORTAR SURFACING



FOUNDATION OF STEEL TANK



COMPLETION



MOLDS

MOLDING  
CONCRETE RINGS



WASHING AGGREGATE

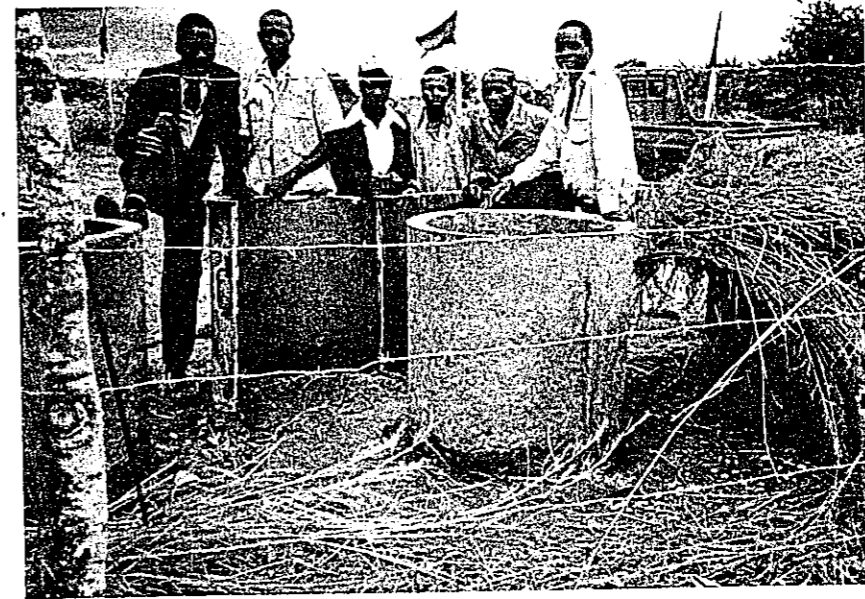


DRAWING OIL



MIXING CONCRETE

MOLDING  
CONCRETE RINGS



COMPLETION



FILLING CONCRETE



COLLECTING SAND

COLLECTING  
MATERIALS

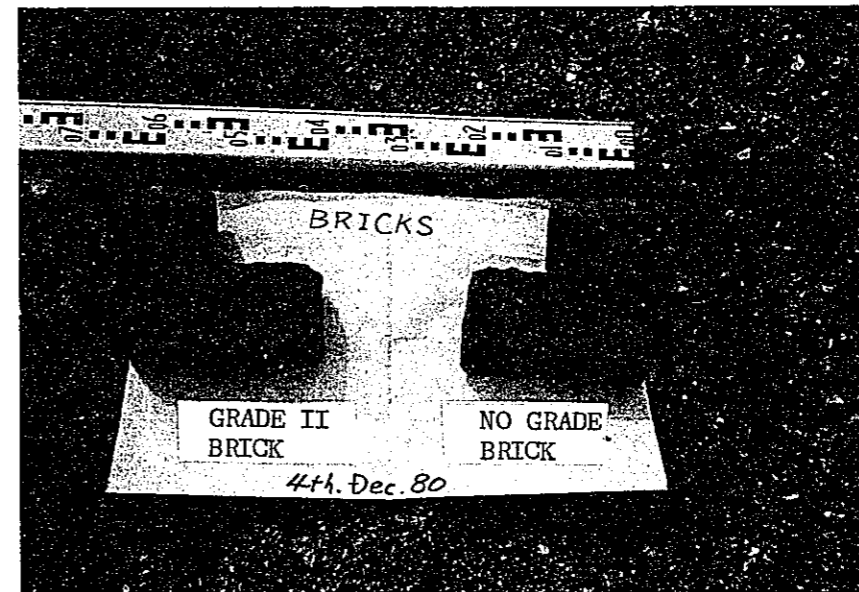


COLLECTING STONES  
WITH CRUSHING



COLLECTING  
AGGREGATE

COLLECTING MATERIALS



COLLECTING BRICKS

EXPENDITURE

II ACTUAL EXPENDITURE

I COST PRICE

Cost Price of Construction Works	K70,200-00t
Cost Price of Administration	K10,000-00t
Total	K80,200-00t

2. COST SUMMARY

		PERCENTAGE OF TOTAL COST
Labour	K7,400-00t	(10.5f)
Materials	27,700-00t	(39.5f)
Plant	34,600-00t	(47.0f)
Other	700-00t	(1.0f)

Total K70,200-00t (100f)

REMARK:

1. "Other" means Rest House Cost for Foreman.
2. The above costs include price rises.

3. COST OF CLASSIFIED WORK

Pipe Line Work	K58,780-00t
Gross Culvert & Access Road	3,080-00t
Cut off Trench	2,300-00t
Foundation of Steel Tank	5,490-00t
Incompleted work	550-00t
Total	K70,200-00t

4. HIRING VEHICLES FROM P.V.H.O.

- Nissan Pick Up
- Land Rover
- 7 Ton Leyland Lorry
- Bedford Water Tanker
- Compressor

Cost Breakdowns are shown on the attached sheets

CHILUMBA D.W.S.P. 1980 WORK CONSTRUCTION SCHEDULE (CONSTRUCTION PERIOD  
10/6 - 13/12) NO. 1

ITEM	WHOLE WORK	1980 WORK		JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	SPENT DAYS	REMARKS
<u>BUILDING COMPOUND</u>				—							18 days	
<u>PIPE LINE</u>												
<u>PUMPING MAIN</u>												
Trenching	805.5 <sup>m</sup>	562.0 <sup>m</sup>	69.8%			—	—	—	—		45 days	
Pipe laying	809.5 <sup>m</sup>	562.0	69.4			—	—	—	—		26	
Testing	809.5 <sup>m</sup>	—	—								—	
<u>MAIN TO LEPRA</u>												
Pipe laying	663.0 <sup>m</sup>	—	—								—	
Testing	663.0 <sup>m</sup>	—	—								—	
<u>TRUNK MAIN TO SECONDARY SCHOOL</u>												
Trenching	1,912.0 <sup>m</sup>	1900.0	99.4	—		—	—	—	—		31	
Pipe laying	1,912.0 <sup>m</sup>	1812.5	94.8			—	—	—	—		42	
Testing	1,912.0 <sup>m</sup>	1273.0									28	
<u>TRUNK MAIN TO NOIL CO.</u>												
Trenching	1,943.5 <sup>m</sup>	1570.5	80.1		—	—	—	—	—		90	( 724.5 <sup>m</sup> pipe testing has not yet been finished)
Pipe laying	1,954.5 <sup>m</sup>	1451.5	74.3		—	—	—	—	—		59	
Testing	1,954.5 <sup>m</sup>	—									11	
<u>MAIN ON 100</u>												
Trenching	1,541.5 <sup>m</sup>	1254.5	81.4		—	—	—	—	—		16	( 547.5m pipe testing has not yet been finished)
Pipe laying	1,541.5 <sup>m</sup>	1254.5	81.4			—	—	—	—		25	
Testing	1,541.5 <sup>m</sup>	1234.5	80.1					—	—		39	

Carried from sheet No. 1.

CHILUMBA D.W.S.P. 1980 WORK CONSTRUCTION SCHEDULE (TERM 10/6 - 13/12) NO.3

WORK ITEMS	WHOLE WORK	1980 WORK	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	SPENT DAYS	REMARK
<u>TOTAL</u>											
Trenching	6206.5m	5287.5	85.2%							132	14/8-26/9
Pipe laying	6880.5m	5080.5	73.8%							137	Reservoir site
Testing	6880.5m	1960.0	28.5%							39	Excavation





## BILL OF QUANTITIES

PROJECT CHILUMBA D.V.S.P. Date.....  
 SHEET NO. 1 of .....

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	RATE	K	L
1.01	Salaries of Clerks Timekeepers, Store-keepers Watchman and the other Staff		Sum		1137	50
1.02	Absenteeism				575	52
1.03	Overtime wages as a Bounty for encouraging workers to make work harder		Sum		1430	32
1.04	Office Supplies		Sum		76	68
1.05	Clothes & Boots for workers		Sum		470	85
	<b>TOTAL</b>				<u>3750</u>	<u>77</u>
	<b>BILL NO.2 GENERAL ITEMS</b>					
	<b>EQUIPMENT REQUIREMENT</b>					
1.06	Hired Charge of Vehicles		Sum		4579	75
1.07	Appliances' depreciation		Sum		365	00
1.08	Tools' wear & Tear		Sum		2180	00
1.09	Transport of equipment		Sum		3275	60
1.10	Maintenance of equipment		Sum		90	90
	<b>Sub - Total</b>				<u>10491</u>	<u>25</u>
	<b>COMMON CONVEYANCE</b>					
1.11	Short carriage of Materials, workers in the site		Sum		1938	36
1.12	Conveyance of Labourers from Village to the site		Sum		2958	40
	<b>Sub P Total</b>				<u>4896</u>	<u>76</u>
	<b>CONTRACTORS' REQUIREMENT</b>					
1.13	Offices, Workshops, Welfare and other accommodation including furniture and equipment for staff and employees		Sum		1764	14
1.14	Transport for Supervision, Construction and Communication for contractor's Engineer		Sum		1438	05
1.15	Travelling Cost for Site Engineers For Branch's Staff		Sum Sum		247 966	06 65
1.16	Transferring Cost		Sum		874	21
1.17	Testing of Materials		Sum		20	00
1.18	Surveying, Setting out of works and other small jobs		Sum		141	08
	<b>Sub - Total</b>				<u>5451</u>	<u>19</u>
	<b>PROVISIONAL SUMS</b>					
1.19	Expenditure for contingencies				158	25
1.20	Provision for Price rises				945	39
	<b>TOTAL</b>				<u>21942</u>	<u>84</u>

# BILL OF QUANTITIES

PROJECT CHILIMBA D.H.S.P. Date                       
 BILL NO. 3 CONSTRUCTIONAL ITEMS Sheet 2 of 2

ITEM No.	DESCRIPTION	QUANTITY	UNIT	RATE	K	I
<u>MATERIALS</u>						
1.21	Bricks Grade II	7.5	100 No.	1900t	142	50
	No Grade	16.196	1000 No.	1500t	242	94
1.22	Cement	630.3	bags	K4.85	3056	96
1.23	P.V.C. Pipes Ø150	3226.0	m	424.1t	16226	97
	Ø100	1242.5	m	339t	4212	98
1.24	Valves, DI Pipes etc.		Sum		2153	60
1.25	Reinforcement Bars	24	Yo	K4-65t	111	60
	Sub - Total				26145	75
	<u>WORKERS</u>				4237	22
	<u>RUNNING COST</u>					
1.26	Tractor		Sum		23	56
	Bedford water Tanker	4150	miles	K1.09	452	35
1.27	7 ton Leyland Lorry &		miles		1248	63
	5 ton Bedford Tanker	998.9		K1.25	66	90
1.28	Water Pump diesel	100	1	66.9t	107	34
1.29	Compressor Diesel	160	1	66.9t	81	12
	Oil	8	51	K10-14t		
1.30	Transport of Cement, Pipes & valves etc. by Lorry		Sum		5371	30
1.31	P.V.C. Pipe's Carriage by Ilala		Sum		2712	27
	Sub - Total				11052	87
	<u>TOTAL</u>				41445	84
<u>HILL NO. 4 EXTRA ITEMS</u>						
1.32	Expenditure caused by poor administration		Sum		1192	97
1.33	Private Trip's expenditure		Sum		709	41
1.34	Sum due to lack of supervision		Sum		343	85
1.35	Mismanagement		Sum		720	18
					2966	41
<u>SUMMARY OF THE TOTALS</u>						
<u>BILL NO. 1</u>						
	Management & Assistant Items				3750	77
<u>BILL NO. 2</u>						
	General Items				21942	84
<u>BILL NO. 3</u>						
	Constructional Items				41445	84
<u>BILL NO. 4</u>						
	Extra Items				2966	41
	Miscellaneous				94	14
	Carried to Summary				70200	300

ESTIMATION

III ORIGINAL ESTIMATION SHEETS FOR 1980

CHILUMBA D.V.S.P. WORK

PREFACE

In Japan all estimation is based on the "EFFICIENCY PER UNIT WORK RATE" system which has been decided by Government. Firstly, every "UNIT PRICE" is calculated from the "EFFICIENCY PER UNIT WORK RATE", secondly "COST PER UNIT CONSTRUCTION WORK", thirdly "OVERHEAD EXPENSES", then all estimation is completed.

But, in Malawi there is no data about "EFFICIENCY PER UNIT WORK RATE" and whether such data is useful or not for estimation must be considered especially as labour costs are relatively low in Malawi. However, as I consider the data is useful for Site Engineers to derive a construction schedule and supervise workers, I have tried to provide the "EFFICIENCY" and study also the means of calculation for "OVERHEAD EXPENSES".

These "ORIGINAL ESTIMATION SHEETS" are calculated according to the "EFFICIENCY". If required before construction, detailed investigation of the site ~~was~~ done by the engineer (as in Japan) and the "EFFICIENCY" would be arrived at. Such an estimation sheet could have been prepared in later Branch.

A. B. The costs of Hard Rock trenching and crushing by the compressor has not been estimated because these areas could not be found even after detailed investigation was done.)

Naturally there are some discrepancies between "ORIGINAL ESTIMATION" and "ACTUAL EXPENDITURE", but if the balance is small the original estimation is useful, then it is hoped that this example of original estimation sheets is used as a guide for improvement of later Branch's estimation and good supervision.

March, 1981

H. KANAMORI.

SUMMARY

1. Cost Price	
Cost price of Construction Work	K72,200-00t
Cost Price of Administration	K10,000-00t
Total	K82,200-00t
2. COST SUMMARY	
Construction costs	K41,400-00t(57.3%)
Overhead Expenses	K30,800-00t(42.7%)
Total	K72,200-00t(100%)
3. COST OF CLASSIFIED WORK	
Pipe line work	K60,450-00t
Gross Culvert & Access Road	3,170-00t
Cut off Trench	2,370-00t
Foundation of Steel Tank	5,640-00t
Uncompleted Work	270-00t
	K72,200-00t
4. MAIN MATERIALS COST	
Cement Bag 622.9 bags x K4.85t/bag =	K 3,021-07t
P.V.C. Pipe $\phi$ 150mm 3826m x K4-24t =	K16,226-07t
$\phi$ 100mm 1242.5mxK3-39t/m=	K 4,212-08t
Valves	K 2,153-60t
Total	K25,612-82t

Cost Breakdowns are shown on the attached sheets.

**BILL OF QUANTITIES**

PROJECT CHILUMBA V.D.M.S.P. Date ..... of .....  
 BILL NO. 1 SHEET 1 OF .....

ITEM No.	DESCRIPTION	QUANTITY	UNIT	RATE	K	t
1.01	<u>MANAGEMENT &amp; ASSISTANT REQUIREMENT</u> K4130 x 0.10=		Sum		4130	00
1.02	<u>VEHICLE REQUIREMENT</u> Hired Charge of Vehicles Land Rover (10/6-13/12) Motor cycle (10/6-13/12) 7 ton Leyland Lorry 1/8-13/12 Bedford Motor Tanker 1/8-13/12 Sub - Total	187 187 135 135	days days days days	775t 450t 950 1000	1449 841 1252 1350 4923	25 50 50 00 25
1.03	<u>Appliances' Depreciation</u> Water Pump & Hose (1/13-13/12) Depreciation for 135 days $K2750 \times (0.2 \div 6 + 0.05) \times \frac{135}{365}$ Repairing cost Level Machine & Tripod (10/6-13/12) Depreciation for 187 days $K665 \times (0.2 \div 5 + 0.05) \times \frac{187}{365}$ Hand Pump & Pressure meter (1/10 - 13/12) Sub - Total		Sum Sum Sum Sum		203 65 79 25 371	42 00 36 00 78
1.04	<u>Tools' Wear &amp; Tear</u> K4130 x 0.05 =		Sum		2065	00
1.05	<u>Transport of Equipment</u> Land Rover with motor cycle Hire & off (Mzuzu-Chilumba) (K7-75+120 miles x 60t) x 2= For service (Chilumba-Karonga) 60 miles x 60t x 2= 7 ton Leyland Lorry Hire & off (Mzuzu-Chilumba) (K9-50+120 miles x 130t) x 2= For service (Chilumba-Karonga) 60 miles x 130t x 2= Bedford water tanker Hire & off (Mzuzu-Chilumba) (K10-00+120 miles x 110t) x 2= For service (Chilumba-Karonga) 60 miles x 110t x 2 Tools' conveyance by 7 ton lorry (Mzuzu-Chilumba) ( <del>K9-50t</del> + 5 trips (K9-50t+120 miles x 130t) x 2 x 5= Sub - Total		Sum Sum Sum Sum Sum Sum Sum Sum Sum Sum		159 72 331 156 142 132 1655 2647	50 00 00 00 00 00 00 50
1.06	<u>Maintenance of Equipment</u> Operator of Water Pump 1/8-13/12 135 days Assistant of Vehicle 2 vehicle x 135 days Sub - Total Miscellaneous	135 270	man-days car-days	72t 25t	97 57 164	20 50 70 77

## BILL OF QUANTITIES

PROJECT CHILUMBA D.W.S.P. Date \_\_\_\_\_ of \_\_\_\_\_  
 MILL No. 1 Continued. OVERHEAD EXPENSES Sheet 2 of \_\_\_\_\_

ITEM No.	DESCRIPTION	QUANTITY	UNIT	RATE	K	t
	Sub - Total : Hired charge of vehicles				4923	25
	Appliances' depreciation				371	78
	Tools' wear & Tear				2065	00
	Transport of Equipment				2647	50
	Maintenance of Equipment				164	70
	Miscellaneous				7	77
	<b>Total</b>				10180	00
1.07	Short carriage of materials workers in the site by 7 ton Lorry. Term 10/6-13/12 135 days Sunday 20 days Average mileage per day (according to the site's map) 8 miles/day Hence! 8x(135-20) =				1196	00
1.08	Conveyance of Labourers from village to the site by 7 ton Lorry. Hence 20x(74-10) Term 1/-13/12 74 days Sunday 8, Holidays 10 days. Mileage to the village 20 miles Miscellaneous	2560	mile	130t	3328	00
	<b>TOTAL</b>				6	00
1.09	<b>CONTRACTORS' REQUIREMENT</b> Offices, Workshops, Welfare and other accommodation including furniture and equipment for staff and employees. K41300 x 0.04 =		Sum		1652	00
1.10	Best house cost for Foreman (10/6-13/12)		days	350	534	50
1.11	Transport for Supervision, construction and communication Term 10/6-13/12 187 days Sunday 30 days Average mileage Land Rover 25 miles/day Motor cycle 10 miles/day Hence; Land Rover 25x(187-30) = Motor cycle's fuel 10x(187-30)+10 miles/1 =	197				
1.12	Travelling Cost 1) for Site Engineers Mzuzu-Chilumba 2 times by Land Rover. 120 miles x 2x 2 times	3925	miles	60	2355	00
		157.0	litre	73.5	115	40
		480	mile	60t	288	00
	Carried forward to page 3				5064	90

## BILL OF QUANTITIES

PROJECT **CHILUMBA D.W.S.P.** Date ..... of .....  
 BILL NO. **1** SHEET **3** OF .....  
OVERHEAD EXPENSES

ITEM No.	DESCRIPTION	QUANTITY	UNIT	RATE	K	t
1.12	Brought forward from page 2				5064	90
	Travelling Cost					
	ii) for Branch's Staff					
	Lilongwe-Chilumba 6 times	12	Tri p	44.50 t	534	00
	Lilongwe-Muzu by Air 2x6-					
	Muzu-Chilumba by Land				957	00
	Hover (x7.75x120 milesx60t)	12	trip	Sum		
	x2x6-			4450t	534	00
1.13	Transferring Cost for two					
	Engineers.					
	Lilongwe-Muzu by Land Hover					
	x7-75x400 miles x 60t)x2x2 times				391	00
1.14	Testing Materials & Surveying					
	K41300 x 0.005-				206	50
	Miscellaneous				6	50
	TOTAL				7760	00
1.15	<u>PROVISIONAL SUMS</u>					
	41300 x 0.03-				1239	00
	Miscellaneous				1	00
	TOTAL				1240	00
1.16	Extra Expense					
	K41300 x 0.07 =				2891	00
	Miscellaneous				9	00
	TOTAL				2900	00
	<u>SUBMARY OF THE TOTALS</u>					
	Management & Assistant				4130	00
	Requirements				10180	00
	Equipment Requirement				4530	00
	Common Conveyance				7760	00
	Requirement				1240	00
	Contractors' Requirement				2900	00
	Provisional Sums				60	00
	Extra Expense				30800	00
	Miscellaneous					
	Carried to Summary					

## BILL OF QUANTITIES

PROJECT CHILUMBA D.V.S.P. Date ..... of .....  
 BILL NO. 2 Sheet 1 of .....

ITEM NO.	DESCRIPTION	UNIT PRICE NO.	QUANTITY	UNIT	RATE	K	t	
<b>PIPE LAYING WORK</b>								
2.01	<b>TRENCHING</b>							
	(Sandy Soils) 1530m x 0.72 + 10	0.01	110.2	10m <sup>3</sup>	70t	77	14	
	Sandy loam 360m x do	0.02	25.9	do	100	25	90	
	Loam Soils 1750m x do	0.03	126.0	do	120	151	20	
	Soft Rocky Soils 11x40m x do	0.04	42.1	do	530	435	13	
	420m x do	0.05	30.2	do	790	238	58	
	Soft silt & steep 60m x 0.5m	0.07	30.0	m <sup>3</sup>	200	60	0	
Sub - Total							987	
2.02	<b>PIPE LAYING MATERIALS</b>							
	Ø 150mm P.V.C.	0.28	3226	m	500t	19,130	00	
	Ø 100mm P.V.C.	0.29	1242.5	m	420	5,218	50	
	Valves			Sum		2,153	60	
	Conveyance of valves by 7 ton lorry (Lilongwe- Chilumba) 2 trips x 400 miles x 2 =	0.13	1600	mile	130		2,080	00
Sub - Total							28,582	
2.03	<b>PIPE LAYING WORK</b>							
	Labour Cost for Laying							
	Sandy Area	0.48	15.30	100m	1020	156	06	
	Except Sandy Area	0.49	35.50	100m	2170	770	35	
	Face sand for filling 0.6x0.40x3550.5x1.10	0.23	937.3	m <sup>3</sup>	130	1218	49	
	Sub - Total							2144
	<b>TESTING WORK</b>	0.50	1.96	100m	3750	73	50	
	<b>VALVE CHAMBERS</b>							
	Excavation							
	Sandy Soils 5 points x 4.1 + 10	0.01	2.05	10m <sup>3</sup>	70t	1	44	
Sandy loam 1 point x 4.1 + 10	0.02	0.41	do	100t	0	41		
Loam Soils 5 points x 4.1 + 10	0.03	2.05	do	120t	2	46		
Soft Rocky Soils 3 points x 4.1 + 10	0.04	1.23	do	530t	6	52		
Chambers' setting	0.53	14.0	Points	10780t	1,502	20		
Sub - Total							1,520	
2.06	<b>ANCHOR BLOCK</b>							
	(Including Temporary Block for testing pipes)	0.51	25	Points	1150t	287	50	
	Sub - Total : TRENCHING MATERIALS							987
	PIPE LAYING WORK							28582
	TESTING PIPES							2144
VALVE CHAMBERS							73	
ANCHOR BLOCK							1520	
Miscellaneous							33600	
TOTAL							4	
							33600	
							00	



## BILL OF QUANTITIES

PROJECT **CHILUMBA D.S.S.P.**

Date ..... of .....  
Sheet **2** of .....

CONSTRUCTIVE PRICE

ITEM No.	DESCRIPTION	UNIT PRICE NO.	QUANTITY	UNIT	RATE	K	L
2.07	<u>STRUCTURES</u> CROSS CULV FT & ACCESS ROAD						
	SOIL CRK access road excavation (soft rocky soils) 54.33 x 1.20	0.08	65.20	m <sup>3</sup>	130t	84	76
	Digging cut off sill point (soft rocky soils)	0.04	0.35	10m <sup>3</sup>	530	1	36
	Cutting a slope(soft rocky soils) 7.25x120= Banking	0.10	8.70 (Including Access Road Work)	m <sup>3</sup>	60t	5	22
2.08	Sub - Total					91	84
	CONCRETE MIXING PLACE	0.54	2	Points	2820t	56	40
2.09	CONCRETE R.I.C. CRK the price of \$750 casting concrete rings	0.46	19	No	1510t	286	90
	Labour cost for installing Ø 750mm concrete rings	0.47	19	No.	100t	19	00
2.10	Carriage cost by Land Rover 2 mile x 19 No. =	0.12	38	miles	50t	22	80
	Sub - Total					328	70
	<u>WET MASONRY</u> Labour Cost for Trapezoid section wet masonry work 3.90 x 1.30	0.37	5.07	m <sup>3</sup>	440	22	31
	Stones price for the above 5.07 x 1.20	0.18	6.08	m <sup>3</sup>	280	17	02
2.11	1:5 mortar price for the above 5.07 x 0.60=	0.34	3.04	m <sup>3</sup>	4230	128	59
	Labour cost for 20cm thick stone wall	0.38	5.8	m <sup>3</sup>	310t	17	98
	Labour cost for 25 cm thick stone wall	0.39	9.6	m <sup>2</sup>	260t	24	96
	Stones price for these walls (5.8 x 0.2+9.6x 0.25)x 1.20	0.18	4.27	m <sup>3</sup>	280t	11	96
2.12	1:5 mix mortar for these wall 4.27 + 1.20x0.80=	0.34	2.85	m <sup>3</sup>	4230t	120	56
	Sub Total					343	38
	<u>REINFORCEMENT CONCRETE</u> Labour cost for reinfor- cement work (31+14+3x9)+ 10	0.45	7.2	10 No	150t	10	50
	Labour cost for concrete work 3.10x1.10= Reinforcement bars price 1:2:4 mix concrete price	0.35 0.30	3.41 3.41	m <sup>3</sup> m <sup>3</sup>	460t 455t 5830t	15 111 198	69 60 80
Sub - Total					336	89	
2.12	CONCRETE FILLING Mixing small stones price						

## BILL OF QUANTITIES

PROJECT CHULUPTA D.M.S.P. Date: .....  
 BILL NO. 2 CONSTRUCTION PRICE Sheet 3 of .....

ITEM No.	DESCRIPTION	UNIT PRICE NO.	QUANTITY	UNIT	RATE	K	t
2.12	CUT OFF FILLING						
	Mixing small stones price 14.2x0.20x1.3	0.17	3.69	m <sup>3</sup>	260t	9	59
	Labour cost for concrete work 14.2x0.8x1.10	0.35	12.50	m <sup>3</sup>	460t	57	50
	1:3:6 mix concrete price 0.32	0.32	12.50	m <sup>3</sup>	430t	541	25
	Sub - Total					508	34
	Sub-Total: SOIL WORK					71	84
	CONCRETE MIXING PLACE					36	40
	CONCRETE MIXING WORK					325	70
	WET MASONRY					343	38
	REINFORCEMENT CONCRETE					336	89
	CONCRETE FILLING					608	34
	Miscellaneous					4	45
	Total					1770	00
2.13	CUT OFF TRENCH						
	SOIL WORK						
	Trenching soft rocky soils 57.54 x 1.2 =	0.04	69.05	m <sup>3</sup>	530t	365	97
	Cutting an slope of soft rocky soils 9.80x1.20 =	0.10	11.76	m <sup>3</sup>	60t	7	06
	Banking & Back filling	-	7.10	m <sup>3</sup>	(Commission)		
	Sub P Total					373	03
2.14	CUT OFF SILL						
	Labour cost for concrete work 1:3:6 mix concrete price	0.36 0.32	0.84 0.84	m <sup>3</sup> m <sup>3</sup>	520t 430t	4 36	37 37
	Sub - Total					40	74
	WET MASONRY BASE SLAB						
	Labour cost for wet masonry mortar slab (20% extra) 3.13x1.20	0.40	3.76	m <sup>3</sup>	430t	16	17
	Base stones price 2.19x 1.30 =	0.19	2.85	m <sup>3</sup>	260t	7	41
	1:3 mix mortar price (2.19x0.95+3.13x3/10) x 1.2	0.33	3.62	m <sup>3</sup>	5710t	206	70
	Sub-Total					230	28
2.16	SIDE STONE WALL						
	Labour cost for wet masonry (30% extra) 13.50x1.30	0.37	17.55	m <sup>3</sup>	440t	77	22
	Stones price 17.55x1.20	0.18	21.06	m <sup>3</sup>	280t	58	97
	1:5m x mortar price 17.55 x 0.60 =	0.34	10.53	m <sup>3</sup>	4230t	445	42
	Aggregate price for filter 0.2x0.2x12x1.2 =	0.21	0.58	m <sup>3</sup>	540t	3	13
	Sub - Total					584	74

## BILL OF QUANTITIES

PROJECT: CHILUMLA D.S.P. Date: ..... of .....  
 SHEET NO. 2 of 4

ITEM NO.	DESCRIPTION	UNIT PRICE NO.	QUANTITY	UNIT	RATE	K	t						
2.17	SHORT CARRIAGE BY HAND	0.15	21.06	m <sup>3</sup>	130	27	38						
	Port carriage of stones by hand.												
	Short carriage of mortar small stones, aggregate by hand 0.84+2.85+3.52+10.53+0.58.												
	Sub - Total												
	Sub - Total : SOIL WORK												
	CUT OFF SILL												
	SET MASONRY SLAB												
	SIDE STONE WALL												
	SHORT CARRIAGE BY HAND												
	Miscellaneous												
Sub - Total					55	26							
					82	54							
					373	03							
					40	74							
					230	28							
					584	74							
					82	64							
					8	57							
					1320	00							
2.18	FOUNDACTION OF STEEL TANK	0.08	296.46	m <sup>3</sup>	130	365	40						
	Excavation soft rocky soils 247.05 x 1.20												
	Levelling after excavation 0.11												
	Sub - Total												
					15	35							
					409	75							
2.19	CONCRETE MIXING PLACE	0.54	3	Points	2820	84	60						
	FOOTING WORK												
	Labour cost for 4½" thick Brick wall (20% extra) 6.7x1.20												
	No grade bricks price for the above. 2845x1.20x14+1000												
	1:5 mix mortar for the above 8.04x0.5												
	Labour cost for top surfacing 26.8+10												
	1:3 mix mortar for the surfacing (1 cm thick) 26.8x0.01x3.25=												
	Labour cost for filling concrete work (20% extra) 19.1x 1.20 x 1.10=												
	1:3:6 mix concrete price 0.32												
	Sub - Total												
					89	86							
					170	05							
					11	52							
					49	68							
					115	92							
					1091	16							
					1590	90							
2.21	SUPPORTS WALL	0.41	5.27	10m <sup>2</sup>	1580	83	27						
	Labour cost for 9" thick Brick wall												
	Grade II Bricks Price for the above work. 5270x1.20+1000=												
	1:3 mix mortar price for jointing 5.27x1.00=												
	Labour cost for mortar surfacing (127.4+31.1)+10												
	1:3 mix mortar price for surfacing 127.4x0.01x 3.25+31.1x0.045x1.50=												
	Sub - Total												
												259	75
												300	92
												68	16
					356	30							
					1058	40							

## BILL OF QUANTITIES

PROJECT **CHILUKMA D.S.P.**

Date .....

Sheet **5** of .....

