DEMARCATION AND LAND TENURE SURVEY OF A DAM RESERVOIR FOR COMPULSORY ACQUISITION

A Case Study of Gada Benye Irrigation-Cum-Water Supply Project at Benye Undertaken by Kaduna-Karaduwa River Basin and Rural Development Authority, Dutsin-Ma.

BY

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A Thesis submitted to the Postgraduate School, Ahmadu Bello University, in Partial fulfillment of the requirements for the conferment of the degree of Master of Science (M.Sc.) Honours in Land Surveying.

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August, 1987

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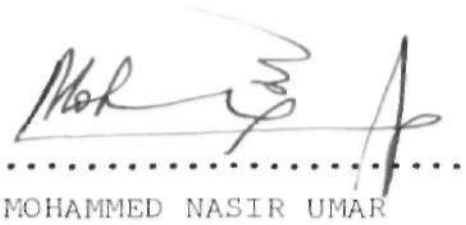
D E D I C A T I O N

This Thesis is dedicated first to the Almighty Allah, the source and giver of all knowledge. Then to my parents, brothers and sisters; as well as to the entire members of my family.

D E C L A R A T I O N

I hereby declare that this thesis is a record of my own research work and was composed by myself. This is a genuine and original work which has not been previously presented in this form.

All quotations are distinguished by quotation marks and the sources of information are specifically acknowledged.



MOHAMMED NASIR UMAR

(AUGUST, 1987)

C E R T I F I C A T I O N

This thesis entitled "DEMARCATION AND LAND TENURE SURVEY OF A DAM RESERVOIR FOR COMPULSORY ACQUISITION" BY MOHAMMED NASIRE UMAR meets the regulations governing the award of the degree of M.Sc. (LAND SURVEYING) of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation

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Member, Supervisory Committee	Date
Member, Supervisory Committee	Date
Head of Department	Date
Dean, Postgraduate School	16-2-88 Date

A C K N O W L E D G E M E N T

A study of this nature definitely involves the contributions of several persons, and I would not have been able to undertake this one, successfully, without the kind co-operation and enormous contributions of my able supervisor Professor N. J. Field, the Head of Surveying Department. I do sincerely wish to express my unalloyed gratitude to him for his factual help, entailing numerous useful suggestions and necessary guidance. Inspite of his heavy administrative and academic responsibilities, he still found time to read through the drafts and make very useful criticisms and suggestions which have contributed immensely to the quality of this thesis/project report.

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I wish to thank all those who in one form or the other, have contributed to the success of this thesis and whose names I cannot mention here because they are too many.

Finally, I am most grateful to the Al-mighty Allah for giveing me the strength and ability to complete this Thesis/Project Report on Schedule and as per specifications.

Any success which this thesis may eventually achieve will be due as much to the assistance which I have received from all friends and relatives as to my personal endeavours.

ABSTRACT

This study is concerned with identifying and determining individual owners or occupiers of the parcels of land to be inundated by the dam reservoir of Gada Benye Irrigation-cum-Water Supply Project in Kaduna State.

The Research was concerned mainly with the: -

1. Demarcation of the highest flood level of the reservoir.
2. Recording information for assessment of compensations for farms, economic trees and buildings which will be inundated and information for rehabilitations, resettlement or relocation of affected communities.

The nature and types of resettlement philosophies are highlighted. The evolution of land tenure systems in the Northern and Southern States is viewed and the issue of compensation for land compulsorily acquired by Government as provided in the Land Use Act is dealt with. Land tenure, acquisistions, transfer and Cadastral Survey Systems in Kaduna State are considered and a theoretical framework is established in order to appreciate prevailing land matters at the Benye dam reservoir.

Fieldwork involved tracing of contour line along the highest flood level, connection surveys for purpose of horizontal control extension points; perimeter traverse and levelling for demarcating and establishing horizontal and vertical control points; and finally, Land Tenure or Claim Survey for determining land ownership, rights to land,

use of land, occupiers and users.

On analyses of the data the following major findings are pertinent:-

1. 6 control extension points were established.
2. l82 property beacons were established. These can serve as horizontal control extension points for future surveys.
3- Ownership or acquisition of farmlands are largely through inheritance, gifts or purchase. Inheritance invariably leads to fragmentation of land.
4. Villages to be submerged by the dam are lienye, Barkiya, liirchi and Rawayan.
5- A total of 1,535 farm holdings were recorded covering an area of about 1,559-811 hectares.
6. Types and numbers of economic trees of each farm was recorded in the register and entitlement for each farmer computed.

The total amount of money required for compensation (in order to extinguish customary/statutory rights of occupancy) was computed but figures were not published for security reasons. Finally, the current provisions of the Land Use Act are grossly inadequate and would have to be reviewed drastically.

TABLE OF CONTENTS PAGE

CHAPTER

Title Page i

Declaration ii

Certification iii

Acknowledgements iv

Abstract viii

Table of Contents xii

List of Tables .....

List of Figures .....

List of Appendices .....

1. INTRODUCTION 1

1.1 A Brief Introduction 1

1.2 Background Information on the Project 4

1. The Purposes of Objectives of the Survey 5

1.4 Scope of Field Work 6

1.4.1 Boundary Demarcation, perimeter survey and levelling 6

1.4.2 Land Tenure Survey 7

1.5 Preliminary Analysis of Available Information 8

1.6 Pillar Numbers Allocated 11

1.7 Statutory Functions of River Basin 11

1.8 Definition of Special Terms 13

1.8.1 Customary Right of Occupancy 13

1.8.2 Developed Land 14

1.8.3 Easement 14

1.8.4	Holder	14
1.8.5	Improvements or unexhausted improvement	14
1.8.6	Occupier	15
1.8.7	Public Purposes	15
1.8.8	Statutory Right of Occupancy	16
1.8.9	Urban Area	16
1.8.10	Owner	16
1.8.11	Public Survey	16
1.8.12	Registrable Instrument	16
1.9	Significance of the Study	17
1.10	Justification for the Study	18
1.11	Layout of the Thesis	19

CHAPTER

2.	NATURE OF RESETTLEMENT PHILOSOPHY	23
2.1	Resettlement General	23
2.2	Basic Approach to Resettlement Schemes	23
2.3	Resettlement Options	26
2.3.1	Full Cash Compensation	27
2.3.2	Comprehensive Resettlement	27
2.3.3	Compromise	28
2.4	Alternative Strategy	28
2.5	Resettlement Features	30
2.5.1	Reservoir demarcation and land tenure survey	31
2.5.2	Comprehensive socio-enonomic survey/ demorgraphic survey	31
2.5.3	Identification and location of resettlement sites	31

2.5.4	Land clearing of the resettlement sites	32
2.5.5	Layout planning	32
2.5.6	Payment of compensations	32
2.5.7	Evacuation of displaced persons	32
3.	LAND TENURE SYSTEM IN NIGERIA	33
3.1	The Evolution of Land Tenure in the Northern States	33
3.2	The Evolution of Land Tenure in the Southern States	34
3.3	Background to the Land Use Decree, 1978	36
3.4	Earlier Statutes and the Issue of Compensation	38
3.5	Land Use Decree as it Affects Compensation	42
3.6	Compulsory Acquisition and Compensation	47
4.	LAND ADMINISTRATION IN KADUNA STATE	51
4.1	Land Tenure, Acquisitions and Transfers	51
4.2	Land Acquired for Government Projects	54
4.3	Problems of Land Rights of Women and Minors	57
4.4	Aro of Farmlands	58
4.5	Sale and Pledge of Land	59
4.6	Rates of Compensation	60
4.7	Allocation of Urban and Rural Plots	64
4.8	Cadastral Survey System	65
4.8.1	Survey procedures	65
4.8.2	Demarcation	67
4.8.3	The survey	67
4.8.4	Layouts	68

CHAPTER		
5.	RECONNAISANCE AND PLANNING	75
5.1	Reconnaisance	75
5.1.1	Checking map information	76
5.1.2	Inspection of existing controls	76
5.2	Planning	78
5.2.1	Accuracy considerations	78
5.2.2	Planning of control extension	79
5.2.3	Choice of instrumentation and survey methods	80
5.3	Preliminary checking of Instruments	81
5.3.1	The adjustment of line of sight	82
5.3.2	Adjustment for vertical collimation	83
5.4	Preliminary Analysis of Accuracy	84
5.4.1	Angular observations	85
5.4.2	Distance measurement	87
5.5	Statistical Analysis of Angular Observations	87
5.6	Station Description	90
5.7	Problems Encountered	92
6.	TRACING OF CONTOUR ALONG HIGHEST FLOOD LEVEL (HFL)	93
6.1	Establishment of Temporary Bench Mark (TBM)	93
6.1.1	Type I	93
6.1.2	Type II	93
6.2	Accuracy	94
6.3	Locating the Highest Flood Level (HFL) Points	95
6.4	Demarcation	95

CHAPTER

7.	CONNECTION SURVEYS	102
7.1	Vertical Controls	102
7.2	Horizontal Controls	103
7.3	Triangulation	105
7.3.1	Grades of Triangulation	106
7.4	Abstract of Adjusted Angles (From Field Book)	
7.5	Computation of Horizontal Control Points Using Analytical Method	109
7.5.1	Basic Principles	109
7.5.2	Check on use of contagngents	110
7.6	Computation of Horizontal controls	111
7.6.1	Co-ordinating FP 517	112
7.6.2	Computation of TP3 Co-ordinates (JAN KASA HILL)	114
7.6.3	Computation of TP2 Co-ordinates	115
7.6.4	Computation of PBKT 2976 co-ordinates	116
7.6.5	Co-ordinating PBKT 2977	117
7.6.6	Co-ordinating PBKT 2978	118
7.6.7	List of co-ordinate of control ext. points	119
8.	PERIMETER SURVEY AND LEVELLING	127
8.1	Perimeter Survey	127
8.2	Angle and Distance Measurement	127
8.3	Astronomical Observations	128
8.4	Traverse Computation	130
8.4.1	Deduction and correction of Azimuth (Grid Azimuth)	131

8.4.2	Computation of co-ordinates	131
8.4.3	Traverse Co-ordinate Adjustment	131
8.4.4	Computation of final Azimuth and distances	132
8.5	Traverse Accuracies	132
8.6	Area Computation	133
8.7	Location of the Position of the Angle Iron Post	133
8.8	Levelling of Boundary Beacons	133
8.9	Plotting	134
8.10	Field Technique for Angle and Distance Measurement	134
8.10.1	Distance measurement	135
8.11	Reduction of Distance	136
8.11.1	Atmospheric Correction	136
8.11.2	Reduction of mean-sea-level	136
8.12	Description and Instruction of the Use of DI 10	137
8.12.1	Functional Principle	137
8.12.2	Internal Calibration	137
8.12.3	The Instrument	138
8.12.4	Instruction for Use	138
8.12.5	Checking Calibration	139
8.12.6	Special Occurrence	139
8.13.	Sources of Errors in the Theodolite Traverse	140
8.13.1	Errors in the Measurement of Traverse Angles	140
8.13.2	Residual parallax	141
8.13.3	Observational errors	141

8.13.4	Errors due to normal causes	142
8.13.5	Personal bias	142
8.13.6	Adjustment procedure	143
8.13.7	Errors in distance measurement	143
8.14	Some sources of Errors in EDM Equipment	144
8.14.1	Frequency drift	144
8.14.2	Calibration and instrument constants	144
8.14.3	Ground swing errors	144
8.14.4	Errors due to inaccurate elevation differences	144
8.14.5	Refractive index error	145
8.14.6	Cyclic error	145
9.	LAND TENURE SURVEY	146
9.1	Concept involved	146
9.2	Methods of Survey	147
9.2.1	Annotations of existing topographic maps or earial photographs	148
9.2.2	Plan table	148
9.2.3	Compass and chain	149
9.2.4	Tacheometry and substense	150
9.2.5	Theodolite and tape	151
9.2.6	Air survey method by use of aerial mosaic	152
9.2.7	Small scale indexes	155
9.3	Identification and survey of farmlands	156
9.3.1	Method of survey	156
9.3.2	Description of the acquisition plans	158
9.3.3	Plotting the acquisition plans	160
9.3.4	Area computation and farm valuation	161

9.4	Farming	162
9.5	Land Acquisition	163
10.	SURVEY COSTS	166
10.1	Determining Factors	166
10.2	Categories of Surveys	167
10.2.1	Category A - Property surveys (including layouts)	167
10.2.2	Category B - Topographical surveys	167
10.2.3	Category C - Control surveys	167
10.2.4	Category D - Engineering surveys	168
10.2.5	Category E - Spacial surveys	168
10.3	Costing	168
10.4	Surveyors cost estimate for the Demarcation/Perimeter and Land Tenure of Gada Benye Project	169
10.4.1	Cost of the perimeter survey	170
10.4.2	Other costs	172
11.	SUMMARY AND CONCLUSION	175
11.1	Summary	175
11.2	Achievement of the study	179
11.3	Implications and Recommendations	183
11.3.1	On resettlement general	183
11.3.2	On implications of Land Survey Works under the Land Use Act	184
11.3.3	Problems met during the implementation of Land Use Act	187
11.5	Conclusion	190

LIST OF FIGURES

FIGURE		PAGE
1.	Stat on Description of SBM Kankiya	
2.	Station Description of SBM Charanchi	
3.	Part of Kaduna State Inteligence Sheet	
4.	A Sketch Plan to Accompany application for Plot	
5.	Plan of Land Granted by Government	
6.	Survey Plan	
7.	Sketch Plan of C. of O.	
8.	Horizontal Collimation Adjustment	
9.	Locating the Highest Flood Level (HFL)	
10.	Station MC 151	
11.	Station KF 12	
12.	Station FP 517(1)	
13.	Station FP 517(2)	
14,	Station TP1	
15.	Station TP2(1)	
16.	Station TP2(2)	
17.	Station TP3(1)	
18.	Station TP3(2)	
19.	Station KT 2976	
20.	Station KT 2977	
21.	Station KT 2978	
22.	Computation of Intersections Using Angles Method	
23.	Main Triangulation Scheme	
24.	Sub-Triangulation Scheme (i)	
25.	Sub-Triangulation Scheme (ii)	

FIGURE		DATE
26.	Co-ordinating FP 517	
27.	Computation of TP3 Co-ordinates	
28.	Computation of TP2 Co-ordinates	
29.	Computation of PBKT 2976 Co-ordinates	
30.	Co-ordinating PBKT 2977	
31.	Co-ordinating PBKT 2978	
32.	Co-ordinating	
33.	Computations of C-ordinates	
34.	Location of Angle Iron Posts with Respect to Boundary Beacons	
35.	Three Tripod system Used in the Measurement of angles.	
36.	Atmospheric Correction DI	

LIST OF TABLES

TABLE		DATE
1.	Co-ordinates of Existing Control Points	
2.	Station Description of aSBM Kankiya	
3.	Station Description of SBM Charanchi	
4.	Allocation of Pillar Numbers	
5.	Number and Percentage of Complaints by Respondents	
6.	Rates of Land Compensation	
7.	Rates for Crops Compensation	
8.	Numbers of Property Beacons	
9.	Co-ordinates of Property Beacons	
10.	Abstract of Adjusted Angles	
11.	Co-ordinates of Control Extension Points	
12.	Farmland owned and Cultivated	
13.	Cost of Demarcation and Land Tenure Survey	
14.	Details of Acquisition Plans	

CHAPTER I

I N T R O D U C T I O N

1.1 A Brief Introduction

One of the key functions of the River Basin and Rural Development Authorities in this country is to develop irrigated agriculture and for this purpose to undertake infrastructural works (such as dams, canals, pump stations, roads) and resettle persons affected by the works under special resettlement schemes. The issues raised by this function are essentially addressed to the circumstances of existing land holdership and land utilization structure. At the same time, the performance of such a function has to be in conformity with the various provisions of the Land Use Act.

Therefore, the title of this Thesis is "Demarcation and Land Tenure Survey of a Dam Reservoir for Compulsory Acquisition". It is an investigation into Land Tenure and Resettlement for areas impounded by a Dam Reservoir for Gada Benye Irrigation-Cum Water Supply Project in Kaduna State. The project is undertaken by Kaduna-Karaduwa River Basin and Rural Development Authority with Headquarters in Dutsinma. Such investigation has to be within a Regional and National context.

The Land Tenure Survey is intended as a census of fields, trees, crops and farmers, and is based

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either on the unit of use/the unit of ownership or the unit of management; it represents what is generally referred to as a "Utility Cadastre". The records do not necessarily identify the Land Owners unless it can assumed that the farmers are all owner-occupiers. In any case, a distinction has been made in the register as to whether occupier is "owner" or not. The Thesis has shown how it may be possible to enable the records compiled to mature into a register of title. Thus an attempt has been made to gain vital insights into the Land Tenurial Policy in Kaduna State; outlined and evaluated problems confronted in the acquisition of land.

As in all other countires, the character of the land tenure system in the North of Nigeria has evolved to a very large extent from the community's responses to economic change over long periods of time. The implementation of the irrigation project has had a sudden and dramatic impact on the local agricultural economy and the success on the project depends on bringing about tenurial changes to suit the new circumstances. To do this by a River Basin Authority is difficult because the formation of land policy is a state responsibilities whereas the project itself is being mounted by a River Basin Authority which as a Federal Agency has no jurisdiction over the land affected. Furthermore, by virture of the nature and strength of

the private rights which have emerged, even the jurisdiction of the state (or local Government) is limited. The thesis makes a detailed analysis of this complex situation and seeks to resolved the impasse. All these have to do with the Cadastre component of the Thesis.

On the Cadastral Surveying aspect, the thesis deals with carrying out the Highest Flood Level (HFL) contour tracing, perimeter and Land Tenure Survey of Gada Benye Reservoir. The Author, who is also the Chief Surveyor of the River Basin is the overall co-ordinator for the survey project. As a matter of fact, he has been involved in this type of projects since 1976 when he joined as Surveyor II. The project area is located at Benye along the Katsina-Malumfachi road in Dutsin-Ma Local Government Area. The total reservoir area surveyed is 2,175 hectares. The highest flood level contour was traced and demarcated with angle iron posts. The reservoir boundary was demarcated with concrete beacons at an average distance of about 30m away from the highest flood level contour to prevent them from being submerged after dam construction. The HFL contour and the heights of the boundary beacons were determined within a third order accuracy and connected to standard bench mark (SBM) Charanchi.

The boundary survey was connected to first and second order control points and it attained an accuracy

of 1:40,000. The survey of the farm plots within the reservoir boundary was done by the plane table and the compass traverse methods. A total of 1,535 farm holdings were surveyed. A schedule of holding and compensations for farm-land and economic trees were computed for each farmland.

Finally, the thesis attempts to delineate conceptual limitations and functional shortcomings. It also seeks to proffer recommendations on substanctive provisions and implementation methodology and conclusions drawn thereof.

1.2 Background Information on the Project

Irrigation projects which aim at development of water resources in the Northern part of Katsina Emirate of Kaduna State were transferred to the Sokoto Rima Basin Development Authority (SRBDA) by Kaduna State Government after its formation in 1975. These projects were included in the Third National Development Plan (1975-80). The project are:

(i) Jibia Irrigation-Cum-Water Supply Scheme

(ii) Gada Benye Irrigation-Cum-Water Supply Scheme

(iii) Kurfi Water Supply Scheme

(iv) Fakuwa-Cheranchi Water Supply Scheme

(v) Ruma Water Supply Scheme.