**BILL NO. 2 CONSTRUCTION PRICE**

ITEM NO.	DESCRIPTION	UNIT PRICE NO.	QUANTITY	UNIT	RATE	K	t
2.21	<u>FOR THIS BILL CONTINUED.</u>						
	Sub - Total					1068	40
	Sub Total : SOIL CRK CONCRETE MIXING PLACE FOOTING WORK SUPPORTS WALL					400 84 1590 1068	75 60 90 40
	Miscellaneous					5	35
	Total					3150	00
2.22	<u>FOR CRK CRK</u>						
	Delivering ater by Bedford Pumper (8-13/12) 135 days x 70% 20 days	0.52	90	days	1160t	1044	00
	Miscellaneous					6	00
	Total					1050	00
2.23	<u>UNCOMPLETED WORK</u>						
	<u>FOR PIPE LINES</u>						
	(setting D.N. Pipes) Plumbers		10x7½	man-days	17t	12	75
	Assistants		25	man-days	72t	18	00
	Labourers		107	man-days	25t	26	75
	Diesel for Water		28	1	66.9	18	73
	(Testing Pipe of pump 1272m) Plumbers		5x7½	man-hours	17t	6	38
	Assistants		9	man-days	72t	6	48
	Labourers		13	do	25t	3	25
	(No 15 Chamber) Excavation	0.04	0.41	10m <sup>3</sup>	530t	2	17
	Base concrete slab (Road Crossing) Labour cost for concrete work	0.36	0.72	m <sup>3</sup>	520t	3	74
	1:3:6 mix concrete price	0.32	0.72	m <sup>3</sup>	4330t	31	18
Sub Total					149	58	
2.24	<u>FOR STRUCTURES</u>						
	<u>(Pipe bridge)</u>						
	Labour cost for carriage of 4 rings & setting on the bottom of River.						
	Leaders		15	man-days	72t	10	80
	Labourers		98	do	25t	24	50
	Water Pump's diesel price		44	1	66.9	29	44
	Conveyance cost of Land cover for rings 2 mile x 4 trip	0.12	8	mile	60	4	80
	The price of 4 No. ø 750 casting concrete rings (Intake)	0.46	4	No	1510	60	40
	Digging a hole for laterite soils including small stones (Remaining concrete rings) 1 No.	0.09	28.0	m <sup>3</sup>	70	19	60
		0.46	1	No	1510	15	10
	Sub - Total					154	64

## BILL OF QUANTITIES

Date .....

PROJECT **CHIUMPA P.W.S.F.** Sheet **6** of .....

**BILL NO. 2 CONSTRUCTION PRICE**

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	RATE	K	t
2.24	FOR STRUCTURES (continued)					
	<del>Sub-Total</del>				164	64
	Sub-Total: For Pipe Line				149	58
	For Structures				164	64
	Miscellaneous				5	78
	Total				320	00
	<u>SUMMARY OF THE TOTALS</u>					
	Pipe Line work				33600	00
	Cross Culvert & Access Road				1770	00
	Cut Off Trench				1320	00
	Foundation of Steel Tack				3150	00
	The Other Work				1050	00
	Uncompleted Work				320	00
	Miscellaneous				90	00
	Carried to Summary				41300	00

CALCULATION MATERIALS' VOLUME TABLE

WORK	CEMENT	SAND	AGGREGATE		SMALL STONES 50 Ø 100	STONES Ø 100	MATERIALS
			Ø=25mm	Ø=50mm			
<u>PIPE LINE WORK</u>	Bags	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>	
<u>VALVE CHAMBERS</u>							
Base stones					4.06		
1:3:6 mix concrete 5.6m <sup>3</sup>	26.9	287					
1:5 mix mortar 10.6m <sup>3</sup>	54.0	11.88					No Grade Bricks 10540 No. 700 No.
1:3 mix mortar 5.2m <sup>3</sup>	37.1	4.94	5.76	5.76			
1:5 mix mortar 0.7m <sup>3</sup>	3.5	0.77					
1:3 mix mortar 0.4m <sup>3</sup>	2.4	0.38					
<u>ANCHOR BLOCK</u>							
1:5 mix mortar 4.5m <sup>3</sup>	22.5	4.95			1.00		
<u>STRUCTURES</u>							
<u>CROSS CULVERT</u>							
1:5 mix mortar 1.2m <sup>3</sup>	6.0	1.32			0.84		Reinfor-cement 24 No.
1:2:4 mix concrete							
For rings 3.6m <sup>3</sup>	24.8	1.76	3.52			6.08	
1:5 mix mortar 5.9m <sup>3</sup>	29.5	6.49					
1:2:4 mix concrete 3.4m <sup>3</sup>	23.5	1.67					
1:3:6 mix concrete 12.5m <sup>3</sup>	60.0	6.40					
<u>CUT OFF TRENCH</u>							
1:3:6 mix concrete 0.8m <sup>3</sup>	3.8	0.41					
1:3 mix mortar 3.6m <sup>3</sup>	25.7	3.42					
1:5 mix mortar 10.5m <sup>3</sup>	52.5	11.55					
Aggregate							
<u>FOUNDATION OF TANK</u>							
1:5 mix mortar 4.0m <sup>3</sup>	20.0	4.40					
1:3 mix mortar 0.9m <sup>3</sup>	6.4	0.86					
1:3:6 mix concrete 25.2m <sup>3</sup>	121.0	12.90					
1:3 mix mortar 11.5m <sup>3</sup>	82.1	10.93					
1:5 mix mortar 1.7m <sup>3</sup>	8.5	1.87					
<u>UNCOMPLETED WORK</u>							
1:3:6 mix concrete 0.4m <sup>3</sup>	1.9	0.20					
1:3:6 mix concrete 0.7m <sup>3</sup>	3.4	0.36					
1:2:4 mix concrete for rings 1.0m <sup>3</sup>	0.9	0.49	0.98				
<b>TOTAL</b>	bags 622.9	m <sup>3</sup> 30.82	m <sup>3</sup> 4.50	m <sup>3</sup> 50.41	m <sup>3</sup> 13.99	m <sup>3</sup> 31.41	No grade Bricks 16120 No. Grade II Bricks 6220 No. Reinfor-cement bars 24.

UNIT PRICE

UNIT PRICE TABLES

NOTE:

1. These tables show how much the cost would be to complete one job.
2. "UNIT CCST" is calculated from "Efficiency Per Unit Work Rate" and "Unit Price".
3. In the following tables "I.F." column is shown the "Item No" of "EFFICIENCY PER UNIT WORK RATE" and "UNIT COST TABLES", and other informations.
4. The cost for water for concrete mixing, etc has not been included in these tables - water was provided on site by a Bedford Water Tanker and was pumped from the lake and a unit cost for water delivery is provided and will include for all uses.

SUMMARY OF UNIT COST TABLES

ITEM NO	DESCRIPTION	K	t
0.01	Trenching per 10m <sup>3</sup> for Sand Soils	0	70
0.02	Trenching per 10m <sup>3</sup> for Sandy Loam	1	00
0.03	Trenching per 10m <sup>3</sup> for Loam Soils	1	20
0.04	Trenching per 10m <sup>3</sup> for soft rocky soils	5	30
0.05	Trenching per 10m <sup>3</sup> for soft rocky soils included Boulders	7	90
0.06	Trenching per 1m <sup>3</sup> for Hard Pock	10	10
0.07	Trenching per 1m <sup>3</sup> for soft rock and steep	2	00
0.08	Excavation per 1m <sup>3</sup> for soft rocky soils	1	30
0.09	Digging a Hole per 1m <sup>3</sup> for laterite soils including small stones	0	70
0.10	Cutting a slope per 1m <sup>3</sup> for soft rocky soils	0	60
0.11	Levelling excavated area (soft rock) per 1m <sup>2</sup>	0	10
0.12	Land Rover's cost per mile (new car)	0	60
0.13	7 ton Lorry's cost per mile	1	30
0.14	Water Tanker's cost per mile	1	10
0.15	Short carriage of stones per 1m <sup>3</sup> (by hand)	1	30
0.16	Short carriage of bricks per 1000 No. (By hand)	2	50
0.17	Short carriage of Mortar etc. per 1m <sup>3</sup> (By hand)	3	00
0.18	Unit price of stones per 1m <sup>3</sup>	2	80
0.19	Unit price of small stones per 1m <sup>3</sup>	2	60
0.20	Unit price of Aggregate ( $\phi$ 25mm) per 1m <sup>3</sup>	6	50
0.21	Unit price of Aggregate ( $\phi$ 50mm) per 1m <sup>3</sup>	5	40
0.22	Unit price of Sand (for construction) per 1m <sup>3</sup>	5	20
0.23	Unit price of fine sand (for pipe line) per 1m <sup>3</sup>	1	30
0.24	Cement price per 1 bag	7	30
0.25	Unit price of grade II bricks per 1000 No.	41	10
0.26	Unit price of No. M0 Grade Bricks per 1000 No.	18	80
0.27	Carriage cost of P.V.C. Pipes ( $\phi$ 100-150) per 100 No.	155	30
0.28	Unit price of $\phi$ 150 P.V.C. Pipe per 1m	5	00
0.29	Unit price of $\phi$ 100 P.V.C. pipe per 1m	4	20
0.30	Materials cost for 1m <sup>3</sup> 1:2:4 MIX Concrete (for concrete rinks)	59	30
0.31	Materials cost for 1m <sup>3</sup> 1:2:4 MIX Concrete (for structures)	58	30
0.32	Materials cost for 1m <sup>3</sup> 1:3:6 MIX Concrete	43	30
0.33	Materials cost for 1m <sup>3</sup> 1:3 MIX Mortar	57	10
0.34	Materials cost for 1m <sup>3</sup> 1:5 MIX Mortar	42	30
0.35	Labour cost for Mass concrete work per 1m <sup>3</sup>	4	60
0.36	Labour cost for small volume concrete work per 1m <sup>3</sup>	5	20
0.37	Labour cost for trapezoidal section wet masonry work per 1m <sup>3</sup>	4	40
0.38	Labour cost for 20 cm thick vertical stone wall per 1m <sup>2</sup> (standing type)	3	10
0.39	Labour cost for 25 cm thick vertical stone wall per 1m <sup>2</sup> (standing type)	2	60
0.40	Labour cost for wet masonry slab per 1m <sup>3</sup>	4	30
0.41	Labour cost for 9" thick brick wall per 10m <sup>2</sup> (for supports' wall)	15	80
0.42	Labour cost for 9' thick brick wall per 10m <sup>2</sup> (for chambers' wall)	12	20
0.43	Labour cost for 4 1/2" thick brick wall per 10m <sup>2</sup>	7	80
0.44	Labour cost for Mortar surfacing per 10m <sup>2</sup>	4	30



ITEM NO.	DESCRIPTION	k	t
0.45	Labour cost for reinforcement work per 10 No.	1	50
0.46	Unit price of $\phi$ 750mm casting concrete ring per 1 ring (No flame)	15	10
0.47	Labour cost for installing $\phi$ 250mm concrete rings per 1 No.	1	00
0.48	Labour cost for P.V.C. pipe laying per 100m (sandy soil area)	10	20
0.49	Labour cost for P.V.C. pipe laying per 100m (Hot sandy area)	21	70
0.50	Labour cost for testing $\phi$ 100 - 150mm pipe line per 100m	37	50
0.51	Setting cost of anchor blocks for one point	11	50
0.52	Cost price of delivering water by tanker per one day	11	60
0.53	Cost price of valve chamber for 1 point setting	107	80
0.54	Cost price of "Concrete Mixing place" for 1 point setting	28	20

## BILL OF QUANTITIES

PROJECT 1980 CHILUMBE D.W.S.P. WORK Date                      Sheet 1 of           

ITEM No.	DESCRIPTION	I.F.	QUANTITY	UNIT	RATE	K	L
0.01	<u>TRENCHING PER 10m<sup>3</sup> FOR SANDY SOILS</u> Leaders Labourers Miscellaneous Total	A.(ii)	0.01x10	man-days	72t	0	07
			0.22x10	man-days	25t	0	55
						0	08
						0	70
0.02	<u>TRENCHING PER 10m<sup>3</sup> FOR SANDY LOAM</u> Leaders Labourers Miscellaneous Total	A.(ii)	0.02x10	Man-days	72t	0	14
			0.33x10	Man-days	25t	0	83
						0	03
						1	00
0.03	<u>TRENCHING PER 10m<sup>3</sup> FOR LOAM SOILS</u> Leaders Labourers Miscellaneous Total	A.(ii)	0.02x10	Man-days	72t	0	14
			0.41x10	Man-days	25t	1	03
						0	03
						1	20
0.04	<u>TRENCHING PER 10m<sup>3</sup> FOR SOFT ROCKY SOILS</u> Leaders Labourers Miscellaneous Total	A.(ii)	0.13x10	Man-days	72t	0	94
			1.73x10	Man-days	25t	4	33
						0	03
						5	30
0.05	<u>TRENCHING PER 10m<sup>3</sup> FOR SOFT ROCKY SOILS INCLUDED SCULPERS</u> Leaders Labourers Miscellaneous Total	A.(ii)	0.15x10	Man-days	72t	1	08
			2.69x10	Man-days	25t	6	73
						7	99
						7	90
0.06	<u>TRENCHING PER 1m<sup>3</sup> FOR HARD ROCK</u> Leaders Labourers Miscellaneous Total	A.(ii)	1.32	Man-days	72t	0	95
			36.58	Man-days	25t	9	15
						-	-
						10	10
0.07	<u>TRENCHING PER 1m<sup>3</sup> FOR SOFT ROCK &amp; STEEP</u> Leaders Labourers Miscellaneous Total	A.(ii)	0.57	Man-days	72t	0	41
			6.30	Man-days	25t	1	58
						0	01
						2	00
0.08	<u>EXCAVATION PER 1m<sup>3</sup> FOR SOFT ROCKY SOILS</u> Leaders Labourers Miscellaneous Total	A.(iii)	0.25	Man-days	72t	0	18
			4.34	Man-days	25t	1	09
						0	03
						1	30
0.09	<u>DIGGING A HOLE PER 1m<sup>3</sup> FOR LATERITE SOILS INCLUDING SMALL STONES</u> Leaders Labourers Miscellaneous Total	A.(iv)	0.33	Man-days	72t	0	24
			1.69	Man-days	25t	0	42
						0	04
						0	70
0.10	<u>CUTTING A SLOPE PER 1m<sup>3</sup> FOR SOFT ROCKY SOILS</u> Leaders Labourers Miscellaneous Total	A.(vi)	0.17	Man-days	72t	0	13
			1.91	Man-days	25t	0	48
						0	50
						0	50

**BILL OF QUANTITIES**

PROJECT **1980 CHILUMBA D.N.S.P. WORK** Date ..... of .....  
 Sheet **2** of .....

ITEM No.	DESCRIPTION	I.F.	QUANTITY	UNIT	RATE	K	t
0.11	LEVELLING EXCAVATION AREA (Soft Rock) PER 1m <sup>2</sup> Leaders Labourers Miscellaneous Total	A(vii)	0.03 0.32	Man-days Man-days	72t 25t	0 0	02 08 -
0.12	LAMP COVER'S COST PER MILE B(i) (New Car) Petrol Mileage Charge Miscellaneous Total		0.25 1.0	1 mile	73.5t 35t	0 0 0	18 35 07
0.13	7 TON LORRY COST PER MILE B(i) Diesel Mileage Charge Miscellaneous Total		0.74 1.0	1 mile	66.9t 75t	0 0 0	50 75 05
0.14	WATER TANKER'S COST PER MILE B(i) Diesel Mileage Charge Miscellaneous Total		0.28 1.0	1 mile	56.9t 90t	0 0 0	19 90 01
0.15	SHORT CARRIAGE OF STONES PER 1 100 (BY HAND) C(i) Leaders Labourers Miscellaneous Total		0.39 3.86	Man-days Man-days	72t 25t	0 0 0	28 97 05
0.16	SHORT CARRIAGE OF BRICKS C(i) PER 1000 No. (BY HAND) Leaders Labourers Miscellaneous Total		0.62 7.92	Man-days Man-days	72t 25t	0 1 0	45 98 07
0.17	SHORT CARRIAGE OF SKING C(ii) etc. PER 1 m <sup>2</sup> (BY HAND) Leaders Labourers Miscellaneous Total		0.09 0.30	Man-days Man-days	72t 25t	0 2 0	64 33 03
0.18	UNIT PRICE OF STONES PER 1m <sup>3</sup> D(i) Collecting Leaders Labourers Loading on Soft (3 trips per day) Leaders Labourers Carried by 7 ton Lorry 2 miles x 2 <sup>1</sup> / <sub>2</sub> x 3 trips + 12m <sup>3</sup> Miscellaneous Total		0.38 3.64 0.08 0.83 1.00	Man-days Man-days Man-days Man-days mile	72t 25t 72t 25t 130t	0 0 0 0	27 91 06 21 30 05 80

## BILL OF QUANTITIES

PROJECT 1980 CHILUKMA P.W.S.P. WORK,

Date.....  
Sheet 3 of .....

ITEM NO.	DESCRIPTION	I.F.	QUANTITY	UNIT	RATE	K	L	
0.19	<u>UNIT PRICE OF SMALL STRUCTURES</u> <u>PER 1m<sup>3</sup></u>							
	Collecting Leaders	A(i)	0.34	Man-days	72t	0	24	
	Labourers		2.89	Man-days	25t	0	72	
	Loading on & off (3 times per a day)	B(iv)	0.08	Man-days	72t	0	06	
	Labourers		0.83	Man-days	25t	0	21	
Carriage by 7 ton Lorry	0.13	1.0	mile	130t	1	30		
2 miles x 2 trip + 12m <sup>3</sup>					0	07		
Miscellaneous					2	60		
Total								
0.20	<u>UNIT PRICE OF AGGREGATE</u> <u>(6-25mm) PER 1m<sup>3</sup></u>							
	Collecting Leaders	B(ii)	0.68	Man-days	72t	0	49	
	Labourers		15.27	Man-days	25t	4	07	
	Loading on & off (2 times per day)	D(iv)	0.13	Man-days	72t	0	09	
	Labourers		1.88	Man-days	25t	0	47	
Carriage by 7 ton Lorry	0.13	1.0	mile	130t	1	30		
2 miles x 2 x 2 trip + 8m <sup>3</sup>					0	08		
Miscellaneous					6	50		
Total								
0.21	<u>UNIT PRICE OF AGGREGATE</u> <u>(6-50mm) PER 1m<sup>3</sup></u>							
	Collecting Leaders	B(ii)	0.75	Man-days	72t	0	55	
	Labourers		11.66	Man-days	90t	2	92	
	Loading on & off (2 times per day)	D(iv)	0.13	Man-days	72t	0	09	
	Labourers		1.88	Man-days	25t	0	47	
Carriage by 7 ton Lorry	0.13	1.0	mile	130t	1	30		
Miscellaneous					0	07		
Total								
0.22	<u>UNIT PRICE OF SAND (for Construction) PER 1m<sup>3</sup></u>							
	Loading on & off (2 times per a day)	D(iv)	0.13	Man-days	72t	0	09	
	Labourers		1.88	do	25t	0	47	
	Carriage by 7 ton Lorry	0.13	3.5	miles	130t	4	55	
	2 miles x 2 trip + 8m <sup>3</sup>					0	99	
Miscellaneous					5	20		
Total								
0.23	<u>UNIT PRICE OF FINE SAND (for Pipe Lining) PER 1m<sup>3</sup></u>							
	Loading on & off (3 times per a day)	D(iv)	0.08	Man-days	72t	0	06	
	Labourers		0.83	do	25t	0	21	
	Carriage by 7 ton Lorry	0.13	0.75	mile	130t	0	98	
	1.5 miles x 2 x 3 trip + 12m <sup>3</sup>					0	05	
Miscellaneous					1	30		
Total								



## BILL OF QUANTITIES

PROJECT 1980 CHILUMBA D.V.S.P. WORK.

Date ..... of  
Sheet **5** of .....

ITEM No.	DESCRIPTION	L.F.	QUANTITY	UNIT	RATE	K	t
0.29	UNIT PRICE OF Ø100 P.V.C. PIPE PER 1m						
	Ø100 P.V.C. Pipe Price	0.27	1	m	339	3	39
	Carriage Cost		1	m	45530 ÷ 600	0	76
	Miscellaneous					0	05
	<b>Total</b>					4	20
0.30	MATERIALS COST FOR 1m <sup>3</sup> 1:2:4 MIX CONCRETE (for concrete rings)	E(1)					
	Cement	0.24	6.9	bags	730	50	37
	Sand	0.22	0.490	m <sup>3</sup>	520	2	55
	Aggregate	0.20	0.999	m <sup>3</sup>	650	6	36
	Water		0.400	m <sup>3</sup>	(Other way)	0	-
	Miscellaneous					0	02
	<b>Total</b>					52	30
0.31	MATERIALS COST FOR 1m <sup>3</sup> 1:2:4 MIX CONCRETE (for structures)	E(1)					
	Cement	0.24	6.9	bags	730	50	37
	Sand	0.22	0.490	m <sup>3</sup>	520	2	55
	Aggregate	0.21	0.979	m <sup>3</sup>	540	5	29
	Water				(Other way)	0	-
	Miscellaneous					0	09
	<b>Total</b>					58	30
0.32	MATERIALS COST FOR 1m <sup>3</sup> 1:3:6 MIX CONCRETE (for Base Concrete)	E(1)					
	Cement	0.24	4.8	bags	730	35	04
	Sand	0.22	0.512	m <sup>3</sup>	520t	2	66
	Aggregate	0.21	1.029	m <sup>3</sup>	540t	5	56
	Water		0.400	m <sup>3</sup>	(Other way)	0	-
	Miscellaneous					0	04
	<b>Total</b>					43	30
0.33	MATERIALS COST FOR 1m <sup>3</sup> 1:3 MIX MORTAR						
	Cement	0.24	7.14	bags	730t	52	12
	Sand	0.22	0.95	m <sup>3</sup>	520t	4	94
	Water				(Other way)	0	-
	Miscellaneous					0	04
	<b>Total</b>					57	10
0.34	MATERIALS COST FOR 1m <sup>3</sup> 1:5 MIX MORTAR	E(1)					
	Cement	0.24	5.0	bags	730t	36	50
	Sand	0.22	1.10	m <sup>3</sup>	520t	5	72
	Water				(Other way)	0	-
	Miscellaneous					0	08
	<b>Total</b>					42	30
0.35	LABOUR COST FOR MASS CONCRETE WORK PER 1m <sup>3</sup>	E(11)					
	Mixing		1.50x7½	Man-hours	<del>17t</del>	11t	91
	Bricklayers			hours		1	48
	Assistants		0.67	Man-days	72t	0	06
	Labourers		4.25	Man-days	25t	1	19
	Short Carriage Leaders		0.27	Man-days	72t	0	05
	Miscellaneous		3.62	Man-days	25t	8	91
	<b>Total</b>					1	20

## BILL OF QUANTITIES

PROJECT 1980 CHILUMBA D.W.S.P. WORK.

Date ..... of .....  
 Sheet **6** of .....

ITEM No.	DESCRIPTION	I.P.F.	QUANTITY	UNIT	RATE	K	L
0.36	LABOUR COST FOR SMALL VOLUME CONCRETE WORK PER 1m <sup>3</sup>	E(111)	0.28x7½	Man-hours	17t	0	36
	Bricklayers		Man-days	72t	1	98	
	Assistants		-do-	25t	2	78	
	Labourers				0	08	
	Miscellaneous						
	Total		5			20	
0.37	LABOUR COST FOR TRAPEZOIDAL SECTION WET MASONRY WORK PER 1m <sup>3</sup>		2.03x7½	Man-hours	17t	2	59
	Bricklayers		Man-days	72t	0	84	
	Assistants		Man-days	25t	0	97	
	Labourers						
	Miscellaneous						
	Total		4			40	
0.38	LABOUR COST FOR 20CM THICK VERTICAL STONE WALL PER 1m <sup>2</sup> (Standing type)	F(11)	1.56x7½	Man-hours	17t	1	99
	Bricklayers		Man-days	72t	0	37	
	Assistants		Man-days	25t	0	65	
	Labourers				0	09	
	Miscellaneous						
	Total		3			10	
0.39	LABOUR COST FOR 25CM THICK VERTICAL STONE WALL PER 1m <sup>2</sup>	F(111)	1.15x7½	Man-hours	17t	1	47
	Bricklayers		Man-days	72t	0	53	
	Assistants		Man-days	25t	0	55	
	Labourers				0	05	
	Miscellaneous						
	Total		2			60	
0.40	LABOUR COST FOR WET MASONRY SLAB PER 1m <sup>3</sup>	F(1V)	1.52x7½	Man-hours	17t	1	94
	Bricklayers		Man-days	72t	1	15	
	Assistants		Man-days	25t	1	20	
	Labourers				0	01	
	Miscellaneous						
	Total		4			30	
0.41	LABOUR COST FOR 9" THICK BRICK WALL PER 10m <sup>2</sup> (For Supports' Wall)	F(V)	6.83x7½	Man-hours	24t	12	29
	Bricklayer		Man-days	72t	0	96	
	Assistants		Man-days	25t	2	52	
	Labourers				0	03	
	Miscellaneous						
	Total		15			80	
0.42	LABOUR COST FOR 9" THICK BRICK WALL PER 10m <sup>2</sup> (For Chambers' Wall)	F(V)	6.83x7½	Man-hours	17t	8	71
	Bricklayers		Man-days	72t	0	96	
	Assistants		Man-days	25t	2	32	
	Labourers				0	01	
	Miscellaneous						
	Total		12			20	
0.43	LABOUR COST FOR 4½" THICK BRICK WALL PER 10m <sup>2</sup>		3.26x7½	Man-hours	17t	4	16
	Bricklayers		Man-days	72t	2	19	
	Assistants		Man-days	25t	1	40	
	Labourers				0	05	
	Miscellaneous						
	Total		7			80	

**BILL OF QUANTITIES**

PROJECT 1980 CHILUYBA D.V.S.P. WORK. Date ..... Sheet **7** of .....

ITEM No.	DESCRIPTION	I.P.F. I.I.I.	QUANTITY	UNIT	RATE	K	t
0.44	LABOUR COST FOR MORTAR SURFACING PER 10m <sup>2</sup>	F(v1)					
	Bricklayers		2.20x7½	Man-hours	17t	2	81
	Assistants		0.85	Man-days	72t	0	61
	Labourers		3.37	Man-days	25t	0	84
	Miscellaneous					0	04
	Total					4	90
0.45	LABOUR COST FOR REINFORCEMENT WORK PER 10 sq. m.						
	Cutting & Bending	G(1)					
	Bricklayers		0.39x7½	Man-hours	17t	0	50
	Labourers		0.39	Man-days	25t	0	10
	Setting	G(11)					
Bricklayers		0.53x7½	Man-hours	17t	0	58	
Labourers		0.79	Man-days	25t	0	20	
Miscellaneous					0	02	
	Total					1	50
0.46	UNIT PRICE OF Ø750mm CASTING CONCRETE RING PER 1 RING (No Frame)	H(1)					
	Bricklayers		0.52x7½	Man-hours	17t	0	66
	Assistants		0.52	Man-days	72t	0	37
	Labourers		2.96	Man-days	25t	0	74
	1:2:4mix concrete		0.19	m <sup>3</sup>	5930	11	27
	Oil		0.2	l	1014	2	03
	Miscellaneous					0	03
	Total					15	10
	LABOUR COST FOR INSTALLING Ø750mm CONCRETE RING PER 1 No.	H(6)					
	Leaders		0.62	Man-days	72t	0	45
Miscellaneous					0	07	
Labourers		1.90	Man-days	25t	0	48	
Miscellaneous					0	07	
Total					1	00	
0.48	LABOUR COST FOR P.V.C. PIPE LAYING PER 100m (Sandy Soil Area)	I(4)					
	Plumbers		1.72x7½	Man-hours	17t	2	19
	Assistants		1.52	Man-days	72t	1	09
	Labourers		27.67	Man-days	25t	6	92
	Miscellaneous					-	-
	Total					10	20
0.49	LABOUR COST FOR P.V.C. PIPE LAYING PER 100m (Except Sandy Area)	I(1)					
	Plumbers		3.08x7½	Man-hours	17t	3	93
	Assistants		6.29	Man-days	72t	4	53
	Labourers		52.89	Man-days	25t	13	22
	Miscellaneous					0	02
	Total					21	70
0.50	LABOUR COST FOR TESTING Ø100-150mm PIPE LINE PER 100m	I(11)					
	Plumbers		5.61x7½	Man-hours	17t	7	15
	Assistants		9.69	Man-days	72t	6	98
	Labourers		93.38	Man-days	25t	23	35
	Miscellaneous					0	02
	Total					37	50



## BILL OF QUANTITIES

PROJECT 1980 CIVILURBA D.V.S.P. WORK.

Date .....  
Sheet 8 of .....

ITEM No.	DESCRIPTION	I.S.	QUANTITY	UNIT	RATE	K	L	
0.51	<u>SETTING COST OF ANCHOR BLOCK FOR 15' DEPT (Set Masonry Type)</u>							
	Labour cost Bricklayers		0.73x7½	Men-days	17t	0	93	
	Assistants		0.57	Man-days	72t	0	41	
	Labourers		1.36	Man-days	25t	0	34	
	Materials 1:5 mix Mortar	0.34	0.18	m <sup>3</sup>	4230	7	61	
	Carriage of Bkg stones							
	Labour cost for loading on & off labourers		1.00	Man-days	25t	0	25	
	Land Rover 1 trip	0.12	3.0	miles	60t	1	80	
	Small stones	0.19	0.04	m <sup>3</sup>	260t	0	10	
	Miscellaneous					0	06	
	Total					11	50	
0.52	<u>COST PRICE OF DELIVERING WATER BY TANKER PER ONE LAY</u>							
	Carriage of Pump by Land Rover to Lake & back it	0.12	4.00	miles	60t	2	40	
	Fuel cost of Pump		0.13x4	1	66.9	0	35	
	Travelling mileage of Bedford Water Tanker	0.14	8.0	miles	110t	8	80	
	Miscellaneous					0	05	
		Total				11	60	
	0.53	<u>COST PRICE OF VALVE CHAMBER FOR 1 PCINF SETTING (NOTE: To calculate the cost as 1.30m high wall, 0.35m high support &amp; 6cm thick side mortar surfacing.)</u>						
		Excavation 1.8x1.8x1.25						
		Ease slab						
		Base stones						
0.07x1.8x1.8x1.30		0.19	0.29	m <sup>3</sup>	260t	0	75	
1:3:6 mix concrete								
1.8x1.8x(0.7x0.3+0.08)x1.20		0.32	0.40	m <sup>3</sup>	4330	17	32	
Labour Cost		0.36	0.40	m <sup>3</sup>	520	2	08	
Sub-Total						20	15	
<u>Chamber</u>								
(Brick wall)								
Labour cost for 9" thick Wall								
(5x1.3-0.2x2)+10		0.42	0.64	10m <sup>3</sup>	1220	7	81	
Materials								
1:5 mix mortar 0.64x1.20		0.34	0.77	m <sup>3</sup>	4230	32	57	
NO CURRE BRICKS								
0.64x850x1.40+1000		0.26	0.76	1000 No	1880	14	29	
(Surfacing)								
Labour cost								
Side (10.x1.3-0.2x0.2x4)+10		0.44	1.28	10m <sup>2</sup>	430	5	50	
Top 0.27x5+10	0.44	0.14	10m <sup>2</sup>	430	0	60		
1:3 mix mortar								
Side 1.28x10x0.008x3.25	0.34	0.33	m <sup>3</sup>	5710	18	84		
Top 0.14x10x0.02x1.50	0.34	0.04	m <sup>3</sup>	5710	2	28		
<u>Support</u>								
(Brick wall)								
Labour Cost 0.6x0.35x2+10	0.42	0.04	10m <sup>2</sup>	1220	0	49		



EFFICIENCY PER UNIT WORK RATE TABLES

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NOTE:

- 1) This paper was compiled, by averaging, from the daily records that comprise the "Preparation of Howwe Extension Work" report and "1980 CHILUMBA D.W.S.P. WORK" report. Hence, this paper should, if not used in connection with Howwe and Chilumba, be modified to suite local site conditions.
- 2) In respect of manpower efficiency, a unit of "man-days" has been adopted. For all workers, "days" have been used, i.e. "how many days would be required for one worker to complete one job".
- 3) "Assistant" means NO GRADE BRICKLAYER, MIXER and ASSISTANT PLUMBER. And "Leaders" means CAPITAOS.

4) In the following tables, an \* refers to information based on limited data - figures which were determined on less than one day's work and are therefore not representative of average condition.

5) A \*\* mark refers to information determined from other schemes and therefore such figures do not refer directly to my experience, although they can be used as a guide.

Obviously, "a standard" cannot be determined from data relating to only one scheme and it is hoped that as more information is gathered from other sites, a more representative general compilation of efficiency and work unit data can begin.

CHAPTER 1 : CONSTRUCTION

A. SITE PREPARATION & SOIL WORK

( 1) Cutting and Stumping per 100m<sup>2</sup>

WORK	CUTTING		STUMPING		TOTAL	
	LEADER	LABOURERS	LEADER	LABOURERS	LEADER	LABOURERS
Wood Cutting on average 7 x 10cm diameter trees per 100m <sup>2</sup>	0.05	0.35	0.32	2.84	0.37	3.19
Grass Cutting* long grass about 100cm high	0.10	0.60	-	-	0.10	0.10
All values represent "man-days"						

NOTES:

- Work done by labourers involves using hoes, axes, picks and shovels.
- Cutting and stumping involved transportation of timber of distances not exceeding, on average, 20m.
- Stumping values would be lower if powerfully-built labourers were not available.

CONCLUSIONS:

The following daily Tasks were set.

Wood cutting - 1 labourer - 500m<sup>2</sup>/day

Stumping - 1 labourer - 50m<sup>2</sup>/day

(ii) Trenching (By Hand) Per 1.0m<sup>3</sup>

WORK	SITE CONDITIONS	LEADER	LABOURERS
Narrow (less than 2.0m) & shallow (less than 1.5m) excavation by hand.	Sandy Soils	0.01	0.22
	Sandy loam Soils	0.02	0.33
	Loam Soils	0.02	0.41
	Wetter clay soils requiring use of hoes	0.13	0.65
	Dry, heavy clay soils requiring use of picks	0.14	1.06
	Soft rocky soils requiring use of picks	0.13	1.73
	Soft rocky soils included boulders	0.15	2.69
Hard rock requiring use of 14 lbs hammers & crow bars	1.32	36.58	
		Man-days	

NOTES:

- If the excavated material is to be used for filling, loading and transport factors should be added to the above.
- If levelling of the excavated material is necessary, such factors should be added to the above.
- The above efficiency comprise the data from a generally flat area. Hence, this efficiency should, if steep area, be increased. For information, the efficiency for the trenching in soft rocky soils (including boulders) in a steep location ( $S = \frac{1}{2}$ ), is shown below.

Leaders 0.57 man-days  
Labourers 5.30 man-days per 1 m<sup>3</sup>

Conclusion:

In sandy soil, 1 labour should be set a task of 6.0m<sup>3</sup>/day excavation.

Conclusion:

In loam soil, 1 labour should be set a task of ~~6m<sup>3</sup>/day excavation~~,  
3.5m<sup>3</sup>/day excavation.

In heavy clay,  
- do -  
1.5m<sup>3</sup>/day excavation

REMARKS:

For the tasks below 3 hours overtime should be given as a bourty.

(iii) Excavation by hand per 1 m<sup>3</sup>.

WORK	SITE CONDITIONS	LEADER	LABOURERS
Width (more than 2.0m) and Depth (more than 1.5m) excavation by hand	Soft rocky soils including boulders	0.25	4.34
		Man-days	

NOTES:

a) The above efficiency include short carriage of dug soils by wheel barrows (less than 20m) to take them outside of excavation place.

(iv) Digging A Hole (By Hand) Per 1.0m<sup>3</sup>

WORK	SITE CONDITIONS	LEADER	LABOURERS
Narrow and Deep (more than 2.0m) Hole's excavation with using a ladder.	Sandy Soils	0.08	1.04
	Loam Soils	-	5.55
	Laterite Soils including small stones.	0.33	1.69
		Man - days	

(v) Crushing Rock (By Compressor) Per 1.m<sup>3</sup>

WORK	DIESEL	OIL	LABOURERS	DAYS
For trenching in a rocky bed.	566.7	166.7	200	48
		Liters		
		Man-days		

NOTE:

a) This hired compressor was not well serviced and used too much oil.

(vi) Cutting A Slope (By Hand) Per 1 m<sup>3</sup>

WORK	SITE CONDITIONS	LEADERS	LABOURERS
Cutting a slope to design specification.	* Clay	0.14	1.57
	Soft rocky soils	0.17	1.91
		Man-days	

(vii) Levelling work

WORK	SITE CONDITIONS	UNIT	LEADERS	LABOURERS
Levelling excavated bottom to design specification	Soft rocky Soils	1m <sup>2</sup>	0.03	0.32
Levelling existing Surface	Road Bed	100 m <sup>2</sup>	0.07	0.75
Levelling dug soil including breaking and crushing	Dry heavy clay (already dug)	1m <sup>3</sup>	0.01	0.10

(viii) Backfilling per 1.0m<sup>3</sup>

WORK	SOIL	LEADER	LABOURERS
Backfilling a small structure less than 1m. deep or high, and to include for filling, watering and compacting (by hand compactor)	Clay	0.23	2.76
			Man-days

NOTES:

- a) Compacting involves 400 litres water per 10m<sup>3</sup> infilled soil.
- b) Detailed compacting at corners with sticks is required.

(ix) Banking per 10.m<sup>3</sup>

WORK	SOIL	LEADER	LABOURERS
Banking, watering and Compacting	Clay	1.13	5.08
			Man - days

NOTES:

- a) Factors for carrying soil and land-forming are not included.
- b) "Watering" is at a rate of 400 litres per 10m<sup>3</sup> soil.
- c) Compacting is carried out, using hand compactors, three times for each 30 cm. thick banking layer.

B. EQUIPMENT

(i) Fuel requirement

EQUIPMENT	FUEL REQUIREMENTS	FUEL TYPE
Land Rover	0.25 l/mile	Petrol
New car	**0.32 l/mile	do
Gld car		
Nissan Pick Up	0.35 l/mile	do
7 ton Leyland Lorry	0.74 l/mile	Diesel
Bedford water tanker	0.28 l/mile	do
Dump Truck (5 ton)	**0.59 l/mile	do
Tractor and Trailer (old vehicle)	0.42 l/mile	do
Water Pump (ø 75cm) new machine	1.00 l/hour	do

(ii) Driver And Assistant Cost Per 1 mile \*\*

EQUIPMENT	DRIVER	ASSISTANT
Land Rover	0.02	-
Dump Truck	0.02	0.02
Tractor & Trailer	0.04	0.05
		Man-days

NOTES:

- a) When P.V.H.O.'s equipment is hired, these costs should not be used for mileage rates.
- b) For Irrigation Branch's own equipment, this table can be used. The other costs should be added on to the Driver's cost, which include depreciation, repairs and miscellaneous maintenance. As a guide, the cost of 6t per mile (1980), derived from Hara Scheme data (based on wages for mechanics and welders and for all vehicles), has been included.



C. SHORT CARRIAGE BY LABOURERS

(i) Short Carriage By Hand

WORK	SITE CONDITION	UNIT	LEADERS	LABOURERS
Carriage of stones for Masonry	Carry to 12.0m high place by hand 120m distance.	1.0m <sup>3</sup>	0.39	3.86
Carriage of Bricks	Carry to 3.0m high place by hand 20.0 distance.	1000No.	0.62	7.92
				Man-days

(ii) Short Carriage With Pails Or Mortar Pans Per 1 m<sup>3</sup>

WORK	SITE CONDITION	LEADERS	LABOURERS
Carriage of Aggregate mortar, concrete, etc., using pails or mortar pans	Carry to 12.0m high 120.0m for place on foot.	0.99	9.30
			Man-days

(iii) Short Carriage With Wheel - Barrows Per 1 m<sup>3</sup>

WORK	SITE CONDITION	LEADERS	LABOURERS
Carriage using wheel barrows	Carry to 3.0m high and 30.0m distance with wheel barrows.	0.27	3.62
			Man - days

NOTE:

A wheel barrow can carry about 0.05m<sup>3</sup> per 1 trip.

D. Collecting Materials

(i) Collecting Stones Per 1 m<sup>3</sup>

WORK	LEADERS	LABOURERS
Digging up with picks and heaping stones from where stones are buried in ground.	0.07	1.45
Crushing Rock mound with 14 lbs hammers and Crow bars and heaping the broken pieces.	0.38	3.64
Collecting small stones (50mm-φ (4100mm) into small heaps from where stones are laying.	0.34	2.89
		Man - days

Conclusion

- 1) In the case of digging up stones a task of 1 labourer per 2.0m<sup>3</sup> of stones was set.
- 2) In the case of crushing rock mound a task of 1 labourer per 0.3m<sup>3</sup> of stones was set.
- 3) For small stones a task of 1 labourer per 0.5m<sup>3</sup> (10 wheel barrow trips) was set.

(ii) Collecting Aggregate Per 1 m<sup>3</sup>

WORK	GRAIN SIZE	LEADERS	LABOURERS
Collecting aggregate into small heaps from where much aggregate is lying	φ ≤ 25mm	0.68	16.27
	φ ≤ 30mm	0.76	11.66
			Man - days

NOTES:

a) The above is net collected volume, but carried volume divided by total of workers.

Conclusion

- 1) For φ=25mm aggregate a task of 0.10m<sup>3</sup> (4.5 pails) was set for one labourer.
- 2) For φ=50mm aggregate a task of 0.20m<sup>3</sup> (10.0 pails) was set for one labourer.

(iii) Washing Aggregate Per 1 m<sup>3</sup>

WORK	LEADERS	LABOURERS
Washing aggregate to remove attached soils using water carried by wheel barrow.	0.17	3.33
		Man - days

(iv) Loading On and Off Time For Materials

For shovelling sand, loading on and off collected materials, it is difficult to determine the "Efficiency Per Unit Work Rate". In this case time for loading and off loading of materials is shown on the below table. It should be able to calculate the number of trips which can be done per a day according to the below data and then estimate the unit cost.

MATERIAL	TRANSPORT	CHECKED VOLUME	WORKERS USED		LOADING		
			LEADERS	LABOURERS	ON	OFF TOTAL	
Sand	7 ton Lorry	4.0m <sup>3</sup>	1	15	50	20	1.17
Aggregate	do	4.0m <sup>3</sup>	1	15	70	40	1.83
Bricks	do	2500kg	1	10	120	50	3.00
Stones	do	4.0m <sup>3</sup>	1	10	30	15	0.75
φ 100-150 P.V.C. Pipes	do	75 No	1	10	60	60	2.00
Gravel or Loose Soil	Tractor & Trailer	2.0m <sup>3</sup>	1	6	30	10	0.67
			Members		Minutes		Hours

(v) Drawing Water

For drawing water, some information is shown below. It is hoped that the unit cost can be estimated by calculating conveyance time.

DRAWING METHOD	TRANSPORT	INFORMATION
By labourers with buckets	Bedford water tanker	2.0m <sup>3</sup> water drawn by 4 labourers per a day
Pumping (φ550mm) from Lake	do	0.13 l Diesel used per 1 m <sup>3</sup> water.

**B. CONCRETE WORK**

(1) Concrete & Mortar Materials Table Per 1 m<sup>3</sup>

MIXING RATE	CEMENT	SAND	AGGREGATE	WATER
<u>CEMENT: SAND: AGGREGATE MIX</u>				
<u>CONCRETE</u>				
1:2:4	6.9	0.490	0.979	0.40
1:3:6	4.8	0.512	1.029	0.40
2:5:8	6.55	0.726	1.155	0.40
<u>MORTAR</u>				
1:3	7.14	0.95	-	0.70
1:5	5.00	1.10	-	0.75
	bags	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>

**NOTE:**

- a) All "Materials" quantities (except cement) include extra volume of 10%.  
 (ii) Mixing Concrete (By Hand) For Mass Volume Per 1 m<sup>3</sup>

WORK	SITE CONDITION	BRICK LAYERS	ASSIS-TANTS	LABOU-DRERS
Conveyance (less than 10m) of materials; mixing concrete; and trimming surface; and curbing with grass matting; stamping.	1) The height of forms to be less than 1.0m. ii) Concrete is mixed on mortar rendered place and carried.	1.50	0.67	4.25
		Man - days		

**NOTE:**

- a) The above is for mass volume (less than 1 m<sup>3</sup>) & concrete.  
 b) The above is for when about 0.3m<sup>3</sup> concrete per 1 time can be mixed on 2m x 3m mixing place.  
 c) The carriage costs of concrete are not included in the table.  
 (iii) Mixing Concrete (By Hand) For Small Volume Per 1.m<sup>3</sup>

WORK	SITE CONDITION	BRICK-LAYERS	ASSIS-TANTS	LABOU-DRERS
All process to fill and trim concrete including short carriage (less than 10m) concrete.	i) This mix is for base slab ii) Forms not to be set. iii) Concrete to be mixed close to the site location.	0.28	2.75	11.13
		Man - days		

**NOTES:**

- a) The above is for small volume (less than 1m<sup>3</sup>) concrete.  
 b) A special mixing place is not used in this case.

**P. STONE WORK, BRICK WORK**

**NOTES:**

Short carriage (less than 10m) of mortar and materials are included in the below. But, if the route of conveyance is in bad condition (i.e. too steep) or longer than 10m, the costs should be increased accordingly.

(i) \* Net Masonry per 1m<sup>3</sup>

WORK	BRICKLAYERS	LABOURERS	MATERIAL VOLUME
Carrying materials (less than 10m) * and dry masonry work. (less than 1 m high wall)	0.13 days	0.88	1.20m <sup>3</sup>
	Man - days		

(ii) Trapezoid Section Wet Masonry Per 1 m<sup>3</sup>

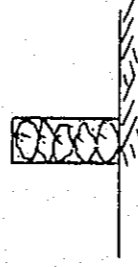
WORK	BRICK-LAYERS	ASSIS-TANTS	LABOUR-ERS
Conveyance (less than 10m) of materials and wet masonry work. The front slope to be built to design specification. (less than 1.5m high wall).	2.03	1.16	3.88
	Man - days		

(iii) Vertical Stone Wall Per 1m<sup>2</sup>

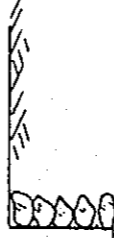
WORK	TYPE	BRICK-WITH	ASSIS-TANTS	LABOUR-ERS
As same as "Trapezoid Section Wet Masonry"	Standing	*20	1.56	0.52
	Type	25	1.15	0.73
	Back fill	*20	0.36	-
	Type	30	0.40	-
	CM			
			Man - days	

**NOTE:**

Standing type



Back fill type



(iv) Net Masonry Slab Per 1m<sup>3</sup>

WORK	BRICK-LAYERS	ASSISTANTS	LABOUR-ERS
Plastering Mortar on one layer stores and building slab.	1.52	1.60	4.80
	Man - days		

**NOTE:**

Mortar plastering



one layer stones.

(v) Brick Work Per 10m<sup>2</sup>

NAME	WORK	BRICK- LAYERS	ASSIS- TANTS	LABOU- RERS
9" thick wall	To build less than 2m high Brick wall	6.83	1.33	10.06
4 1/2" thick wall	- do -	3.26	3.04	5.59
				Man - days

NOTE:

If very tidy work is required (i.e. the joint width is fixed) high grade Bricklayers are required.

(vi) Mortar Surfacing Per 10m<sup>2</sup>

WORK	SITE CONDITION	BRICK- LAYERS	ASSIS- TANTS	LABOU- RERS
Mortar Sur- facing	The height of surfacing to be less than 2.0m	2.20	0.85	3.37
				Man - days

(vii) Stone Pitching Per 1 m<sup>2</sup>

WORK	THICKNESS	LABOUR	
		BRICKLAYERS	LABOURERS
Carrying materials (less than 20m) and Stone pitching work	10-15	0.12	0.52
		CM	Man - days

NOTES:

a) The mortar mixing ratio is 1:5, cement : Sand

G. REINFORCEMENT WORK

(i) \*Cutting And Bending Reinforcement Bars Per 10 No.

WORK	BRICKLAYERS	ASSIS-TANTS	LABOU- RERS	
Cutting and Bending bars to design specification.	0.39	-	0.39	
				Man - days

(ii) \*Setting Bars

WORK	SITE CONDITION	BRICK- LAYERS	ASSIS- TANTS	LABOU- RERS
Placing the bent bars above the forms and jointing with wire.	For hori- zontal slab.	0.53	-	0.79
				Man - days

H. PRECAST CONCRETE

(i) Castling Concrete Rings For Each Ring

WORK	SIZE	TYPE	BRICK- LAYERS	ASSIS- TANTS	LABOU- RERS
Inclusive all work	Ø 750-1000mm 80mm thick	**Mesh Frame	0.50	1.00	3.00
	900-1000mm long	No Frame	0.52	0.52	2.96
	Ø 500mm 50mm thick 900mm long	**Mesh Frame	0.50	1.00	3.00
				Man - days	

NOTES:

- a) Concrete is mixed by Hand.
- b) 2 concrete rings were made per one day with 1 Bricklayer, 1 Assistant and 6 Labourers.

(ii) Installing Concrete Rings

WORK	SIZE	LEAPERS	LABOURERS
Loading, unloading and laying each ring re setting out.	Ø=750-1000mm	0.62	1.90
	*Ø=500mm	0.11	1.11

(iii) Jointing Rings For Each Ring

WORK	LABOUR		MATERIALS	
	BRICKLAYERS	LABOURERS	CEMENT	SAND
1000mm Ø rings, jointing with mortar and curing.	0.67	2.12	0.61	0.04
500mm Ø rings as above	0.28	1.15	0.34	0.02
		Man - days	Bags	m <sup>3</sup>

NOTES:

- a) The mortar ratio mix was 1:1, cement : Sand
- b) Water was carried (by pails) 700m. to site.

I. PIPE LINE

NOTE: This work data was provided by the Malawian Foreman.

(i) Pipe Laying Per 100m

WORK	PIPE SIZE	SOIL	PLUMBERS	ASSISTANTS	LABOURERS
Inclusive all work for setting pipes in the bottom of trench and back filling, except trenching.	100mm Ø	Sandy Soils	1.72	1.52	27.67
	-150mm Ø	All the other type Soils	3.08	6.29	52.89
					Man - days

(ii) Testing Pipe Per 1000m

WORK	FLUHERS	ASSISTANTS	LABOURERS
Taking out covering soil of pipe joints to check the leakage			10.21
Filling water in pipes and adding pressure by hand pump	5.61	5.61	41.33
Back filling over joint		4.08	41.84
Total	5.61	9.69	93.38
			Man - days

NOTE:

Water costs not included.

(iii) Setting Anchor Blocks For Each Point

WORK	TYPE	BRICKLAYERS	ASSISTANTS	LABOURERS
Setting Anchor Block to support water pressure for tees, End caps, etc.	Wet Masonry mixed very big stones (Ø 500mm)	0.73	0.57	1.36
	Concrete mixed stones (Ø 200mm)	1.50	2.00	8.50
				Man - days

**NOTE:**

*(big stone)*

On average 0.16m<sup>3</sup> mortar and 0.04m<sup>3</sup> small stones for 1 point wet masonry blocks and 0.52m<sup>3</sup> concrete for 1 point concrete blocks were used.

**J. MISCELLANEOUS**

(i) \*Installing Gabion Baskets Per 1 No.

WORK	SIZE	BRICK-LAYERS	ASSIS-TANTS	LABOURERS
Setting first layer Gabion baskets on the trimmed dry ground to design specification.	500x 1000x 4000	0.23	0.23	4.20
Piling and placing Gabion baskets on the first layer Gabions.	1000x 1000x 2000	0.28	0.28	2.80
	mm	Man - days		

(ii) Setting Up Pale Fencing Per 10m

WORK	LEADER	LABOURERS
Cutting to size 108 No. wooden pales (approx. 100mm wide and 80cm long), transporting them 0.700m and piling them to a depth of 40cm into the ground over a length of 10m.	1.46	11.67
	(Man-days)	

**CHAPTER 2 : "BUILDING"**

**A. PREPARATION WORK**

(i) Collecting Sticks, Bamboo and Grasses

WORK	UNIT	LEADER	LABOURERS
Cutting Sticks (see note a), bundling them loading on a trailer and unloading.	100 No.	3.09	13.90
As above for Bamboo (see note b)	100 No.	1.00*	5.00*
As above for Grasses (a "bundle" of grasses has approx. circumference of 90cm)	100 bundles		5.36
		Man - days	

**NOTES:**

- a) A "stick" is defined as more than 5cm  $\phi$  and more than 2m long
- b) "Bamboo" should be more than 1.5cm.  $\phi$  and more than 5m long.
- c) A tractor will require 1 trip per 100 sticks, 0.5 trip per 100 bamboo pieces, and 1.56 trips per 100 Grass bundles.

**Conclusions:**

The following tasks were set

For 100 sticks per day, a team of 1 leader and 5 labourers was sufficient.  
 For 200 bamboo per day, a team of 1 leader and 5 labourers was sufficient.  
 For 25 bundles of grasses per day, a team of 1 leader and 1 labourer was sufficient.

(ii) Setting out per 1m

WORK	BRICKLAYERS	LABOURERS
Setting out according to design specification, digging holes 30-40 cm. deep for wooden supports	0.18days	0.54
	Man - days	

**B. WALLS AND FLOORS**

(i) Framing Per 10m<sup>2</sup>

WORK	LABOUR	MATERIALS
	BRICKLAYERS	LABOURERS
	STICKS	BAMBOO
Constructing a wall frame with sticks and bamboo	0.55days	3.62
	14.65	16.69
	Man-days	No. No.

A Task of 100m<sup>2</sup> per day was set for a team of 1 Bricklayer and 5 Labourers

(ii) Plastering Per 100m<sup>2</sup> With Mud

WORK	LABOUR		MATERIALS
	BRICKLAYERS	LABOURERS	
Mixing soil and water and plastering the frame	9.83 days	58.08	15.52 4700
	Man-days		m <sup>3</sup> litres

A Task of 3.33m<sup>2</sup> per day for either mixing or plastering the mud was set to each Labourer.

(iii) Gravel Floor Per 100m<sup>2</sup>

WORK	BRICKLAYERS	LABOURERS
Compacting gravel by watering and checking with spirit level.	10.20	33.58
	Man - days	

NOTE:

a) Materials' costs are not included.

Conclusion

A Task of 65m<sup>2</sup> per day was set for a team of 1 Bricklayer and 3 Labourers.

(iv) Plastering Per 100m<sup>2</sup> With Mortar

WORK	LABOUR		MATERIALS	
	BRICKLAYERS	LABOURERS	CEMENT	DAMBO SAND
Plastering on a mud wall	16.06	40.11	11.63	1.54 2.30
Plastering a floor on Gravel	8.92	19.86	18.39	- 2.43
	Man - days		Bags	m <sup>3</sup>

NOTES:

a) For walls, the mortar mixing ratio should be 1:3:4.5, Cement:Dambo sand: Sand.

b) For floors, the mortar mixing ratio should be 1:3, Cement: Sand.

c) Both above includes a 10% extra volume except cement.

d) Water costs are not included.

Conclusions:

For a team of 1 Bricklayer and 2 Labourers the following Tasks were set:

8m<sup>2</sup> per day for wall plastering and  
35m<sup>2</sup> per day for floor plastering.

C. MISCELLANEOUS

(i) Grass Work Per 1m<sup>2</sup>

WORK	LABOURERS	GRASS
Binding grasses on frames for a roof or a wall.	0.24 days	5.40 bundles

A Task of 5m<sup>2</sup> per day was set to each labourer.

(ii) Painting Per 10m<sup>2</sup>

WORK	CARPENTER OR BRICKLAYER	BRICKLAYERS	MATERIALS (PAINT)	
Painting a wall ("Snowcem")	0.10 day	0.41		0.08
Painting shutters, door and window frames	0.56 day	1.40		0.22
		Man - days		Tins

NOTES:

a) 1 Tin of "Snowcem" can cover about 120m<sup>2</sup>

b) 1 Tin of normal paint can cover about 452



Conclusions

The following Tasks were set

For walls, 1 Bricklayer and 2 Labourers were given 80m<sup>2</sup> per day to paint.  
For doors or windows, 1 semi-skilled labourer was given 5m<sup>2</sup> per day to paint.

CHAPTER 3 : SURVEYING

A. TRAVERSING PER 1 KM

WORK	DAYS	CHIEF SURVEYOR	SURVEYOR	ASSISTANT	LABOURERS	MATERIALS
Making and trans- porting Pegs.	0.22	-	-	-	1.93	12x1 inch Nails
Site clearing and setting out main pegs(12+12 in number)	2.39	2.27	-	1.73	11.69	0.1 Tin of white paint plus a little coloured pai- nt for numb- ering the pegs
Setting out centre pegs(30 in number)	0.47	0.12	-	0.35	2.80	
Painting	0.24	-	-	-	0.94	-
Sub-Total	3.32	2.39	-	2.08	17.36	-
Level Surveying	0.94	-	0.94	0.40	3.34	-
<b>TOTAL</b>	<b>4.26</b>	<b>2.39</b>	<b>0.94</b>	<b>2.48</b>	<b>20.69</b>	
						Man-days

NOTES:

- a) The above table is based on the following site conditions:
  - (i) long grasses (2m+) require extensive clearing,
  - (ii) on average 10 trees per km length (diameter about 10cm) required cutting.
- b) The traversing involved setting Main ("principal") and centre pegs according to the design and then recording their levels.  
"Main Pegs" are defined as those at the start and end of the traverse, at corners and at every 100m interval. They will comprise one short stick (with nail at top) for position and elevation and one long stick painted with the position number.  
"Centre Pegs" are set a 25m intervals between Main Pegs and comprise of one short stick only.

c) The Chief Surveyor should be a T.O. or S.T.O.

The Surveyor(s) should be an Irrigation Assistant or Surveyor.  
The assistants will be Chain-men or Leaders (Capitans).

d) The Allowable Error is as follows:

- (i) Traversing-  
In hilly or difficult terrain a closing error of  $1.5\sqrt{n}$  minutes is permitted  
In flat terrain a closing error from  $1.0\sqrt{n}$  to  $0.5\sqrt{n}$  minute is permitted.  
( "n" refers to the number of sides).
- (ii) Levelling-

In, for example, channel surveying, a final error of  $1.5\sqrt{s}$  cm. is permitted ("s" = survey distance in km).

Conclusions:

- (i) For setting Main Pegs with a theodolite, a team comprising of 1 T.O., 1 Assistant and 4 Labourers could do 500m per day.
- (ii) For setting Centre Pegs, using Principal Pegs and lining up method, 1 Assistant and 5 Labourers could do 100 pegs per day.
- (iii) For painting and numbering, 1 Assistant and 3 Labourers could do 8 km per day
- (iv) For levelling, 1 T.O. and 3 Labourers could do a 1 km return distance daily.

**B. TOPOGRAPHICAL SURVEYING**

DESCRIPTION	WORK	DAYS	CHIEF SURVEYOR	SURVEYOR	ASSIS- TANT	LABOU- RERS
Control point surveying (per 1km)	-Same as A. Traversing					
Topo. Site as A	Clearance	1.0	-	1.0	1.0	5.0
	Surveying	1.1	-	1.1	1.1	2.5
Control Difficult site	Clearance	2.5	-	0.5	2.5	5.3
Surveying per 1km. conditions	Surveying	2.0	-	2.0	0.5	5.3
						Man-days

**NOTES:**

- a) "Difficult" site conditions occur where the bush is thick and tangled and occasionally shallow marshes are encountered.
- b) The area is divided into a grid, spot heights are determined for each intersection and contours are plotted.
- c) Road and river alignments should also be plotted.
- d) Allowable Error:
  - (i) In control point surveying the permitted errors are as in A (Traversing)
  - (ii) In topographic control surveying relatively large errors are permissible.
- e) Control points are established by Traversing. Levelling is done 25-50m either side of these points for topographic control.

Conclusions:

- (i) Control Point Surveying - same as Traversing.
- (ii) Topographic Control Surveying-

In difficult terrain/vegetation conditions, 1 Surveyor, 1 Assistant and 4 Labours could do 250m per day.

In easier conditions, the same team could do 500m per day.

**C. ESTABLISHING BENCH MARKS PER 10 POINTS**

WORK	DAYS	CHIEF SURVEYOR	SURVEYOR	ASSISTANT	LABOURERS
Transporting, pla- oing, painting and numbering stones	1.67	0.42	-	0.83	6.67
Level Surveying	1.67	-	1.67	-	3.33
TOTAL	3.34	0.42	1.67	0.83	10.00
					Man-days

**NOTE:**

- a) The distance between B.M. points was between 100 and 700m.

Conclusions:

- (i) A team of 1 T.O., 1 Assistant and 7 Labourers could do a task of setting 20 Bench Marks out per day.
- (ii) A team of 1 T.O. and 3 Labourers could do a task of 1500m of levelling per day.

**D. ROUTE SURVEYING PER 1 KM**

WORK	DAYS	CHIEF SURVEYOR	SURVEYOR	ASSISTANT	LABOURERS
Setting pegs every 25m along an exist- ing road	0.31	0.31	-	0.9	0.9
Level Surveying	0.62	-	0.90	0.30	1.50
TOTAL	0.93	0.31	0.90	1.20	2.40
					Man-days

NOTE:

a) An allowable error as in Travelling is permitted.

Conclusions

(i) For setting pegs, 1 T.O., 1 Assistant and 1 Labourer were set  
Tasks of 1000m per day.

(ii) For levelling a team of 1 T.O., 1 Assistant and 2 Labourers were set  
Tasks of 2000m per day.

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APPENDIX

A. OVERHEAD EXPENSES

With regard to "OVERHEAD EXPENSES" the only data that could be collected was for "CHILUMBA D.S.P.". From this data the following has been suggested:--

Obviously, as this method has been determined from limited data, it should only be used as a guide.

1. For Management and Assistant Requirements, 10% of constructional requirements should be estimated.
2. For Tools' wear and tear, 5% of constructional requirements should be estimated.
3. For the price of building site office compound, 4% of constructional requirements should be estimated.
4. For testing materials and surveying, 0.5% of constructional requirements be estimated.
5. For Provisional Sums 3.0% of constructional requirements be estimated.
6. If extra expenditure caused by poor administration is accepted, it is 7% of constructional requirement (from CHILUMBA's data).

7.3. For the estimation of the remaining "OVERHEAD EXPENSES".

SUMMARY OF 1980 CHILUMBA P.V.S.P.

<u>Work</u>	
Pipe laying and structures	
<u>Cost</u>	K 70,200-
Cost price of construction works	
Cost price of Administration	<u>K 10,000-</u>
<u>Total</u>	K 80,200-
<u>Labour</u>	
Average Number of Labourers Employed	90 members/day
<u>Hired Vehicle</u>	
7 ton Leyland Lorry	
Bedford Water Tanker	
Nissan Pick Up	
Land Hozer	
Compressor	

B. INFORMATIONS

When estimation is done using this efficiency, the following must be emphasised and come from attached "INFORMATION":

- a) Mortar Volume
 

1:5 mix mortar	1 bag mix	0.20m <sup>3</sup>
1:3 mix mortar	1 bag mix	0.14m <sup>3</sup>
- b) Water requirement for mixing
 

For concrete	400 l/m <sup>3</sup>
For 1:5 mix mortar	150 l per 1 bag cement mix
For 1:3 mix mortar	100 l per 1 bag cement mix
- c) Extra volume which must be prepared as provisional quantity for conveyance loss, etc.
 

Sand, Aggregate, Concrete.....	10%
Small stones ( 50mm Ø 100mm).....	30%
Stones (Ø 100mm), Grade II Bricks.....	20%
No Grade Bricks.....	40%
- d) Mortar and Bricks Requirement for wet masonry.

TYPE OF NET MASONRY		MORTAR	STONES OR BRICKS
<u>STONE MASONRY</u>			
Standing type vertical wall		80%	
Back fill type vertical wall		50%	120%
Sloped type stone masonry		60%	
Stone Pitching (10-15cm thick)		25%	
<u>BRICK WALL</u> 9" thick wall		1.00m <sup>3</sup> /10m <sup>2</sup>	1000No/ 10m <sup>2</sup>
		where joint thickness must be kept 1 cm.	
		where joint thickness can vary.	850No/ 10m <sup>2</sup>
4½" thick wall		0.50m <sup>3</sup> /10m <sup>2</sup>	425No/ 10m <sup>2</sup>
		where joint thickness can vary.	

NOTE: "X" is the rate of structures volume.

e) Mortar Requirement for surfacing.

For side - surfacing of stone wall 4.00 times of designed volume.

For side - surfacing of Brick wall 3.25 times of designed volume.

For Top - surfacing of Brick wall 1.50 times of designed volume.