For the purpose at hand, we are only concerned with Gada Benye Irrigation-Cum-Water Supply Scheme. This is located about 30km South West of Katsina on the Katsina-Malumfashi Road. The p pose of the Scheme is development of irrigated agriculture and supply of potable water to the village in the vicinity of the project area. It has been purposed to develop a total area of about 2,500 hectares for growing food and fibre crops throughout the year (Wakuti 1976). Substantial development of livestock and diary products is also expected (over 1 million litres of milk production/in the 10th year). The average income of farmers is expected to go up from ₦460 per annum to ₦4,300 per annum (nine fold increase) after 10 years of project implementation (Wakuti 1976). It is estimated to distribute potable water to a population of 87,000 people in the year 1975.

1.3 The Purposes or Objectives of the Survey

The survey project involved in this phase of the Gada-Benye Irrigation-Cum-Water Supply project aims at demarcating the highest flood level of the reservoir, record for assessment of compensation of the farmland, economic trees and buildings which will be inundated and gather further information relevant towards the rehabilitation, resettlement/or relocation of the affected communities.

The survey is primarily a land tenure survey (acquisition survey, claims survey or compensation survey). A given contour (510 meters) is traced on the ground. The area enclosed by it is then subdivided and surveyed according to the existing land tenure and other unsufract rights prevailing on it at the time of the survey. The results of the survey will be used jointly by Kaduna State Government Katsina and Dutsin-Ma Local Government along with other data to extinguish any customary and/or statutory rights of occupancy in existence, and to confer on and enable Kaduna Karaduwa River Basin and Rural Development Authority (KKRB & RDA) to establish its own unimpeachable title over the said parcel of land. The area within the traced contour, which represents the established highest flood level of the Gada and Sanka Rivers will form the land parcel likely to be flooded by the proposed dam. The parcels adjacent to the dam site (i.e. downstream) will be irrigated by canals using gravity method.

1.4 Scope of Field Work

1.4.1 Boundary demarcation, perimeter survey and levelling

(a) The reservoir area (about 2,000 hectares) enclosed by contour 510m (based on National Datum) was demarcated by permanent survey beacons fixed at suitable intervals not exceeding 200 meter along the reservoir boundary. The location of the beacons

was referenced to the National Framework and Heights Surveyed to second order accuracy.

(b) The reservoir boundary survey was done along the highest flood level (H.F.L) of (MSL) which had been earlier determined to be the contour 510.0 meters.

(c) The above survey was repeated to trace the normal level (NPL) along Gada River.

(d) The results of this survey was then ploted at a horizontal scale of 1:2500 and the area enclosed by the reservoir computed. The location and elevation of survey beacons were also indicated.

1.4.2 Land tenure survey

(a) All existing farm holdings identified, located and surveyed with reference to the reservoir boundary.

(b) Register and identity cards of the farm owners were prepared in respect of each farm holding to show holding identification numbers, types and sizes of buildings and other structures and and owners name and photograph.

(c) A schedule of farm-holdings and entitlements for each individual farmer for compensation of farmlands, economic trees, structure was prepared for the purposes of payment of compensation and/or resettlement.

1.5 Preliminary Analysis of Available Information

A request to the Federal Survey Department Office in Kaduna South provided information on existing survey control as follows:-

(a) Maps-Topographic
(KATSINA SW-SHEET 34W and RUMA SE-SHEET 43 SE).

(b) Horizontal controls, first and second order trigonometric stations.

	NORTHINGS (Meters)	EASTINGS (Meters)
MC 151	1 382 213.313	346 751.538
MC 152	1 392 421.528	364 468.065
KE 11	1 418 564.839	344 851.522
KF 12	1 399 800.091	334 934.254
KF 13	1 386 216.422	344 999.016
KF 14	1 377 232.643	336 585.993
KF 16	1 380 604.620	377 076.956
KF 17	1 393 853.113	372 541.409
KF 18	1 400 850.334	363 635.511
KF 19	1 406 741.984	356 082.574

Table 1: Co-ordinates of existing control points

(c) Benchmarks

SBM Katsina to SBM Charanchi

SBM Charanchi to SBM Kankiya

SBM Kankiya to SBM Yashe

SBM Yashe to SBM Kuchi

In addition, the survey descriptions of SBM's Charanchi and Kankiya, complete with compass bearings and distances to and from natural landmarks in their immediate environs were obtained. These are shown in Table 2 and Figure 1 for SBM Kankiya and also Table 3 and Figure 2 for SBM Charanchi

SBM KANKIYA 1798.1027 Feet above sea level.

Point	Reference Marks	Bearings	Distance
1	Electric Pole with Transformer SBM	328°00'	22.35 meters
2	Blazed tree SBM	342°30'	27.0 meters
3	Electric Pole SBM	130°30'	25.67 meters
4	Building Corner SBM	29°30'	30.95 meters
5	Center of the junction road SBM	251°00'	33.90' metters

Table 2: Station Description of SBM Kankiya.

SBM CHARANCHI 1778.2789 Feet above sea level.

1	Easter Corner of dispensary SBM	$86^{o}00'$	27.50 meters
2	Edge library/ Education Office SBM	$151^{o}00'$	27.20 meters
3	Blazed Tree Across Road SBM	$284^{o}00'$	31.80 meters
4	Blazed Tree same side SBM	$99^{o}00'$	18.50 meters
5	Arrow on Well SBM	$45^{o}00'$	25.65 meters
6	Tree (not Blazed) SBM	$349^{o}30'$	9.83 meters

Table 3: Station Description of SBM Charanchi.

1.6 Pillar Numbers Allocated

The project was allocated 200 Kaduna State property beacon numbers.

KT 2926 to KT 3025, 100 Nos

KM 2488 to DM 2537, 50 Nos

KK 561 to KM 610, 50 Nos.

Table 4: Allocation of Pillar Numbers.

1.7 Statutory Functions of River Basin Authorities

The Sokoto-Rima Basin Development Authority was constituted by the Federal Military Government Decree No. 33 of 1973 which was later repealed and replaced by Decree No. 25 of 1975. The latter was subsequently revised Via Decree No. 87 of 1979. Generally, the Decree establishing River Basin Development Authorities in Nigeria specifically empowers them to:

(i) Undertake comprehensive development of both surface and underground water resources for multi-purpose use;

(ii) Undertake schemes for the control of floods and erosion, and for watershed management.

(iii) Construct and maintain dams, dykes, polders, wells, bore-holes, irrigation and drainage systems and other works necessary for the achievement of the authority's function.

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(iv) Develop irrigation schemes for the production of crops and livestock and to lease the irrigated land to farmers or recognised associations in the locality of the area concerned, for a fee to be determined by the Authority concerned with the approval of the Commissioner (now Minister);

(v) Provide water for reservoirs, wells and bore holes, under the control of the Authority concerned for Urban and Rural Water Supply Schemes on request by the State Government and when directed to do so by the Commissioner (now Minister);

(vi) Develop fisheries and improve navigation of rivers, lakes, reservoirs, and lagoons in the Authority's area;

(vii) Process Crop and Livestock produced under paragraph (iv) above;

(viii) Control pollution in rivers and lakes in the Authority's area in accordance with nationally laid down standards; and

(ix) Resettle persons affected by the works and Schemes specified in paragraphs (iii) and (iv) above or under special resettlement schemes.

Sokoto Rima Basin Development Authority (SRRBDA) was one of the eleven Authorities established under the aforementioned Decree and having the function set out above. However, with the advent of Military intervention in December 1983, Eighteen River Basin and Rural development authorities were created on State basis. In this regard then, it was out of Sokoto-Rima Basin and Niger River Basin that a River Basin and Rural Development Authority exclusively for Kaduna State, namely; Kaduna-Karaduwa River Basin and Rural Development Authority with Head-quarter in Dutsin-Ma was created. Yet again, as fate would have it, when the military struck again on 27th August 1985, the River Basin Authority were drastically reduced from Eighteen to Nine. Essentially most of them reverted back to their quasi-former structure. For the purpose of this thesis, Kaduna-Karaduwa River Basin will be treated as an entity and of course an off-shoot of Sokoto Rima Basin.

1.8 Definition of Special Terms

1.8.1 "Customary Right of Occupancy"

The right of a person or community lawfully using or occupying land in accordance with customary law and includes a customary right of occupancy granted by a Local Government under the Land Use Act.

1.8.2 "Developed Land"

Land where there exists physical improvement in the nature of road development services, water, electricity, drainage, building, structure or such improvement that may enhance the value of the land for industrial, agricultural or residential purposes.

1.8.3 "Easement"

A right annexed to land to utilize other land in different holding in a particular manner for road of access affecting the land (not involving the taking of any part of the natural produce of that land or of any part of its soil) or to prevent the holder of the other land from utilizing his land in a particular manner.

1.8.1 "Holder"

A person entitled to a right of occupancy and includes any person to whom a right of occupancy has been validly assigned or has been validly passed on the death of a holder but does not include any person to whom a right of occupancy has been sold or transferred without a valid assignment, nor a mortgagee, sub-lessee or sub-underlessee.

1.8.5 "Improvements" or "unexhausted improvements"

Anything of any quality permanently attached to the land, directly resulting from the expenditure of capital or labour by an occupier or any person acting on his behalf, and increasing the productive capacity,

the utility or the amenity thereof and includes buildings, plantations of long-lived crops or trees, fencing, walls, roads, and irrigation or reclamation works, but does not include the resulf of ordinary cultivation other than growing produce.

1.8.6 "Occupier"

Any person lawfully occupying land under customary law and a person using or occupying land in accordance with customary law and includes the sub-lessee or sub-underlessee of a holder.

1.8.7 "Public Purposes"

Includes:-

(a) for exclusive Government Use or for general public use;

(b) for use by anybody corporate directly established by law or by anybody corporate registered under the Companies Decree 1968 as respects which the Government owns shares, stocks or debentures;

(c) for obtaining control over land required for or in connection with planned urban or rural development or settlement;

(d) for obtaining control over land required for or in connection with economic, industrial or agricultural development.

(e) for educational and other social services.

1.8.8 "Statutory Right of Occupancy"

A right of occupancy granted by the Governor under the Land Use Decree.

1.8.9 "Urban Area"

Such area of the state as may be designated as such by the Governor; usually 10km radius.

1.8.10 "Owner"

Any person receiving rents or profits from any tenant or occupier thereof whether on his own account or as agent or trustee for any other person or who would receive the same if the land were let.

1.8.11 "Public Survey"

Any survey made for the purpose of defining the boundaries of any land which is owned by the Federal State or Local Government.

1.8.12 "Registrable Instrument"

Any document relating to land the registration of which is required by any written law.

1.9 The Significance of the Study

From the various studies on resettlement as well as author's many years of field experience in the Survey Profession, it is apparent that there is enough background to warrant a study that will examine factors of the land question from a purely cadastral point of

view. Since current investigations have revealed little scienctific search in this area (most researches on resettlement are from sociologists or other humanities), the study will somewhat pioneer a search for the true position regarding our land tenure systems at both regional and national level. As far as the author is aware, this is the first time a comprehensive compilation and documentation on marriage between Cadastre, Engineering Surveys and Cadastral Surveying for compulsory acquisition of a dam reservoir is made. This study will be significant in that the River Basin and Rural Development Authorities need to know who owns and holds rights; who uses and occupies the parcels of land they would wish to compulsorily acquire for overriding public interst. By and large, Federal/ State or other governmental agencies are frequently concerned with long range plans for dam constructions and the associated thorny issues of resettlement and compulsory acquisition of land, it necessarily calls for. They therefore need to know the predictive implications of satisfactory tenurial adjustment by appreciating the role of survey profession in resettlement programmes. Government policy makers will also be assured on the reliability of survey methods and other recommendations contained herein and it is hoped to prescribe, as a general policy statement, the broad criteria to be used in preparing resettlement programmes, in general.

1.10 Justification for the Study

The research, besides being a search for knowledge as an end in itself, it also a search for a solution to the problem of land ownership and compensations thereof sequel to compulsory acquisition by some governmental order. As a basic research, its findings are aimed at drawing generalisations (hypotheses) that can stand the Test of falsification in both time and space. As an applied research, its findings are aimed at producing ideas that can be used to bring about an improvement in the methods of land acquisitions in Kaduna State and even in the whole country. It is pertinent to mention at this juncture that some State Government and Federal Government agencies like River Basin Authorities, Steel Companies, National Electric Power Authority and others have been implementing resettlement programmes haphazardly. A times this results into bloddy clashes with the land owners. This is to confirm that the Governments have not yet found solution to this recurrent problems. Hence the need for this study.

1.11 Layout of the Thesis

1.11.1 Chapter I

Land Tenure Survey for compulsory acquisition by Government is primarily concerned with land and the people who occupy and use it. Thus in this

introductory chapter the purpose and importance of this study are highlighted. It is pointed out that the central idea of such survey is to determine how the affected land is owned and who holds rights in it; and also to deterine how the land is used and who occupies and uses it. An analysis of the scope of fieldwork and framework for this research are also highlighted. This consists of contour tracing (to define our area of operation), boundary demarcation, perimeter survey and levelling. This is then followed by Land Tenure Survey (or claim/survey). A preliminary analysis of available information concerning co-ordinates of existing control points and the survey descriptions of SBM's Charanchi and Kankiya has also been attempted. The statutory functions of the River Basin concerning land matters have also been brought into sharp focuss. An attempt has been made to define certain special terms (relating to land) within an accepted legal framework. The significance and justification for the study are also highlighted.

1.11.2 ChapterII

An over-view of the nature of resettlement philosophy is the major engagement in Chapter II. Issues concerning basic approach to resettlement schemes and resettlement options are highlighted. This is to enable us to grasp the necessary theoretical

background in order to be able to choose from the alternative strategies on resettlement, given the specifics on the statutory provisions on land matters. Finally, a broad out-line of resettlement features is given. It is then deduced that, this practical task (namely, Perimeter/Demarcation and Land Tenure Survey) is only a component (out of six other components parts) of resettlement; hence the diversity of the subject of resettlement.

1.11.3 Chapter III

This chapter traces the evolution of land tenure systems in both the Northern and Southern states, and then tackles the issue of compensation as is provided in the Land Use Decree.

1.11.4 Chapter IV

While chapter III deals with the issue of Land Tenure at national level, chapter IV treats land tenure at regional level, namely; the methods of land tenure, acquisitions, transfers and cadastral survey systems in Kaduna State.

1.11.5 Chapter V

This chapter deals with Reconnaisance and planning. The planning of control extension points and preliminary checking of instruments and analysis of accuracy are also discussed.

1.11.6 Chapters VI and VII

While chapter VI deals with the tracing of contour along highest flood level, chapter VII deals with connection surveys for the purposes of computation of co-ordinates of horizontal control extension points.

1.11.7 Chapter VIII

This is the largest chapter and represents parts of the actual field work. It deals with the perimeter survey and levelling. The methods adopted for the field work. Astronomical observations, traverse co-ordinate adjustment and computations are all discussed. Location of the position of the angle irons posts and levelling of boundary beacons are highlighted. Some description and instruction of the use of EDM equipments and the sources of errors in the theodolite traverse are also high-lighted.

1.11.8 Chapter IX

This chapter completes the field work and it deals with the Land Tenure Survey with the exclusive view of determining how the land is owned and who holds right in it and how the land is used and who occupies and uses it. Different methods of carrying out the survey and the acquisition plans obtained thereof, are also described.

1.11.9 Chapter X

According to the recommended scale of fees by the Surveyor-Generals, Surveys are classified into five categories; each of which is broadly outlined in this chapter. The possible cost estimate for this project is then evaluated along these guidelines.

1.11.10 Chapter XI

Lastly, this concluding chapter deals with the overall summary of the thesis, summary of findings, implications and recommendations, the achievement of the study and then conclusions drawn thereof.

CHAPTER II

NATURE OF RESETTLEMENT PHILOSOPHY

2.1 Resettlement General

The dearth "of published research dealing with both the execution and the evaluation of specific resettlement programmes" has been noted by Scudder even as late as 1973.

According to Oyedipe (1983) resettlement is a very vast subject. He stated that when people are resettled, diverse social changes do take place. These changes affect the socio-economic, socio-cultural and socio-political institutions. He further contended that there is the technical aspect of resettlement, which relates to surveying and engineering. It is pretty obvious that no one single thesis can cover the entire spectrum of resettlement schemes. Thus, the primary engagement in this thesis is to examine the inter-relationship between land utilization schemes and land tenure arrangements. It is hoped that this could be achieved by only highlighting the essentials of resettlement scheme and then concentrating on the land tenure and compensation issues.

2.2 Basic Approach to Resettlement Schemes

Resettlement projects are more complicated than it may first seem. Depriving human beings of their land and homes, even when the methods adopted are

technically perfect, often creates unexpected social problems. Resettlement affects people's lives more directly than any other aspects of a development project. In general terms, a resettlement situation arises when people move from one physical location to another and such movements could be caused by:-

(i) Certain natural phenomenon such as earth quakes, flood etc.

(ii) Deliberate action on the part of a people in the form of adventurism or a desire to break new frontiers.

(iii) Compulsory order from a governmental Authority requiring people to move in order to make room for physical development aimed at benefitting the society.

When people move on their own, they tend to choose for themselves a place which suits their convenience and interests. However, when it becomes necessary and compulsory for people to move in order to make room for some development efforts aimed at accelerating the socio-economic improvement of the society as a whole, such people expect the agency responsible for their movement to make adequate arrangement to satisfy their social, economic and other needs. It could be said, without any fundamental loss of generality, that people involved

in compulsory displacement and resettlement tend to resist removal and when movement eventually occurs, they feel defeated. This is a traumatic experience that precipitates stress and which, if not properly handled results in normlessness (anormie) and a crisis of cultural identity. The people feel greatly alienated and tend to develop a dependence syndrome which makes them look to the Government not only as the sorces of their disorganized life byt as the provider of whatever they might require.

It is selft-evident that there is no resettlement exercise which is trouble free. However, what determines the relative success of any exercise is the degree to which the people to be resettled are cared for and the extent to which their social economic and cultural needs are recognized and accorded an equal importance vis-a-vis the development effort for which they had to forsake their home or farmlands. Losing one's land and home can cause suffering from stress and uncertainty. These uncertainty and stress however can be reduced by allowing the affected people to perticipate actively in the project. Full perticipation of the people to be resettled is almost a guarantee of the success of a resettlement project. However, such participation requires a flexible approach and means that planning, although essential, should not be over-detailed and that at all times the wishes of the people can be

incorporated, especially wishes concerning layout and location of resettlement site.

Participation of the affected people also requires explanation of the activities which are expected to be achieved by the construction of a dam and the benefits to be derived. It is therefore essential that known and trusted persons should talk to the people to be displaced at an early stage and explain the procedures together with how and when and why the resettlement is to take place. However, inspite of all efforts it should be born in mind that most villages will not be able to comprehend how the project will affect them personally. It is therefore essential that throughout the implementation of the project, the project staff maintain close contact with those affected.

2.3 Resettlement Options:

In general three methods of approach to resettlement have been distinguished:-

(a) Full cash compensation, the displaced people are left to go wherever they wish after being compensated in cash.

(b) Comprehensive resettlement; no cash compensation but new houses are built for the displaced people and free land is allocated.

(c) Compensation, partly in cash and partly in kind. Various services are rendered in addition to cash payments.

2.3.1 Full Cash Compensation

Full compensation is paid for farm-land, economic trees and buildings, the people are left to go wherever they wish. This is without any doubt the easiest solution from the Authority's point of view, but it will affect rural-urban migration. In such cases, the rich will go first, thoroughly up-setting the social structure of a village and leaving the poorer people in the village. Although in theory this solution might be defensible, in practice it is a great injustice.

2.3.2(b) Comprehensive resettlement

No compensation is paid at all, but instead new houses are built for those people requiring resettlement, and land is cleared and allocated. Although this method has already been implemented more or less successfully (e.g. in Kainji Dam) it has been found that not everyone accepts standard and usually prefabricated housing, as many people prefer to build their houses according to their own requirements. And it should be noted that this method is very expensive compared to the first method and it requires thoroggh planning and an extensive organizational structure. Alternative farmland, to be allocated to the displaced farmers can often not be found in the vicinity of the new resettlement sites.

2.3.3 (c) The third approach is abasically a compromise between the two above. Compensation is paid for land, economic trees and buildings; but less than under paragraph(a) above, while in addition to the cash payment, various services are rendered to assure a reasonable standard of living for the displaced people in their new environment. This approach has, with some variations, been adopted for Dam construction projects like, Tiga, Jakara, Garim and other dams in Kano under the Hadeija-Jama'are River Basin Development Authority. Similarly, the same approach has been adopted for Bakolori and Goronyo Dams Resettlement schemes under the Sokoto-Rima River Basin Development Authority. But due to social and political compromise, the same authority could not successfully adopt such approach when implemented the Zobe Dam resettlement scheme in Kaduna State. This was between March 1980 - August, 1983. During the period under review Kaduna State was under the People Redemption Party (PRP) whereas the project itself was being embarked upon by an agency of the Federally controlled National Party of Nigeria (NPN).

2.4 Alternative Strategy

In deciding what resettlement option to adopt, the Kaduna-Karaduwa River-Basin has been guided by three Fundamental legal stand-view points on land and resettlement, namely:

(a) Land Use Decree No. 6 of 29th March, 1978.

(b) Kaduna State Land and Economic Tree (Compensation) Law, 1981.

(c) River Basin Development Authority's Decree; in paragraphy 4 of Decree No. 87 of 28th September, 1979 (i.e. amendment to that of 1976).

The issues raised by all these functions are essentially addressed to the circumstances of existing land holdership and land utilization structure. At the same time, the performance of these function has to be in conformity with the various provisions of the land Use Decree. Although the Decree No. 25 (Section 2, subsection (1)(g) empowers the Authority to resettle persons affected by the works and schemes under special resettlement schemes, land policy in Kaduna State is the responsibility of the State Government, even though the project is mounted on by a Federal agency which has no jurisdiction over land administration in the state. Furthermore, Part V, Section 33, sub-section(1)-(3) of the Land Use Decree (LUD) provides for option to accept resettlement in case of revocation of right of occupancy. The Governor/Local Government may resettle the persons affected in any other place by way of a reasonable alternative accommodation in lieu of compensation. Also where a person accepts a resettlement his right to compensation shall be deemed to have been duly satisfied and no further compensation shall be payable

to such person.

It is against this background information that the resettlement of people to be affected by the scheme has to be seen as a joint and co-operative endeavour between the Management of Kaduna-Karaduwa River Basin on one hand; the Kaduna State Government, the concerned Local Governments and the people of the area to be affected by the project on the other hand. At present, there is no National Policy on resettlement for the River Basins. But when the three resettlement policy options are scaled against the existing legal provisions in this local circumstance; it is clear that the mode or philosophy of resettlement shall be that of full and adequate cash compensation of all landed properties displaced plus some additional assistance; in other words, alternative (C) under paragraph 2.1.2 above. On compassionate grounds, and in pursuit of justice and fairness, the Federal Government should offer additional assistance. This is because resettlement exercises should be carried out in such a way that there is minimum social disruption.

2.5 Resettlement Features

According to Umar (1982), cumulative years of experience on Dam constructions and resettlement programmes by SRBDA (for example; Bakolori, Goronyo

Zobe and Zauro-Polder Schemes) have shown that a resettlement programmes arising from a dam construction shall be the following features;

2.5.1 Reservoir demarcation and land tenure survey:-

(i) In order to ascertain exactly which villages and farmlands will be affected by a dam project it is essential to determine the area to be inundated by the Lake. For this purpose the contour line coinciding with the maximum water level has to be set out and marked by positioning permanent bench marks fixed at suitable intervals round the perimeter of the reservoir.

(ii) Identification and recording of existing farm plot boundaries within the area coming under the contour.

2.5.2 Comprehensive socio-economic survey

Demographic Survey of each village in the reservoir area, to establish number and value of individuals landed properties affected.

2.5.3 Identification and location of resettlement sites

(i) Integration of the villages in accordance with their political administrative areas.

(ii) Perimeter and Topographical Survey of the proposed settlement sites.

(iii) Identification of pockets of private farm

holdings for replacement or payment of compensation.

2.5.4 Land clearing of the resettlement sites

2.5.5 Layout planning

(i) Production of layout design showing plots dimensions, streets and so forth;

(ii) Demarcation of the plots, access roads;

(iii) Physical allocation of plots.

2.5.6 Payment of compensations

From the foregoing, it is pretty obvious that resettlement subject is very vast and this thesis is primarily concerned with the component. 2.5.1 (i) above, i.e. Demarcation and Land Tenure Survey.

CHAPTER III

LAND TENURE SYSTEM IN NIGERIA

3.1 The Evolution of Land Tenure in the Northern States

Before 1900, when the protectorate of Northern Nigeria was formally procalaimed by Lord Lugard (The British Commissioner), the Sultan or the Shehu of Bornu (as the case may be) had an apparent ultimate title over land. For Elias (1971) stated that in the muslim emirate of Northern Nigeria, the emirs and other native rulers "were never lords and masters of the land; they were only political, religious and military rulers of their respective states". Thus the Emirs were looked upon as trustees of the land on behalf of the people, to whom the land belonged; as pointed out by Meek (1946). Through negotiation and warlike operations the Northern Emirates were overpowered and at the same time the administrative functions of the Royal Niger Company were taken over by Lord Lugard.

Lord Lugard's proclamation in 1900 held back wholesale European acquisition of land in the North initially. This gave Sir Percy Gironard, who succeeded Lord Lugard as Governor of the North in 1906, time to investigate the real nature of customary law and make recommendations for legislation which would obviate the conflict in land tenure which was obtained

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in Lagos and its environs.

The result was the Land and Native Rights proclamation of 1910. This marked a turning point in Northern Nigeria Land Law. In reality, the land was nationalized i.e. controlled and administered by the Governor in the interests of the indigenous population. Individuals could hold land under customary title. In effect, this means usufructory rights of customary law. No non-native could hold land without the consent of the Governor, which meant that aliens could only hold what were limited lease holds from the Government, properly surveyed and properly compensated for. Thus, we get the beginning of statutory Rights of Occupancy-granted for 'X' number of years and hence the start of the Northern Cadastre.

The proclamation of 1910 was expanded and updated in Land and Native Rights Ordinance of 1916 without major changes in substances. Again, when the Ordinance was replaced in 1963 by the Land Tenure Law of Northern Nigerian there was no basic change. It merely substituted "Ministers" for "Governor".

3.2 The Evolution of Land Tenure in the Southern States

Unlike what existed in the North before the coming of the British, land in the southern states was firmly in the control of the native. The tenure

While stool and chieftancy lands were common with the Yorubas, there were holdings such as the individual, family or state lands which were common throughout the south. The method of acquisition of land throughout the South was by conveyancing. Conveyance or deed of lease as the case may be, was the instrument by which ownership and interest in land were transferred before the Land Use Act. Government Land or "Crown Land's as it was then called, referred to only those people that the natives gave to the Crown by Virtue of any treaty, cession, convention or agreement for any public purpose. The rest of the land was considered as private land.

Deed registration which was introduced in 1883, was re-enacted in 1907 to Unify the registration of instruments throughout Southern Nigeria. Differences in the ethnic groupings made it impossible to have a single land tenure Law operating throughout the South. Thus bringing into being the Land Instruments Registration Law, Cap. 72 in the 1963 edition of the Laws of the former Eastern Nigeria. The Land Instruments Registration, Cap. 56 of the 1959 edition of the Laws of the former Western Nigeria. These two registration Laws were for the Deed System of registration. However, in Lagos the system has already lost its value due to ever growing increase in population and the subsequent demand for accomodation; thereby giving rise to a new system of registration called, the Registration of Titles Act, Cap. 181 of 1935. This

Registration of Titles Act, Cap. 181 of 1935. This system shows exactly what rights the individual has over a piece of land. The Registration of Titles solved a lot of problem in the Lagos Land Registry and has continued ever since to be used only in certain Title Registration Districts in the city of Lagos.

What happens when the instrument has been accepted and registered by the Land Registry, is that a Certificate of Registration is issued. In the South, this certificate of Registration continued to serve the same purpose as the statutory certificate of occupancy that were being issued in the North before the coming of the Land Use Act.

3.3 Background to the Land Use Decree, 1978

The Land Use Decree of 1978 was not the first major land reform in Nigeria. It was preceeded by Lord Lugard's Land Policy or the Land and Native Rights Proclamation of 1910, of non-interference in peasant agriculture; the Colonel Row Commission of 1926 with its land registrattion and Land courts; the Eastern Nigeria Land Tenure and Land consolidation Committee of 1962; and Public Lands (Miscellaneous Provisions) Decree of 1976. So far, the most profound, easily the most controversial, and possibly the most explosive land policy in the country is the Land Use Decree No. 6 of 29th March, 1978.

Prior to this, an eleven member Land Use Panel headed by a Justice of the Supreme Court was established on 26th May, 1977 and given the followings terms of reference:-

(a) To undertake an in-depth study of the various land tenure, Use and land conservation practices in the country and recommend steps to be taken to streamline them;

(b) to study and analyse all the implication of a uniform land policy for the country;

(c) to examine the feasibility of a uniform land polic for the entire country, make necessary recommendations, and

(d) to examine steps necessary for controlling future land use and also opening and developing new land for the needs for Government and Nigeria's growing population in both urban and rural areas and make appropriate recommendations.

Indeed, according to the Chief of Staff, Supreme Headquarters, during the Panels inaugural meeting;

> The need for the establishment of this Panel arose from the recommendation from previous Commission and Panels set up to examine some aspects of the structure of our social and economic life. The problem had also been forseen and was well articulated in the Third National Development Programme. Both the Anti-Inflation Task Force and the Rent Panel Reports, identified land as one of the major bottlenecks to development efforts in the country and recommended various solutions. For example, the Anti-inflation Task Force expressed concern over the need to reduce the injustice that stems from the private appropriation and socially created

> wealth and to remove the battlenecks that land constitutes generally to the development.

The Land Use Panel completed its task and submitted its report in December, 1977. Igbozurike (1980) argued that the findings of this panel were not made public either in the original form or in modified form via the usual "White Paper". However, the National Conference on Land Tenure, Land Use and Land conservation practices in Nigeria (1980) was unanimous that the larger part of the findings of the panel were not adopted by the Government. It was further held that the provisions of Land Use Act, are diametrically opposed to the recommendation made by the Panel. A cursory look at Land Use Panel (Main Report) will further strengthen this position.

3.4 Earlier Statutes and the issue of Compensation

This section will briefly trace the various statutes which have dealt with the issue of compensation for land in Nigeria before the Land Use Act came into effect.

The public Land Acquisistion Act in Section 15 provides:

> In estimating the compensation to be given for any Land or any estate or insterest therein or for any means profits thereof the court shall act on the following principles:

(a) No allowance shall be made on account of the acquisition would be impossible.

(b) the value of the land, estate, interest or profits shall, subject as hereinafter provided be taken to be the amount which such lands, estate, interest or profits if sold in the open market by a willing seller might be expected to realize.

The constitution of the Federal Republic of Nigeria, 1963 makes similar provision in Section 31 as follows:-

> No property, movable or immovable, shall be taken possession of compulsory and no right over or interest in any such property shall be acquired compulsorily in any part of Nigeria except by or under the provision of a law that:
>
> (a) requires the payment of adequate compensation therefore and
>
> (b) gives to any person claming such compensation a right of access, for the determination of interest in the property and the amount of compensation, to the High Court having jurisdiction in that part of Nigeria.

Thus, up to 1976 the principles of assessment of compensation for land which was compulsorily acquired was based on the full market value of the land. The Public Acquisition (Miscellaneous Provisions) Act, No. 33 of 1976 provides in Section (1) as follows:

> Compensation payable in respect of land compulsorily acquired under the Public Lands Acquisition Act, the State Lands Act or any other enactment or law permitting the acquisition of land compulsorily for the public purposes of the Federation or of a state shall be assessed and computated in accordance with the provisions of this act, notwithstanding anything to the contrary in the constitution of the Federation or in any other enactment or law or rule of law.

Section 2 of the Act stipulates the maximum compensation payable in respect of the computation. The scale of the compensation payable are set out in Schedule 1 to the Act. The whole land in the country is zoned into A,B,C and D. Zone A is the Metropolitan Lagos where the maximum payable for an hectare is fixed at ₦7,500. Zone B is Lagos State other than Zone A and is fixed for ₦3,750 per hectare. This scale also applies to state capitals and industrial and urban centres. Zone C which covers other urban centres attracts ₦1,500. Finally, Zone D takes care of all other areas and is fixed at ₦1,250 per hectare.

Section 3 provides:

> Any claim in respect of compensation payable by virtue of the Public Lands Acquisition Act or the State Lands Act or any other enactment or law shall be determined in accordnace with the provisions of the Act, and any dispute arising from such claim shall be referable by any party to the dispute for adjudication by a tribunal established under section 12 below.

Further detailed provision are made in Section 4 relating to computation of compensation. For example sub-section 2 of the section provides that where land is underdeveloped, compensation payable shall be limited to the actual cost of the land together with interest at the bank rate calculated from the date of the purcahse of the land to the date of publication of notice of acquisition. But this cannot exceed the maximum fixed by the Act for the area where the land is located. Sub-section 4 deals with the case where land is developed and provides:

> "where land is a developed land, compensation:
>
> (a) in respect of the land, shall be assessed on the same principles as in sub-section (2) of the section and
>
> (b) in respect of the building or structure on the land, shall be limited to the current replacement cost of the building or structure".

This act not only provides for future guidance on compensation but also states that even with respect to acquisition made before its coming into effect, compensation must be paid in accordance with its provisions where such compensation has not been paid before its commencement.

Section 1 sub-section 2 provides as follows:

> without prejudice to sub-section (1) of this section, where before the commencement of this Act any land has been compulsorily acquired by the Government or notice for the acquisition of any land has been given in accordance with the

> Provisions of the Public Land Acquisition Act, or any other applicable law and and compensation payable shall be determined in accordance with the provisions of this Act, notwithstanding anything in the contrary in the constitution of the Federation or in any other enactment or law or rule of law.

The Land Use Act provides that the 1976 Act is still to govern all acquisition made before it came into force. It provides, however, that the 1976 Act shall no longer apply in the case of any acquisition subsequent to 29th March, 1978, when it came into effect. As from that day, therefore, the only provisions which will govern payment of compensation are those contained in the Land Use Act. Section 31 of the Act provides:

> The provisions of the Public Lands Acquisition (Miscellaneous Provisions) Act 1976 shall not apply in respect of any land vested in, or taken over by the Governor or any Local Government pursuant to this act or the right of occupancy to which is revoked under the provisions of this act but shall continue to apply in respect of land compulsorily acquired before the commencement of this Act.

3.5 Land Use Decree as it Affects Compensation

In September, 1978; the Land Use Decree, was formally incorporated into Nigerian's new constitution by the Supreme Military Council. Among the objectives of the decree were:

(a) To facilitate rapid economic and social transformation through a rationalisation of land Use;

(b) To remove a main cause of social and economic inequality;

(c) To provide an incentive to development through easy access to land for the state and the people.

Infact, the Federal Government has summarised the objectives and justification of the Land Use Decree by stating in the preamble to decree that

> It is in the public interest, that the rights of all Nigerians to the Land of Nigeria be asserted and preserved by Law and that the rights of all Nigerian to use and enjoy land in Nigeria and the natural fruits thereof in sufficient quantity to enable them provide for the sustenance of themselves and their families should be assured, protected and preserved.

Our immediate task is to examine the nature of the policy in relation to compensation. The relevant provision are to be found in Part V -

REVOCATION OF RIGHTS OF OCCUPANCY AND COMPENSATION THEREOF

Section 29, 30, 31 (also provisions of the Public Lands Acquisition (Miscellaneous Provisions) Decree 1976) 33 and finally PART VI - TRANSITIONAL AND OTHER RELATED AND OTHER PROVISIONALS, Section 35, summarised in simple language, the relevant high-lights of these sections are:-

(a) A right of occupancy must be revoked in a formal manner, and by an official duly authorised by the Governor to do the same. The holder of a right of occupancy must be duly notified of the cancellation, and his rights shall cease either immediately he receives such notice or with effect from any date that may be specified in the notice.

(b) When a right of occupancy is revoked on grounds of overriding public interest, the person actually occupying the land (if these are different people) are entitled to compensation for buildings, crops, and any other improvements existing on the land as at the date of revocation. In case of Land taken from a holder for mining purposes or for the laying of oil pipelines, compensation will be paid under the applicable law governing minerals and mineral oils, or under any legislation replacing that law.

(c) If it is a community that is entitled to compensation, the Governor may direct that the payment be made (i) to the community, (ii) to the leader or chief of the community, who will dispose of it for communal benefit according to the

community's customary laws or (iii) into a special fund set up for the benefit of the community.

(d) Compensation for land taken in overall public interest is categorised as follows: (i) for land the amount will be equal to the rent, if any, paid by the occupier during the year in which the right of occupancy is revoked; (ii) for buildings excluding fixtures in or on them), mechanical installations, and other associated improvements; the amount will be the replacement cost of these establishments, as assessed by the appropriate official, and will take into account the rate of depreciation as well as entitlements due to the holder for delays in paying him the compensation and for any improvements on the land in nature of reclamation works; and (iii) for crops; the amount will be equal to their value as determined and prescribed by the appropriate official.

(e) If the land in respect of which a right of occupancy has been revoked constitutes part of a larger area, compensation will be computed for only the segment regarding

which the right of occupancy has been revoked.

(f) Any disputes over the amount of compensation shall be referred to Land Use and Allocation Committee.

(g) The Land Use Decree has cancelled the provisions of the public Lands Acquisition (Miscellaneous Provisions) Decree of 1976, except however, in cases of Land compulsorily acquired before 29th March, 1978.

(h) The revocation of a statutory right of occupancy does not cancel any debt owed to the government in respect of such right of occupancy.

(i) If a right of occupancy is revoked and this right is over a land on which a residential building has been constructed, its discretion to offer the holder (in lieu of monetary compensation) reasonable alternative accommodation a elsewhere. And where the value of the alternative accommodation, as determined by the appropriate official or the Land Use and Allocation Committee, is greater than what the monetary compensation would

have been, the parties concerned may agree to treat the difference as a loan which the holder shall repay to the government on terms to be specified.

(j) If the holder accepts alternative resettlement, his right to any other compensation is deemed to have been extinguished.

3.6 Compulsory Acquisition and Compensation

Before the coming into force of the land Use Decree there was a lot of formality before the authorities could get the land required for public purposes. There would be the need to declare the intention to acquire a certain area of land for a specific public purposes or for several public purposes; the need to identify the owners and get them round to comply and there would be the fixing of the compensation. The procedure used to take a long time, and when the need was urgent, red tape prevented the procedure from being telescoped.