DRAWING SHEETS FOR CHILUMBA D.W.S.P.DESIGNED & DRAWN  
H. Kanamori

## 1. INDEX

CHILUMBA SITE MAP .....	1
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FOUNDATION OF STEEL TANK.....	9
VALVE CHAMBER .....	12
ANCHOR BLOCK .....	13
CONCRETE MIXING PLACE .....	14

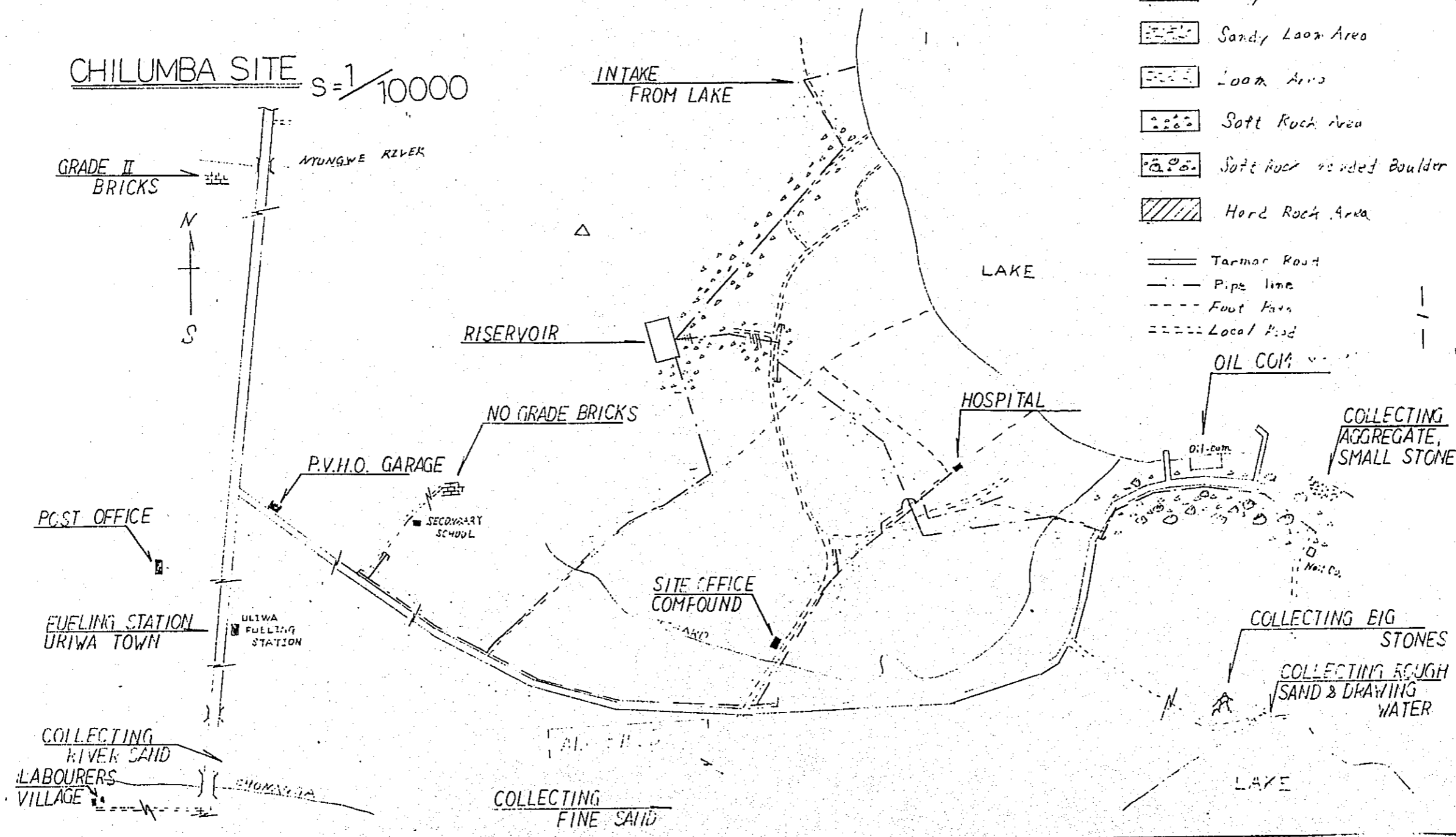
## 2. NOTE

- 1) All dimensions are given in centimetres
- 2) All brick work is based on a 9" (22.5 cms) brick size, but local no grade#G. II brick vary in size between 22 and 24 cms and the drawings are modified accordingly.
- 3) For supports, Bricks used are to be higher quality than Grade II. For the other works No. Grade Bricks can be used.
- 4) For supports' Brickwork and surfacing, the mortar to be 1:3 Cement; Sand mix.
- 5) For all the other Brickwork and stone pitching, the mortar to be 1:5 Cement; Sand mix except when special instructions are on drawings.
- 6) For reinforcement slab, concrete to be 1:2:4 Cement; Sand ; Aggregate mix.
- 7) For all the other work concrete used to be 1:3:6 Cement ; Sand ; Aggregate mix.
- 6) Back fill for structure to be thoroughly compacted.


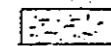
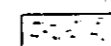
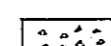
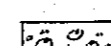
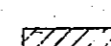

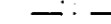


## 3. DESIGNER

All drawings are drafted by the Site Engineer of Howard Humphreys & Sons (Malawi), and designed and drawn by H. Kanamori, The Irrigation Engineer (J.O.C.V.)

CHILUMBA SITE S=1/10000



NOTE

-  Sandy Area
-  Sandy Loam Area
-  Loam Area
-  Soft Rock Area
-  Soft rock rounded Boulder
-  Hard Rock Area
-  Tarmar Road
-  Pipe line
-  Foot Path
-  Local Road

DISTANCE FROM THE COMPOUND (SHORT TRIP)

COMPOUND	- RESERVOIR	1.0 Mile
	- INTAKE	1.5 Mile
	- HOSPITAL	0.5 Mile
	- OILCOM	1.0 Mile
	- POST OFFICE	4.0 Miles
	- FUELING STATION & ULIWA TOWN	5.0 Miles
	- LABOURERS VILLAGE	10.0 Miles

(COLLECTING MATERIALS)

COMPOUND	- AGGREGATE, SMALL STONES	1.0 Mile
	- BIG STONES	1.0 Mile
	- ROUGH SAND AND WATER	1.0 Mile
	- RIVER SAND	7.0 Miles
	- FINE SAND	1.0 Miles
	- NO GRADE BRICKS	2.0 Miles
	- GRADE II BRICKS	20.0 Miles

LENGHT TO CLASSIFIED SOIL TYPE

LINE'S NAME	SANDY AREA	SANDY LOAN	LOAM AREA	SOFT ROCK	SOFT ROCK & BOULDER	STEEP PLACE	RIVER CROSS	TOTAL
PUMPING MAIN				810.0 (560.0)				810.0
TRUNK MAIN	820.0		890.0	130	60.0		12.0	1912
SECONDARY	(do)		(do)	(do)	(do)		(-)	(1900)
SCHOOL	<del>670.0</del>		<del>860.0</del>				<del>12.0</del>	<del>1542.0</del>
MAIN AN 100	<del>670.0</del>		<del>860.0</del>				<del>12.0</del>	<del>1542.0</del>
TRUNK MAIN TO NOIL CO.	330.0 (do)	360.0 (do)		4500 (do)	800.0 (420.0)		11.0 (-)	1951.0 (1560.0)
TOTAL	1820.0 (1530.0)	360.0 (do)	1750.0 (do)	1390.0 (1140.0)	800.0 (420.0)	60.0 (do)	35.0 (12.0)	6215.0 (5272.0)

REMARK

The number of ( ) shows completed length of trenching during '80 work.



PIPE LINE WORK FOR 1980 WORK

F.V.C. PIPES

∅ 150 mm  
(5080.5 - 12.0 - 1242.5) x K4-24<sup>1/2</sup>m  
= K16,226-06t

∅ 100 mm  
1242.5 x K3-39t/m = K4212-07t

TOTAL K20438-13t

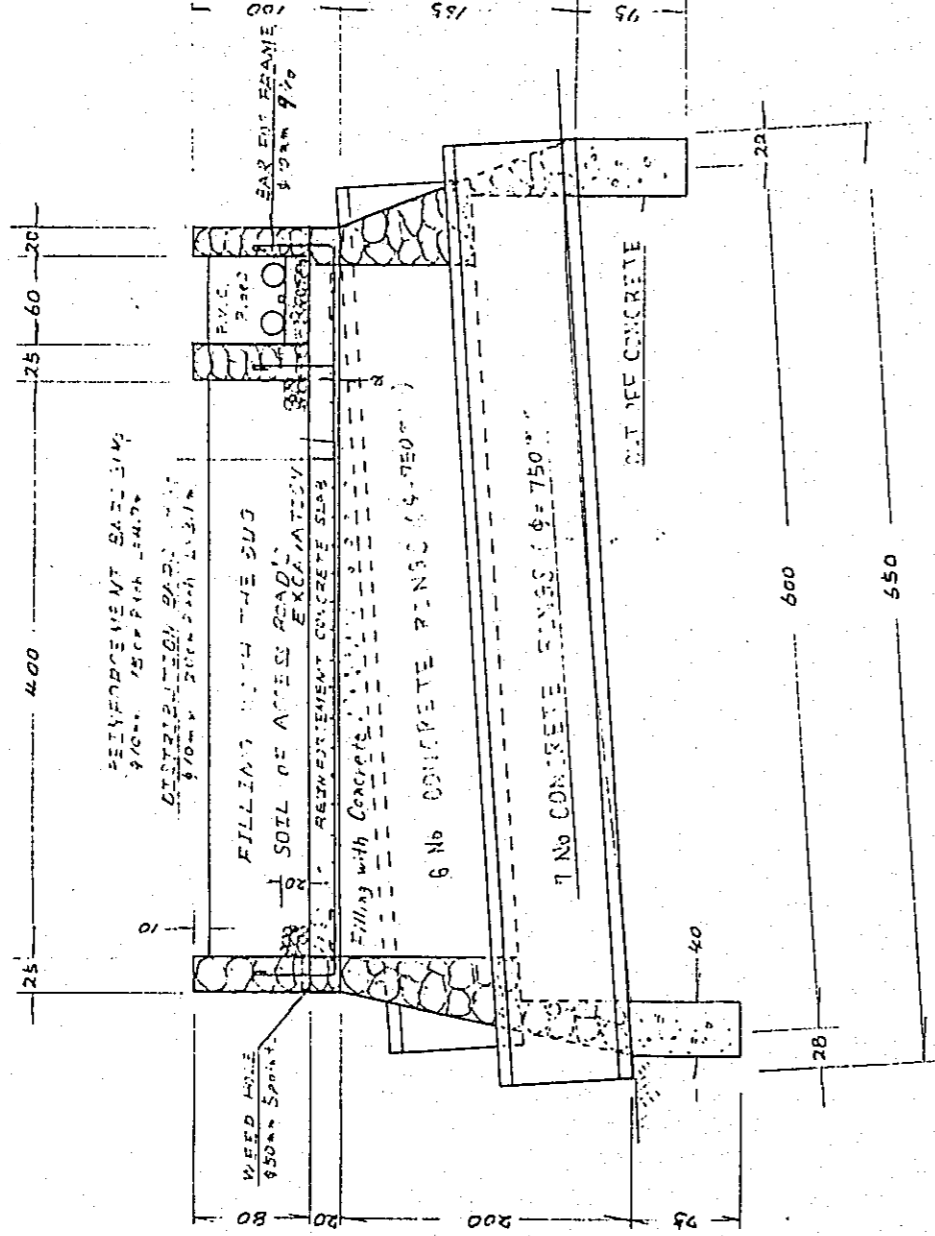
THE OTHER MATERIALS

PARTS' No.	QUANTITY	UNIT PRICE	COST	NOTE
A2	1	K t 72 - 85	K t 72 - 85	Gate Valve
A4	1	72 - 85	72 - 85	Gate Valve
A8	2	90 - 72	181 - 44	Sluice Valve
A9	2	13 - 69	27 - 38	Sluice Valve
B1	3	104 - 00	312 - 00	Air Valve
B2/3	2	33 - 00	66 - 00	Bend
B2/7	2	33 - 00	66 - 00	Bend 45o
B2/	1	31 - 37	31 - 37	Bend 45o
B2/8	1	33 - 00	33 - 00	Bend 90o x 150 9 bar
B2/9	1	17 - 00	17 - 00	
B2/17	3	28 - 00	84 - 00	On Tees
B2/19	2	49 - 00	98 - 00	
B2/21	2	49 - 00	98 - 00	
B2/26	1	36 - 00	36 - 00	
B2/30	7	56 - 50	395 - 50	Tee Valve
B3/2	3	19 - 50	58 - 50	
B3/3	7	30 - 00	210 - 00	150mm Socket Adaptors
B3/8	4	14 - 00	56 - 00	End CAP
B3/9	4	22 - 00	88 - 00	
150 x 150 TEE	1	45 - 67	45 - 67	
A 1/8mm	12m	8.6 7/m	104 - 04	
TOTAL			2153 - 60	

TESTING PIPE LENGTH

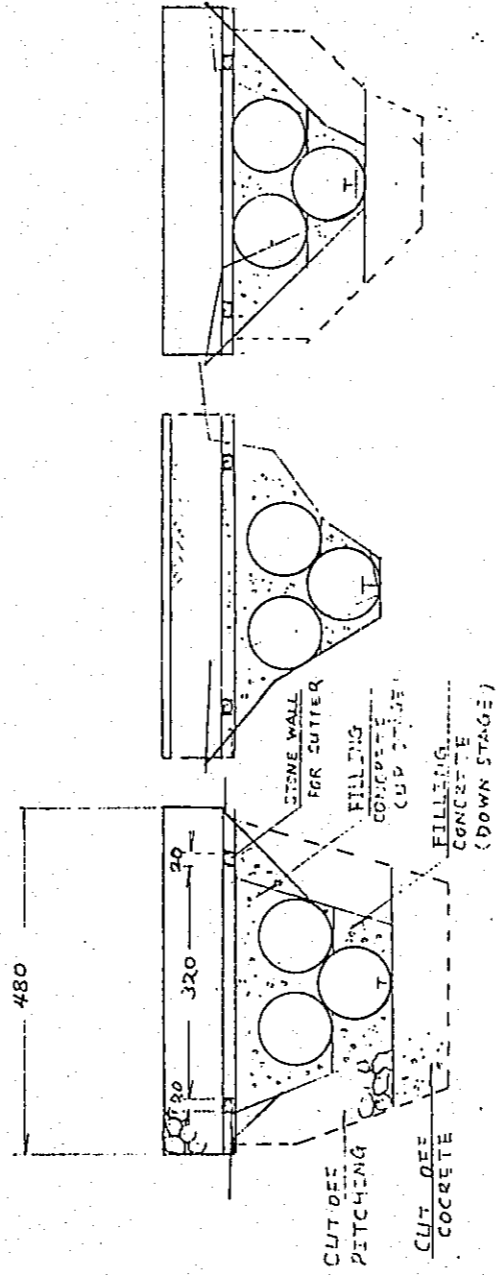
TOTAL 1,960 m





NOTE  
COVER TO REINFORCEMENT TO BE 2 CM THICK

LONGITUDINAL SECTION S = 1/50



1	0.60
2	3.30
3	2.40
4	0.70
5	2.50
6	2.70
No. 1	
-0.013	

1	1.65
2	2.40
3	-
4	-
5	-
6	-
No. 2	
-0.112	

1	1.70
2	2.50
3	1.50
4	0.50
5	1.13
6	2.90
No. 3	
-0.158	

CROSS SECTION S = 1/100

NOTE

1	CUT SOIL AREA
2	FILLING CONCRETE AREA
3	STONE PITCHING AREA EXCEPT VERTICAL WALL - UP STREAM SIDE
4	do - DOWN STREAM SIDE
5	CUT OFF CONCRETE AREA
6	CUT OFF PITTING AREA

CROSS CUVERT  
RESERVOIR SITE

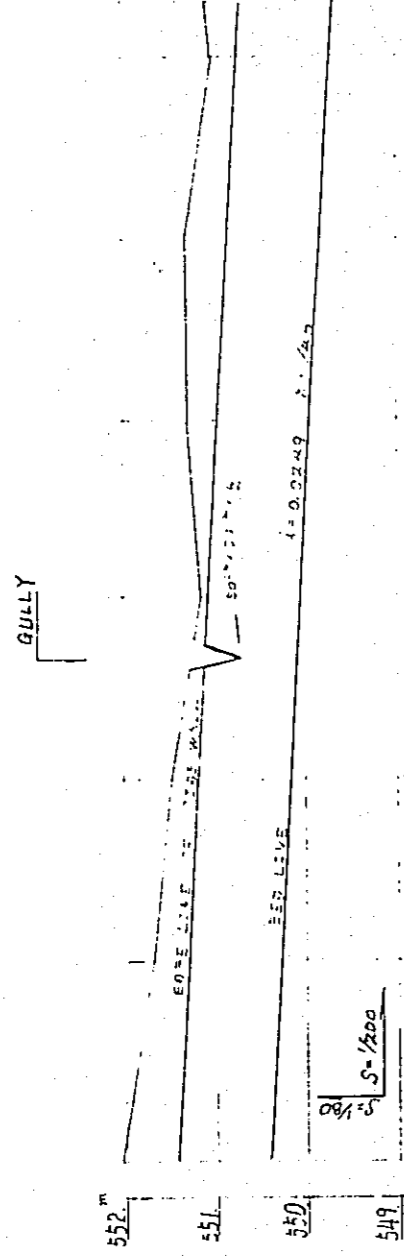
STATION No.	DISTANCE (A)	AVERAGE DISTANCE		CUT SOUL		FILLING CONCRETE	
		(A)	(B)	(1) (B)	(2) (B)	(1) (B)	(2) (B)
1	0.	1.25	0.60	0.75	3.30	4.10	
2	2.5	2.50	1.65	4.10	2.40	6.00	
3	2.5	1.25	1.90	2.40	2.00	2.50	
TOTAL	5.0	5.00		7.25		12.60	

NAME	THICKNESS OR AVERAGE THICKNESS cm	AREA m <sup>2</sup>	VOLUME m <sup>3</sup>	TOTAL VOLUME m <sup>3</sup>
STONE PITCHING VERTICAL WALL	20.	4.8x1.5=0.2x 4.8= 5.8	1.00	3.40
	25.	4.8x2= 9.6	2.40	
SLOPE WALL Up Stage	Down Stream 40	2.40	0.96	
	Upper do. 35	1.60	0.56	
Down Stage	Down Stream 30	0.90	0.27	
	Upper do. 35	0.50	0.18	
CUT OFF Stone Wall	Down Stream 35	2.70	0.95	3.90
	Upper do.	2.70	0.95	
Concrete	Down Stream 40	1.60	0.60	1.60
	Upper do.	1.60	0.60	

CALCULATION TABLE

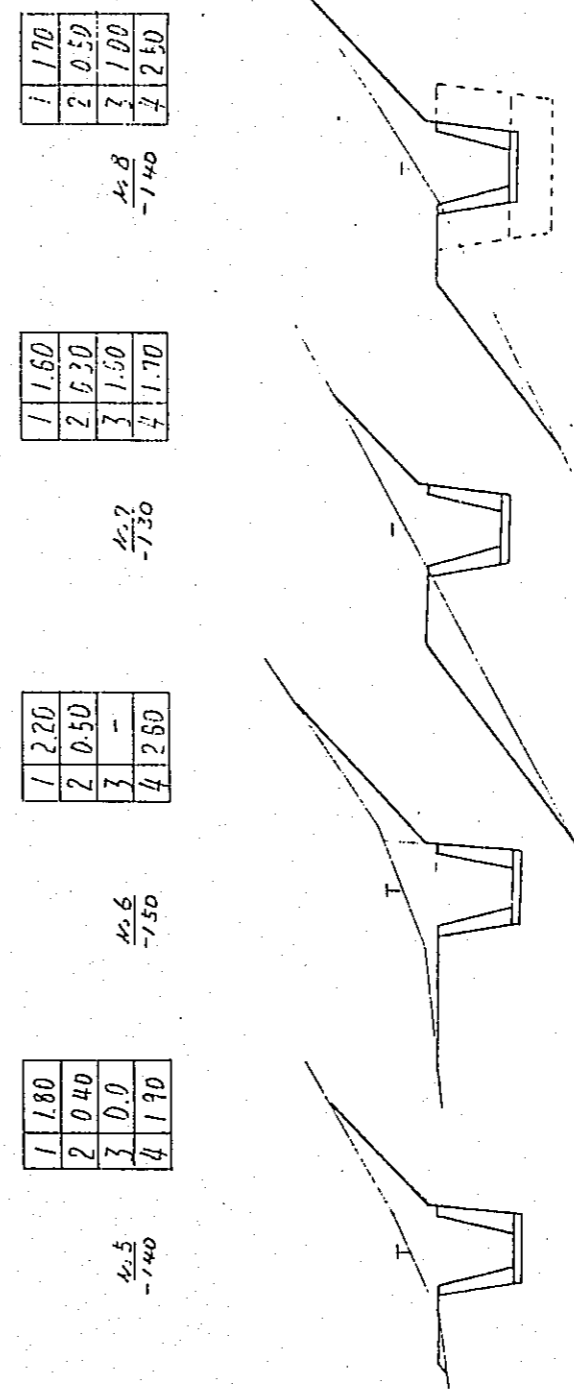
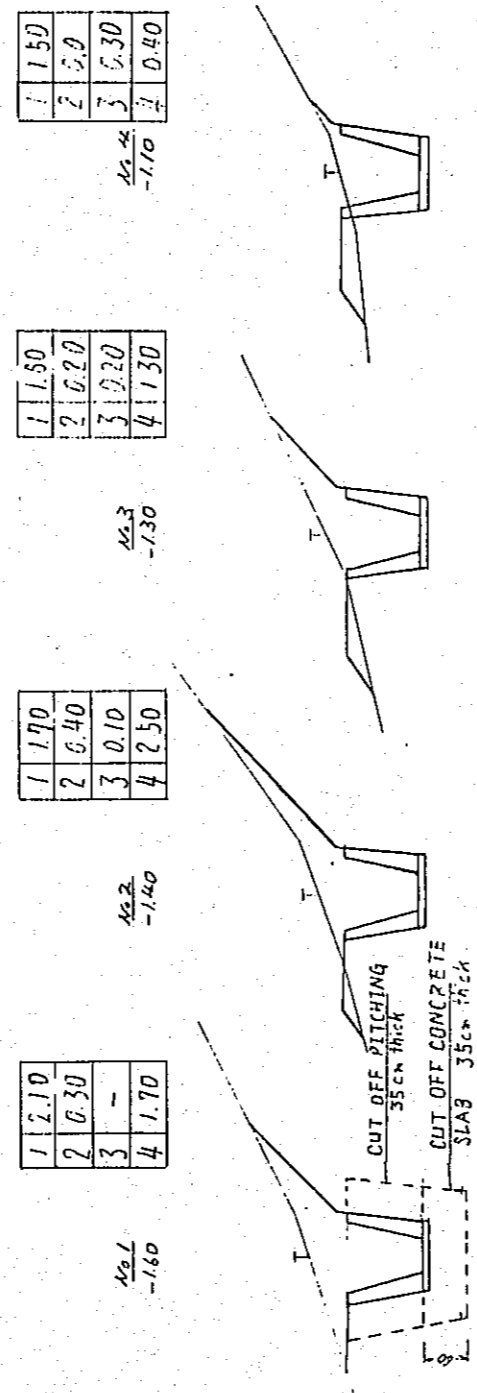
Access Road Excavation 54.33 m<sup>3</sup>  
 Reinforcement Concrete 4.8x3.2x0.2=3.10 m<sup>3</sup>  
 Filling & Cut Off Concrete 12.60+1.60 14.20 m<sup>3</sup>  
 Reinforcement Bars 24 No.  
 Stone Pitching 20 cm thick 5.8 m<sup>2</sup>  
 (Vertical Wall) 25 cm thick 9.6 m<sup>2</sup>  
 Wet Masonry Volume for Slope Wall 3.90 m<sup>3</sup>  
 Cut Soil Volume 7.25 m<sup>3</sup>  
 Dig Cut off 1.60+0.95+0.95= 3.50 m<sup>3</sup>  
SUMMARY OF MATERIALS

— 9 —



STATION	ADD'L PLAIN	TIGRAL ELEV. 11/11	DISTANCE	ADD'L PLAIN	TIGRAL ELEV. 11/11	DISTANCE
552	450	552	0	450	552	0
549	325	551	25	325	551	25
548	205	551	50	205	551	50
547	175	551	75	175	551	75
546	150	551	100	150	551	100
545	125	551	125	125	551	125
544	100	551	150	100	551	150
543	75	551	175	75	551	175
542	50	551	200	50	551	200
541	25	551	225	25	551	225
540	0	551	250	0	551	250
539	25	551	275	25	551	275
538	50	551	300	50	551	300
537	75	551	325	75	551	325
536	100	551	350	100	551	350
535	125	551	375	125	551	375
534	150	551	400	150	551	400
533	175	551	425	175	551	425
532	200	551	450	200	551	450
531	225	551	475	225	551	475
530	250	551	500	250	551	500
529	275	551	525	275	551	525
528	300	551	550	300	551	550
527	325	551	575	325	551	575
526	350	551	600	350	551	600
525	375	551	625	375	551	625
524	400	551	650	400	551	650
523	425	551	675	425	551	675
522	450	551	700	450	551	700
521	475	551	725	475	551	725
520	500	551	750	500	551	750

LONGITUDINAL SECTION

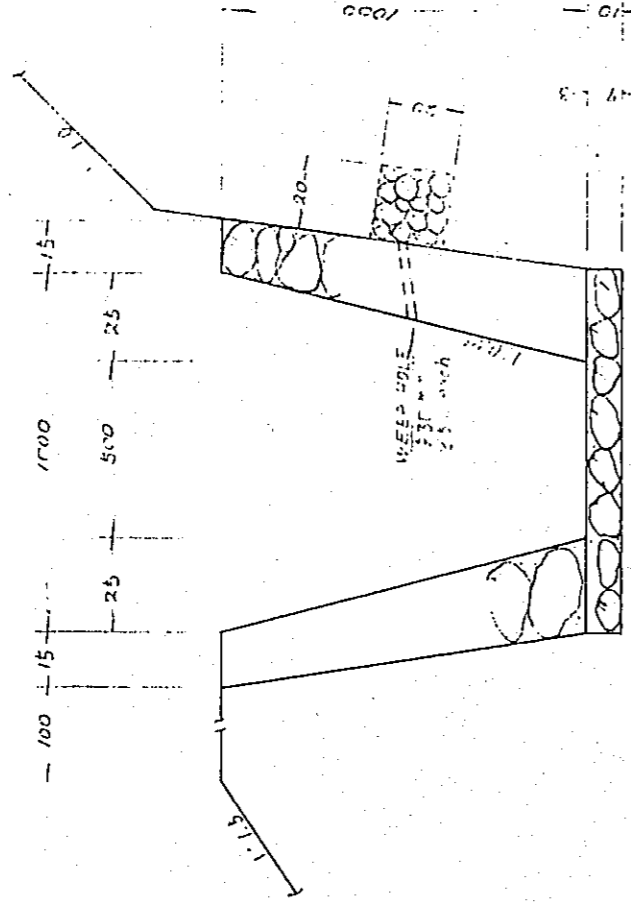


CROSS SECTION  
S=1/100

CUT OFF TRENCH

NOTE

1	TRENCHING AREA
2	CUT OFF AREA
3	BASE AND FILLING AREA
4	TRENCH LENGTH BY CUT SLOPE



STANDARD CROSS SECTION  $S = 1/20$

STA. TICH	DISTANCE a	AVERAGE DISTANCE h	PERCENT VOLUME	CUT SOIL VOLUME	BANKING & FILLING VOLUME	TRENCHING AREA
161	0	2.75	2.10	5.50	2.50	2.50
2	5.50	5.25	1.75	2.75	2.10	0.50
3	5.00	5.00	1.55	2.60	1.00	1.00
4	5.00	5.00	1.45	2.50	1.50	1.50
5	5.00	5.00	1.35	2.40	0.95	0.95
6	5.00	5.00	1.25	2.30	0.50	0.50
7	5.00	3.25	1.05	2.00	1.00	1.00
8	1.50	0.75	0.75	1.50	0.85	0.85
TOTAL	32.00	32.00	—	59.75	—	159.50

CALCULATION TABLE

TRENCHING VOLUME  $56.75 + 0.24 = 57.54 \text{ m}^3$

CUT SOIL VOLUME  $9.80 \text{ m}^3$

BANKING & FILLING VOLUME  $7.10 \text{ m}^3$

CUT OFF CONCRETE

$$2.0 \times 0.5 \times 2.5 \times 2 = 0.84 \text{ m}^3$$

BASE STONE PITCHING

$$1.0 \times 0.17 \times 2.2 \times 0.35 \times 2 = 3.15 \text{ m}^3$$

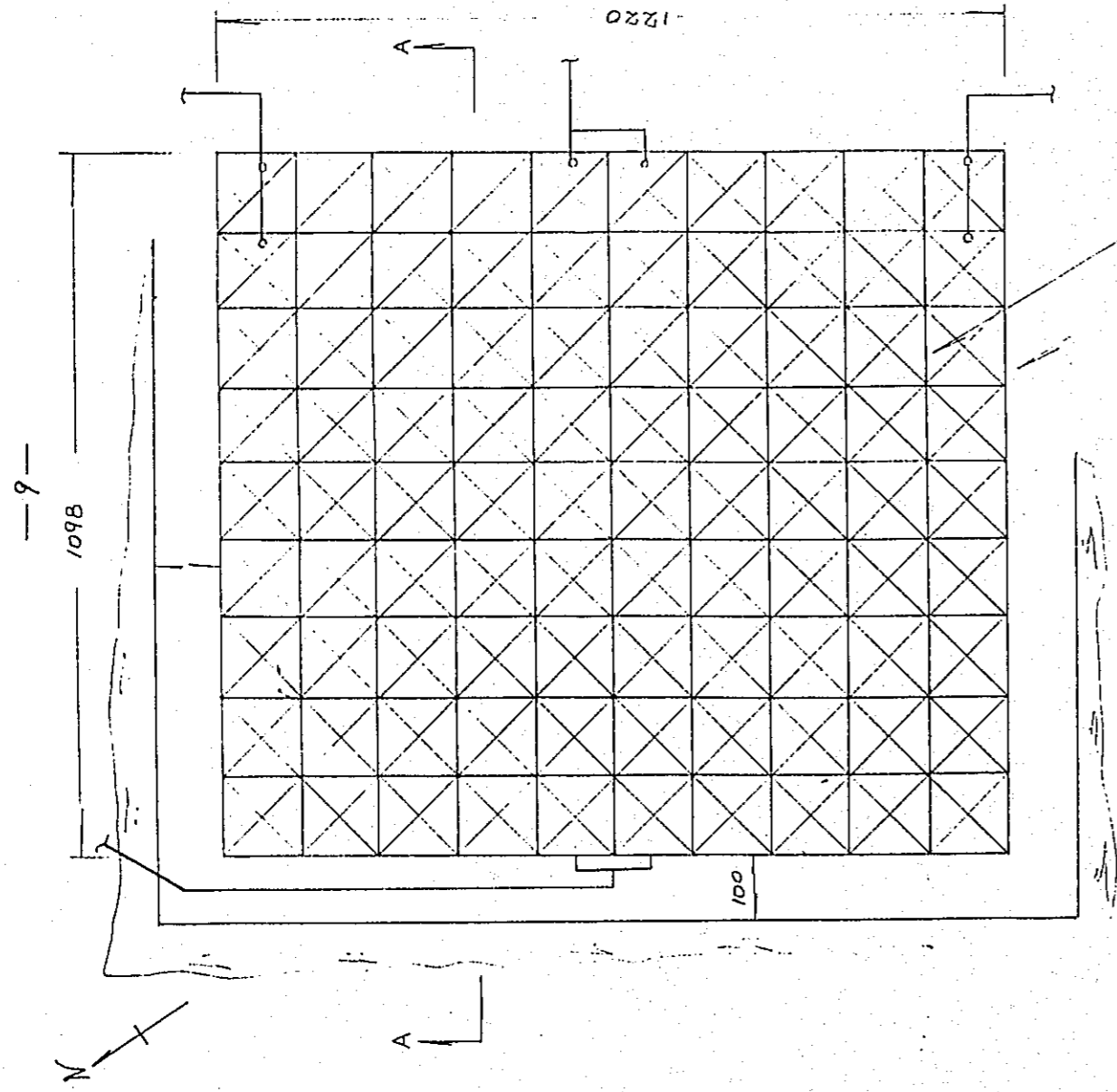
SIDE STONE PITCHING

$$(0.05 + 0.25) \times 1.0 \times 2.2 \times 0.35 \times 2 + 0.5 \times 1.7 \times 0.35 \times 2 = 1.57 \text{ m}^3$$