Now however, since all land is vested in the Governor, he only has to declare the area required by the government for public purposes and the acquisition is automatic. Any such areas which may already be subject to rights of occupancy will be considered as to the compensation necessary to the occupiers and holders for the unexhausted improvement made by

them. In general, no compensation is given for the bare land; but where rent is paid on the bare land by the occupier, he will be paid an amount equal to the rent paid during the year in which the right of occupancy is revoked (LUD) Section 29(4) (a).

On the ground of ease with which government can now acquire land for public purposes there is a strong case for retaining the Decree. The power of compulsory acquisition is also extended to a Local Government within the area of its jurisdiction to acquire land for public pruposes (LUD 6/3). Only that there are some exception to land which the local government can acquire;

(i) Land within an area declared to be an urban area.

(ii) Land the subject of a statutory right of occupancy.

(iii) Land the subject of any laws relating to minerals or minerals oils and for the purpose to revoke any customary right of occupancy on any such land.

The Local Government shall have exclusive rights to the lands so occupied against all persons except the Governor. It is important to say a word or two on the Federal Government and the power of compulsory acquisition of land. Much emphasis has been placed on the Decree vesting all the land comprised in a state,

to the extent that some people have expressed the view that a Governor of a state may refuse the Federal Government the permission to acquire land compulsorily (as witnessed during the last civilian regim) in the state for the public pruposes of the Federation. But a cursory glance at section 28 of the Decree will reveal that the Decree has taken proper care of the situation. Section 28(4) provides that the Governor shall revoke a right of occupancy in the event of the issue of a notice by or on behalf of the Head of State, that such land is required by the Government for public purposes. It is clear from this provision of the Decree that although Section I vests the land comprised in a state to the State Governor, the latter is obliged to release any land in the state to the Federal Government whenever a request is made for it for the public purposes of the Federal Government.

During the last civilian regime (1979-1983) there had been a lot of controversies as to who should pay for parcels of land acquired for Federal Government projects. At one time the Council of Ministers had to resolve in favour of paying compensation for projects which are exclusively a Federal Government affair, such as Military and Police Barracks. But where the projects are meant for the common benefit of the people in the state (such as irrigation projects, public and

educational institutions) then the state Government concerned should agree to bear the cost of compensation (that is to give land free to the Federal Government). However, it remained to be seen as to what extent such a resolution had been implemented. This was all the moreso, in the case of non NPN controlled states. Unfortunately, the decree is silent about who should pay the compensation for land acquired compulsorily by the Federal Government. But it is safe to assume that the party that acquires must pay the compensation. There is a further provision in Section 33(1) for a reasonable alternative accommodation (if appropriate in the circumstances) in lieu of compensation for a right of occupancy on which a residential building has been erected and is revoked under the Decree by the Governor or a Local Government.

CHAPTER IV

LAND ADMINISTRATION IN KADUNA STATE

4.1 Land Tenure, Acquisition and Transfers

Olawoye (1982) defines Land Tenure as a set of rules which govern access to land and the relationship between the holder of land and the community on the one hand, and/or that between holder and another party having superior title. Tenure therefore defines what intersts may subsist in land, the conditions under which the interest are held, the mode of acquisition and transfer as well as the rights and liabilities of holders of land.

It is against this background that it can easily be appreciated that the current land tenure system operating in Kaduna State and generally in the Northern parts of this country is essentially a product of colonial rule and the attendant social and economic changes which it brought in its wake. The current laws governing land transactions have their origins in colonial legislation which vested radical title to land in the hands of the government; right from Lands and Native Rights Proclamation, 1910; Lands and Native Rights Ordinance, 1916; through Land Tenure Law, 1962 and now the Land Use Act, 1978. All these laws and regulations give the government absolute title to all land and as such has made the government a rallying point on the question of land. All other communities or institutions

in the society have only titles of occupiers and users and the government can acquire land, revoke titles, but subject to the payment of adequate compensation.

Land acquisitions and transfers in Kaduna State can be classified in two broad and related categories. The first is the class of lands acquired by the government or Local Governments for various public projects including rural and urban layouts. The second is associated with land transfers, allocations, acquisitions and often seizures occassioned by feudal arm of the Land Administration System. This is represented by the powers of the roles played by the traditional power structure in especially rural land transactions.

According to the While Paper on 'Report of the Lands investigation Commission' issued by Kaduna State Government in 1980, the importance of the aforementioned two arms of the system of land administration can be seen in the fact that over 89 percent of the complaints received and analysed by the Commission identified the government, the Local Government or the traditional authority functionaries as the respondents. This can be seen from the table 5 below:

NUMBERS OF COMPLAINTS BY RESPONDENT

Respondents	Number	%
Local Authority	5,589	26.8
Traditional Authority	5,383	25.8
Local Government Traditional Authority (Combined)	368	1.8
Government	6,743	32.3
Government and Traditional Authority	508	2.4
Other Individuals	1,046	5.0
Other Combinations	1,238	5.2
Total	20,875	100.00

Table 5: Number and percentage of complaints by respondents.

Source: Abdullahi (1980).

Infact nearly 70 percent of the complaints received and analysed are over land acquisition for public projects where little or no compensation was offered. The type of projects where lands are acquired from the people for various projects by the Government or Local Government are as follows:-

4.2 Land Acquired for Government Projects

Such as educational institutions and other social services including forestry reserves, shelter belts, grazing reserves,

- Dams, small irrigation schemes

- Road construction
- Layout and village re-groupings.

On a general note, the commission recommend that the Government should always insist that in all cases of land acquisition for official projects, under no circumstance should anybody be disposed of his land without prior information, prior assessment and payment of full compensation and/or provision of alternative land. Whatever the importance of a project the survival and welfare of the community should be paramount in the determination of its execution.

Prior to 1900 and possible even beyond the regulation governing the control and use of rural land in the state puts too much powers in the hand of the traditional power structure. These regulation are essentially built around the following provisions:

4.2.1 That anybody who has a farm on which he has effected some development on migrating can sell it to another person living in the same area provided he acquired the land initially by purchase or inheritance and provided that the district and the Village Heads are informed.

4.2.2 Lands classified as bush land or (Saura) cannot be sold by anybody. These lands are given to other people free of charge.

4.2.3 If somebody has a farm and wants to migrate, he can leave his farm to his children or relations at the discretion of the Village Head especially if the latter is satisfied that they are seriously in need of farmland. In other wards, reversion to them is not automatic.

4.2.4 Anybody can sell or pledge his farm only to somebody who is residing in the village area where the land is situated. The regulation is made to prevent Nomijidi (or Absentee Land-Lord) which in effect is made to stop and discourage the practice of a peasant living within a particular politically determined boundary, farming in another one, that is, paying taxes here and farming there.

4.2.5 The districts and Village Heads have the power to acquire for re-allocation any piece of land which has been left uncultivated for up to ten (10) years. If the holder initially inherited or bought the land, he can be forced to sell it by the District or Village Head after ascertaining that he has

enough land. The exception to this rule is only when such land is being used for cattle grazing by a large scale farmer.

4.2.6 When a person holding land in a particular village area dies, and his heirs live in another village area, instead of them to inherit it, the land is 'sold' out to somebody living in the village area and the heirs paid in cash. This is also designed to put a stop to Nomijidi.

These regulations lead to a lot of abuses and mismanagement of land by the traditional rulers and their associates. They led to the oppression of the peasant by restricting their access to the control and use of the land. Presently, the control over allocation and administration of rural lands is vested in the hands of the Land Allocation and Advisory Committees at the Local Government levels. However, influence of the older regulations are still felt, though sparingly.

4.3 Problems of Land Rights of Women and Minors

Women were often deprived of their rights to inherit the lands of their fathers who had no other male heirs resident in the village. The village local nature of marriage means that often women marry and live outside the village area. So when their fathers die , the same Nomijidi regulation is used to deprive them of the land without taking their

special circumstances into consideration.

The problem of children's inheritance normally arises whenever a man dies leaving infants or children who are minors and the land are kept in the hands of the Village Head (the Mai Unguwa) on trust for the children until they are strong enough to use them. In this case the mothers normally take the children away to their own parents house and then marry again.

When the children grow up they will be told of their fathers lands and they would come to the Village Head to assert their claims. Sometime it happens that the Village Head has already converted the lands to his own use or have been included in his estate after his death and divided up among his own children. This represents an area which has generated alot of disputes over land in the rural areas.

Taxation and issues built around it, is one of the principal ways in which the peasantry lose title to land.

4.4 Aro of Farmlands

According to Abdullahi(1980), Aro of farmlands was found to be of three, namely;

4.4.1 Where a family with excess lands, and to those with little or no lands at all. This tend to be made as an agreement between the two whereby the user acknowledges the rights of the

lender by way of token annual gifts of a bundle or two of guinea-corn or some part of the produce. In the Southern parts of the state; this used to take the form of a keg of local brew, annually. But now these payments have largely been commuted to cash payments which are rising constantly.

4.4.2 There are other cases of aro which are infact, hire system where people with surplus land give out their lands to others for an annual fee already predetermined. There are, infact, cases where these payments amount to more than the gross returns of the land itself.

4.4.3 There are also cases when land is taken away from the people by the traditional rulers on aro basis. But as always, this kind of aro from the weak to the powerful always ends up in the total alienation of the land. Such lands are often converted to gonan Sarauta (official farms) by the traditional authorities or held by them as private property.

4.5 Sale and Pledge of Land

It was mentioned in the 'Report of the Lands Investigation Commission (1980)' that Sale and pledge of land are very rampant in the state. The twin issues of sale and pledge of land are caused by the same problems which are essentially rooted in the

poverty of the people and the fact that the land is the principal asset that they have, which can readily be converted into liquid cash.

Sale and pledge of land occur for a variety of reasons.

4.5.1 People sell their farmlands when they intend to migrate permanently either to seek for better opportunities elsewhere, or to escape oppression, creditors, and

4.5.2 Poor farmers normally sell or pledge because of hunger, indebtedness, threat of land confiscation or fear of impending acquisition by the Government or Local Government knowing fully well that the authorities do not pay well for the lands they acquire.

4.5.3 Sale or pledge also occur to provide them with cash to meet socio-cultural obligations, such as marriages, naming ceremonies, and so on.

4.5.4 Land is also sold or pledged to pay taxes court fines and fees.

4.6 Rates of Compensation

In accordance with 'The Kaduna State Land and Economic Trees Compensation Law', 1981 C 28 KD.S. Bill No. 7 of 1981, the following rates shall apply:

4.6.1 FIRST SCHEDULE (Per Hectare)

ZONE A - Kaduna @ N2,000.00 per hectare

This is designated as urban area.

ZONE B - Local Government Head-quarters

@ N1,000.00 per hectare. This is

designated as semi-urban area.

ZONE C - Rural Area (other than Local Government

Headquarters @ N650.00.

ZONE D - Fadama @ N1,500.00

Table 6: Rates for Land Compensation.

4.6.2 Second Schedule

1.	Mangifera in (Mangwaro)	₦60.00
2.	Pankia Slappertoniana (Dorawa)	90.00
3.	Phonix Sp (Dabino)	40.00
4.	Ficus Sp (Gamji)	40.00
5.	Butyraspermum Parki (Kadanya)	40.00
6.	Ceiba Pestandra (Rimi)	60.00
7.	Tamarindus Indica (Tsamiya)	30.00
8.	Pterocarpus arinaceous (Madobiya)	20.00
9.	Raya Senegalensis (Madaci)	40.00
10.	Psedium Gewjawa (Goba)	50.00
11.	Carica Papaya (Gwanada)	15.00
12.	Anacadium Occidentale (Kanju)	21.00
13.	Djospy us Mespilt intomis (Kanju)	20.00
14.	Citrus Sp)Lemon Tsami)	80.00
15.	Citrus Acida (Lemon Zaki)	80.00
16	Anageissus Lelocarpuss(Makare)	5.00
17.	Acaci Albida (Gawo)	40.00
18.	Albizzia Sp (albijiya)	5.00
19.	Balanites Aigyptiaca (Aduwa)	5.00
20.	Azadirachta Indica (Neem)	5.00
21.	Acacia Nitotica (Bagaruwa)	15.00
22.	Frens Synomorus (Bauren rafi)	5.00
23.	Cassia Siamea (Kashiya)	5.00
24.	Dalbegia Sp. (Dalbajiya)	5.00
25.	Acacia Seyal (Dushe)	5.00
26.	Bombax Constatum (Gurjiya)	5.00
27.	Parinari Sp (Gawasa)	20.00
28.	Ziziphus Spinachristi (Kurna)	10.00

29.	Albizzi'a sp (Katsari)	₦ 5.00
30.	Praspis ofricana (Kirya)	30.00
31.	Daniellia Oliveri (Maje)	10.00
32.	Delenix Regia (Franshana)	5.00
33.	Stereras Permum Kunthianum (Sansami)	5.00
34.	Tarminalla Glaucanthus (Baushe)	5.00
35.	Scleroarya Birrea (Dinya)	5.00
36.	Punica grantum (Fasadabur)	2.00
37.	Ruman	15.00
38.	Ziziphus Sp (Magarya)	5.00
39.	Deterium Microcarpum (Taura)	3.00
40.	Piliastigana Reticulatin (Kargo)	2.00
41.	Mosa Saplentum (ayaba)	3.00
42.	Ficuspolita (Chediya)	35.00
43.	Ficuspolita (Durumi)	35.00
44.	Hyphane thebari (Goruba)	10.00
45.	Borassas Thebari Acthinpan (Giginya)	60.00
46.	Ficus Kawuri (Kawuri)	5.00
47.	Adansonis Sugitata (Kuka)	60.00
48.	Laphira Indica (Lalle)	6.00
49.	Moringa allenfera (Zogala	20.00
50.	Matragyana neruis (Giyayya)	2.00
51.	Vitex doniana (Dinya)	30.00
52.	Inabi	2.00
53.	Kattakara	2.00
54.	Matsatsagi	2.00
55.	Combretum Sp. (Geza)	2.00
56.	Isobaluna doka (Doka)	2.00
57.	Eucalyptus Sp (Turare)	5.00

58.	Gmelina Arborea (Nalina)	₦2.00
59.	Bambasa Bambasa (Tukurwa)	3.00
60.	Acaci Senegal (Dakwara)	5.00
61.	Celtis Integra Felia (Zuw)	5.00
62.	Vitis Vermifera (Aliliba)	2.00
63.	Kola Nut (Goro)	20.00
64.	Cashew	10.00
65.	Bauren Lambu	20.00
66.	Gwandar Dawa	2.00

Table 6: Rates for Economic Trees Compensation.

4.6.3 Third Schedule

1.	Millet	₦400.00
2.	Oil Palm Tree	160.00
3.	Guinea Corn	400.00
4.	Maize	600.00
5.	Rice	1,500.00
6.	Beans	500.00
7.	Groundnuts	1,000.00
8.	Yams	2,500.00
9.	Cotton	350.00
10.	Cocoyams	920.00
11.	Cassava	1,500.00
12.	Soya Beans	110.00
13.	Sugar Cane	3,000.00
14.	Tomatoes	1,800.00
15.	Sweet Patatoes	800.00
16.	Irish Potatoes	350.00

17.	Pepper	N1,000.00
18.	Other vegetables e.g. carrot, cabbege, lettus and onions etc	500.00
19.	Rizga (a type of Tube)	1,000.00
20	Beniseed (Ridi)	500.00
21.	Ginger (Citta)	1,000.00
22.	Tigernuts (aya)	250.00
23.	Digitaria (Acca)	1,000.00
24.	Cereal grass (buro)	1,000.00
25.	Cocoyam (Gwaza)	600.00
26.	Tobacco (Taba)	500.00

Table 7: Rates for Crops Compensation.

4.7 Allocation of Urban and Rural Plots

Allocation of urban and rural plots for both private, agricultural, commercial and residential purposes are made as follows:

4.7.1 Land Use and Allocation Committee takes charge of control and administration of all urban lands, as provided in LUD (1978). It has the responsibility of advising the Governor on any matter connected with the management of urban land and with the resettlement of people who are displaced from the land they occupy in the wake of its acquisition in the greater public interest and handing dispute over the amount of compensation payable to disposed persons for improvement made on the land prior to dispossession.

The committee has its membership drawn from legal practitioners, two estate surveyors or land officers of at least 5 years post qualification experience and members of the community at large. Plots for residential purposes are cut in the following sizes:

High Density Layouts	-50' x 100'
Medium	-75' x 100'
Low Density	-100' x 100' (GRA)

4.7.2 In rural areas, the management of land is the responsibility of the Local Governments. A Land Allocation and Advisory Committee was established by the Governor for each Local Government to advise their respective local Government on the management of the rural land.

4.8 Cadastral Survey Systems

4.8.1 Survey Procedures

Property Surveys are carried out both by Licensed and Government Surveyors in the State. Licensed Surveyors are engaged for the most part on fairly extensive sub-divisions of layouts and topographical survey of fairly large areas for use as a base for designing comprehensive development plans. The government surveyors concentrate their efforts on survey of government items, sub-divisions of layouts not of large extent and surveys for organisation and

individual often at uneconomic rates. In addition government surveyors are engaged on common requests of re-establishment of missing beacons and also adhoc surveys for planned and rationalization of developments.

An applicant occupies his plot physically after getting a grant for a Right of Occupancy or approval letter. When an offer of a Right of Occupancy has been made to an applicant, he has to state, when accepting the grant whether he requires the land to be demarcated and surveyed by either the Surveyor General (who is not legally bound to undertake any survey or investigation, Cap. 129, S. 42(i)) or a License Surveyor. In either case, the method of survey is the same. Prior to the actual demarcation and survey, the surveyor collects the following information from the survey department in the form of an 'Instructions to Survey':-

(i) Copy of applicants site plan (as shown in Figures 4 and 9).
(ii) Allocation of pillar numbers
(iii) Details of cadastral control points.
(iv) Any data concerning adjoining property.

For land that is held under a customary Right of Occupancy where the owner wants to convert to statutory title, the applicant already knows his boundary and he is to show the Surveyor the extent of his property. This is normally incorporated in the Surveyor

General's instructions to carry out the survey. The Surveyor will then demarcate and survey the area according to survey Regulations. In case of layouts, survey starts after the layout plan has been approved by the Governor who is also the Commissioner of Land and Survey. The Surveyor is normally required to demarcate and survey the whole perimeter, layout the roads, the blocks and the individual plots; thus applying the principle of working from whole to parts.

4.8.2 Demarcation

According to section 23(1) of Cap. 194 Laws of the Federation of Nigeria and Lagos, the boundaries of all areas surveyed for the purpose of issuance of Certificate of Occupancy are normally demarcated by beacons of concrete mixed in the proportions of five parts of sand or sand and rubble to one of cement being 76cm long, 18cm square in section, buried in the ground projecting 7.5cm above the ground surface. These have been considered and discussed further in section 6.4.

4.8.3 The Survey

Cadastral boundary surveys are in most cases carried by closed theodolite traverse. That is, the traverse begins and ends on survey control points. Section 11 of Chapter 194 (survey regulations) requires that the positions of the control points be checked by angular and linear measurements before they are

used to control other surveys.

Section 3(b) (iii) also requires that the error in the surround traverse shall not exceed 1/3,000 in the case of country lands, and 1/4,000 in the case of town lands. An angular closure of 30 n where n is the number of stations, is expected. Other specifications are adhered to and sharply brought into focuss under sections 7.2, 8.2 and 8.3.

4.8.4 Layouts

There are two sources of layouts in the state. Those in urban areas are produced by the Kaduna State Urban Planning and Development Authority (KASUPDA) and those in other local government areas are prepared by the Department of Lands and Survey of the Governor's Office. Both categories are sent to the Surveyor General for Cadastral clearance before passing them to the Governor for approval.

Layouts at Local Government Headquarters are implemented by the State Government and Local Government layouts, that is those other than those covered above are implemented by the Local Government concerned. Implementation here covers both survey and provision of services.

A layout plan is a design of roads, building plots, social and recreational facilities and other utilities which have been drawn on paper by Town Planners.

There are two types of layout designs in the state. The general layout with standard size plots for residential, commercial and industrial purpose. The second layout commonly known as High Density Layout mainly for residential purpose and is usually meant for the masses who cannot afford to develop according to the G.R.A. standard. The plots are usually of dimension 20m x 30m.

The survey department has intelligence charts which are compiled township charts showing the boundaries of contiguous parcels of land and the associated transport/communication networks and Rights of Way (as shown in Figure 3). With the aid of the sketch plan a land percel is charted on the intelligence chart in pancil. It is later charted in ink on granting of the certificate of occupancy. The survey fees for demarcation and survey are just norminal.

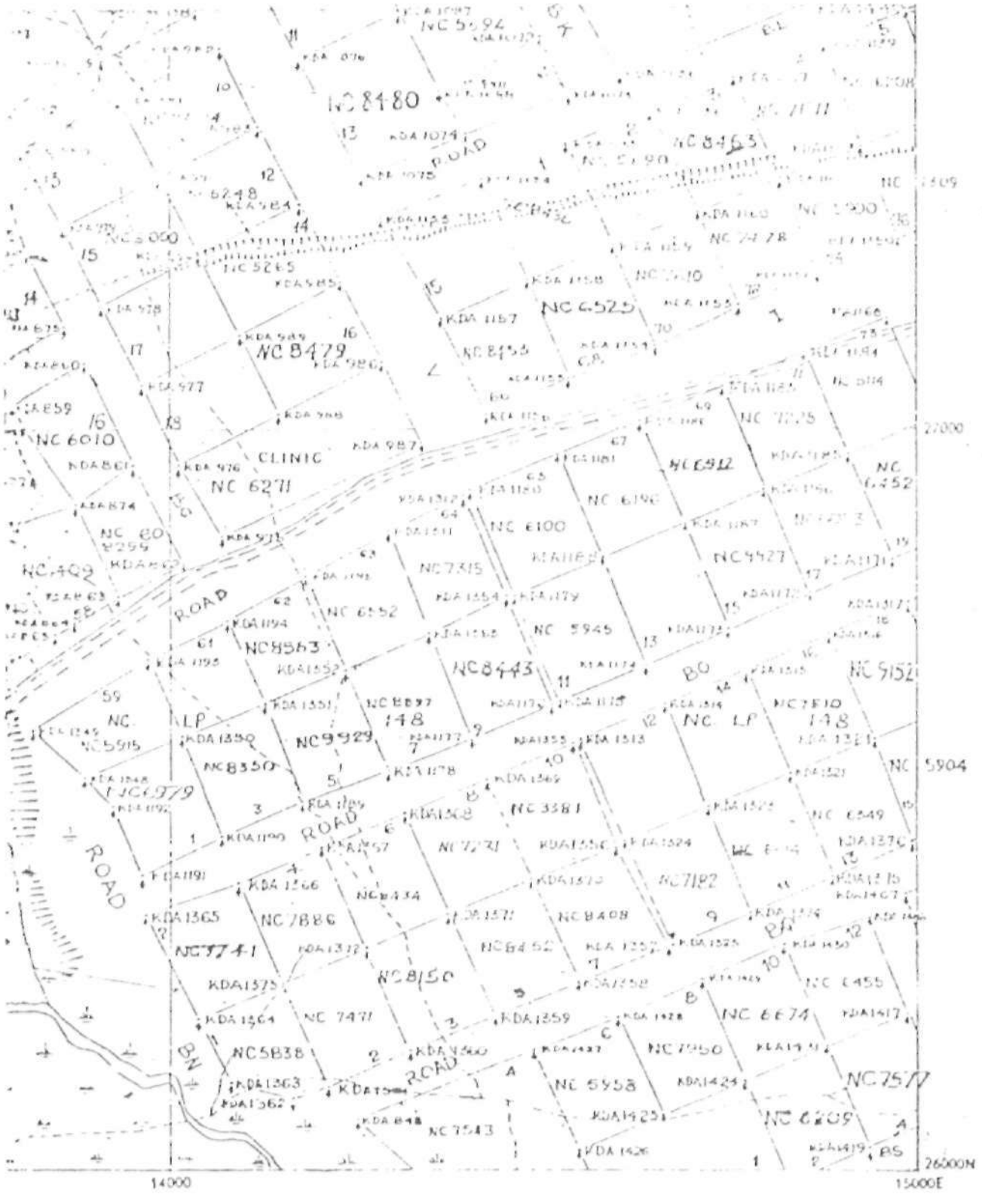
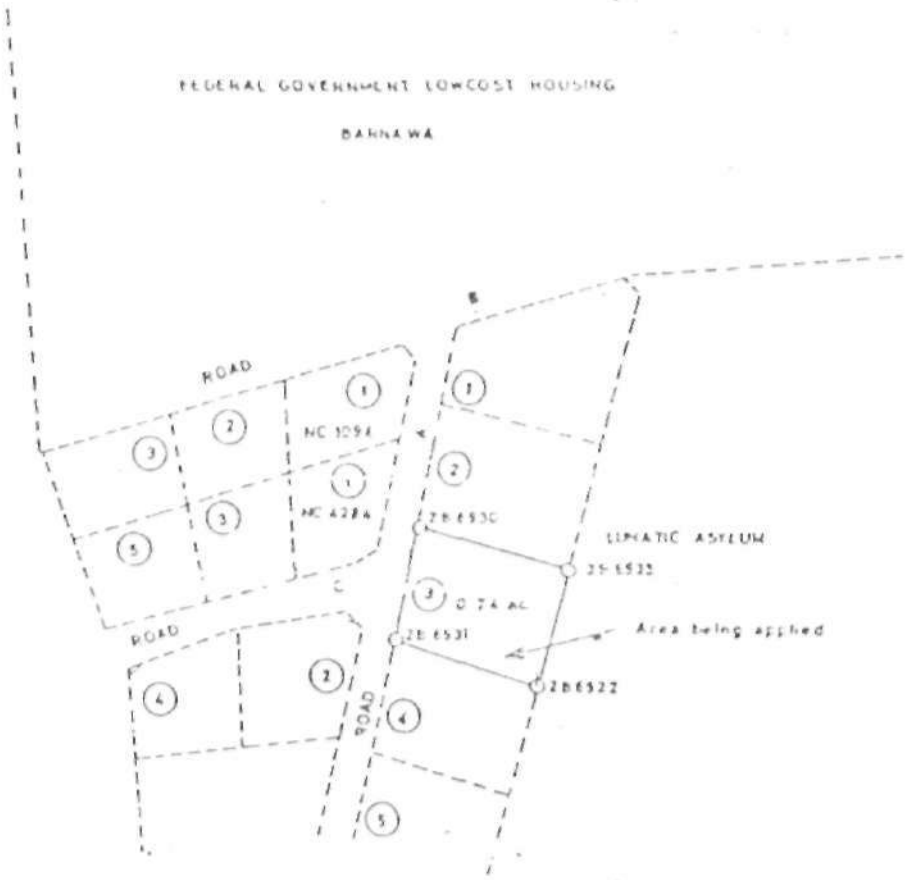


Fig. 3: Part of Kaduna State Intelligence Sheet.

SKETCH PLAN OF LAND BEING APPLIED BY
YAKUBU MAIKANO
FOR RESIDENTIAL PURPOSE
KADUNA



PART OF
KADUNA SHEET 95

SCALE: 200 FEET TO 1 INCH.

Fig. 4: A sketch plan to accompany application for a plot.

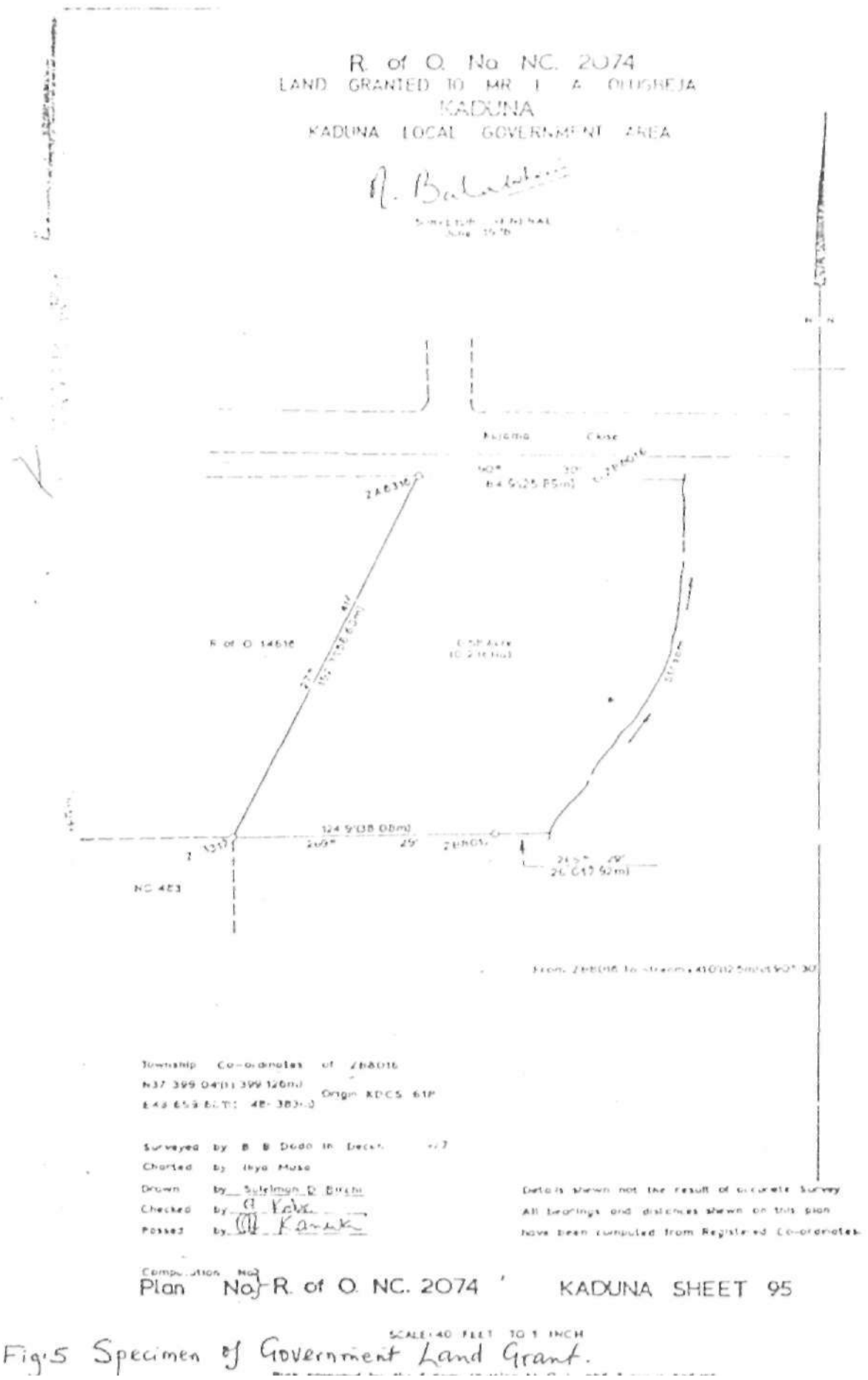


Fig.5

Fig.5 Specimen of Government Land Grant.

C. A. Manta Limited

M. L. 17138

ZARIA PROVINCE

Zaria Division

SURVEYOR GENERAL
Jan 1969

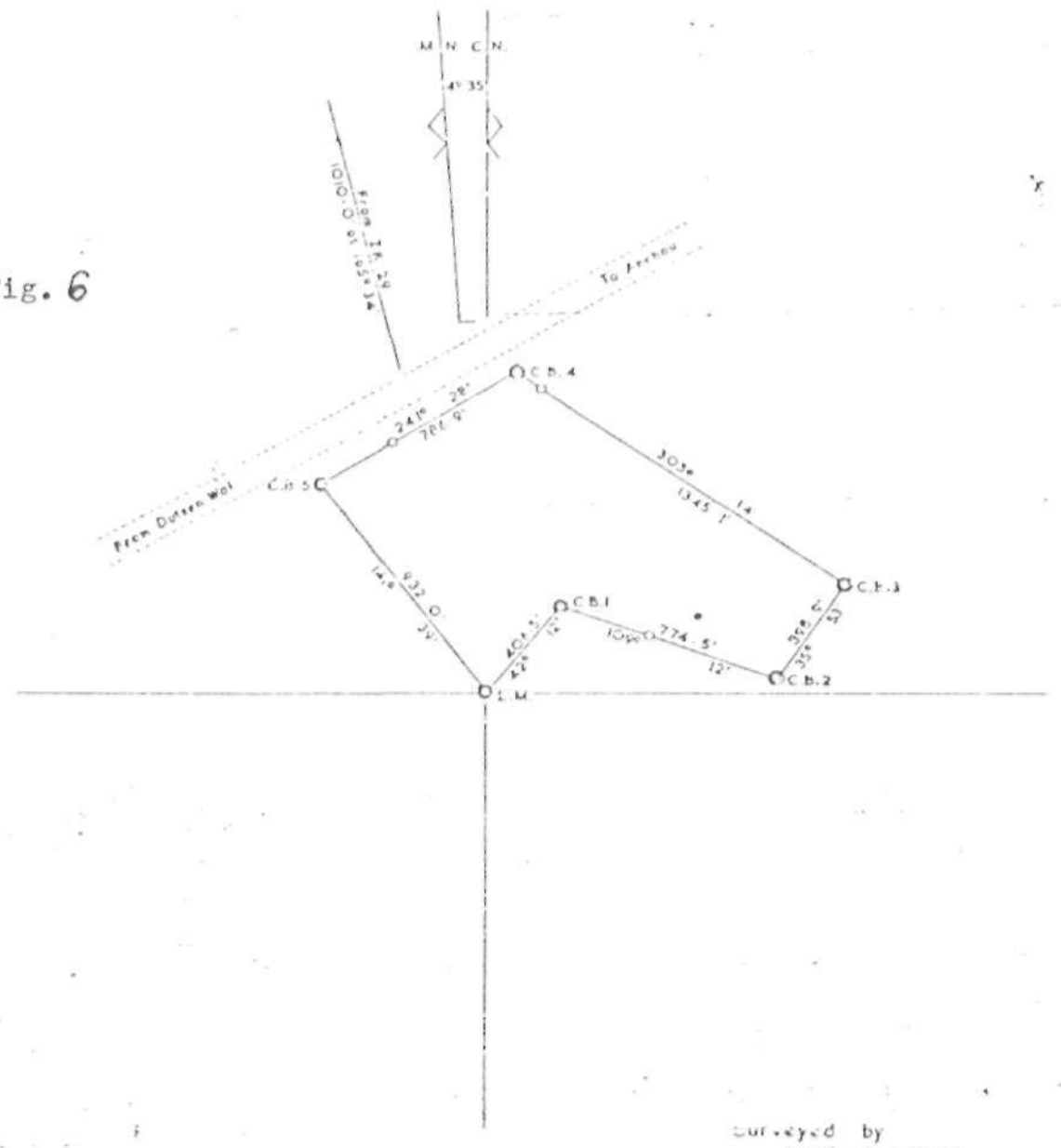


Fig. 6

Surveyed by
(sgd) O. Laleye
(Licensed Surveyor)
25.1.68

Colony Co-ordinates of L M
N 2 459 655 E 2 104 098

Drawn by [illegible]
Checked by [illegible]
Passed by [illegible]

—Area :- 23.82 Acres—

—Scale :- 1: 5000—

Sheet AN-1 / J 5 & 6

FT 500 0 500 1000 FT

Fig. 6 Survey Plan

M. K. EJUKORIEM & Co. LTD

APPLICATION — PLAN FOR A M.L OVER 48·48 ACRES
IN JEMA'A DIVISION OF ZARIA PROVINCE
P.R 21/66 DATE 29-4-66 SCALE 1" 5000' SHEET

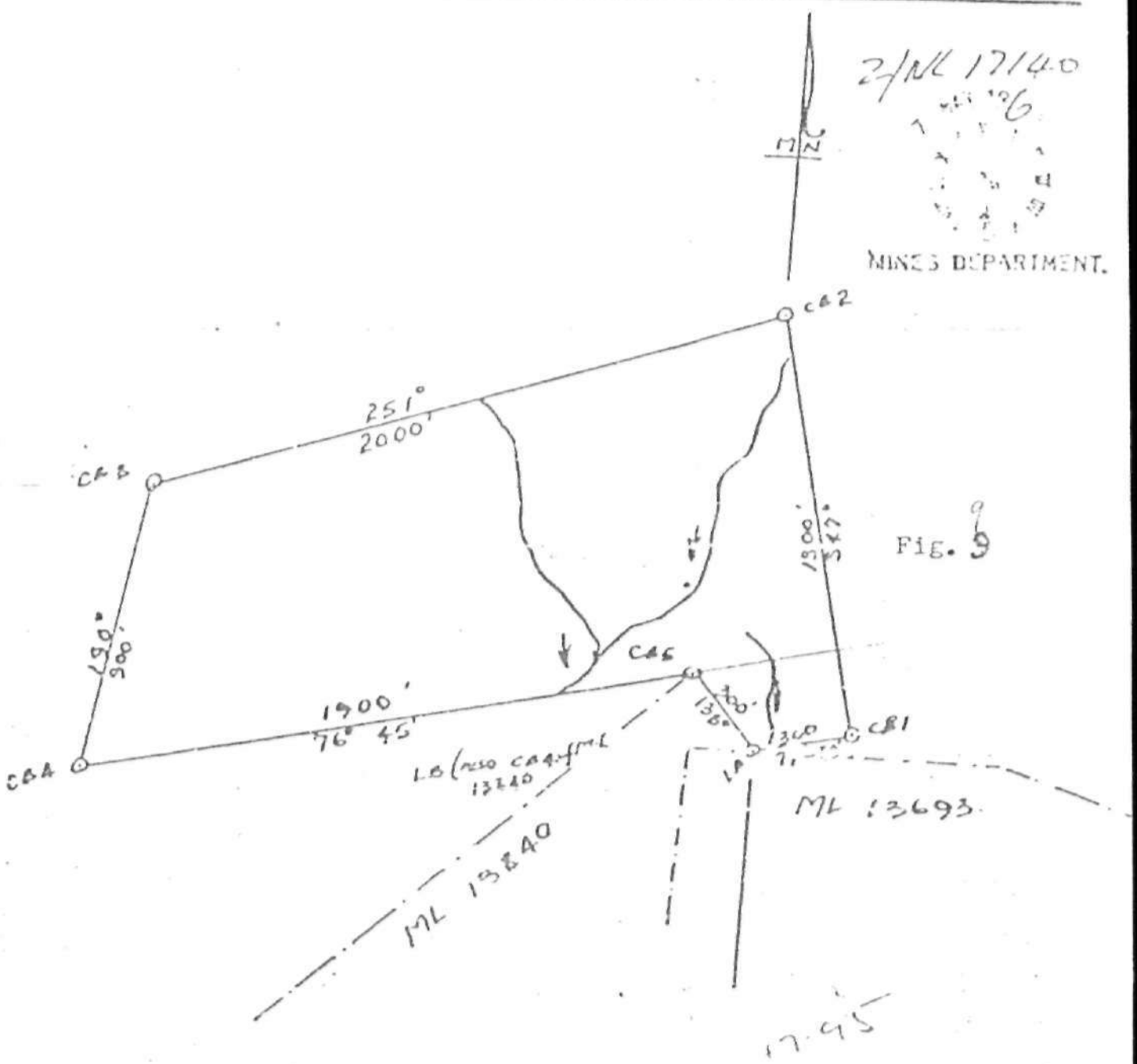


Fig. 9

CB1 to be placed on CB6-CB7 of ML 13693 on Survey

Fig. 7 Sketch Plan of C. of O

CHAPTER V

RECONNAISANCE AND PLANNING

5.1 Reconnaisance

The area enclosed by contour lines 510m in the immediate vicinity of rivers Gada, Sauka and their tributaries, is about 17000 hectares. This area starts at about 500m away from their confluence at a premarked area, where the head of the Dam is proposed. The terrain is generally flat and monotonous, rolling gently towards river Gada and its major tributary the Sauka River. Only at these river valleys would noticeable undulation occur.