BASE STONE

$$1.0 \times 0.07 \times 52.0 \times 0.35 \times 2 = 2.17 \text{ m}^3$$

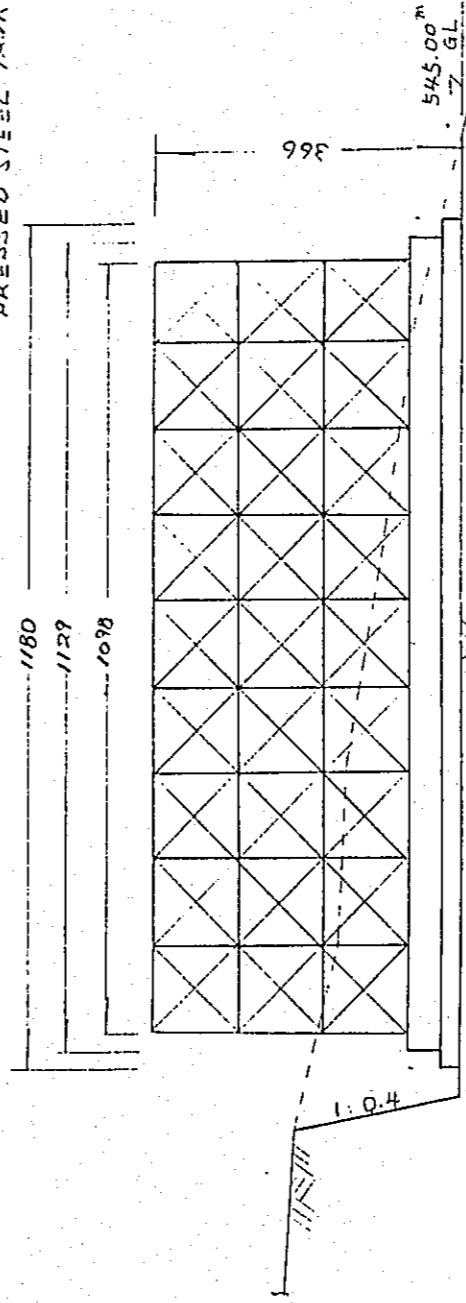
SUMMARY OF MATERIALS VOLUME



PLAN

Scale 1:100

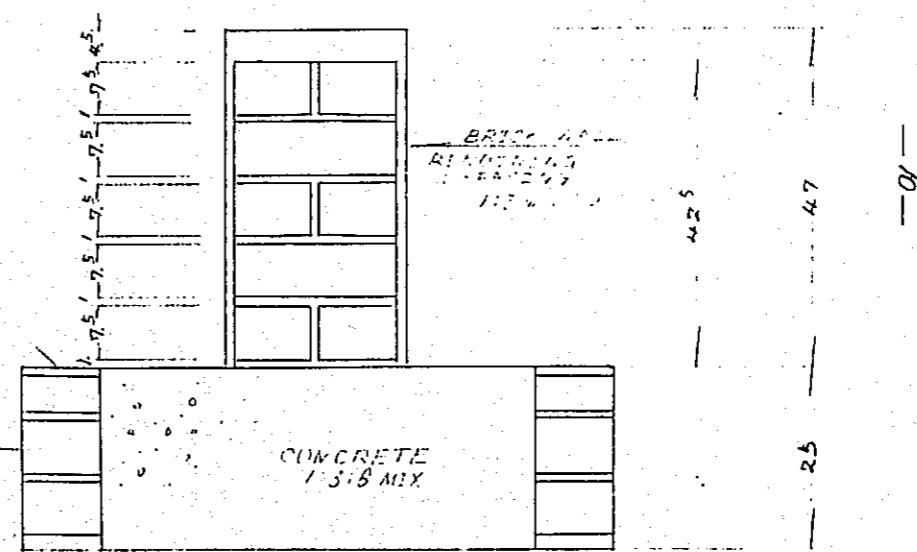
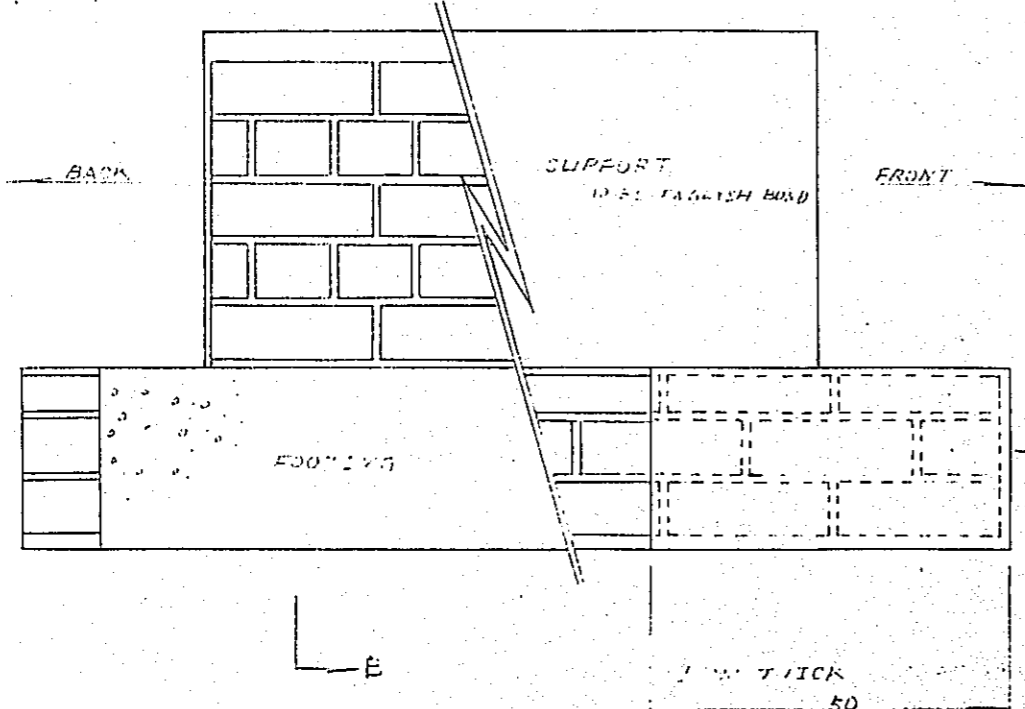
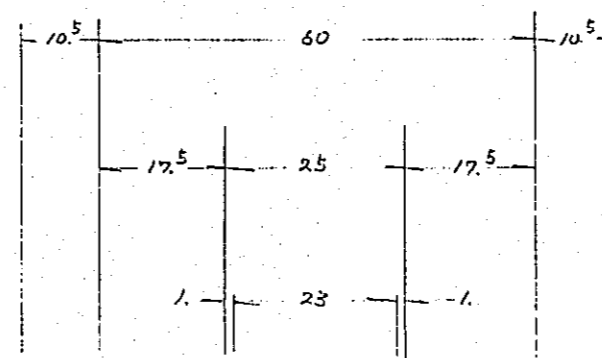
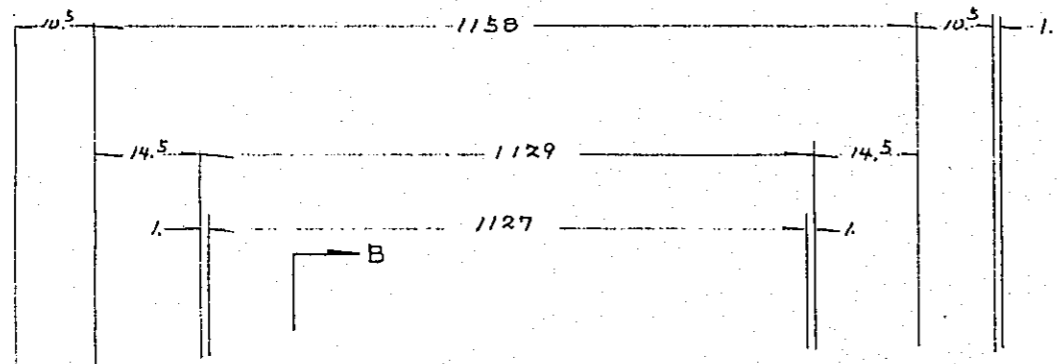
PROPOSED 500 m<sup>3</sup>  
PRESSED STEEL TANK



SECTION A - A

Scale 1:100

FOUNDATION OF STEEL TANK



FOUNDATION  
S = 1/10

SECTION E-B  
S = 1/10

NOTE  
THE THICKNESS OF BRICKS  
JOINT & REINFORCING TO BE  
KEPT AS SHOWN.



EXCAVATION 247.05 m<sup>3</sup>  
~~LEVELING~~  
LEVELING ~~155.92 m<sup>3</sup>~~ 11.80 x (12.20 + 0.81) 153.52 m<sup>2</sup>

BRICK WALL'S AREA FOR SHUTTERING CONCRETE  
(11.58 + 0.60) x 2 x 11 x 0.25 = 67.0 m<sup>2</sup>  
BRICKS: 425 No./10m<sup>2</sup> x 6.7 = 2848 No.  
TOP AREA (11.58 + 0.60) x 2 x 11 x 0.10 = 26.8 m<sup>2</sup>

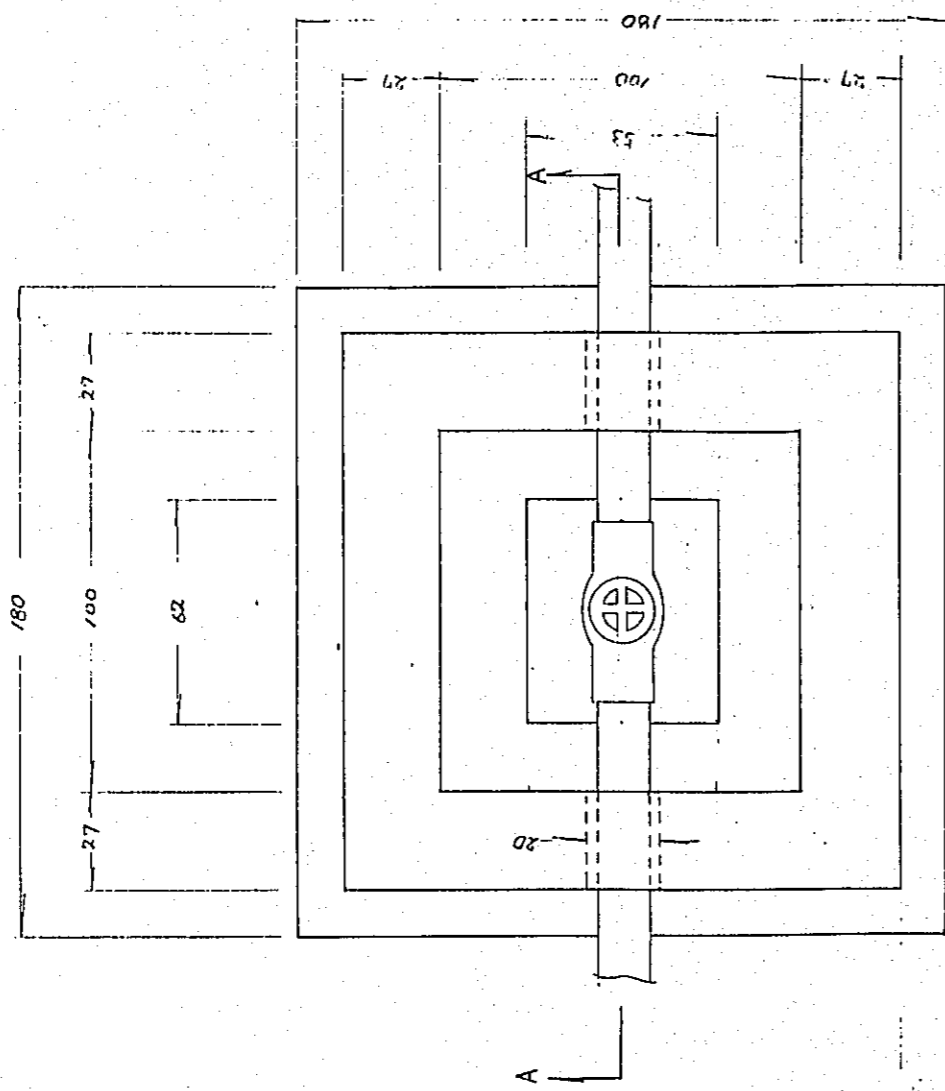
23 CM THICK BRICK WALL'S AREA FOR SUPPORTS  
0.425 x 11.27 x 11 = 52.7 m<sup>2</sup>  
BRICKS : 1000 No./10m<sup>2</sup> x 5.27 = 5270 No.

SIDE MORTAR SURFACING AREA  
0.425 x 0 11.27 + 0.23 ) x 2 x 11 x 2 + ( 0.6 + 0.105  
x 2 ) x 11 = 127.4 m<sup>2</sup>

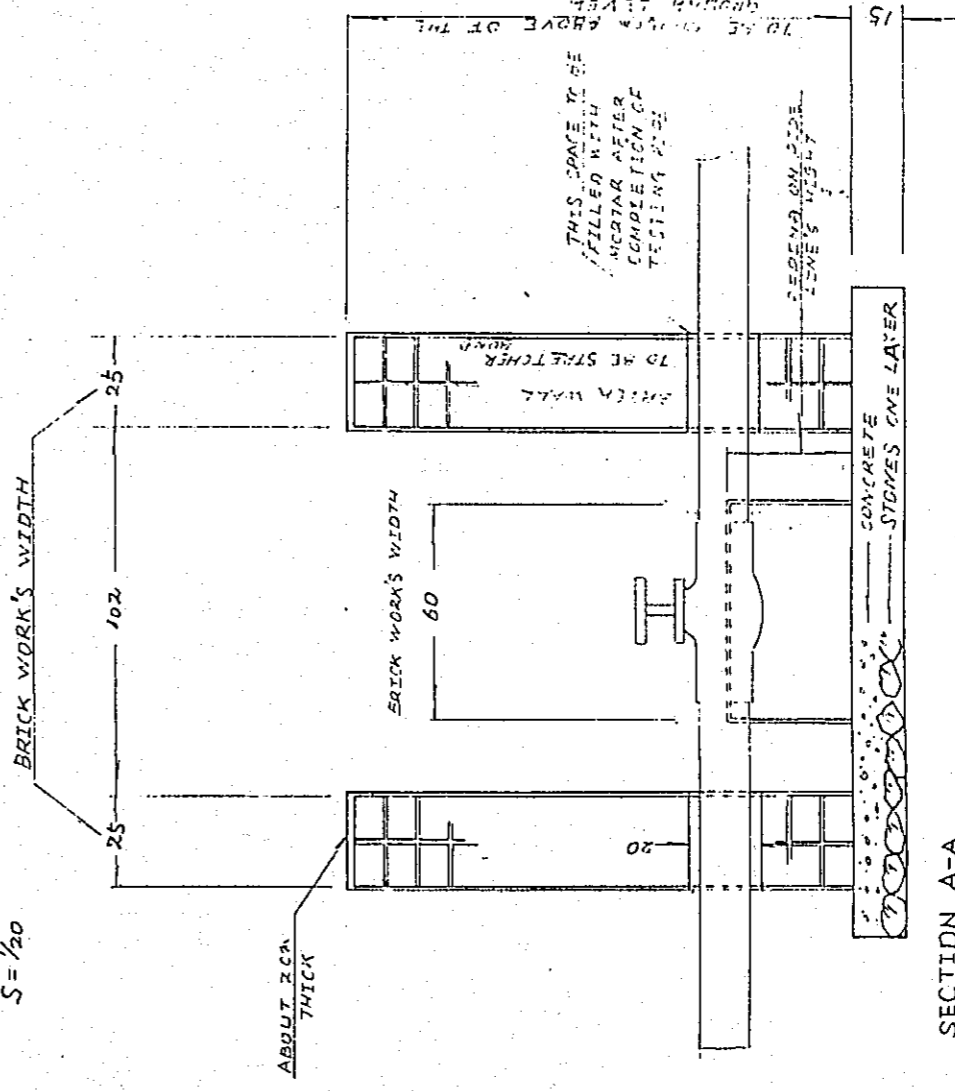
TOP MORTAR SURFACING AREA  
0.25 x 11.29 x 11 = 31.1 m<sup>2</sup>

FILLING CONCRETE VOLUME  
0.25 x 0.6 x 11.58 x 11 = 191 m<sup>3</sup>

SUMMARY OF WORK



PLAN  
S = 1/20

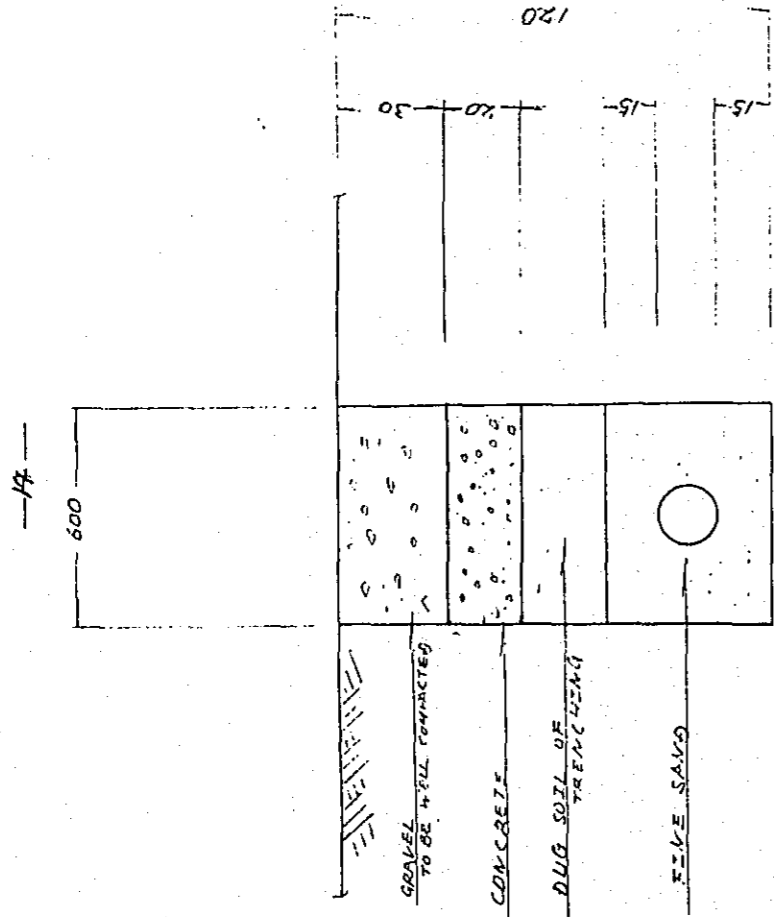


SECTION A-A  
S = 1/20

- REMARK
1. SIDE MORTAR BRACING TO BE AS THEY ARE POSSIBLE.
  2. THE TOP SURFACE TO BE HORIZONTAL.

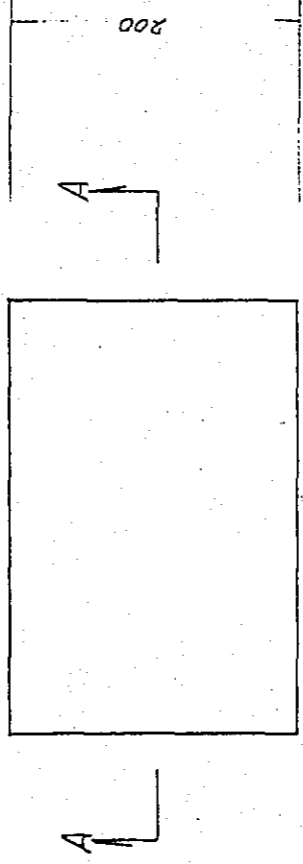
VALVE CHAMBER



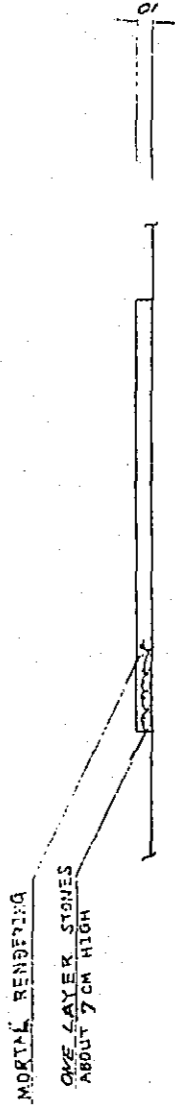


ROAD CROSSING (for no pavement road)  
 $S = 1/20$

300



PLAN  $S = 1/50$



SECTION A-A  $S = 1/50$

NOTE  
 THIS MORTAR TO BE 1:5 =  
 CEMENT : SAND : WATER

CONCRETE MIXING PLACE

PREFACE

INFORMATION

During supervision of construction in Malawi, I collected data which is useful for correct estimation and for supervision. The results are shown as following.

Obviously this information has been determined from limited data relating to my experience. But as such information has not been collected yet in Malawi, it is hoped that this will help Estimation and Supervision work.

INFORMATION

CONTENTS

1. Materials Loss & Discrepancy
  - i Aggregate for concrete
  - ii Sand
  - iii Stones
  - iv Bricks
2. With Regard to Concrete Work
  - i Water Requirement for concrete work
  - ii Conveyance Loss
  - iii Economical Rate
  - iv Filling Rate
3. With Regard To Mortar Work
  - i Water Requirement For Mortar Work
  - ii Mortar Volume Per 1 bag mixed
  - iii Net Masonry's Mortar Volume
  - iv Surfacing Mortar's Volume
  - v Filling Rate
4. The Limit Of Supervision
5. Others
  - i With Regard To Labourers
  - ii Private Trip's Rate
  - iii Workable Rate

1. Materials Loss & Discrepancy

To discover how much whole volume was not used for spreading etc. I compared the collected and the carried volume with the actual used volume.

Note: "Carried volume" is that measured from the size of transport.

- i Aggregate For Concrete  
Labourers' Collected Volume with task job : A 118.5m<sup>3</sup>  
Carried volume from collecting place to the site : B 56.14m<sup>3</sup>  
Actually used volume and remaining volume : C 51.14m<sup>3</sup>

(Calculation)

- i  $A + B = 118.5 + 56.14 = 2.0$   
This means only a half of the collected volume which the capitao reported can be trusted.
- ii  $B + C = 56.14 + 51.32 = 1.10$   
It means 1.1 times of designed volume must be carried to the site.

ii Sand

Collected and carried volume by Lorry : A 94.3m<sup>3</sup>  
Actual used Volume at the site : B 84.89m<sup>3</sup>

$A + B = 1.10$

The result is the same as Aggregate.

iii Stones

- i Big Stones ( $\phi > 100mm$ )  
Carried Volume of stone works : A 21.20m<sup>3</sup>  
The volume of stone works : B 17.66m<sup>3</sup>  
 $A + B = 21.20 + 17.66 = 1.20$   
This means 1.20 times of designed pitching volume is necessary.

iii. Stones (Continued)

ii Small Stones (50mm ~~40~~  $\angle$  100mm)

Carried volume : A 19.7m<sup>3</sup>

Actual used volume at the site : B 14.8m<sup>3</sup>

A + B = 19.7 + 14.8 = 1.30

This means 1.30 times of designed volume must be carried to the site.

iv Bricks

i No Grade Bricks (low quality)

Carried bricks

A 16196 No.

Actual used bricks and remaining bricks : B 11720 No.

A + B = ~~16196~~ + 11720 = 1.40

This means designed volume's 1.40 times Bricks must be carried to the site.

ii Grade II Bricks

Carried bricks

A : 7500 No.

Actual used bricks and remaining bricks B : 6207 No.

A + B = 7500 + 6207 = 1.20

1.20 times of designed volume must be carried to the site.

2. With Regard To Concrete Work

2.1 Water Requirement For Concrete Work

The following water volume must be prepared when concrete work is done. The below include curing and the other work's volume.

For 1 m<sup>3</sup> concrete 400 l water

barrow

2.2 Conveyance Loss

During mixing or conveyance of concrete the volume is diminished by spreading, etc. I measured this loss volume for the reinforcement concrete slab of Chilumba work's cross culvert. In this case the concrete was mixed about 5m from the slab and carried by wheel barrow.

Designed volume A : 3.10m<sup>3</sup>

Mixed volume B : 3.33m<sup>3</sup>

B + A = 1.07  $\rightarrow$  1.10

This means 1.10 times of designed volume must be mixed.

2.3. Economical Rate

If a reduced concrete volume is required stones can be mixed with concrete. I measured how much of whole designed volume can be economized with the mixed stones:-

a) In the example of filling concrete for Chilumba's cross culvert.

Designed volume

A : 14.20m<sup>3</sup>

Actual filled volume

B : 12.47 + 1.10 = 11.33m<sup>3</sup>

(A - B) + A = 0.20  $\rightarrow$  20%

b) In the example of cut off Trench's Sill.

Designed volume

A : 0.7m<sup>3</sup>

Actual mixed volume

B : 0.44 + 1.10 = 0.4m<sup>3</sup>

(A - B) + A = 0.42  $\rightarrow$  40%

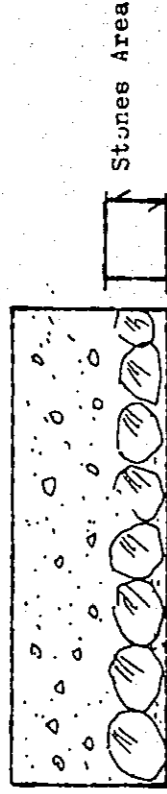
In the example of cross culvert the concrete was for filling the narrow space between concrete rings and it was difficult to mix big stones. In the trench's case, big stones could be mixed. Hence, it can be concluded 20 - 40% concrete volume can be economized by mixing stones.

2.4 Filling Rate.

I measured how much volume of concrete was used to fill the

2.4 Filling Rate (continued)

space between stones in the example of placing concrete on stones for the chamber's base concrete slab.



From my measuring 0.06m<sup>3</sup> concrete was filled 0.23m<sup>3</sup> stones' Area.

$$0.06 + 0.23 = 0.26 \rightarrow 30\%$$

3. With regard to Mortar Work

i Water Requirement For Mortar Work

The following water volume must be prepared when mortar work is done. The below includes curing and the "other work's" volume.

For 1 bag cement mix of 1:5 = cement; sand

For mix mortar 0.15m<sup>3</sup> water  
do 1:3 = cement; sand  
mix mortar 0.10m<sup>3</sup> water

ii Mortar volume per 1 bag mixed.

On site mixing of mortar is apt to include much water as soft mortar is useful for the rendering of rock work. I measured mixed mortar's volume with putting it in a drum tin. The results are shown below.

1 : 5 cement : sand mix mortar 2 bag mix 0.20m<sup>3</sup>  
1 : 3 do 0.14m<sup>3</sup>

iii Wet masonry's mortar volume

I measured mortar volume for wet masonry and averaged it. The results are as follows:-

TYPE OF STRUCTURE	MORTAR	STONES OR BRICKS
<u>STONE MASONRY</u> Standings type vertical wall	80% of structure's volume	120% of structures volume
Jackfill type vertical wall	50% do	120% do
Sloped type stone masonry	60% do	120% do
<u>BRICK WALL</u> 9" thick wall.	Where joint thickness must be kept at <del>1.00m<sup>3</sup></del> 1cm.	1000No/10m <sup>2</sup>
4½" thick wall.	Where joint thickness can vary	850No/10m <sup>2</sup>
	Where joint thickness can vary	0.50m <sup>3</sup> /10m <sup>2</sup>
		425No/10m <sup>2</sup>

Remark

- 1) The volume of mortar is calculated with item 3-ii
- 2) The above volume includes all loss during working.

iv Surfacing Mortar's Volume

In case of mortar surfacing for wet masonry some volume of mortar is lost because of spreading during carriage and working and the mixing water escaping from it. In this case a much larger volume must be prepared. I measured how much volume mortar has been used for this job (which includes for the losses). The results are shown below.

For side surface rendering of Stone Wall:  
4.00 times of designed mortar volume to be prepared.

For top place surfacing of Brick Wall:  
1.50 times of designed mortar volume to be prepared.

For side surface rendering of Brick Wall:  
3.25 times of designed mortar volume to be prepared.



v Filling Rate

As in the Concrete Filling Rate (Item 2 - iv), I measured the Filling Rate of mortar slab which is plaster mortar on stones.

2.95 m<sup>3</sup> mortar was filled 3.10m<sup>3</sup> stone's area.  
2.95 ÷ 3.10 = 0.95 → 95%

When mortar slab compares with concrete slab, the Filling rate at mortar is too much. I think the reason is as follows:

- a) Water is lost from mortar into the ground.
- b) Concrete will not fill the whole area of stones and the space near the bottom will not be filled.

4. The Limit of Supervision

In my experience, workers on-site are not able to follow instructions well and therefore over-excavation was apt to occur due to poor supervision by capitalists and misunderstanding of the setting out (for excavation and trimming). I checked how much a site engineer can avoid over-excavation based on my experience.

Although I appointed a capitalist who had experienced construction work before over-excavation occurred when trenching as I had to leave the site for some hours.

Therefore as over-excavation is likely to occur the volume of base slab and side stone wall has been increased as shown below.

STRUCTURE	DESIGNED VOLUME		ACTUAL CONST- BALANCE		RATE 3x100 1
	(1)	(2)	(2-1)	(3)	
Base Slab	3.13m <sup>3</sup>	3.80m <sup>3</sup>	0.67m <sup>3</sup>		21.4%
Side Stone Wall	13.50	17.25	3.75		27.8

From this result it can be concluded that an increase of about 20% for base trimming about 30% for side trimming required even when supervised.

However, the above was a "worst" case. Therefore if the situation is improved the rate can be reduced. In fact the capitalist improved the over-excavation for the next structure as he became more experienced.

As it is difficult to get a good capitalist, this is also another problem.

5. Others

i With Regard To Labourers

- a) The rate for compensation of absent Labourers by reason of mourning or illness.

Total paid labourers                    4:14598 man-days  
Total actual worked labourers B:12931 man-days

- b) A + B = 1.13 → 1.15

1.15 times of designed labourers must be estimated for Labour Costs.

- b) The rate of overtime wages as a means of encouraging workers to work harder.

Total price of overtime wages A : K1490-22t

Total Labourers wages except overtime wages : K4826-67

A + B = 0.31 → 30%

For "encouragement" 30% increase in the labourers cost must be allowed for.

iii Private Trip's Rate

Land Rover

Travelled mileage for working A : 2166.8 miles

Private trip's mileage B : 928.2 miles

B + A = 428% → 40%

It means if the chief's administration is poor, about 40% of worked mileage will be for private trips.

Bedford Water Tanker

Travelled mileage for working A : 559 miles

Private trip's mileage B : 138 miles

$B \div A = 24.7\% \rightarrow 25\%$

It means if the administration is poor about 25% of worked mileage can be allowed for as "private" for big vehicles.

In fact, it is difficult to prevent private trips and much effort is required to reduce them to a minimum.

iv Workable Rate

Almost all hired vehicles from P.V.H.O. are not well serviced, and sometimes they had to be sent to the P.V.H.O. Garage for repair. Then the vehicles could not work full times. I checked how many days the vehicle actually worked, and compared it with hired times. Hence the workable rates are shown below Land Rover (new car)

Hired term A 49 days  
Off hired term to B 3 days  
workable rate  $100 - (B \div A \times 100) = 93.9 \rightarrow 95\%$

7 ton Lorry

Hired term A 122 days  
Off hired term B 16 days  
workable rate  $100 - (B \div A \times 100) = 86.9 \rightarrow 85\%$

Bedford Water Tanker

Hired term A : 117 days  
Off hired term B 13 days  
workable rate  $100 - (B \div A \times 100) = 88.9 \rightarrow 85\%$

Motor cycle

Hired term A : 117 days  
Off hired term B : 24 days  
workable rate  $100 - (B \div A \times 100) = 79.5 \rightarrow 80\%$

(Remark)

"Hired term" is the number of term which was planned to hire the vehicle.

協力隊蔵書

1979  
IMPROVEMENT OF ROAD  
FOR  
WOVWE EXTENSION  
RICE SCHEME

IRRIGATION BRANCH

CONSTRUCTION

PHOTOGRAPHS

IMPROVEMENT OF ROAD



BEFORE CONSTRUCTION



AFTER CONSTRUCTION

ROAD WORK



1. DIGGING DRAIN



2. LEVELING DUG SOIL

ROAD WORK



3. COMPACTING BY A TRACTOR

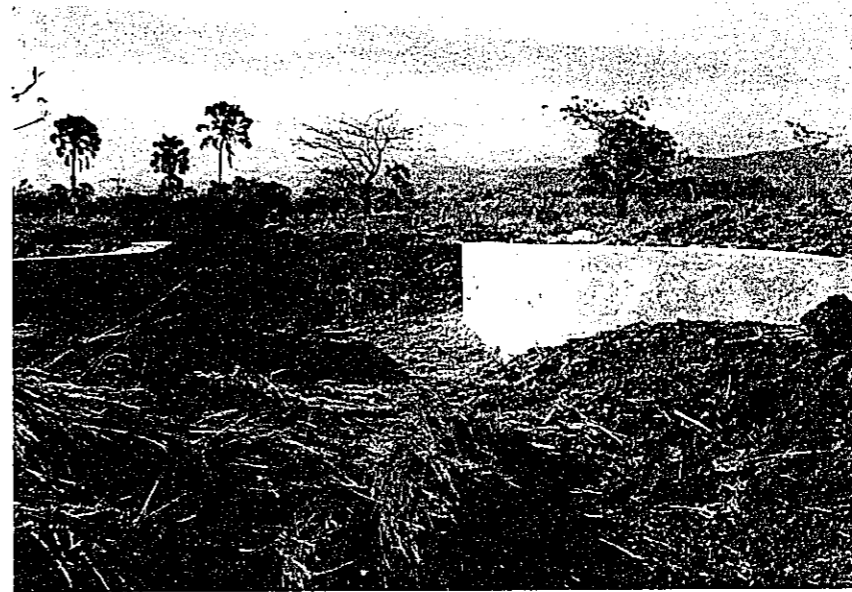


4. GRAVEL PAVEMENT

BRIDGE



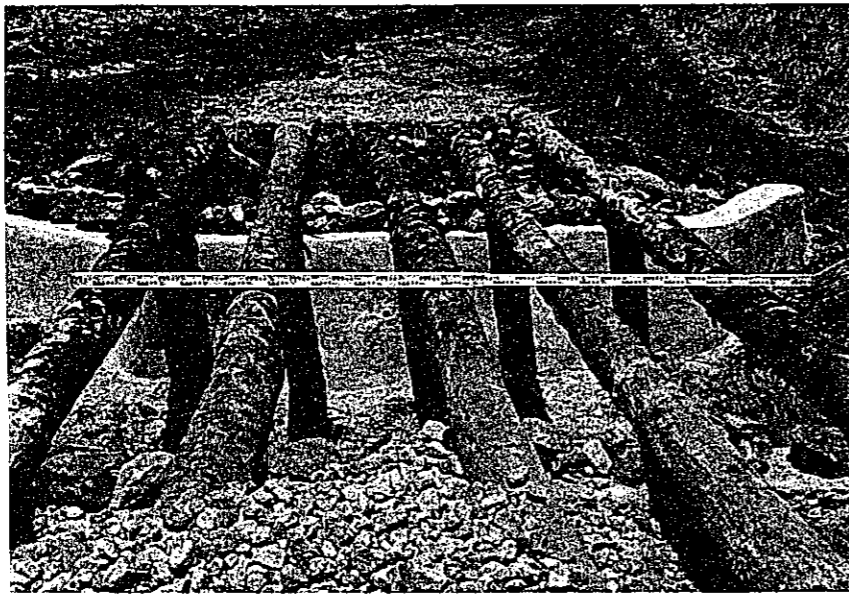
BEFORE CONSTRUCTION



1. BRIDGE FOUNDATION



BRIDGE

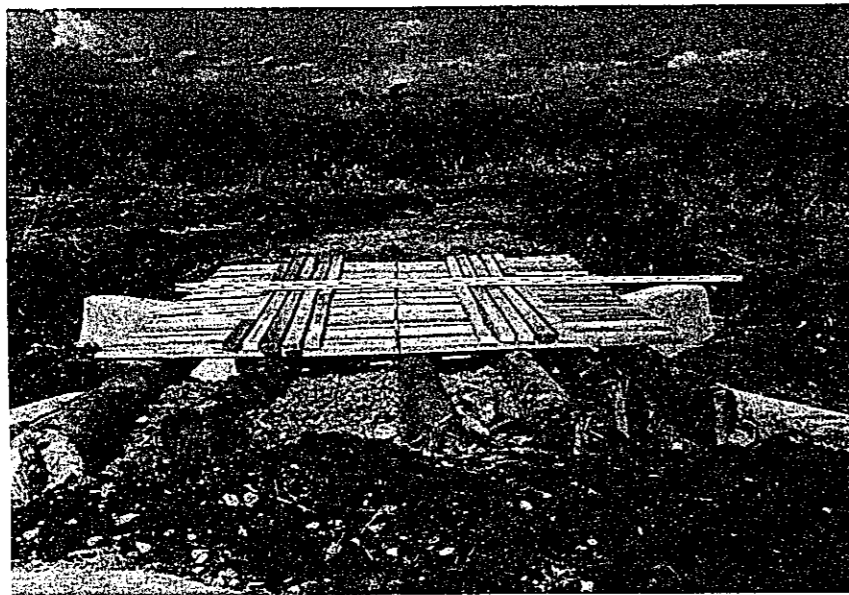


2. BASE FOR BRIDGE PLATFORM  
( COCONUT TREES )



3. SETTING BASE CONCRETE(8cm thick)

BRIDGE



4. BRIDGE PLATFORM



AFTER CONSTRUCTION

CROSS CULVERT No.1



BEFORE CONSTRUCTION

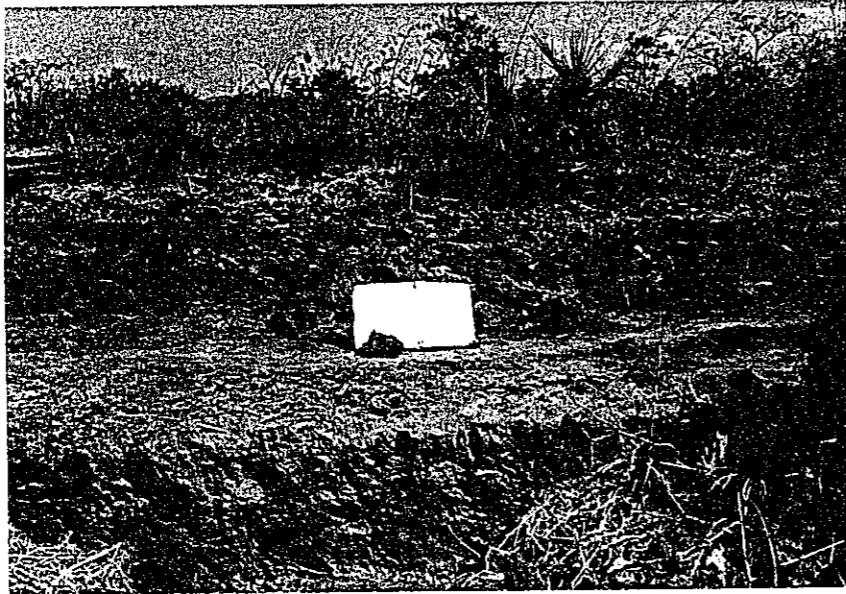


UNDER CONSTRUCTION



AFTER CONSTRUCTION

CROSS CULVERT No.2



BEFORE CONSTRUCTION



AFTER CONSTRUCTION

CROSS CULVERT No.3



BEFORE CONSTRUCTION

CROSS CULVERT No.3

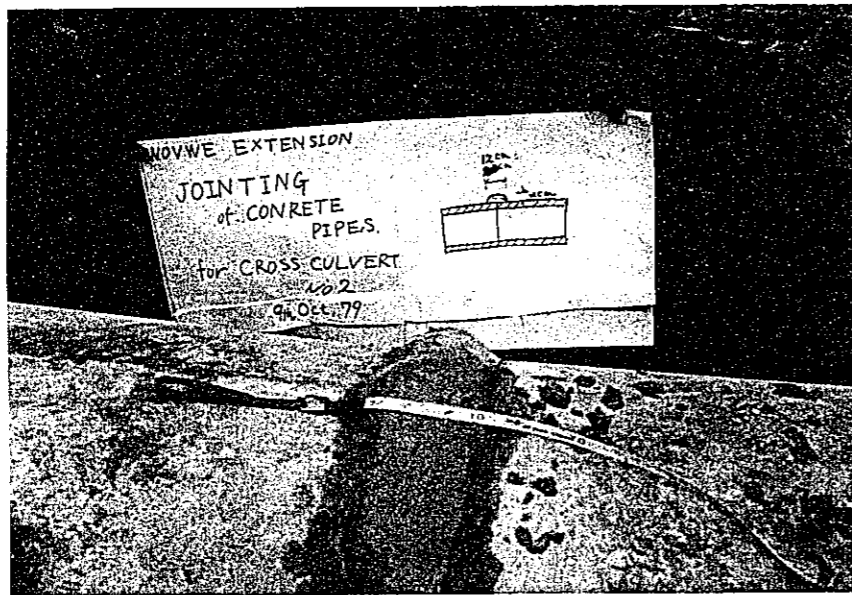


1. THE BASE



2. SETTING CONCRETE RINGS

CROSS CULVERT No.3

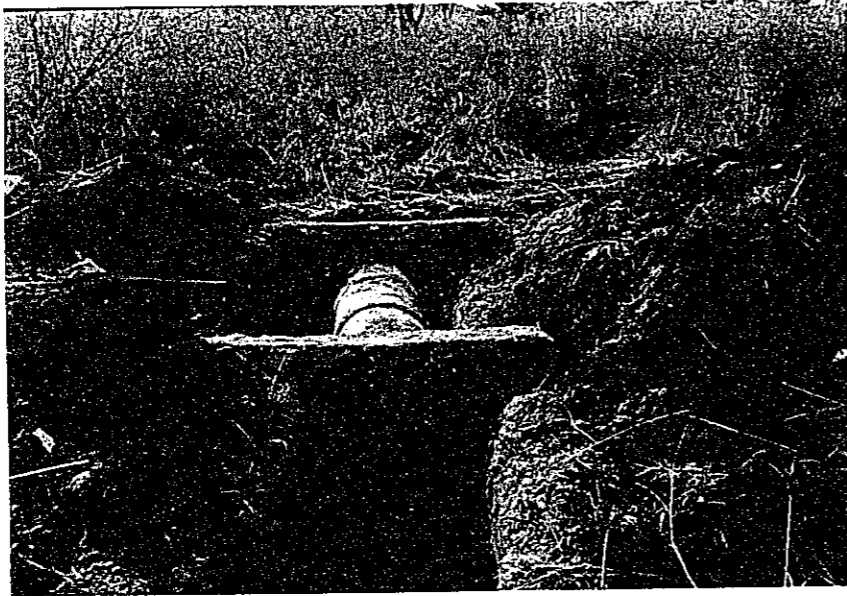


3. JOINTING WITH MORTAR



CURING WITH GRASS MAT

CROSS CULVERT No.3



5. STONE WORK



AFTER CONSTRUCTION



COLLECTING MATERIALS



PICKING UP STONES

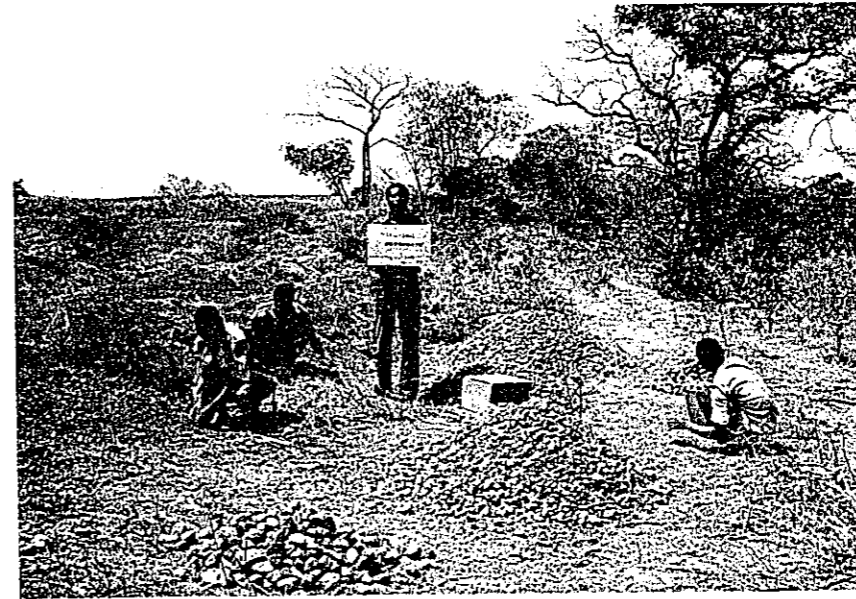


A SHORT CARRIAGE TO A TRACTOR  
AND LOADING

COLLECTING MATERIALS

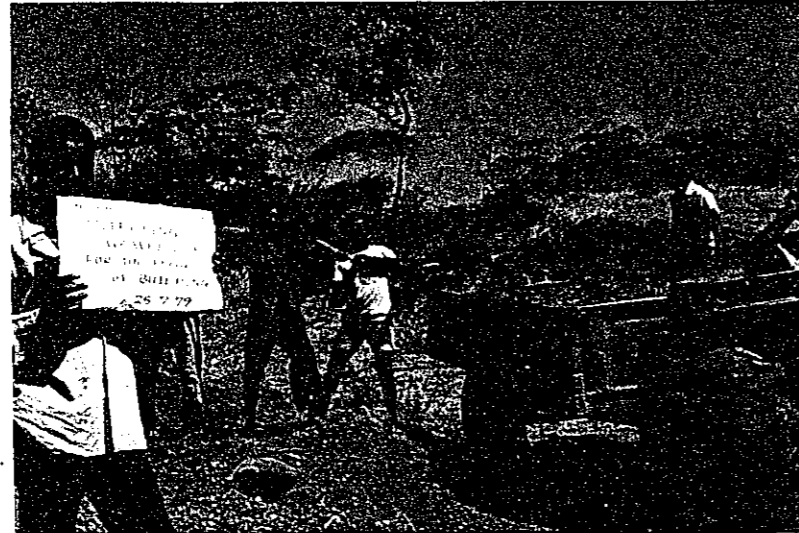


COLLECTING SITE FOR GRAVEL  
AND COARSE AGGREGATE

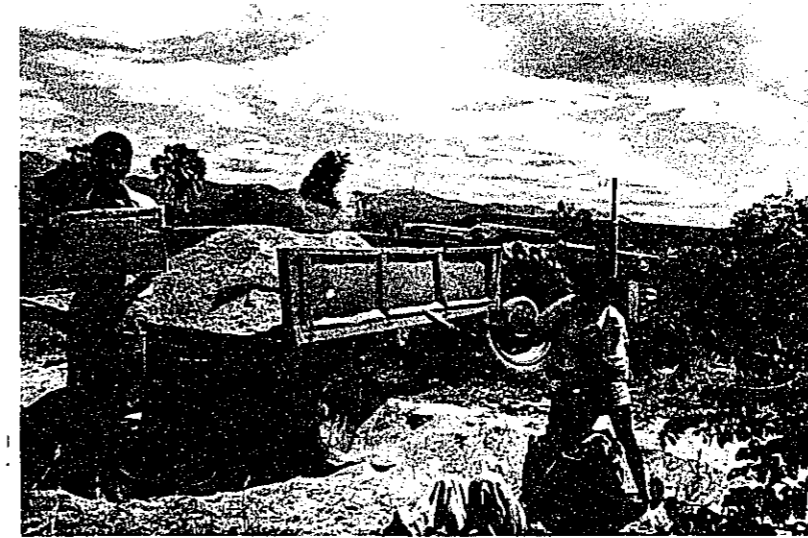


PICKING UP COARSE AGGREGATE

COLLECTING MATERIALS



COLLECTING GRAVEL



COLLECTING SAND

Ref. No.

19th March, 1981.

FROM : THE IRRIGATION ENGINEER(J.C.C.V.), P.O. BOX 591, LILONGWE.  
TO : THE PRINCIPAL IRRIGATION ENGINEER, P.O. BOX 591, LILONGWE.  
c.c. : The Chief Technical Officer(C), Hara/Kovwe Irrigation Schemes,  
P.O. Box 11, CHILWA.

WITH REGARD TO THE EXPENDITURE FOR  
"KOVWE EXTENSION RICE SCHEME"

I would like to report on the expenditure for "KOVWE EXTENSION RICE SCHEME".

For the Extension 3 types of work have been completed, and I have estimated the expenditure. The results are shown below:-

1. Topographic Surveying & Soil Examination(September, 1978 - December, 1978), Investigation(January, 1979 - March, 1979), & Surveying Extension Area according to the Proposal (May, 1979 - November, 1979).  
The Cost K5,000-00t
2. Improvement of the Road(June, 1979 - November, 1979)  
The Cost K2,150-00t
3. Building 3 Houses for T.A. Staff(May, 1979 - November, 1979)  
The Cost K4,890-00t

TOTAL COST                    K12,040-00t

Therefore, about K12,000-00t was spent on the preparation of the Extension Work.

To estimate the Items 2 & 3 Costs, I adopted the method which I was using before joining J.C.C.V.. In Japan all estimation is based on the "Efficiency Per Unit Work Rate" system which has been derived by Government. But in Malawi there is no data available to derive this efficiency, and if such data was available for estimation it must be evaluated before being taken as a guide for future estimation as Labour Costs are comparatively much reduced in Malawi. However, as I want to show Malawi's Building, Construction & Efficiency as a guide to the new volunteers who will come after I have left, I have made Estimation Sheets with Construction Photographs.

If you accept my ideas, please put them in the Branch's Library;

I would be very grateful,

Yours faithfully,

(H. Kamatori)  
IRRIGATION ENGINEER(J.C.C.V.)

HK:HEIM

# BILL OF QUANTITIES

Date 9th March, 198

Sheet 1 of 5

PROJECT IMPROVEMENT OF LCCAL ROAD

MILL NO. 1 OVERHEAD EXPENSE

ITEM No.	DESCRIPTION	UNIT PRICE NO.	QUANTITY	UNIT	RATE	K
	<u>GENERAL ITEMS</u>					
1.01	Tool Wear and Tear			Sum		34 41
1.02	Short carriage of materials, workers by tractor and Trailer on the site	0.09	700	miles	50t	350 00
1.03	Transport for Supervision, Construction and Communication for Engineer.			Sum		100 13
1.04	Transferring cost for Driver of Tractor			Sum		37 51
1.05	Surveying, Setting out of works and other small jobs					36 40
	Sub-Total					558 45
	<u>PROVISIONAL SUMS</u>					
1.06	Expenditure for contingencies			Sum		121 52
	<u>EXTRA ITEMS</u>					
1.07	Tractor and Trailer was based at Hara Scheme and had to return every week and before transferring to Kove Scheme.					
	16 trips x 46 miles	0.09	736	miles	50t	365 00
1.08	Concrete rings were carried by Dump Truck from Hara Scheme.	0.09	46	miles	50t	23 00
	Miscellaneous					2 03
	Total					1070 00

# BILL OF QUANTITIES

Date 9th March, 19

Sheet 2 of 5

PROJECT IMPROVEMENT OF LOCAL ROAD

## BILL NO. 2 CONSTRUCTIONAL ITEMS

ITEM No.	DESCRIPTION	UNIT PRICE NO.	QUANTITY	UNIT	RATE	K
<b>IMPROVEMENT OF ROAD</b>						
2.01	Trenching Gutter (Heavy clay) (618.2+594.8+72.5x2+26+2+ 56.2+2)x0.5x0.5+10 =	0.01	35.0	10m <sup>3</sup>	370t	129 50
2.02	Levelling the above dug soils (350-25.)+10=	0.06	32.5	10m <sup>3</sup>	40t	13 00
2.03	Compacting levelled soil 3 times by the Tractor (734.8-84.2)+1600x2x3=	0.09	2.44	miles	50t	1 22
2.04	Carriage of Gravel by Tractor, and Levelling (10% extra) 365.5x3mx0.10x1.10=	0.13	120.6	m <sup>3</sup>	130t	156 78
	Miscellaneous					0 50
	Sub-Total to Collection					301 00
<b>EXCAVATION OF DRAIN</b>						
2.05	Trenching Catchment drain of the Bridge (1x1x111.0+1.1x1.5x $\frac{1}{2}$ )+10	0.01	11.35	10m <sup>3</sup>	370t	42 00
2.06	Trenching Drain for No.2 Cross culvert 0.8x0.8x(15.5+8+2)+10=	0.01	1.25	10m <sup>3</sup>	370t	4 63
2.07	Trenching Drain for No.3 Cross Culvert 0.8x0.6x(71.8+25x $\frac{1}{2}$ )+10=	0.02	4.05	10m <sup>3</sup>	260t	10 53
	Miscellaneous					0 84
	Sub-Total to collection					58 00
<b>CONSTRUCTION OF BRIDGE</b>						
2.08	Cut soil behind the planned foundation of the Bridge (4x1x4+4x1x0.75)+10 =	0.01	0.7	10m <sup>3</sup>	370t	2 59
2.09	Scraping existing stone wall surface for jointing wall		1.0	man-days	25t	0 25
2.10	Labour cost for 30 cm thick vertical stone wall (1.0+0.6)x2.2+1.0x4.3=	0.21	7.82	m <sup>2</sup>	110t	8 60
2.11	Stone price for the above 7.82x0.30x1.20=	0.10	2.82	m <sup>3</sup>	430t	12 13
2.12	1:5 mix mortar for the above wet masonry work 7.82x0.3x0.50+	0.19	1.17	m <sup>3</sup>	2790t	32 64
	Carry forward to page 3					56 21

# BILL OF QUANTITIES

Date 9th March, 198

Sheet 3 of 5

PROJECT IMPROVEMENT OF LOCAL ROAD

## MILL NO.2 CONSTRUCTIONAL ITEMS

ITEM No.	DESCRIPTION	UNIT PRICE R.O.	QUANTITY	UNIT	RATE	K	L
	Brought forward from page 2.					56	21
2.13	Labour cost for Mortar surfacing 7.82x2+10	0.22	1.56	10m <sup>2</sup>	320t	4	99
2.14	1:5 mix mortar for surfacing 15.6x0.01x4.00	0.19	0.62	m <sup>3</sup>	2790	17	30
2.15	Stone price for back filling 1.x1.x4.0x1.2x2-	0.10	9.60	m <sup>3</sup>	430	41	28
2.16	Materials cost of Base concrete(10% extra) 1.x4.x0.08x2x1.10	0.17	0.70	m <sup>3</sup>	3420	23	94
2.17	Labour cost for mixing concrete work Labourers		5.0	man-days	25t	1	25
2.18	Labour cost for cutting, loading, unloading and installing 5 No. coconut trees. Leaders Labourers		4.0 40.0	man-days -do-	72t 25t	2 10	88 00
2.19	Carriage of coconut trees by Tractor & Trailer 7.5 miles x 5 trips	0.09	37.5	miles	50t	18	75
2.20	2"x4"x12' soft wood for frame		25	No.	330t	82	50
2.21	Carriage of soft wood from Mzusu by Land rover	0.07	250	miles	40t	100	00
2.22	4" long nails		9	lb	20t	1	80
2.23	Labour cost of installing soft wood on coconut trees with nails. Grade I Carpenter Labourers		7½ 1.0	man-hours man-days	48t 25t	3 0	60 25
2.24	Carriage of Gravel for banking by Tractor & Trailer. (2+2+1)x0.35x3.45x2- Miscellaneous	0.13	7.25	m <sup>3</sup>	130t	9	43
	Sub-Total to collection					0	82
	<u>CROSS CULVERT NO.1</u>					375	00
2.25	Labour cost for scraping surface of ground (20cm thick) 20m <sup>2</sup> x0.2+10-	0.01	0.4	10m <sup>3</sup>	370t	1	48
2.26	Levelling Culvert bed Leaders Labourers		1.0 8.0	man-days do	72t 25t	0 2	72 00
2.27	Price of concrete rings 1000mm ø	0.23	4.	No	2770t	110	80
2.28	Carriage of rings by Tractor & Trailer from Hara Scheme		(Account of Tractor's travel for every week end).				
2.29	Installing concrete rings	0.25	4.	No.	100t	4	00
	Carry forward to page 4.					119	00





## BILL OF QUANTITIES

Date 9th March, 1981.

PROJECT IMPROVEMENT OF LCCAL ROAD Sheet 5 of 5

ITEM NO.	DESCRIPTION	UNIT PRICE NO.	QUANTITY	UNIT	RATE	K	t
<b>BILL NO.2 CONSTRUCTIONAL ITEMS.</b>							
2.49	<u>CROSS CULVERT NO. 3</u> Trenching for culvert 0.8x0.5x(3.65+0.5x2)+10=	0.02	0.19	10m <sup>3</sup>	260t	0	49
2.50	Levelling bed Leaders Labourers		1.0	man-days	72t	0	72
			6.0	-do-	25t	1	50
2.51	Aggregate price for Bed and Filter (10% extra) 3.65x0.8x0.2x1.1+(0.8x0.8x0.3x0.3x3.14)x0.65x1.1=	0.11	0.92	m <sup>3</sup>	740t	6	81
2.52	Labour cost for Mortar surfacing 3.65x0.8x10=	0.22	0.29	10m <sup>2</sup>	320t	0	93
2.53	1:5 mix Mortar for surfacing 2.9x0.01x1.5=	0.19	0.04	m <sup>3</sup>	2790	1	12
2.54	Price of 500mm $\phi$ concrete rings	0.24	4	No.	1370	54	80
2.55	Carriage of rings by Tractor from Hara Scheme	(Account of Tractor's travel for every week end)					
2.56	Installing rings	0.26	4	No.	40t	1	60
2.57	Jointing rings	0.28	3	points	240t	7	20
2.58	Labour cost of 20 cm thick stone wall. (1.70x0.85-0.3x0.3x3.14)+2	0.20	2.32	m <sup>2</sup>	100t	2	32
2.59	Stones price for wall 2.32x0.2x1.2=	0.10	0.56	m <sup>3</sup>	430t	2	41
2.60	1:5 mix Mortar for wall 2.32x0.2x0.5=	0.19	0.23	m <sup>3</sup>	2790t	6	42
2.61	Labour cost for Back filling 1.9x0.8x10=	0.03	0.15	10m <sup>3</sup>	860t	1	29
2.62	Drawing water		(Omission)			0	39
	Miscellaneous					88	00
	Sub-Total to collection						
<b>COLLECTION</b>							
	IMPROVEMENT OF ROAD					301	00
	EXCAVATION OF DRAIN					58	00
	CONSTRUCTION OF BRIDGE					375	00
	CROSS CULVERT NO. 1					160	00
	CROSS CULVERT NO. 2					96	00
	CROSS CULVERT NO. 3					88	00
	MISCELLANEOUS					2	00
	<b>TOTAL</b>					1080	00

UNIT COST TABLES

NOTE:

1. These tables show how much the cost would be to complete one job.
2. "UNIT COST" is calculated from "Efficiency Per Unit Work Rate" and "Unit Price".
3. In the following tables "I.P." column is shown the "Item No." of "Efficiency Per Unit Work Rate" and "Unit Price Tables".

SUMMARY OF UNIT PRICE TABLES

ITEM NO.	DESCRIPTION	K	t
0.01	Trenching Per 10 m <sup>3</sup> for Dry Heavy Clay Soils	3	70
0.02	Trenching Per 10 m <sup>3</sup> for Wetter Clay Soils	2	60
0.03	Labour Cost of Backfilling Per 10 m <sup>3</sup> for Clay Soils	8	60
0.04	Labour Cost of Backing Per 10 m <sup>3</sup> for Clay Soils	2	10
0.05	Levelling Existing Road Bed Per 100 m <sup>2</sup>	0	30
0.06	Levelling Dug Soil of Dry Heavy Clay Per 10 m <sup>3</sup>	0	40
0.07	Land Rover's Cost Per Mile (Cid car)	0	40
0.08	Dump Truck's Cost Per Mile	0	50
0.09	Tractor & Trailer's Cost Per Mile	0	50
0.10	Unit Price of Stone Per 1 m <sup>3</sup>	4	30
0.11	Unit Price of Aggregate (Ø 50mm) Per 1 m <sup>3</sup>	7	40
0.12	Unit Price of Sand Per 1 m <sup>3</sup>	0	30
0.13	Unit Price of Gravel Per 1 m <sup>3</sup>	1	30
0.14	Carriage Cost of Dug Soil Per 1 m <sup>3</sup> for Banking	0	50
0.15	Unit Price of Water Per 1 m <sup>3</sup>	5	30
0.16	Materials Cost for 1 m <sup>3</sup> 1:2:4 mix Concrete (for rings)	45	40
0.17	Materials Cost for 1 m <sup>3</sup> 1:3:6 mix Concrete	34	20
0.18	Materials Cost for 1 m <sup>3</sup> 1:3 mix Mortar	39	60
0.19	Materials Cost for 1 m <sup>3</sup> 1:5 mix Mortar	27	90
0.20	Labour Cost for 20cm thick Vertical Stone Wall Per 1m <sup>2</sup> (Backfill type)	1	00
0.21	Labour Cost for 30cm thick Vertical Stone Wall Per 1m <sup>2</sup> (Backfill type)	1	10
0.22	Labour Cost for Mortar Surfacing on Stone Wall Per 10 m <sup>2</sup>	3	20
0.23	Unit Price of 1000mm Ø Casting Concrete Ring Per 1 No.	27	70
0.24	Unit Price of 500mm Ø Casting Concrete Ring Per 1 No.	13	70
0.25	Labour Cost for Installing 1000mm Ø Concrete Ring Per 1 No.	1	00
0.26	Labour Cost for Installing 500mm Ø Concrete Ring Per 1 No.	0	40
0.27	Jointing 1000mm Ø Rings Per 1 No.	5	20
0.28	Jointing 500mm Ø Rings Per 1 No.	2	40
0.29	Setting Up Pale Fencing Per 10m	4	00

# BILL OF QUANTITIES

Date 9th March, 1981.