These valleys are easily identifiable even at long distance, by the vegetation growth that cluster along the edges and almost nowhere else. The monotomy of the terrain is interrupted in very few places by isolated hills, some of which are nor more than 20 feet high. Though small, such heights could make a substantial difference in visibility and therefore in the choice and location of horizontal control stations. Accesses to the site and within it are mostly motorable cattle tracks. These are motorable for the most part except after rain, in which case mobility is reduced to virtually zero by fast streams and gullies.

5.1.1 Checking Map Information

The project area was extensively reconnoitred in vehicles, on motor bikes and on foot. Collating existing information involved the identification of prominent features on the 1:50,000 map sheets (as shown in Appendix K. Reconnaisance sketch plan Katsina Sw). But even more important, were the identification and insertion on the map sheets of those landmarks which should have been on maps but were not.

5.1.2 Inspection of existing controls

(a) Vertical controls from the survey descrptions obtained in Kaduna, SBM Charanchi and SBM Kankiya which were the nearest to site were found and uncovered. They were about 0.2 meters underground, visual inspection and cursory checks of the described markers were enough to satisfy that the benchmarks were in-situ. SBM Charanchi is about 19 kilometers by cattle tracks from the site while SBM Kankiya is about 35 kilometers away. Due to inaccessibility and standing crops by the Kankiya route, SBM Charanchi was selected for the control extension of heights.

(b) Horizontal control: A total of 10, first-order traverse trigonometric stations within 25 kilometers radius were inspected. Most of these stations were established in 1976 for the purpose

of extending controls for the Katsina Township mapping. Five of these stations were chosen for the purposes of extending horizontal controls. These are as shown in Appendix L.

These stations are:-

(1) KF 14- a first order traverse station on to of the hill in Dutsin-Ma some 25 kilometers from the site.

(2) KF 12- also a first order traverse station on Kurfi Hill.

(3) MC 151- a part of the National Trigonometric Framework.

(4) MC 152- also a part of Nigeria's National Triagonometric Network.

(5) KK 8- first order traverse station on Fakuwa Hill.

Ten stations which seemed generally higher than average terrain height and near the boundary (some later became position of the boundary beacons) were selected for their positioning with respect to the site and to the Sorgolio hill named FP 517. Most of these points were later used to extend horizontal controls. These points were marked on the 1:50,000 reconnaissance map, as is clearly depicted in Appendix K.

even when accuracy level is easily achieved, it is important not to substitute planning programming for instinctive and often incloate execution. Thus the methods of survey, the choice of instrumentation and the execution of the project should be planned such that not only are the final accuracy levels attained, but the procedures of the survey assures that internal consistencies are built in. For Dale (1976) states: "It is part of survey theory that the adjusted values are likely to be closer to the truth than the measured quantities".

5.2.2 Planning of control extension

Vertical controls were to be extended from SBM Charanchi along the cattle tracks to Benye using a closed loop spirit levelling. Benchmarks were planned to be established every three kilometers and these TBM's are to be levelled in forward and backward directions. The choice of 3 kilometers spacing of the TBM was more a matter convenience and has no empirical basis. From a benchmark established at Benye are to be established, as near to contour 510 as possible, a number temporary benchmarks. These set of TBMS would be used to trace and demarcate the 510 meter contour position.

Horizontal controls would be extended to the site from nearby identified control points. This would enable the perimeter survey to be connected to the extended points. Two methods were considered.

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Horizontal controls would be extended to the site from nearby identified control points. This would enable the perimeter survey to be connected to the extended points. Two methods were considered.

(a) Extension of horizontal controls by traverse was considered and discarded due to standing crops along survey lines.

(b) Extension of controls would follow a set of single triangle point co-ordinations, and by set of intersections from controls. It is possible to extend controls to FP 517 at Sorgoljo hill very near the site, by observing the single triangle KF 12-MC 151-FP 517. It would then be possible to co-ordinate other controls by inter-sections method. From reconnaissance, positions of TP1, TP2 and TP3 were chosen such that their positions later became PB 2976. BP 2977 and PB 2978. When established and co-ordinated, these points could provide the initial and closing controls of the perimeter survey traverse.

5.2.3 Choice of instrumentation and survey methods

instrumentation

Advancement in technology and accuracy of survey equipment has, to a large extent, made the choice of equipment to use on a survey project a matter of what is available. Most organisations would today use some form of short to medium range EDM and a one second theodolite even where the project requirement does not warrant their use. This is more a matter of ease of use than real cost/benefit analysis, Thus in this project, what was available but which would more

than satisfy the accuracy level requirements were:

(i) RETA - 1" theodolite with EDM that has a range of up to 3km.

(ii) Wild T2 - 1" theodolite with Wild DI 10 Distomat and accessories (pole reflector and 3 prism)

(iii) 3 Tripods

(iv) 1 set of Wild Targets

(v) 1 dry bulb thermometer

(vi) 1 Aneroid barometer

(vii) Umbrella and stand.

Survey Methods

The methods employed to carry out the survey and the cautions taken are as specified in the Technical Instruction for Field parties, a handbook on observation produced by the former Northern Region Surveys. A detailed account of procedures employed for each category of observations have been reviewed later under the appropriate heading.

5.3 Preliminary Checking of Instruments

To obtain the required precision and for economy in time, the optical theodolite reading to one second of arc used for angle measurements. The theodolite has the optical micrometer coincidence reading system so that the mean of the two readings on opposite sides of the circle is read directly in an auxilliary eye-piece beside the Telescope. Thus, it halves observing time and also saves disturbance of

the instrument.

The instrument must be checked in order to ascertain its adjustment so as to obtain accurate readings with the accuracy in which the survey is to be carried out. The theodolite was checked for horizontal line of sight end index error in vertical collimation as follows:

5.3.1 The adjustment of line of sight (horizontal collimation)

Consider the plan view of a horizontal theodolite as in Fig. 8.

If the line of sight is horizontal then when the telescope is transited the line of sight will describe a plane perpendicular to the transit eaxis YY^1. However, if the line of sight is not horizontal then the rays of sight would take the form of $E_F{}^1$ and $F_E{}^1$ on transiting. This was checked as follows:

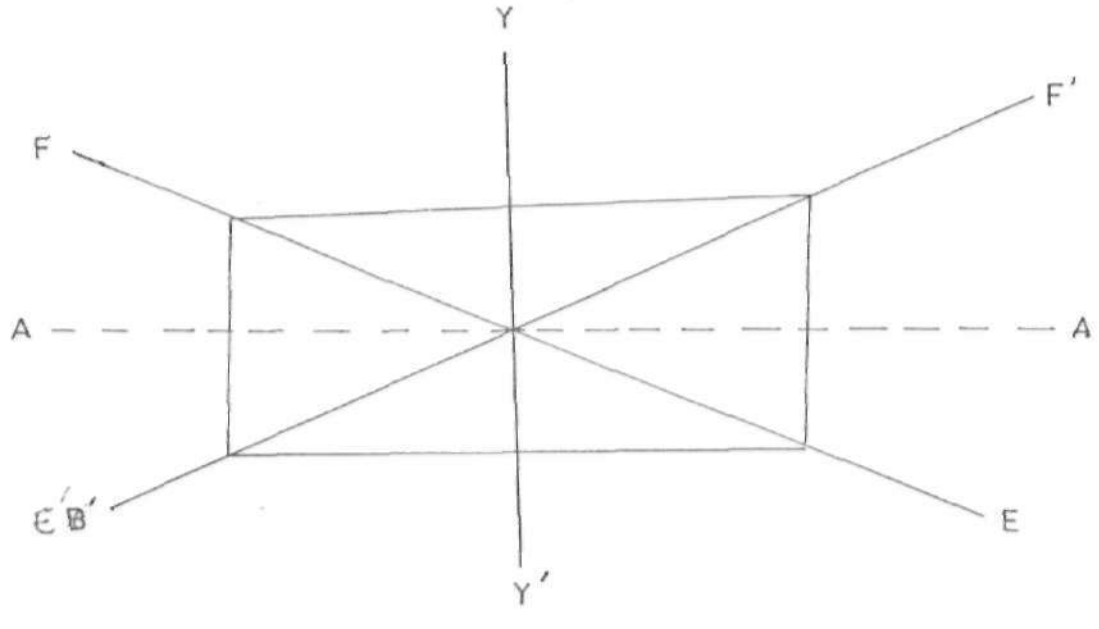


Fig 8: Horizontal Collimation Adjustment.

Instrument was set up on station CP12, the bubbles brought to the centre of their run by the foot screws. The target was then observed bisecting with the vertical cross hair. The horizontal circle reading read to the 135^{o} 30' 10FL. Changing frace (that is, now FR) read 135^{o} 30' 25" 2ND set of reading.

FL 50^{o} 45' 30"

FR 230^{o} 45' 26"

These readings differed by 180^{o} + a'(that is difference between FL and FR reading). However, (a') is not greater than 10" which for a theodolite reading to 1", is not appreciable. Hence the theodolite was considered in adjustment.

5.3.2 Adjustment for vertical collimation

With the instrument in the same position as in paragraph 5.3.1 above and already levelled, the target was bisected with the horizontal cross-hair, The vertical bubble then broght to the centre of its run and vertical circle reading noted as the FL 89^{o} 58' 54". Changing face and bisecting the target in the same manner, reading noted F 270^{o}01' 12". 2ND set of readings.

F_L 89^{o} 58' 52"

F_L 270^{o} 01' 03"

So, F_L 89^O 58' 54" and elevation = 01' 06"

F_R 270^O 01 12 and elevation = 01' 12"

Hence mean elevation = 01' 09"

Thus required reading on F_R is 270^O 01' 09"

Hence the vertical collimation is considered in good adjustment.

The temporary adjustments consisting of centring, levelling, focussing and elimination of parallax were equally carried out.

5.4 Preliminary Analysis of Accuracy

Accuracy is more or less a relative term which tells us how far away we are from the true value. In other words, the difference between the measured quantity and its actual value is designated as the error and has either positive or negative value. It is expressed relative to the measured quantity. Therefore, the ratio of the error to the measured quantity is used to indicate the accuracy of a measured quantity. For example, if we measure 10m to the nearest 0.02m, then the accuracy is 0.02% = 0.002 or 1/500.

In the case of this project, the accuracy that would be achieved will be greater if the length is longer, that is, it is directly proportional to the length. Considerations will be given for both angular and distance measurement accuracies.

5.4.1 Angular observations

These are errors arising due to miscentring of the instrument and target over the stations, bisecting the target and in reading the circles.

Errors due to miscentring. The error can be estimated by the formula:

$$M_{c_t} = \pm \frac{ef}{d} (2-\text{Cos } B)^{\frac{1}{2}}$$

where e = error of centring instrument and signals (target).

B = Angle observed, d = mean length of angle sides.

Suppose error in miscentring a target = 0.005m, and that in miscentring the instrument = 0.005m, that is e = 0.005m, d = 70m, B = 270

$$M_{c_t} = \frac{0.005 \times 206265}{70} (2-\text{Cos } 270)^{\frac{1}{2}}$$

$$= 0.28'.$$

Error due to aiming (ma) and reading (mr)

The error of a single direction is given by

$$md = \pm (ma^2 + mr^2)^{\frac{1}{2}},$$

error of angle measured in one round by both faces

$$M_B = + (2(ma^2 + mr^2)^{\frac{1}{2}} \text{ and}$$

$$\text{Total error } M_B = \pm (M_{c_t}{}^e + M_B{}^2)^{\frac{1}{2}}$$

Total angular misclosure B = $M_B N^{\frac{1}{2}}$

So, for this project let $m_a = \pm \frac{60}{x}$

where x = telescope magnification

$(x = 27)$; $m_a = \pm \frac{60}{27} = 2.22$:

$m_r = 10"$

For one round, $m_B = \pm (2(2.22^2) = 10)^{\frac{1}{2}} = 14".5$

$= 25"$

Total angular misclosure

$B = M_B N^{\frac{1}{2}} = 25 \times 4^{\frac{1}{2}}$

= 50 second of arc.

Thus the angular produced depends upon the error of centering, the lengths of sights, the magnitude of the angle being measured, and the position of the instrument relatively to the station and the points sighted, no error being introduced if the four points are concyclic. Under the worst circumstances, an error of centering of about 4mm may produce an error of 1mm in the angle measured if the sights are only 30m long, but centering would have to be at least 15cm out to produce a similar error with sights 1km long. Considering the ease with which centering may be performed, the error is not likely to be appreciable in this type of work. In any case,

the use of a special outfit with interchangeable theodolite and signals on three tripods eliminates centering errors, as discussed in Section 8.9.

5.4.2 Distance Measurement

Electromagnetic Distance Measurement (EDM) methods enable accuracies of up to 1 in 10 to be achieved without difficulty over ranges up to 100km. EDM is a general term embracing the measurement of distance using electronic methods. There are, at present, in excess of fifty different EDM systems available. The ones used for this purpose are D1 10 with T2 theodolite and RETA - 1" theodolite with EDM that has a range of up to 3km. Further discussion on the sources of error in EDM methods is to be found under Section 8.4.

5.5 Statistical Analysis of Angular Observation

If a quantity is measured several times, as far as possible under the same conditions, the measurements constitute a sample of a random variable. IF it is assumed that the random variable has a specific probability density (PD), certain statements can be made about the sample of values obtained and it is possible to develop criterion for the rejection of any measurement which appears to have been influenced by something other than random functuations in the conditions of measurement. The difference between any two such measured values is a

discrepancy. Analysis of values subject to random errors is based on statistical principles.

The specific probability density taken here will be the normal distribution, since survey measurements have generally been found to resemble this distribution rather than any other.

Properties of the normal frequency distributions:-

(i) f(x) is a maximim at x = E
(E being the most probable value)

(ii) the curve is symmetrical about X = E

(iii) points of inflexion occurs at X = E $\pm$ X

(iv) approximately 68.38% of the area under the curve lies between E $\pm$ X

(v) approximately 95.4% of the area under the curve lies between E $\pm$ 2 X

(vi) approximately 99.7% of the area under the curve lies between E $\pm$ 3 X

Suppose a variable C is defined by C = (Xc - X)/s, where X is any one of n normally distributed measured values, $\bar{X}$ is the arithmetic mean of the n measured values and S is defined by

$$S^2 = \frac{(Xc - \bar{X})^2}{n}$$

the square bracket denoting summation.

I 1% probability level is chosen as the criterion, then any residual which is greater than 2.48 x S should be rejected.

On the other hand, if 10% probability level is chosen, any residual greater than 2.18 x S should be rejected.

For such a criterion to be determined the theodolite was set up at station C and angle between E and F measure in eight rounds, as follows:

	Angle(Xc)			$(Xc - \bar{X})$	$(Xc-X)^2$
1	180	38	22"	-0.88	0.77
2			20"	-2.88	8.29
3			26	+3.12	9.73
4			31	+8.12	65.93
5			21	-1.88	3.53
6			19	-3.88	15.05
7			23	+0.12	0.01
8			21	-1.88	3.53
$\bar{X}$	=		22".88		-106".84

Table: Analysis of Angular Observation

$\bar{X}$ = 22".8 $X_c-\bar{X}^2$ = 106".84

S^2 = 13.36 and S = 3".65

If the 1% probability level is the criterion, lthe maximum residual which can be toterated is 2".48 x 3.65 = 9".06, All the above reading will therefore be accepted. The disadvantage of this criterion is that it could fail to locate a reading which has been subject to non-random effects when there is more than one outlying observation.

Apart from the foregoing statistical basis for the rejection of observation, it is often possible to have other reasons for rejecting certain measurements, usually arising from the noticeable change in the conditions of measurement in the field.

Consequently, it is of common acceptance that the difference between the arithmetic means and any one micrometer reading (for the angle measured) obtained during a series of rapid one-second theodolite pointings should not exceed $\pm$ 15", otherwise such a pointing should be rejected. This criterion has been strictly adhered to throughout the period of the field work.

5.6 Station Description

The efforts put into establish and coordinate controls will be wasted if pillars established cannot be recovered for the purpose they were established. Thus the most important aspect of a control survey after establishing a pillar is to compile sufficient information that will lead another surveyor to recover the pillar for use. Such information are formed from measurements and sketches (at the stations) of features in the locality and the vicinity. The compiling of these informations about the survey mark is known as Station Descriptions and are usually made of control pillars, and bench marks.

The information include:-

5.6.1 Access information and diagram, roads foot-paths and so on.

5.6.2 Approximate bearing and distances to features and other stations.

5.6.3 Accurate panoramic sketches.

5.6.4 Description of the survey mark.

5.6.5 The approximate location.

After the emplacement of the benchmarks, the position of the benchmarks were described. This will help in the future location of these benchmarks.

The equipment for the station description were steel, tape and prismatic compass. The procedure is as follows:-

(i) Prismatic compass was placed on its stand and then set over a station.

(ii) important permanent features e.g. edge of buildings, big trees, electric poles, water towers, junction of roads and pathways, were sighted throguh the eye-piece of prismatic compass. The bearing was read. The distance to the object from the station was measured. These features were then drawn in the traverse description forms.

5.7 Problems Encountered

At the conclusion of the reconnaissance stage, it was found out that the area enclosed by Highest Flood level contour 504.6m on the available map 1:10,000 (enlarged from 1:5,000 topographic sheet) fell far short of the anticipated 2,000 hectares. A ground check, by distance confirms the reservoir area would be much less. Further inspection, showed much of the land especially along the Sokoto tributary to be barren or grazing land, mostly heavily disected by erosion.

Furthermore, it was found that one could move the reservoir area up to contour 510 without including any major village or settlement into the acquisition. It was finally decided that:

5.7.1 the overall compensation to be paid for the land and economic trees will not be sustantially increased if the contour 510m was demarcated, surveyed and acquired in place of the 504.6 contour, initially conceived.

5.7.2 only a few compounds would be affected by the increase in area. No major village or settlement would be affected. However, the buffer provided between the area to be flooded and any settlement and/or farmland would be such as to ensure that the dam could not possibly affect any unacquired properties.