PROJECT IMPROVEMENT OF LOCAL ROAD

Sheet 1 of 4

ITEM No.	DESCRIPTION	QUANTITY	UNIT	RATE	K	t
<b>I.F.</b>						
		TIES No. %				
0.01	<u>TRENCHING PER 10 m<sup>3</sup> FOR DRY HEAVY CLAY SOILS</u> Leaders Labourers Miscellaneous Total	0.14x10 1.06x10	man-days -do-	72t 25t	1 2 0 3	01 65 04 70
0.02	<u>TRENCHING PER 10 m<sup>3</sup> FOR MEDIUM CLAY SOILS</u> Leaders Labourers Miscellaneous Total	0.13x10 0.55x10	man-days -do-	72t 25t	0 1 0 2	94 63 03 60
0.03	<u>LABOUR COST OF BACK FILLING PER 10m<sup>3</sup> FOR CLAY SOILS</u> Leaders Labourers Miscellaneous Total	0.23x10 2.76x10	man-days -do-	72t 25t	1 6 0 8	66 90 04 60
0.04	<u>LABOUR COST OF BANKING PER 10 m<sup>3</sup> FOR CLAY SOILS</u> Leaders Labourers Miscellaneous Total	1.13 5.08	man-days -do-	72t 25t	0 1 0 2	81 27 02 10
0.05	<u>LEVELLING EXISTING ROAD BED PER 100m<sup>2</sup></u> Leaders Labourers Miscellaneous Total	0.07 0.76	man-days -do-	72t 25t	0 0 0 0	05 19 06 30
0.06	<u>LEVELLING DUG SOIL OF HEAVY CLAY PER 10 m<sup>3</sup></u> Leaders Labourers Miscellaneous Total	0.01x10 0.10x10	man-days -do-	72t 25t	0 0 0 0	07 25 08 40
0.07	<u>LAND ROVER'S COST PER MILE (Old car)</u> Petrol Drivers Maintenance Total	0.32 0.02x7½	1 man-hours sum	64.4t 27t	0 0 0 0	21 04 15 40
0.08	<u>DUMP TRUCK'S COST PER MILE</u> Diesel Drivers Assistants Maintenance Total	0.59 0.02x7½ 0.02	1 man-hours man-days sum	58.8t 27t 72t	0 0 0 0 0	35 04 01 10 50
0.09	<u>TRACTOR &amp; TRAILER'S COST PER MILE</u> Diesel Drivers Assistants Maintenance Total	0.42 0.04x7½ 0.05	1 man-hours man-days sum	58.8t 24t 72t	0 0 0 0 0	25 07 04 14 50

# BILL OF QUANTITIES

Date: 7 9th March, 1981

PROJECT: IMPROVEMENT OF LOCAL ROAD I.F. Sheet 2 of 4

ITEM No.	DESCRIPTION	UNIT PRICE NO.	QUANTITY	UNIT	RATE	K	I
0.10	<u>1 m<sup>3</sup></u> Collecting Leaders	∅ (i)	0.07	man-days	72t	0	05
	Labourers		1.45	man-days	25t	0	36
	Loading on & off (3 times per a day)	∅(v)					
	Leaders		0.22	-do-	72t	0	16
	Labourers		1.33	-do-	25t	0	33
	Carriage by Tractor & Trailer		6.7	miles	50t	3	35
	1.5m <sup>3</sup> /10 mile trip	0.09				0	07
	Miscellaneous						
	Total		7			4	40
0.11	<u>1 m<sup>3</sup></u> Collecting Leaders	∅ (i)	0.76	man-days	72t	0	55
	Labourers		11.66	man-days	25t	2	92
	Loading on & off (3 times per a day)	∅(v)					
	Leaders		0.22	man-days	72t	0	16
	Labourers		1.33	man-days	25t	0	33
	Carriage by Tractor & Trailer		6.7	miles	50t	3	35
	1.5m <sup>3</sup> /10 mile trip	0.09				0	09
	Miscellaneous						
	Total		7			7	40
0.12	<u>1 m<sup>3</sup></u> Loading on & off	∅(v)	0.5	man-days	25t	0	13
	Labourers						
	Carriage by Tractor & Trailer		0.3	miles	50t	0	15
	2m <sup>3</sup> /2 mile trip	0.09				0	02
	Miscellaneous						
	Total		0			0	30
0.13	<u>1 m<sup>3</sup></u> Loading on & off	∅(v)	0.08	man-days	72t	0	06
	(6 times per day)		0.67	-do-	25t	0	17
	Leaders						
	Labourers		2.00	miles	50t	1	00
	Carriage by Tractor & Trailer					0	07
	(6 trips per day)						
	2m <sup>3</sup> /4 mile trip	0.09				1	00
	Miscellaneous					0	07
	Total		1			1	30
0.14	<u>1 m<sup>3</sup></u> CARRIAGE COST OF DUG SOIL	∅(iv)	0.08	man-days	72t	0	06
	PER 1 m <sup>3</sup> FOR BANKING		0.67	man-days	25t	0	17
	Loading on & off						
	Leaders						
	Labourers		0.5	miles	50t	0	25
	Carriage by Tractor & Trailer					0	02
	(6 trips per a day)						
	2m <sup>3</sup> /2 mile trip					0	50
	Miscellaneous						

# BILL OF QUANTITIES

Date 9th March, 1981.

PROJECT IMPROVEMENT OF LOCAL ROAD

Sheet 3 of 4

ITEM NO.	DESCRIPTION	UNIT PRICE £0.	QUANTITY	UNIT	RATE	K	t
0.15	<u>UNIT PRICE OF WATER PER 1 m<sup>3</sup></u>	D(V)	1.0	man-days	25t	0	25
	Drawing Labourers						
	Carriage by Tractor & Trailer with 5 Drums						
	Miscellaneous						
Total							
0.16	<u>MATERIALS COST FOR 1 m<sup>3</sup> 1:2:4 MIX CONCRETE (for concrete rings)</u>	E(I)					
	Cement						
	Sand aggregate						
	Water						
	Miscellaneous						
Total							
0.17	<u>MATERIALS COST FOR 1 m<sup>3</sup> 1:3:6 MIX CONCRETE</u>	E(I)					
	Cement						
	Sand						
	Aggregate						
	Water						
Total							
0.18	<u>MATERIALS COST FOR 1 m<sup>3</sup> MIX MORTAR</u>	E(I)					
	Cement						
	Sand						
	Water						
	Miscellaneous						
Total							
0.19	<u>MATERIALS COST FOR 1 m<sup>3</sup> 1:5 MIX MORTAR</u>	E(I)					
	Cement						
	Sand						
	Water						
	Miscellaneous						
Total							
0.20	<u>LABOUR COST FOR 20CM THICK VERTICAL STONE WALL PER 1m<sup>2</sup> (Backfill type)</u>	F(III)					
	Bricklayers						
	Labourers						
	Miscellaneous						
Total							
0.21	<u>LABOUR COST FOR 30CM THICK VERTICAL STONE WALL PER 1m<sup>2</sup> (Backfill type)</u>	F(III)					
	Bricklayers						
	Labourers						
	Miscellaneous						
Total							
0.22	<u>MORTAR SURFACING ON STONE WALL PER 10 m<sup>2</sup></u>	F(V)					
	Bricklayers						
	Labourers						
Total							

# BILL OF QUANTITIES

Date 9th March, 198

PROJECT IMPROVEMENT OF LOCAL ROAD

Sheet 4 of 4

ITEM No.	DESCRIPTION	I.F. NO.	QUANTITY	UNIT	RATE	K	I
0.23	<u>UNIT PRICE OF 1000mm Ø CAST-ING CONCRETE RING PER 1 NO.</u>	H(i)					
	Bricklayers		0.50x7½	man-hours	27t	1	01
	Assistants		1.00	man-days	72t	0	72
	Labourers		3.00	-do-	25t	0	75
	1:2:4 mix concrete	0.16	0.28	m <sup>3</sup>	4540t	12	71
	B.R.C. Mesh		0.036	roll	31300t	11	27
	Oil		1.0	l	120t	1	20
Miscellaneous					0	04	
	<b>Total</b>					27	70
0.24	<u>UNIT PRICE OF 500mm Ø CASTING CONCRETE RING PER 1 NO.</u>	H(i)					
	Bricklayers		0.50x7½	man-hours	27t	1	01
	Assistants		1.00	man-days	72t	0	72
	Labourers		3.00	-do-	25t	0	75
	1:2:4 mix concrete		0.11	m <sup>3</sup>	4540t	4	99
	B.R.C. Mesh		0.018	roll	31300t	5	63
	Oil		0.5	l	120t	0	60
Miscellaneous					-	-	
	<b>Total</b>					13	70
0.25	<u>LABOUR COST FOR INSTALLING 1000mm Ø CONCRETE RING PER 1 NO.</u>	H(i)					
	Leaders		0.62	man-days	72t	0	45
	Labourers		1.90	-do-	25t	0	48
	Miscellaneous					0	07
	<b>Total</b>					1	00
0.26	<u>LABOUR COST FOR INSTALLING 500mm Ø CONCRETE RING PER 1 NO.</u>	H(i)					
	Leaders		0.11	man-days	72t	0	08
	Labourers		1.11	-do-	25t	0	28
	Miscellaneous					0	04
	<b>Total</b>					0	40
0.27	<u>JOINTING 1000mm Ø RINGS PER 1 NO.</u>	H(iii)					
	Cement		0.61	bags	550t	3	36
	Sand		0.04	m <sup>3</sup>	30t	0	01
	Grade III Bricklayers	0.12	0.67x7½	man-hours	24t	1	21
	Labourers		2.12	man-days	25t	0	53
	Miscellaneous					0	09
	<b>Total</b>					5	20
0.28	<u>JOINTING 500mm Ø RINGS PER 1 NO.</u>	H(ii)					
	Cement		0.34	bags	550t	1	87
	Sand		0.02	m <sup>3</sup>	30t	0	01
	Bricklayers		0.28	man-days	72t	0	20
	Labourers		1.15	-do-	25t	0	29
	Miscellaneous					0	03
	<b>Total</b>					2	40
0.29	<u>SETTING UP PALE FENCING PER 10m</u>	J(i)					
	Leaders		1.46	man-days	72t	1	05
	Labourers		11.67	-do-	25t	2	92
	Miscellaneous					0	03
	<b>Total</b>					4	00

BUILDING T.A. STAFF  
HOUSES FOR WOVWE  
RICE SCHEME (1979)

IRRIGATION BRANCH



CONSTRUCTION

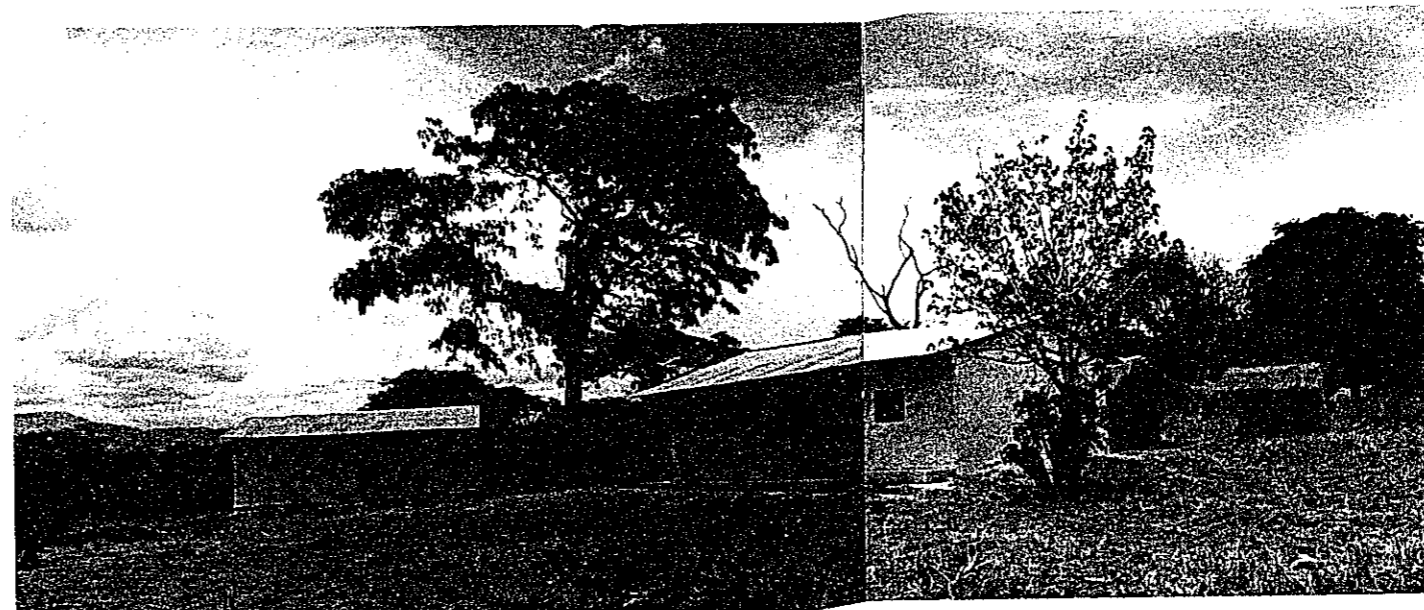
PHOTOGRAPHS

BUILDING OF STAFFS' HOUSE

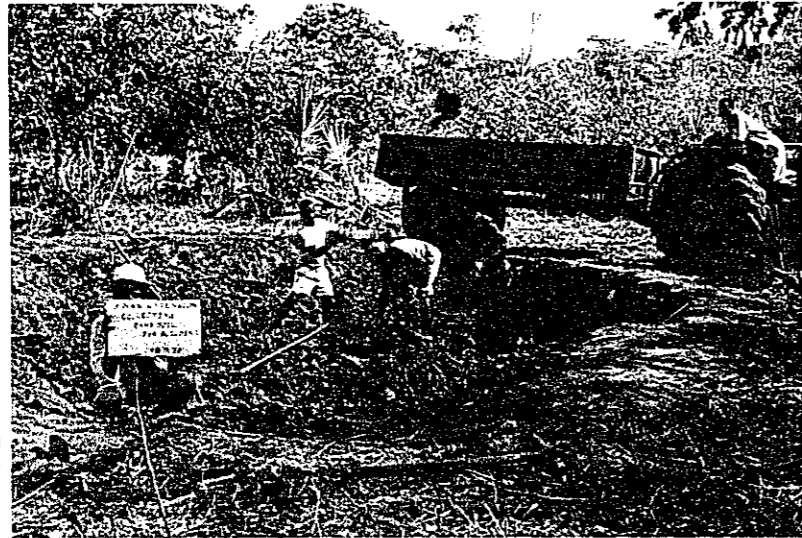
UNDER CONSTRUCTION  
(First stage)



AFTER CONSTRUCTION



MAKING MUD WALL



COLLECTING DAMBO SOIL



MIXING DAMBO SOIL WITH WATER

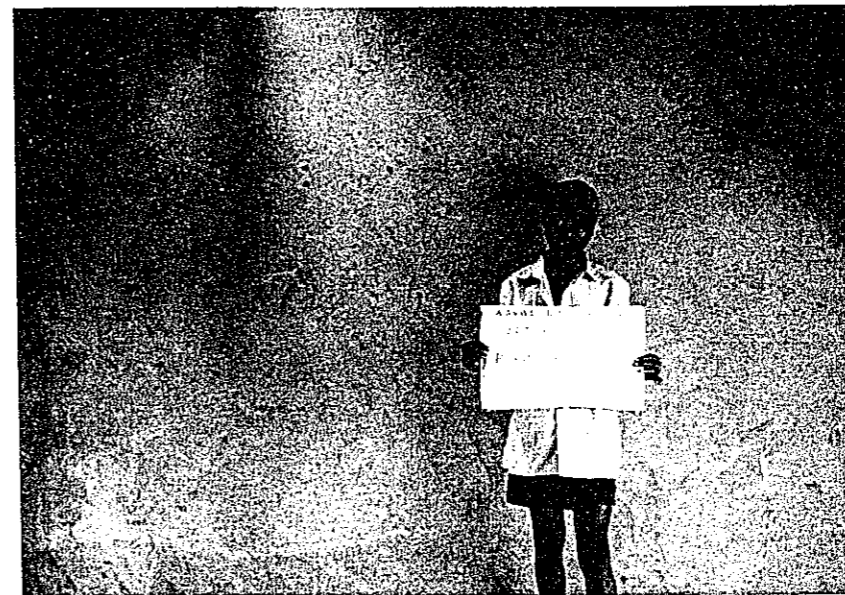
PLASTERING MUD WALL



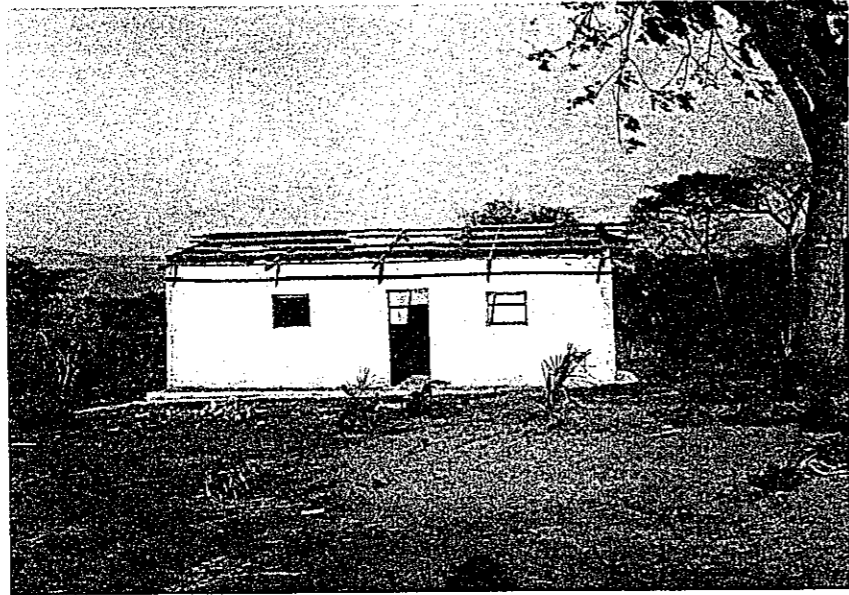
MORTAR PLASTERING FOR A WALL



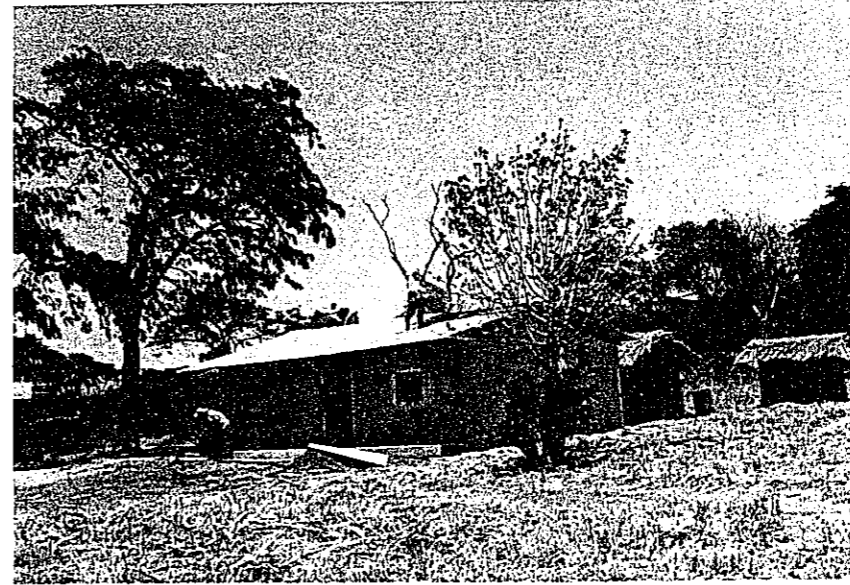
MORTAR PLASTERING ON A MUD WALL



AFTER PLASTERING

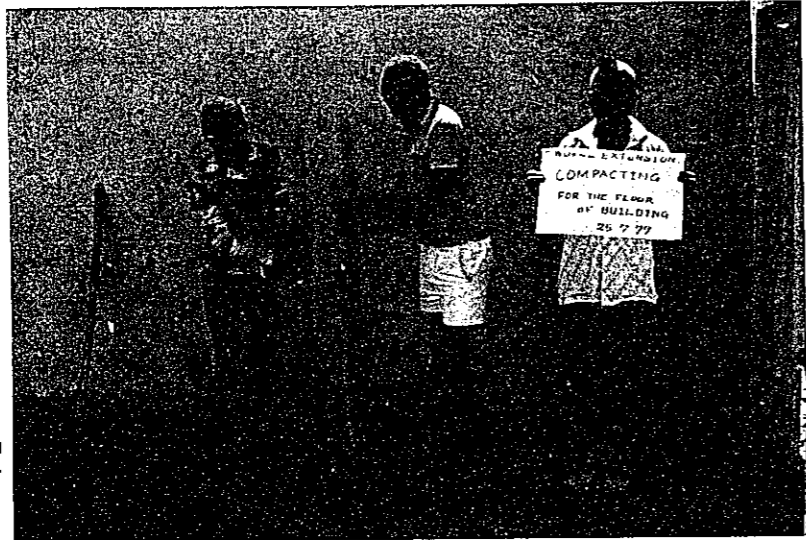


ROOF FRAMING

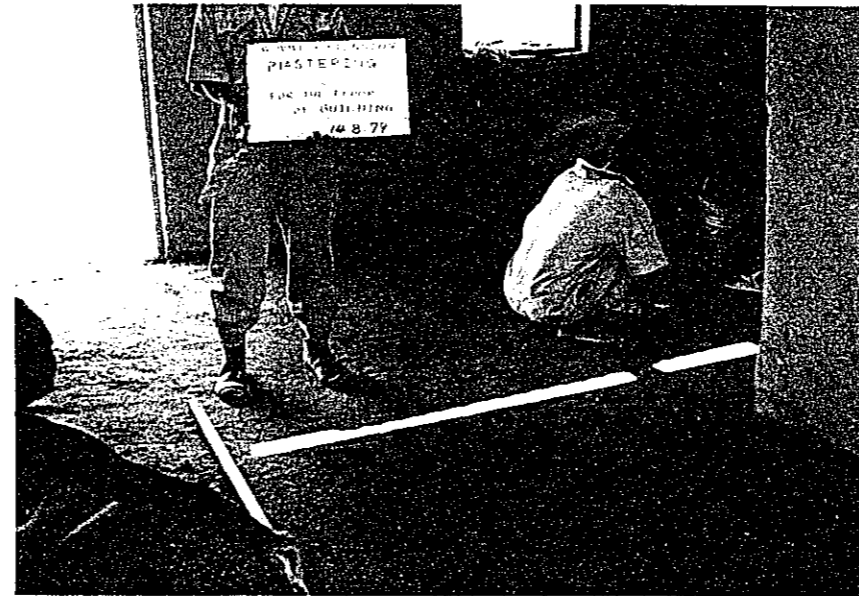


FIXING CORRUGATED SHEETS

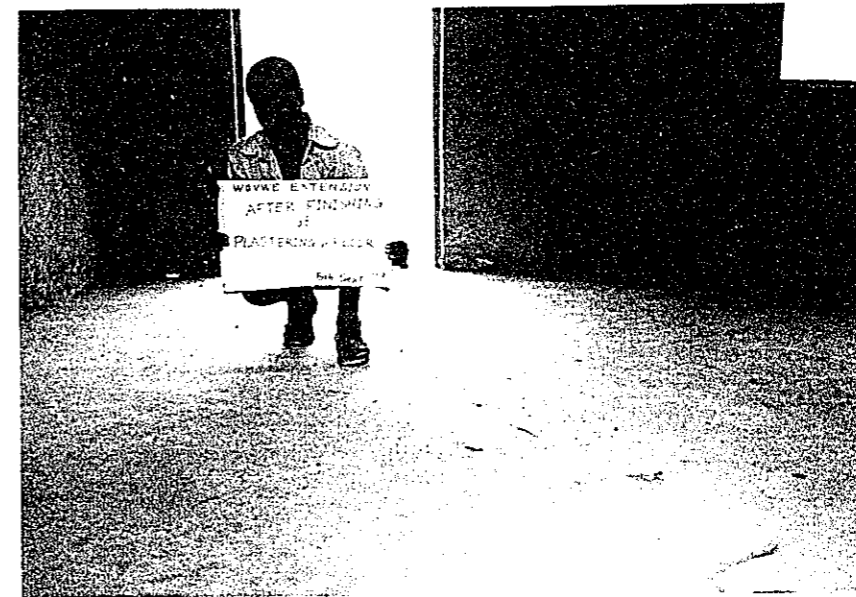
FLOOR



COMPACTING GRAVEL



MORTAR PLASTERING

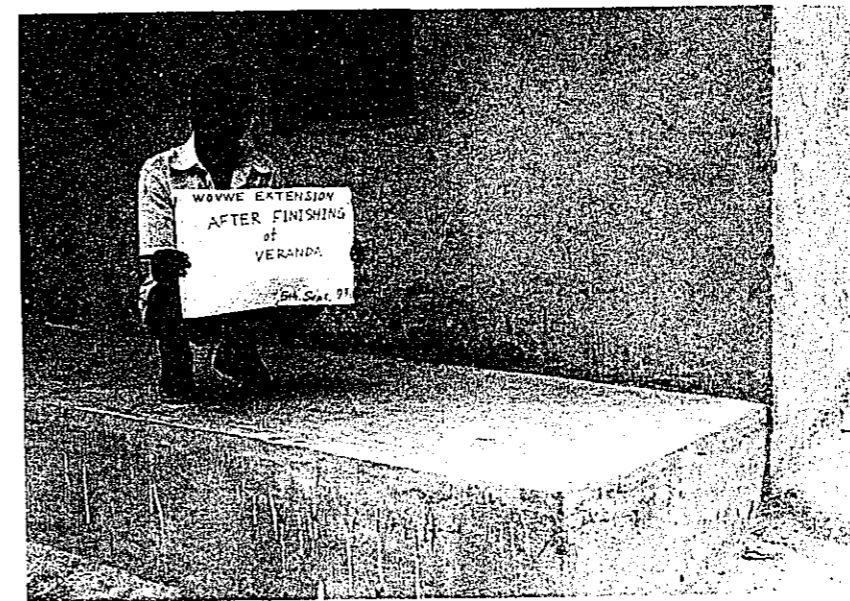


AFTER PLASTERING

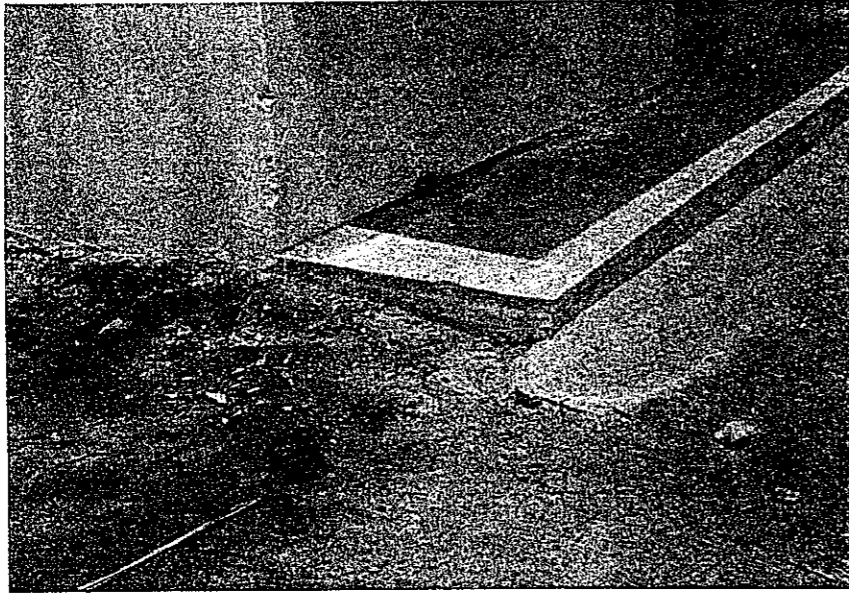
VERANDAH



UNDER CONSTRUCTION



AFTER CONSTRUCTION



DRAIN

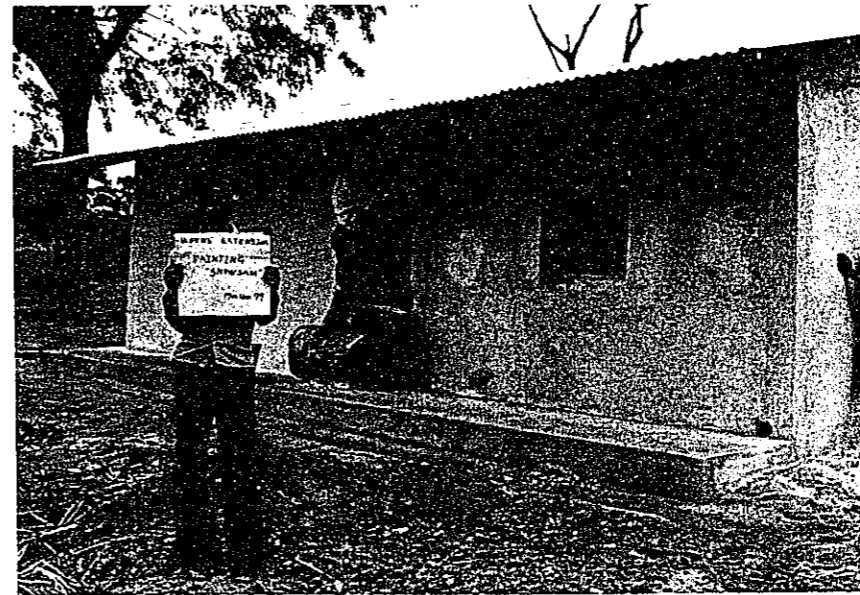


MORTAR FILLING



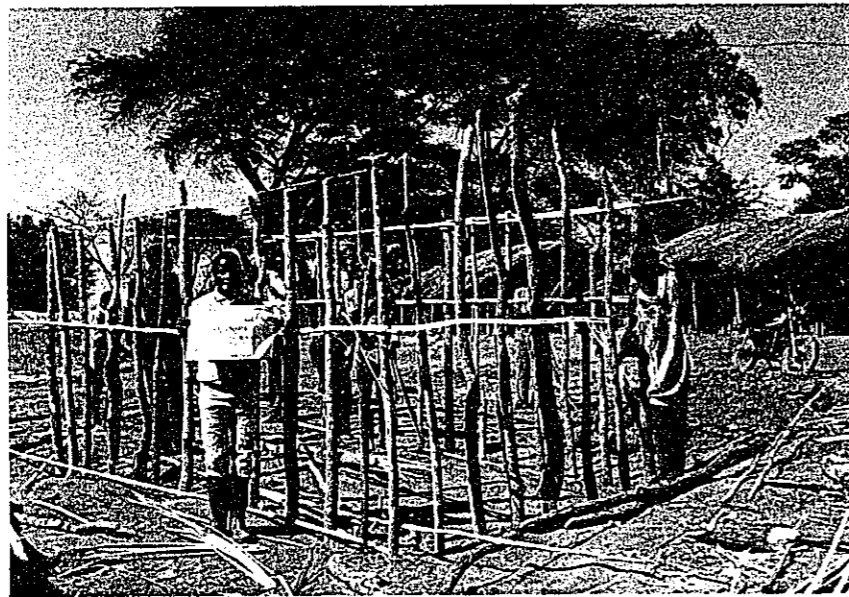


INSTALLING DOORS AND WINDOWS

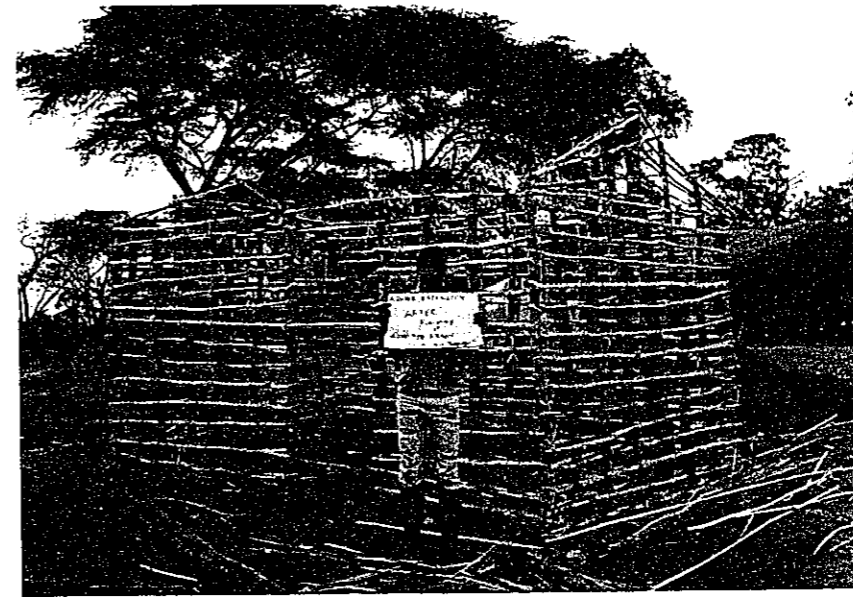


PAINING

KITCHEN

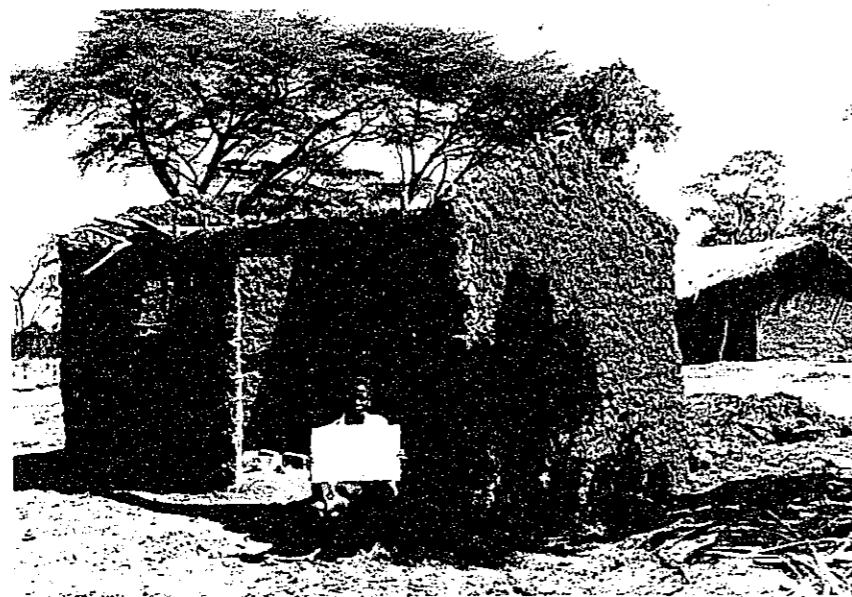


STANDING SUPPORTS

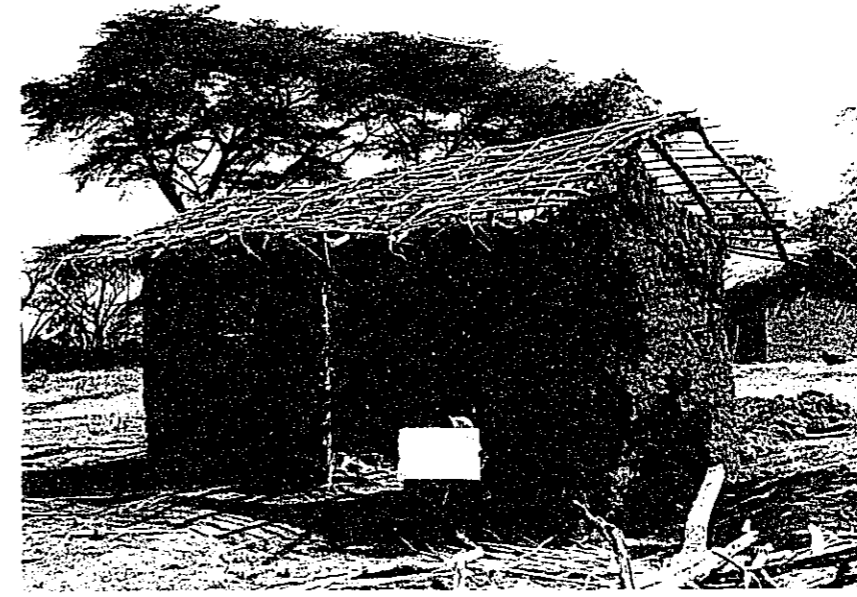


FRAME

KITCHEN



MUD WALL

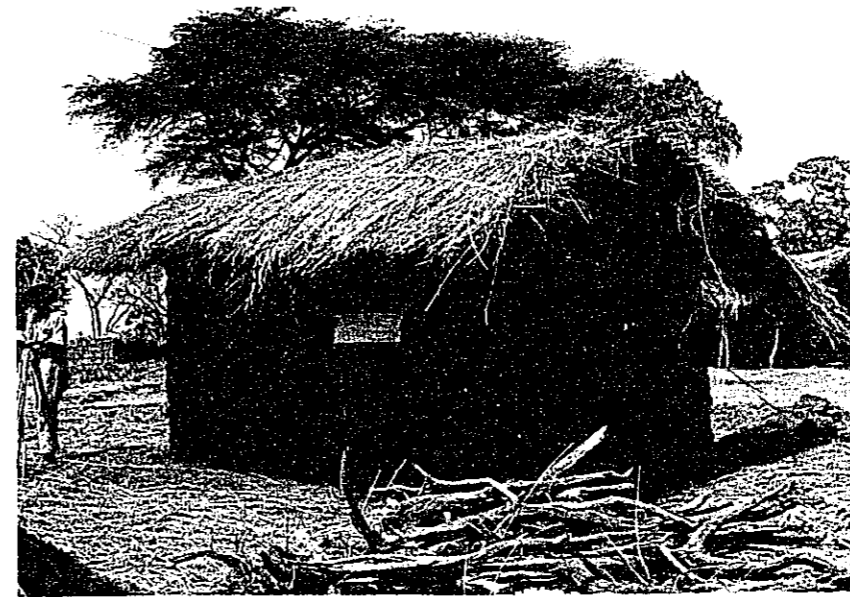


ROOF FRAME

KITCHEN



COVERING WITH GRASS



COMPLETION

PIT LATRINE

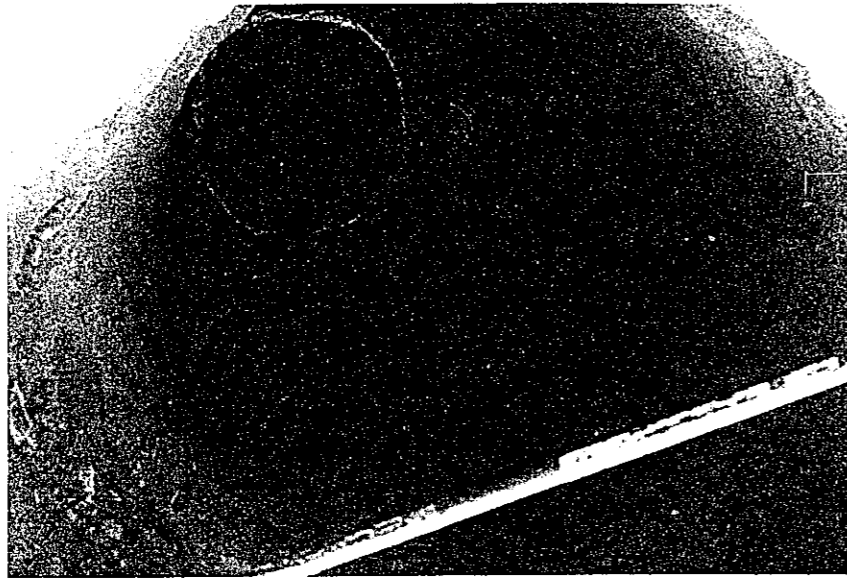


PIT



CUTTING DRUM TINS

PIT LATRINE



LAYING DRUM TINS

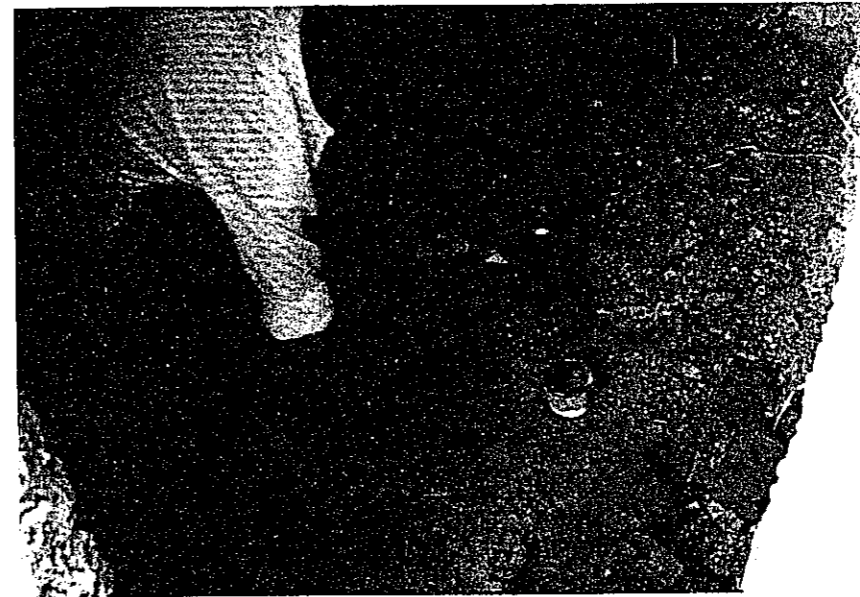


AFTER LAYING

PIT LATRINE

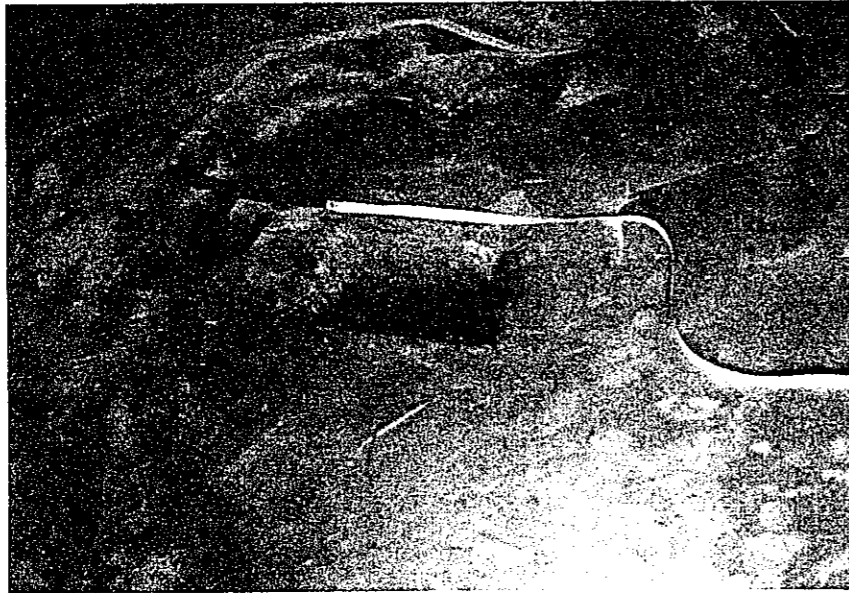


MAKING A HUT FOR PIT



PLASTERING THE PIT

PIT LATRINE



PIT



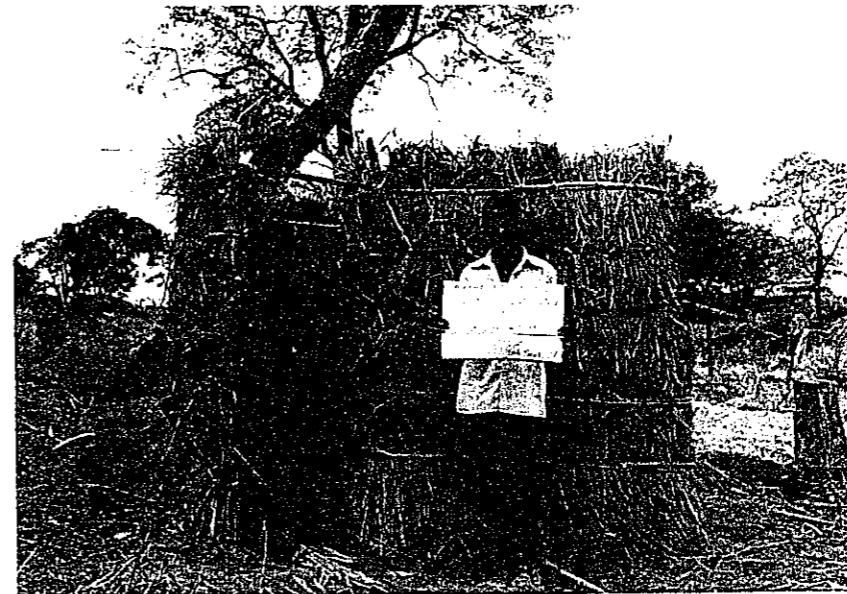
COMPLETION



BATH ROOM



FRAME



COMPLETION

COLLECTING MATERIALS



COLLECTING GRASS



COLLECTING DAMBO SAND FOR A WALL

BUILDING T.A. STAFF HOUSES  
FOR MOVIE RICE SCHEME

1. CONSTRUCTION COST FOR EACH HOUSE

OVERHEAD EXPENSES	K 310-00t
CONSTRUCTION COSTS	K 1320-00t
TOTAL	K 1630-00t

2. COST SUMMARY (for each House)

		PERCENT OF TOTAL COST
Labour	K 560-00t	(34.2%)
Materials	880-00	(54.4%)
Plant	190-00	(11.4%)
Total	K 1630-00t	(100.0%)

3. WORK SUMMARY

WORK

For accommodation of three Assistant Irrigation Officers.

CONSTRUCTION PERIOD

May, 1979 - November, 1979

LABOUR FORCE

1 GRADE II Bricklayer  
2 GRADE III Bricklayers  
1 NO GRADE Bricklayers  
10 Labourers

Cost Breakdowns are shown on the attached sheets.

(H. Kanamori)  
IRRIGATION ENGINEER (J.O.C.V.)

# BILL OF QUANTITIES

Date 1.1979.

PROJECT Building T.A. Staff House for Wovwe Scheme Sheet ..... of .....  
PILL NO. 1 OVERHEAD EXPENSES

ITEM No.	DESCRIPTION	UNIT	PRICE QUANTITY	RATE	K	t
			NO.			
	<u>GENERAL ITEMS</u>					
1.01	Absenteeism	Sum			15	30
1.02	Transport for carpenters from Para Scheme	Sum			35	88
1.03	Site clearance	Sum			8	29
1.04	Maintenance work on Wovwe Scheme	Sum			78	85
1.05	Bricklayers' Night Allowance	Sum			46	00
	<u>PROVISIONAL SUMS</u>					
1.06	contingents	Sum			80	28
	<u>EXTRA ITEMS</u>					
	Overtime work	Sum			44	66
	Miscellaneous				0	74
	Total				<u>310</u>	<u>00</u>

# BILL OF QUANTITIES

Date: 1979.

PROJECT: Building T.A. Staff House for Wovwe Scheme Sheet 1 of 1  
 BILL NO. 2 BUILDING ITEMS

ITEM No.	DESCRIPTION	UNIT PRICE NO.	QUANTITY	UNIT	RATE	K	I
<b>MAIN HOUSE</b>							
<b>WALL</b>							
2.01	Collecting Sticks	0.10	1.50	100 No	520t	12	39
2.02	Cutting Bamboo trees	0.11	2.30	100 No	200t	4	60
2.03	Carriage of Bamboo trees from Hara by Dump Truck	0.02	15.3	miles	50t	7	70
2.04	46miles + 3 houses Setting out Supprts (5.6+8.45)x2+2.15x2+5.60-(0.8x3+0.6)=	0.13	35.2	m	30t	10	86
2.05	Labour cost for framing 36.2mx(2.30+3.0)+2-	0.14	9.59	10m <sup>2</sup>	140	13	43
2.06	Plastering mud	0.15	0.96	100m <sup>2</sup>	4400t	42	24
2.07	Mortar surfacing on the mud wall (95.9-0.5x0.6x4)x2+100-	0.17	1.89	100m <sup>2</sup>	11620t	212	62
Sub-Total						310	75
<b>FLOOR</b>							
2.08	Carriage of Gravel (10% extra) 8.45x5.60x0.1x1.10-	0.07	5.20	m <sup>3</sup>	80t	4	16
2.09	Levelling & Compacting Floor	0.16	0.47	100m <sup>2</sup>	2910t	13	68
2.10	Mortar surfacing on Gravel Floor	0.18	0.47	100m <sup>2</sup>	13270t	52	37
2.11	Drawing water for compacting and Mortar mixing	0.09	0.30	m <sup>3</sup>	80t	0	24
Sub - Total						80	45
<b>DOOR, WINDOW</b>							
(Materials & the Carriage)							
2.12	Aluminium roofing sheet 2'x9'		6	No	1421t	65	26
2.13	Corrugated iron sheet 12' long		40	NP 820t	528t	331	20
2.14	Screw nails 3" long		16	1lb	67t	10	72
2.15	Washers		2	bag S	453t	9	36
2.16	Soft Wood 6"x2"x16'		16	To	330t	52	80
2.17	Adhesive for wood		1	tin	854t	2	85
2.18	Rings for Door & Window Knob		12	No	95t	10	20
2.19	Screw nails 1" long		2	No	425t	8	50
2.20	Wooden nails 4" long		1	lb	140t	1	40
2.21	Carriage of the above Materials by Dump Truck from Nzuzu to Wovwe (251+46)+ 3 houses=99 miles	0.02	99	miles	50t	49	50
2.22	Local Hard Wood for Doors & Windows 2"x9" Section 2"x4" Section		7	No	360t	25	20
			7	No	360t	25	20
2.23	Carriage of Hard Wood by Dump truck Hara-Chilumba-Hara 20 miles + 3 Houses (Labour Cost)	0.02	6.67	miles	50t	3	34
2.24	Processing Hard Woods Carpenters (GRADE III) Assistants		30x7½	Man-hours	27t	60	75
	Installing Frames for Roof, Door and Window		30	Man-days	72t	21	60
2.25	Carpenter (GRADE III) Labourers		6.5x7½	Man-hours	27t	13	16
	Installing roofing sheets		6.5	Man-days	25t	1	63
2.26	Carpenters (NO GRADE) Labourers		3.5	Man-days	72t	2	52
			3.5	Man-days	25t	0	88
Sub-Total						716	89

Carried forward to page 3.

## BILL OF QUANTITIES

Date ....., 1979.

PROJECT Building T.A. Staff Quarters for Wovwe Scheme Sheet 2 of .....

ITEM NO.	DESCRIPTION	UNIT PRICE	QUANTITY	UNIT	RATE	K	t
2.28	Brought Forward from page 1 NO. 1 Installing shutters for Door & Window Carpenter (V.B.E III)		1.5x7½	sq. ft.	574	716	67
	Sub-Total					719	71
<b>CONCRETE</b>							
<b>(Faruwa)</b>							
2.29	Labour cost of 23 cm thick stone wall for shutter (8.65x2)x0.2	0.21	2.13	m <sup>2</sup>	150t	3	20
2.30	Stones' price for the above 2.13x0.2x1.20x	0.05	0.51	m <sup>3</sup>	430t	2	19
2.31	1:5 mix Mortar for the above 2.13x0.2x0.5=	0.20	0.20	m <sup>3</sup>	3150t	6	26
2.32	Carriage of Gravel (10% extra) 1x8.65x0.1x1.1=	0.07	0.95	m <sup>3</sup>	80t	0	76
2.33	Leveling & Compacting Gravel 1x8.65x100	0.16	0.09	100m <sup>2</sup>	2310t	2	62
2.34	Mortar plastering on the Gravel carried for	0.18	0.09	100m <sup>2</sup>	13270t	11	94
2.35	Labour cost for Pitching (20.25x19.30)x0.5=	0.22	19.78	m <sup>2</sup>	30t	5	93
2.36	Stones' price 19.78x0.10x1.2=	0.05	2.37	m <sup>3</sup>	430t	10	19
2.37	1:5 mix Mortar 19.78x0.10x0.25	0.20	0.49	m <sup>3</sup>	3130t	15	34
	Sub-Total					58	43
<b>PAINTING</b>							
<b>(Hall)</b>							
2.38	Labour cost of painting snowmen	0.23	16.9	10m <sup>2</sup>	20t	3	78
2.39	Snowmen Cream colour		0.8	tin	3034t	24	27
	White colour		0.8	tin	3055t	24	44
2.40	(Door, Window) Labour cost of painting (0.8x1.65x2+0.5x0.6x4)x2=						
	5.04						
	(5.6+8.45)x2-0.8x2+(2.75x						
	2+5.6)x2-(0.8+0.6)x2=45.9						
2.41	45.9x0.15+5.04	0.24	1.19	10m <sup>2</sup>	80t	0	95
	Paint		0.15	tin	732t	1	19
	Black colour		0.11	tin	326t	1	08
	Blue colour						
	Sub-Total					55	71
	Sub - Total: Wall					310	75
	Floor					80	45
	Roof, Door, Window					719	71
	Others					58	43
	Painting					55	71
	Miscellaneous					0	95
	Total					1226	00
<b>KITCHEN</b>							
2.42	Collecting Sticks for wall	0.10	0.79	100 No.	820t	6	48
2.43	Cutting Bamboo trees	0.11	0.90	100 No.	200t	1	80
2.44	Carriage of Bamboo trees from Hara Scheme		(account of Tractor's travel for every weekend)				
2.45	Setting out for Supports (2.5x4.0)x2-0.7=	0.13	12.30	m	30t	3	69
2.46	Labour cost for framing wall 12.3x(2.3+2.5)+2- 0.5x0.6x2=	0.14	2.9	10m <sup>2</sup>	140t	4	06
	Carried forward to page 3					16	03

# BILL OF QUANTITIES

Date: ..... , 1979.

PROJECT Building T.A. Staff House for Wovwe Scheme Sheet 3 of .....

BILL NO. 2

ITEM NO.	DESCRIPTION	UNIT PRICE NO.	QUANTITY	UNIT	RATE	K	t
2.47	Brought Forward from page 2					16	03
2.48	Plastering mud Labour cost for framing roof 4.0x4.8+10= Thatching for roof 4.0x4.80	0.15 0.14 0.19	0.29 1.92 19.2	100m <sup>2</sup> 10m <sup>2</sup> m <sup>2</sup>	4400t 140t 30t	12 2 5	76 69 75
	Miscellaneous					0	76
	Total					38	00
<b>PIT LATHING</b>							
2.50	Collecting sticks for wall	0.10	0.40	100 0	300t	3	26
2.51	Cutting Bamboo trees	0.11	0.50	100 10	200t	1	00
2.52	Carriage of Bamboo trees from Hara Scheme		(account of tractor's travel for every week:5)				
2.53	Setting out for supports (2.0+1.6)x2-0.7=	0.13	6.50	m	30t	1	95
2.54	Labour cost for framing wall 6.50x2.0+10=	0.14	1.3	10m <sup>2</sup>	140t	1	82
2.55	Plastering mud	0.15	0.13	100m <sup>2</sup>	4100t	5	72
2.56	Labour cost for framing roof 2.8x2.6+10=	0.14	0.73	10m <sup>2</sup>	140t	1	02
2.57	Thatching for roof 2.8x2.6	0.19	7.28	m <sup>2</sup>	30t	2	18
<b>PIT</b>							
2.58	Digging a hole 0.7x3.14x2.70	3.04	1.15	m <sup>3</sup>	40t	1	56
2.59	Carriage of Drum tins by Dump truck from Hara 46 miles+3 houses	0.62	15.33	miles	50t	7	67
2.60	Carriage of Gravel (100 extra) 1.53x1.43x0.10x1.10+ (0.7x0.7-0.55x0.55+4)x3.14 x0.9x1.10	0.07	1.56	m <sup>3</sup>	80t	1	25
2.61	Stores' price for filling (0.7x0.7-0.55x0.55+4)x3.14x 1.2x1.2	0.05	1.87	m <sup>3</sup>	430t	8	04
2.62	Installing Drum tins, fill- ing and compacting Gravel Leaders Labourers		1.0 4.0	Man-days do	72t 25t	0 1	72 00
2.63	Mortar plastering on Gravel floor 1.83x1.43+100 Miscellaneous	0.16	0.03	100m <sup>2</sup>	13270t	3 0	98 71
	Total					42	00
<b>BATH ROOM</b>							
2.64	Collecting sticks for supports	0.10	0.30	100 10	800t	2	45
2.65	Cutting Bamboo trees	0.11	0.15	100 10	200t	0	30
2.66	Carriage of Bamboo trees from Hara Scheme		(account of tractor's travel for every week:5)				
2.67	Setting out for supports 2x4-0.7+1.0	0.13	3.3	m	30t	2	49
2.68	Crass work with framing Labourers Miscellaneous		4.0	Man-days	25t	1 0	00 75
	Total					7	00
<b>SUMMARY OF THE TOTALS</b>							
	MAIN HOUSE					1226	00
	KITCHEN					36	00
	PIT LATHING					42	00
	BATH ROOM					7	00
	MISCELLANEOUS					7	00

UNIT COST TABLES

NOTE:

1. These tables show how much the cost would be to complete one job.
2. "UNIT COST" is calculated from "Efficiency Per Unit Work Rate" and "Unit Price".
3. In the following tables "I.F." column is shown the "Item No." of "Efficiency Per Unit Work Rate" and "Unit Price Tables".



SUMMARY OF UNIT PRICE TABLES

ITEM NO.	DESCRIPTION	k	t
0.01	LAND ROVER'S COST PER MILE(Old car)	0	40
0.02	DUMP TRUCK'S COST PER MILE	0	50
0.03	TRACTOR & TRAILER'S COST PER MILE	0	50
0.04	DIGGERS & HOLE PER 1 m <sup>3</sup> IN SANDY SOILS	0	40
0.05	UNIT PRICE OF STONES PER 1 m <sup>3</sup>	4	30
0.06	UNIT PRICE OF SAND PER 1 m <sup>3</sup>	2	90
0.07	UNIT PRICE OF GRAVEL PER 1 m <sup>3</sup>	0	80
0.08	UNIT PRICE OF DAMBO SAND & DAMBO SOIL PER 1 m <sup>3</sup>	0	90
0.09	UNIT PRICE OF WATER PER 1 m <sup>3</sup>	0	80
0.10	UNIT PRICE OF STICKS PER 100 NO.	8	20
0.11	UNIT PRICE OF BAMBOO TREES PER 100 NO.	2	00
0.12	UNIT PRICE OF GRASS PER 100 BUNDLES	4	10
0.13	SETTING CUT FOR SUPPORTS PER 1m	0	30
0.14	LABOUR COST FOR FRAMING PER 10m <sup>2</sup>	1	40
0.15	UNIT PRICE OF MUD WALL PER 100m <sup>2</sup>	44	00
0.16	LABOUR COST OF LEVELLING & COMPACTING FLOOR 100m <sup>2</sup>	29	10
0.17	UNIT PRICE OF MORTAR SURFACING ON THE MUD WALL PER 100m <sup>2</sup>	116	20
0.18	UNIT PRICE OF MORTAR PLASTERING ON GRAVEL FLOOR PER 100m <sup>2</sup>	132	70
0.19	UNIT PRICE OF GRASS WORK PER 1 m <sup>2</sup>	0	30
0.20	MATERIALS COST FOR 1 m <sup>3</sup> 1:5 MIX MORTAR	31	30
0.21	LABOUR COST FOR 20 CM THICK VERTICAL STONE WALL FOR 1 m <sup>2</sup> (Backfill type)	1	50
0.22	LABOUR COST FOR STONE PITCHING PER 1 m <sup>2</sup>	0	30
0.23	LABOUR COST OF PAINTING A WALL(SHOWCEM) PER 10m <sup>2</sup>	0	20
0.24	LABOUR COST OF PAINTING FOR FLOOR, etc PER 10 m <sup>2</sup>	0	80



# BILL OF QUANTITIES

PROJECT BUILDING 7.A STAFF HOUSE FOR VOWE SCHEME Date ..... of .....  
 Sheet 2 of

## UNIT PRICE TABLES

ITEM No.	DESCRIPTION	I.P.	QUANTITY	UNIT	RATE	K	t
0.08	UNIT PRICE OF WATER PER 100 M <sup>3</sup>						
	Cutting & loading soils Leaders	D(V)	0.13+0.17	Man-days	72t	0	22
	Carriage by tractor & Trailer (3 trips per day) 1 mile + 2m <sup>3</sup> =		0.65+1.00	Man-days	25t	0	41
	Miscellaneous		0.5	mile	50t	0	25
	Total					0	90
0.09	UNIT PRICE OF WATER PER 1m <sup>3</sup>	D(V)					
	Drawing Labourers		1.0	Man-days	25t	0	25
	Carriage by tractor & Trailer with 5 Drum tins	0.03	1.0	mile	50t	0	50
	Miscellaneous					0	05
	Total					0	80
0.10	UNIT PRICE OF SPIGNS PER 100 M <sup>3</sup>	2-A(C)					
	Labour cost Leaders		3.09	Man-days	72t	2	22
	Labourers		13.90	Man-days	25t	3	48
	Carriage by tractor & Trailer	0.03	5.0	miles	50t	2	50
	Miscellaneous					-	-
	Total					8	20
0.11	UNIT PRICE OF TRACTOR PER 100 M <sup>3</sup>	2-A(C)					
	Labour cost Leaders		1.0	Man-days	72t	0	72
	Labourers		5.0	Man-days	25t	1	25
	Carriage by tractor & trailer (account on weekend travel from Here)					0	03
	Miscellaneous						
	Total					2	00
0.12	UNIT PRICE OF GRAES PER 1002-A(C)						
	Labour cost Leaders		5.36	Man-days	25t	1	34
	Labourers		5.46	miles	50t	2	73
	Carriage by tractor & Trailer 1.56 trips x 3.5 miles	0.03				0	03
	Miscellaneous						
	Total					4	10
0.13	SETTING OUT FOR SUPPORTS 2-A(G)						
	PER 1m Bricklayers		0.18	Man-days	72t	0	13
	Labourers		0.54	Man-days	25t	0	14
	Miscellaneous					0	03
	Total					0	30
0.14	LAY OUT COST FOR FENCING PER 1002-B(G)						
	10m <sup>2</sup> Bricklayers		0.55	Man-days	72t	0	40
	Labourers		3.62	Man-days	25t	0	91
	Miscellaneous					0	09
	Total					1	40
0.15	UNIT PRICE OF MUD WALL PER 2-B(G)						
	100m <sup>2</sup> Labour cost Bricklayers		9.83	Man-days	72t	7	08
	Labourers		33.08	Man-days	25t	14	52
	Materials Bambo Soil	0.08	15.52	m <sup>3</sup>	120t	18	62
	Water	0.09	4.70	m <sup>3</sup>	50t	3	76
	Miscellaneous					0	02
	Total					44	00

## BILL OF QUANTITIES

PROJECT: BUILDING T-4 STAFF HOUSE FOR ROYCE SCHEME Date: ..... Sheet 3 of .....  
 UNIT PRICE TABLE

ITEM No.	DESCRIPTION	I.F.	QUANTITY	UNIT	RATE	K	L
0.16	LABOUR COST FOR LEVELLING & COMPACTING FLOOR FOR 100m <sup>2</sup>	B(6)	10.20x7½	Man-hours	27t	20	66
	Bricklayers		33.58	Man-days	25t	8	40
	Labourers					0	04
	Miscellaneous					29	10
<b>Total</b>							
0.17	LABOUR COST FOR MORTAR SURFACING IN THE W/D WALL FOR 100m <sup>2</sup>	B(6)	15.06x7½	Man-hours	27t	32	52
	Bricklayers		40.11	Man-days	25t	10	03
	Labourers		11.63	bags	550t	63	97
	Cement		1.54	m <sup>3</sup>	90t	1	39
<b>Total</b>							
0.18	LABOUR COST FOR MORTAR PLASTERING ON GRAVEL FLOOR 100m <sup>2</sup>	B(6)	15.06x7½	Man-hours	27t	18	06
	Bricklayers		19.65	Man-days	25t	4	97
	Labourers		18.39	bags	550t	101	5
	Cement		2.43	m <sup>3</sup>	230t	7	05
<b>Total</b>							
0.19	UNIT PRICE OF GRASS ROCK FOR 1 m <sup>2</sup>	C(1)	0.24	Man-days	25t	0	06
	Labourers		5.40+100	100	410t	0	22
	Grass			barrels		0	02
	Miscellaneous					0	30
<b>Total</b>							
0.20	MATERIALS COST FOR 1 m <sup>3</sup> 1:5 mix concrete	E(1)	5.00	bags	550t	27	50
	Cement		1.10	m <sup>3</sup>	290t	3	19
	Sand		0.06	m <sup>3</sup>	80t	0	60
	Water		0.09			0	01
<b>Total</b>							
0.21	LABOUR COST FOR 20 CM THICK VERTICAL STONE WALL FOR 1m <sup>3</sup> (Back fill type)	F(1)	0.36x7½	Man-hours	27t	0	73
	Bricklayers		2.75	Man-days	25t	0	69
	Labourers					0	08
	Miscellaneous					1	50
<b>Total</b>							
0.22	LABOUR COST FOR STONE PITCH FOR 1 m <sup>2</sup>	F(1)	0.12	Man-days	78t	0	09
	Bricklayers		0.52	Man-days	25t	0	13
	Labourers					0	08
	Miscellaneous					0	30
<b>Total</b>							

# BILL OF QUANTITIES

PROJECT: BUILDING VIA STAFF HOUSE FOR 4074E SCHEME Date: \_\_\_\_\_ of \_\_\_\_\_  
 Sheet **4**

ITEM No.	DESCRIPTION	I.P.N.	QUANTITY	UNIT	RATE	K	t
0.23	LABOUR COST OF PAINTING A	2-C(11)					
	Wall (Sapwood) 1 to 10m <sup>2</sup>						
	Bricklayers		0.10	Man-days	72t	0	07
	Labourers		0.41	Man-days	25t	0	10
	Miscellaneous				0	03	
	Total				0	20	
0.24	LABOUR COST OF PAINTING	2-C(11)					
	ICA Ecol. etc per 13 <sup>2</sup>						
	Carpenters		0.56	Man-days	72t	0	40
	Labourers		1.40	Man-days	25t	0	35
	Miscellaneous				0	05	
	Total				0	80	

協力隊蔵書