CHAPTER VI

TRACING OF CONTOUR ALONG HIGHEST FLOOD LEVEL (HFL)

6.1 Establishment of Temporary Benchmark (TBM)

Two types of temporary benchmarks were made for the purposes of this project, they are:

6.1.1 Type 1-Called Temporary Benchmarks (TBM) and numbered serially from 1 to 7 were selected at a 3km spacing from SBM Charanchi to the Village of Benye some 12km from Charanchi. The TBMs were monumented with property beacons measuring 18" long, 4" square and buried about 15" in the ground.

6.1.2 Type II-numbered TBM 8 to 18 were selected at planning stage so that they are as close to the boundary as identified from the 510 contour on the 1:50,000 topographic sheet. They are spaced from 700 meters to 1km apart. These points were monumented as in 6.1.1 above, the area near them cleared and two markers made of painted angle irons sunk.

A third order equipment the Ni 2 level was employed. The following procedure were employed:

(a) Readings were taken to check its collimation error and only after it was found to be in adjustment was the equipment used.

(b) the stretch from SBM Charanchi to Benye (i.e. TBM 1 - 7) was double levelled with permanent benchmarks positioned every 3 kilometers along the cattle track. The other TBMS (8-45) where looped to TBM 6 and 7.

(c) the distance between instrument stations was kept to a maximum of 100 meters even where longer distances were possible.

(d) all three wire readings were taken.

Thus a levelling circuit was run from SBM (standard Benchmark) Charanchi of height 542.075m to Benye to establish temporary benchmark TBM7 and closed back on SBM Charanchi. The levelling route covers a distance of about 36km and has a closing error of 0.001m.

6.2 Accuracy

The TBM was determined to a second order accuracy. The second order accuracy of a level net is given by:

$M = 8mm\ k$, where K is the distance in kilometers between points and m is the misclosure. For a distance of 36km the misclosure should be 0.0408m compared with misclosure of 0.001m as obtained.

6.3 Locating the Highest Flood Level (HFL) Points

From the established TBM, the HFL contour was located by back sighting to the levelling

staff on the TBM and computing the value that should be read on the staff at the foreward station to give the value of HFL. The staff was then moved around until the computed reading was obtained. Thus the reading at the foreward station when the staff is at the HFL will be given by (Ref. Figure 9)

$$h_2 = H + h_1$$

where

h_1 = Staff reading at the back station

h_2 = Staff reading at the foreward station

H = Height of TBM (H_1) - height of HFL (H_2).

For subsequent contour points the foreward staff was shifted around until the foresight and backsight readings were equal, so that the difference in elevation between back and foreward stations is equal to zero. The foregoing procedure was repeated until the HFL contour was completely traced. Each back and foreward staff station representing HFL contour points was marked with a peg.

6.4 Demarcation

After the HFL contour was traced each peg marking the contour line was removed and replaced with angle iron post with concrete base.

After marking with iron posts, the reservoir boundary was also demarcated with concrete beacons of 18cm square, 0.78cm long with a 10cm nail in the middle to a depth of 8cm. The beacons were buried to a depth of 0.68m on the ground and the property beacon number along with arrow were stamped at the appropriate places as per instruction of survey. The pillars were placed up 500cm apart with shorter distance dictated by inter-visibility between any two consecutive distance of 30m from HFL so that they will lnot be submerged after dam construction. A tctal of 182 property beacons were buried. The numbers used are:

KT 2926 to KT 3025

KT 561 to KK 592

DM 2488 to DM 2537

Table 8: Numbers of Property Beacons.

GADA BENYE IRRIGATION PROJECT

STATION	NORTHINGS	EASTINGS
KT 2927	1393155 399	331528 921
KT 2928	1393051 563	331588 331
KT 2929	1393018 317	331741 536
KT 2931	1392881 054	331842 286
KT 2931	139715 041	331919 852
KT 2932	1392545 753	331902 653
KT 2933	1392432 187	332001 197
KT 2934	1392362 190	332137 539
KT 2935	1392117 452	332422 708
KT 2936	1391879 872	332563 453
KT 2937	1391767 397	332484 709
KT 2938	1391518 542	332522 448
KT 2939	1391330 473	332848 291
KT 2940	1391188 991	332865 203
KT 2941	1391157 580	332624 529
KT 2942	1390880 098	332712 076
KT 2943	1390757 101	332764 389
KT 2944	1390734 779	332735 979
KT 2945	1390857 219	332581 401
KT 2946	1390924 970	332153 861
KT 2947	1391071 614	331873 360
KT 2948	1390934 756	331720 683
KT 2949	1390631 835	331525 062
KT 2950	1390514 660	331350 921
KT 2951	1390418 285	331255 425
KT 2952	1390125 685	331102 037
KT 2953	1390039 859	331050 941
KT 2954	1389916 099	330942 408
KT 2955	1389888 867	330904 162
KT 2956	1389847 007	330798 249
KT 2957	1389743 016	330627 951
KT 2958	1389524 735	330429 630
KT 2959	1389364 057	330477 336

Table 9: Co-ordinates of Property Beacons.

GADA BENYE IRRIGATION PROJECT

STATION	NORTHINGS		EASTINGS	
DM 2521	1387750	861	328555	592
DM 2522	1387784	872	328556	715
DM 2523	1387815	495	328620	483
DM 2524	1387858	853	328669	441
DM 2525	1387886	484	328680	682
DM 2526	1388389	125	328611	643
DM 2527	1388441	539	328643	469
DM 2528	1388504	742	328559	303
DM 2529	1388567	732	328548	953
DM 2530	1388620	672	328583	987
DM 2531	1388650	333	328598	394
DM 2532	1388682	515	328574	565
DM 2533	1388869	227	328505	734
DM 2534	1388892	439	328312	699
DM 2535	1388815	767	328156	025
DM 2536	1388695	976	328003	219
DM 2537	1388572	609	327988	633
DM 2538	1387242	475	326594	305
DMKK 561	1387242	475	326594	305
KK 562	1387341	530	326630	146
KK 563	1387649	715	326547	996
KK 564	1387943	106	326662	724
KK 565	1388100	596	326832	063
KK 566	1388295	815	326985	951
KK 567	1388608	915	327137	549
KK 568	1388856	907	327245	428
KK 569	1389038	787	327267	296
KK 570	1389256	470	327104	591
KK 571	1389237	101	327272	367
KK 572	1389319	301	327365	727

Table 9; (Continued).

GADA KENYE IRRIGATION PROJECT

STATION	NORTHINGS		EASTINGS	
KT 2993	1385968	002	333783	562
KT 2994	1385927	451	333699	113
KT 2995	1385835	023	333734	395
KT 2996	1385702	994	333793	340
KT 2997	1385516	291	333774	120
KT 2998	1385434	770	333735	984
KT 2999	1388390	283	327769	876
KT 3000	1388371	068	327645	097
KT 3001	1388326	638	327615	186
KT 3002	1388227	958	327571	212
KT 3003	1388095	066	327509	646
KT 3004	1387937	947	327424	694
KT 3005	1387840	178	327408	384
KT 3006	1387778	104	327271	674
KT 3007	1387617	701	327069	598
KT 3008	1387539	607	327010	966
KT 3009	1387187	589	326782	433
KT 3010	1387028	632	326644	818
KT 3011	1386916	340	326587	974
KT 3012	1386849	444	326532	915
KT 3013	1386770	584	326495	142
KT 3014	1386662	628	326428	783
KT 3015	1386407	454	326342	538
KT 3016	1386377	167	326133	566
KT 3017	1386506	745	326170	356
KT 3018	1386593	786	326147	234
KT 3019	1386657	092	326088	005
KT 3020	1386729	407	326106	274
KT 3021	1386685	993	326233	458
KT 3022	1386795	356	32625	694
KT 3023	138694	615	32634	200
KT 3024	1387103	613	326408	827
KT 3025	1387227	402	326513	087

Table 9: (continued)

GA A BENYE IRRIGATION PROJECT

STATION	NORTHINGS		EASTINGS	
DM 2488	1385387	283	333109	740
DM 2489	1385455	990	333140	666
DM 2490	1385561	823	333043	356
DM 2491	1385574	425	332939	871
DM 2492	1385570	849	332631	130
DM 2493	1385676	504	332465	055
DM 2494	1385726	867	332136	404
DM 2495	1385874	478	331888	628
DM 2496	1385877	209	331833	708
DM 2497	1385960	986	331706	054
DM 2498	1386098	582	331577	947
DM 2499	1386312	115	331371	771
DM 2500	1386436	709	331198	791
DM 2501	1386470	732	331092	969
DM 2502	1386554	531	331039	082
DM 2503	1386645	640	330905	517
DM 2504	1386691	594	330789	459
DM 2505	1386774	423	330690	658
DM 2506	1386873	667	330689	355
DM 2507	1387052	481	330390	588
DM 2508	1387213	348	330396	749
DM 2509	1387263	240	330284	935
DM 2510	1387274	947	330098	482
DM 2511	1387176	792	329684	799
DM 2512	1387148	709	329492	373
DM 2513	1387096	242	329374	602
DM 2514	1386965	056	329261	011
DM 2515	1387401	799	328968	984
DM 2516	1387496	202	328925	218
DM 2517	1387608	341	328866	485
DM 2518	1387653	418	328779	091
DM 2519	1387707	070	328631	852
DM 2520	1387754	697	328584	125

Table 9: (Continued).

GAMA BENYE IRRIGATION PROJECT

STATION	NORTHINGS		EASTINGS	
KT 2960	1389219	282	330610	081
KT 2961	1389204	900	330704	603
KT 2962	1389138	629	331112	545
KT 2963	1389170	286	331430	638
KT 2964	1389332	787	331553	076
KT 2965	1389260	889	331594	644
KT 2966	1389112	630	331503	480
KT 2967	1389020	393	331445	233
KT 2968	1388972	300	331394	586
KT 2969	1388687	731	331418	164
KT 2970	1388611	485	331480	572
KT 2971	1388615	067	331653	425
KT 2972	1388682	135	331676	528
KT 2973	1388653	562	331692	579
KT 2974	1388592	597	331681	186
KT 2975	1388497	720	331578	115
KT 2976	1388368	357	331620	116
KT 2977	1388157	489	331697	484
KT 2978	1387631	851	330210	918
KT 2979	1387572	206	331959	253
KT 2980	1387489	291	331925	283
KT 2981	1387398	376	331972	532
KT 2982	1387291	489	332082	702
KT 2983	1387033	058	332334	565
KT 2984	1386809	680	332559	330
KT 2985	1386741	398	332670	071
KT 2986	1386640	660	332863	400
KT 2987	1386439	064	333049	424
KT 2988	1386353	224	333260	239
KT 2989	1386309	016	333335	622
KT 2990	1386298	911	333425	289
KT 2991	1386155	039	333621	169
KT 2992	1386086	026	333647	103

Table 9: (Continued).

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CHAPTER VII

7. CONNECTION SURVEYS

The boundary survey was carried out to determine the location of the boundary beacons and angle iron posts established in Section 6.4. Heights of boundary beacons were also determined. It is necessary to connect these measurements to National Network System.

7.1 Vertical Controls

From survey description available, SBM Charanchi and SBM Kankiya were the nearest to the site. These were buried at about 0.2m below ground level. Visual inspection and cursory checks of the described marks showed that they were in-situ. SBM Charanchi was chosen for the control extension bing the nearest to the site (about 19km by cattle tracks).

Vertical controls were therefore extended along the cattle tracks from Charanchi to Benye using a closed loop spirit levelling. Bench marks were established at intervals of three kilometers and these temporary benchmark (TBM) were levelled at forward and backwark directions. From the benchmark established at Benye, a number of temporary benchmark were established as near as possible to contour 510m. These TBM's were used for the contour trace and the heighting of the property beacons.

7.2 Horizontal Controls

The points selected for the execution of horizontal controls (PF 517, TPI, TP2, TP3, TP4 TP5 and TP6) were also monumented by precast concrete pillars measuring 3 feet, 8" square with 4" nail in the middle, sunk to a depth of 27 inches. At sorgolio hill (FP 517) a beacon was found casted on the hill bearing such number. Its co-ordinates were not available after a search was made at state and Federal Surveys offices in Kaduna and at Kenting Africa in Kano. Its number was adopted and the point co-ordinated. Point TP4, TP5, and TP6 came close to property beacon locations and were discarded in favour of the positions of the property beacons.

Observations were carried out in respect of horizontal control in the following manner:-

7.2.1 two sets of face lefts and two sets of face rights were observed. Two zeros were used with higher order controls always used as Reference Origin(R.O.) and reading taken in clockwise direction. Closing errors on R.O. do not exceed 5". Mean of both FL and FR do not exceed 10" and triangular closure not exceeding 8" observation with bigger errors were rejected and retaken.

7.2.2 A"1" theodolite, the Kern DKM 2A, checked for collimation error before the start of the observations was used.

As pointed out in section 5.1.2 some ten first-order traverse trigonometric stations within 25 kilometers radious were inspected. Five of these were chosen. These were: KF 14, KF 12, MC 151, MC 152 and KK 8. Practical difficulties limited the use to only two of these five control stations - that is, KF 12 and MC 151.

Seven stations which were generally higher than the average terrain were established for the purpose of PBKT 2976, 2977, 2978 later formed part of these boundaries of the perimeter survey. The control points were marked on the 1:50,000 reconnaissance map sheet. The extension of controls follow a set of single point co-ordination, and by set of intersections from first-order controls. Firstly, FP517 at Sorgolio hill was co-ordinated from triangle KF 12-MC 151. With the co-ordinates of FP517, TP3 was co-ordinated using triangle KF 12-MC 151-TP3 and angles observed at FP517 and MC 151.

Thirdly, TP 2 was co-ordinated from triangle TP3-FP517 - TP2 using the angular observations made at TP3 and FP517.

Fourthly, PBKT 2976 was co-ordinated from FP 517, TP3 and KT 2976 using angles at FP 517 and TP 3. Next was the computation of the co-ordinates of PBKT 2977 using triangle FP 517- KT 2977 - TP3 and angles observed at FP 517 and TP3.

Finally, the co-ordinates of PBKT 2978 was computed from triangle KT 2976 KT 2978. The method of computation and the arrangement of figures and diagrams are as shown in section 7.3. The angles in a triangle were usually summed up and adjusted for triangular closure before the computations.

7.3 Triangulation

This is a form of survey which depends upon the proposition that if the length and direction of one side of a triangle are known and the angles of the triangle are measured, a value as obtained for the length and direction of the remaining two sides. Now if we add to this fixed data, the co-ordinates of one and of that line, then the positions or co-ordinates of the other spices of the triangles are obtained. Extending this process with further triangles, a chain can be established across the area to be surveyed or a complete network of triangles or figures can be spread over the whole area.

After fixing the first side, the survey can be continued to cover a considerable are by measurement of angles alone. Of course check

measurements of direction and length at appropriate intervals are desirable in extensive surveys to control swing and scale; and such are check base measurements for scale check, and astro observations to check direction and postion.

7.3.1 Grades of Triangulation

In designing a triangulation for an area, the principle of control and economy of accuracy are honoured by:-

(a) Firstly, covering the whole area with a framework consisting of chains of primary triangulation. The triangles will be comparatively large having sides ranging from about 25-66km (15-40 mls) the length of the baselines is from 5-33km. The mean triangular misclosure is not exceed 1", and amaximum is not to exceed 3". The standard error of mean, in base measurement, or scale checks, is not to exceed 1/750,000 and the actual error not to exceed 1/3000.000. Accuracy of triangulation with regards to closure in the length and/or position is not to exceed 1/60,000. This is the highest order of trinagulation.

(b) Secondly, covering large area with second order triangulation within the frame of the primary network, and tied to it at intervals. It is designed to furnish points closer together than those of the primary triangulation The length of the side range between 13-25km (about 8-15mls).

The mean triangular misclosure is not to exceed 1.5 and the maximum is not to exceed 5". The standard error of mean in the base measurement, or scale to checks, is not to exceed 1/500,000. Actual error is not to exceed 1/150,000. The accuracy of triangulation, with regards to closure in length and or/position not to exceed 1/30,000.

(c) And thirdly, third order or tertiary triangulation is run between the stations of the secondary system. The sides range from 5-13km (about 3 to 8 mls).

The mean triagular misclosure is not to exceed 3". The maximum misclosure is not to exceed 10", the standard error of mean, in the base measurement, or scale checks, is not to exceed 1/200,000. Actual error is not to exceed 1/100,000. The accuracy of triangulation, in regards to closure in length and/or position is not to exceed 1/20,000.

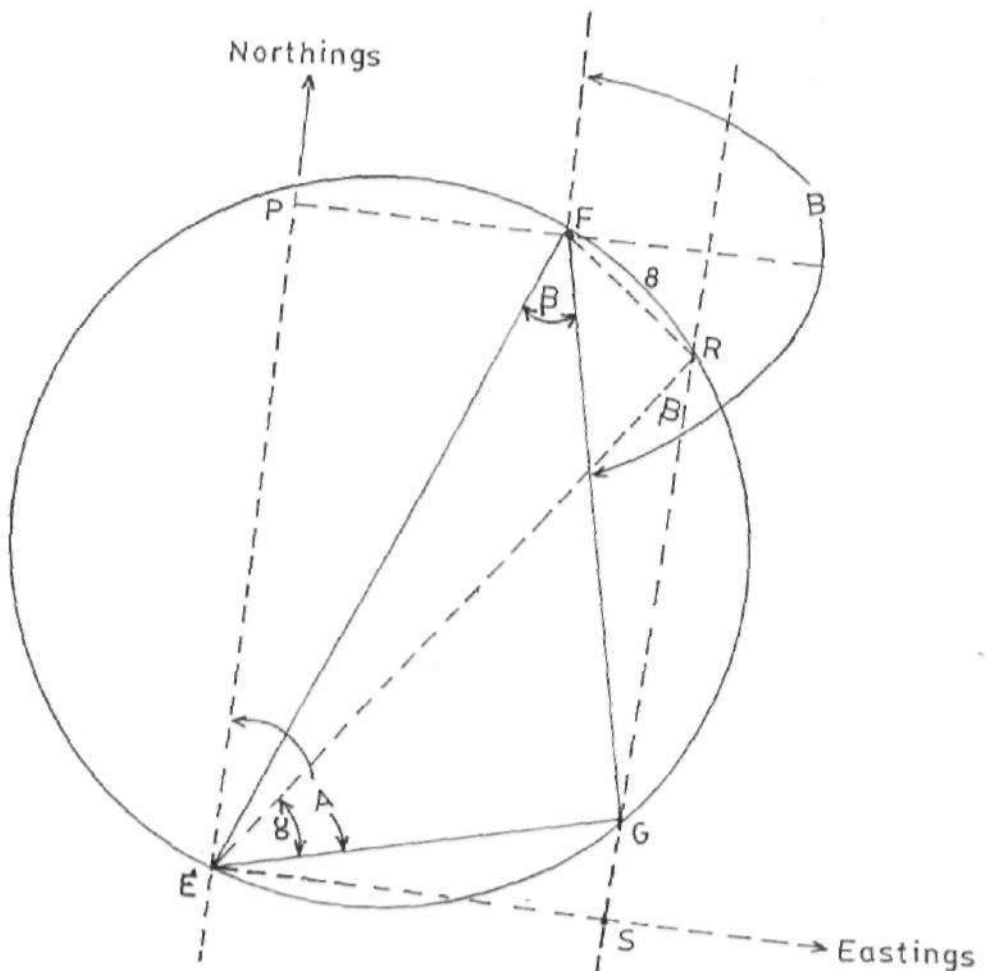
From above, it can be drawn that secondary triangulation is a break down from primary chains, with less refinements of observations. The classification above is in connection with National Control Networks.

The nature, purpose, extent and scope of this work justify the covering of the area with tertiary or third order triangulation points.

7.5 Computation of Horizontal Control Points Using Analytical Method

7.5.1 Basic principles

The formulae used to compute a tri ngle in which only two angles have been observed, are identical to those employed for the fully observed triangles, with the exception that in the former case the third angle is deduced, and in the l tter the three angles are first adjusted for closure on 180°. The minimum number of rays required to fix a point by intersection is two. In most surveys, a third ray will be observed to act as a check on gross error in both observation and computation.



Co-ordinated of the points E and F are known, together with the angles E and F, denoted by and . It is required to compute the co-ordinates of point G.

In the figure above, lines ES and PQ are East-West grid line through E and F respectively, SQ is a North-South line through G meeting the circle through E, F, and G

$E_G - E_E = ES = RS \tan\beta$; $E_G - E_F = FQ = QR \tan\alpha$

$N_F - N_E = QS = QS + RS = (E_G - E_F) \times Cot\alpha + (E_G - E_F)Cot\beta$

$$\text{whence} = \frac{E_E \, Cot\beta + E_F \, Cot\alpha - N_E + N_F}{Cot\alpha + Cot\beta}$$

Similarly, the formular for the northing of Q can be obtained by considering the co-ordinate axes to be rotated through a right angle, but with the E - W direction necessarily reserved, giving

$$N_G = \frac{N_E \, Cot\beta + N_F \, Cot\alpha + E_E - E_F}{Cot\alpha + Cot\beta}$$

7.5.2 Check on use of contangents

When a point is fixed by only one triangle its co-ordinates should be checked in some way. A useful check on the cotangents in the formulae above; is

Cot A Cot B + Cot B Cot C + Cot C Cot A = 1

Where $A + B + C = 180^{o}$. For $A + B = 180 - C$

or $Cot (A+B) = Cot (180 - C) = - Cot C$

that is

$$\frac{Cot\ A\ Cot\ B - 1}{Cot\ A + Cot\ B} + Cot\ C = 0$$

The same applies when A + B + C = 360°

7.6 Computation of Horizontal Controls

7.6.1 Co-ordinating FP 517

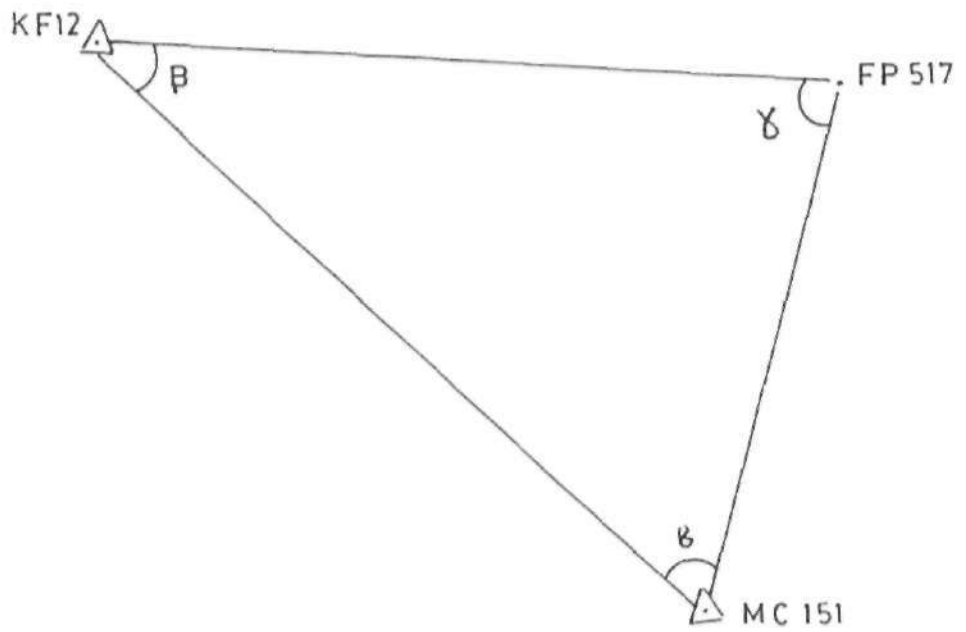


Fig. 26 Co-ordinating FP 517

From the formulae in Section 7.5.1, we have

$$E_G = \frac{E_E \cot \beta + E_F \cot - N_E + N_F}{\cot \alpha + \cot \beta}$$

Re - arranging, we've

$$E_G = \frac{\begin{vmatrix} E_E & N_E \\ 1 & \text{Cot } \beta \end{vmatrix} \quad \begin{vmatrix} E_F & N_F \\ -1 & \text{Cot } \alpha \end{vmatrix}}{\text{Cot} \quad + \quad \text{Cot}}$$

Similarly,

$$N_G = \frac{N_E \text{ Cot } \beta + N_F \text{ Cot } \alpha + E_E - E_F}{\text{Cot } \alpha + \text{Cot } \beta}$$

$$\text{Thus } N_G = \frac{\begin{vmatrix} N_E & E_E \\ -1 & \text{Cot } \beta \end{vmatrix} \quad \begin{vmatrix} N_F & E_F \\ 1 & \text{Cot } \alpha \end{vmatrix}}{\text{Cot } \alpha + \quad \text{Cot } \beta}$$

So with reference to Fig. 19 and Fig. 22

$$E_{(FP\ 517} = \frac{\begin{vmatrix} E_{(MC\ 151)} & N_{(MC\ 151)} \\ -1 & \text{Cot } \beta \end{vmatrix} \quad \begin{vmatrix} E_{(KF\ 12)} & N_{(KF\ 12)} \\ 1 & \alpha \quad \text{Cot } \alpha \end{vmatrix}}{\text{Cot } \alpha \quad + \quad \text{Cot } \beta}$$

$$= \frac{\begin{vmatrix} 346\ 751.538 & 1382\ 213.313 \\ -1 & 0.8992 \end{vmatrix} \quad \begin{vmatrix} 334\ 934.254 & 1399\ 800.091 \\ 1 & 1.1112 \end{vmatrix}}{2.0104}$$

$$= \frac{701560.341}{2.0104} = 348\ 967.867$$

Also,

$$N_{(FP\ 517)} = \frac{\begin{vmatrix} N_{(MC\ 151)} & E_{MC\ 151)} \\ -1 & \text{Cot } \beta \end{vmatrix} \quad \begin{vmatrix} N_{(KF\ 12)} & E_{(KF\ 12)} \\ 1 & \text{Cot } \alpha \end{vmatrix}}{\text{Cot } \alpha \quad + \quad \text{Cot } \beta}$$

$$= \begin{vmatrix} 1382\ 213.313 & 346\ 751.538 \\ -1 & 0.8992 \end{vmatrix} \begin{vmatrix} 1399\ 800.091 & 334\ 934.254 \\ 1 & 1.1112 \end{vmatrix}$$

$$2.0104$$

$$= \frac{2810142.394}{2.0104} = 1397811.879$$

Hence,

$$N = 1397\ 811.879$$

F_p 517 E = 348 967.867

Check on Contangents

$$\text{Cot A Cot B} + \text{Cot B Cot C} + \text{Cot C Cot A} = 1$$

Re-a ranging, we have

$$\begin{vmatrix} \text{Cot A} & \text{Cot B} \\ -\text{Cot C} & \text{Cot B} \end{vmatrix} \begin{vmatrix} \text{Cot C} & 1 \\ 0 & \text{Cot A} \end{vmatrix} = 1$$

where A = α = 41° 59' 08"
B = β = 48° 02' 16"
C = γ = 89° 58' 36"

Hence,

$$\begin{vmatrix} \text{Cot } 41^\circ\ 59'\ 08" & \text{Cot } 48^\circ\ 02'\ 16" \\ -\text{Cot } 89\ 58\ 36" & \text{Cot } 48\ 02\ 16 \end{vmatrix} \begin{vmatrix} \text{Cot } 89^\circ 58'\ 36" & 1 \\ 0 & \text{Cot } 4\ 59'\ 08" \end{vmatrix}$$

$$\begin{vmatrix} 1.11118 & 0.89921 \\ \bar{0}.000407 & 0.89921 \end{vmatrix} \begin{vmatrix} 0.000407 & 1 \\ 0 & 1.11118 \end{vmatrix}$$

$$0.99918 + 0.0003660 - 0.0004522$$

$$= 0.9990938 = 0.999 \simeq 1$$

7.6.2 Computation of TP3 Co-ordinates-
(JAN KASA HILL)

N= 1382213.313

MC151
: E = 346 751.538

N = 1399800.091

KF12:

E = 334934.254

α = 33° 14' 02"

β = 28° 49' 55"

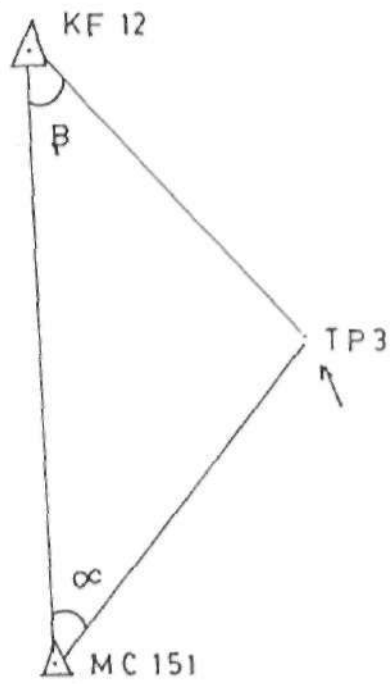


Fig 27: Computation of TP3 Co-ordinates

$$TP3 = \begin{vmatrix} 1382213.313 & 346\ 751.538 \\ -1 & 1.8166 \end{vmatrix} \begin{vmatrix} 1399800.091 & 334934.254 \\ 1 & 1.5262 \end{vmatrix}$$

$$3.3428$$

Thus $N = \frac{4659\ 254.338}{3.3428} = 1393777.796$

TP3:

$$E = \frac{1158680.847}{3.3428} = 346617.330$$

Check on Contangents:

$$\begin{vmatrix} \text{Cot A} & \text{Cot B} \\ -\text{Cot C} & \text{Cot B} \end{vmatrix} \begin{vmatrix} \text{Cot C} & 1 \\ 0 & \text{Cot A} \end{vmatrix} = 1$$

where A = α = 30° 14' 02"

B = β = 28° 49' 55"

C = γ = 117° 56' 03"

Hence,

$$\begin{vmatrix} \text{Cot } 33^{\circ}\ 14'\ 02'' & \text{Cot } 28^{\circ}\ 49'\ 55'' \\ -\text{Cot } 117^{\circ}56'\ 03'' & \text{Cot } 28^{\circ}\ 49'\ 55'' \end{vmatrix} \begin{vmatrix} \text{Cot } 117^{\circ}\ 56'\ 03'' & 1 \\ 0 & \text{Cot } 33^{\circ}14'\ 02'' \end{vmatrix}$$

$$\begin{vmatrix} 1.5262 & 1.8166 \\ +0.5302 & 1.8166 \end{vmatrix} \begin{vmatrix} \bar{0}\cdot 5302 & 1 \\ 0 & 1.5262 \end{vmatrix}$$

$$2.7725 - 0.9632 - 0.8092$$

$$1.8093 - 0.8092 = 1.0001 \quad 1.000 = 1$$

7.6.3 Computation of TP2 Co-ordinates

FP517:

E = 348 967.867

N = 1393777.796

TP3:

E = 346 617.330

α = 115° 22' 20"

β = 23° 05' 38"

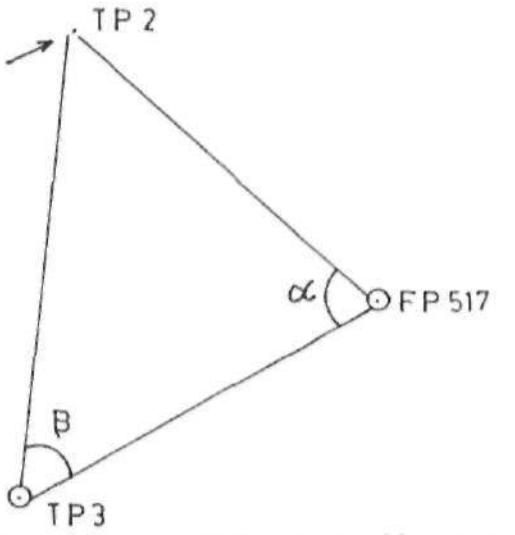


Fig. 28: Computation of TP2 Co-ordinates

$$TP2 = \begin{vmatrix} 1397\ 811.879 & 348\ 967.867 \\ -1 & \frac{2.3452}{1.8709} \end{vmatrix} \begin{vmatrix} 1393777.796 & 346617.331 \\ 1 & -0.4742 \end{vmatrix}$$

$$TP2\ N = \frac{2619456.960}{1.8709} = 1400090.793$$

$$E = \frac{649971.374}{1.8709} = 347\ 407.478$$

Check on Catangents

$$\begin{vmatrix} \text{Cot } 115^{\circ}\ 22'\ 20'' & \text{Cot } 23^{\circ}\ 05'\ 38'' \\ -\text{Cot } 41^{\circ}\ 32'\ 02'' & \text{Cot } 23^{\circ}\ 05'\ 38'' \end{vmatrix} \begin{vmatrix} \text{Cot } 41^{\circ}\ 32'\ 02'' & 1 \\ 0 & \text{Cot } 115^{\circ}\ 22'\ 20'' \end{vmatrix}$$

$$\begin{vmatrix} -0.4742 & 2.3452 \\ -1.1289 & 2.3452 \end{vmatrix} \begin{vmatrix} 1.1289 & 1 \\ 0 & -0.4742 \end{vmatrix}$$

$$-1.1121 + 2.6475 - 0.5353 = 1.0001$$

$$= 1.000$$

7.6.4 Computation of PBKT 2976 Co-ordinates

N = 1397 811.879 BKT 2976

FP 517

E = 348 967.867

N = 1393 777.996

TP3:

E = 346 617.330

α = 780 17' 29"

β = 28° 23' 56"

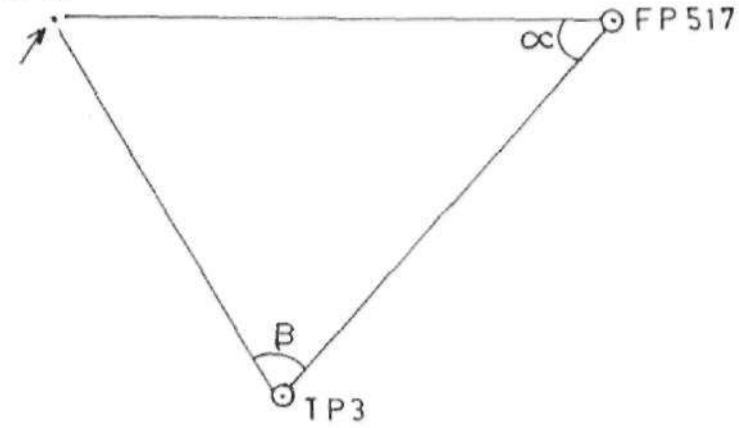


Fig. 29: Computation PBKT 2976 Co-ordinates

$$\text{PBKT 2976} = \begin{vmatrix} 1397811.879 & 348\ 967.867 \\ -1 & \frac{1.8495}{2.0568} \end{vmatrix} \begin{vmatrix} 1393\ 777.796 & 346\ 617.330 \\ 1 & 0.2072 \end{vmatrix}$$

$$N = \frac{2876525.327}{2.0568} = 1398548.212$$

KT 2976:

$$E = \frac{7132333.730}{2.0568} = 346769.677$$

Check on Contangents

$$\begin{vmatrix} \text{Cot A} & \text{Cot B} \\ -\text{Cot C} & \text{Cot B} \end{vmatrix} \begin{vmatrix} \text{Cot C} & 1 \\ 0 & \text{Cot A} \end{vmatrix} = \begin{vmatrix} 1 & \\ & \end{vmatrix}$$

$$\begin{vmatrix} \text{Cot } 78^{\circ}\ 17'\ 29'' & \text{Cot } 28'\ 23'\ 56'' \\ -\text{Cot } 73^{\circ}\ 18'\ 34'' & \text{Cot } 28^{\circ}\ 23'\ 56'' \end{vmatrix} \begin{vmatrix} \text{Cot } 73^{\circ}\ 18'\ 34'' & 1 \\ 0 & \text{Cot } 78^{\circ}\ 17'\ 29'' \end{vmatrix}$$

$$\begin{vmatrix} 0.2072 & 1.8495 \\ 0.2998 & 1.8495 \end{vmatrix} \begin{vmatrix} 0.2998 & 1 \\ 0 & 0.2072 \end{vmatrix}$$

$$0.3832 + 0.5545 + 0.0106 + 0.0621 = 0.9998 = 0.999$$

$$= 1$$

7.6.5 Co-ordinating PBKT 2977

N = 1397 811.879

FP517

E = 348 967.869

N = 1393 777.796

TP 3:

E = 346 617.330

α = 75° 49' 57"

β = 26° 17' 03"

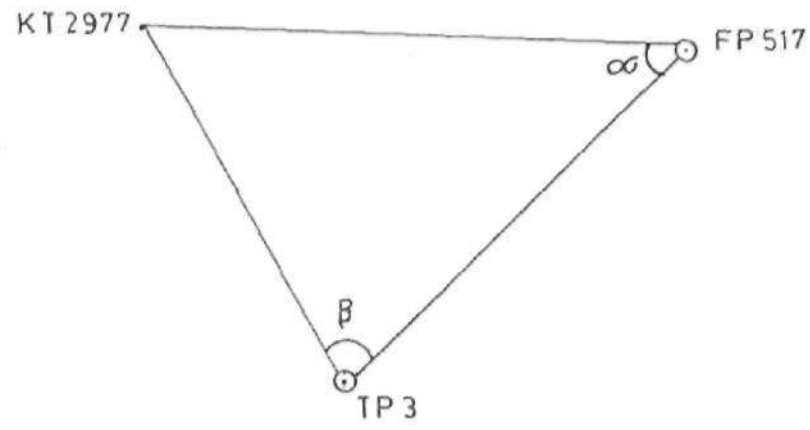


Fig. 30: Co-ordinating PBKT 2977

1397 811.879 348 967.867 1393 777.796 346 617.330

$$\text{KT 2977} = -1 \quad \frac{20248 \qquad 1}{2.27772} \qquad 0.2524$$

$$N = \frac{3184415.627}{2.27772} = 1398\ 396.875$$

$$E_{KT} = \frac{790\ 038.746}{2.27772} = 346\ 935.783$$

Check on Contangents

$$\begin{vmatrix} \text{Cot } 75^{\circ}\ 49'\ 57'' & \text{Cot } 26^{\circ}\ 17'\ 03'' \\ -\text{Cot } 77^{\circ}\ 52'\ 00'' & \text{Cot } 26^{\circ}\ 17'\ 03'' \end{vmatrix} \begin{vmatrix} \text{Cot } 77^{\circ}\ 52'\ 1'' & 1 \\ 0 & \text{Cot } 75^{\circ}\ 49'\ 57'' \end{vmatrix}$$

$$\begin{vmatrix} 0.2524 & 2.0248 \\ 0.2150 & 2.0248 \end{vmatrix} \begin{vmatrix} 0.2150 & 1 \\ 0 & 0.2524 \end{vmatrix}$$

$= 0.51111 + 0.4353 + 0.0543 = 1.0007 = 1.000$

$= 1$

7.6.6 Co-ordinating PBKT 2978

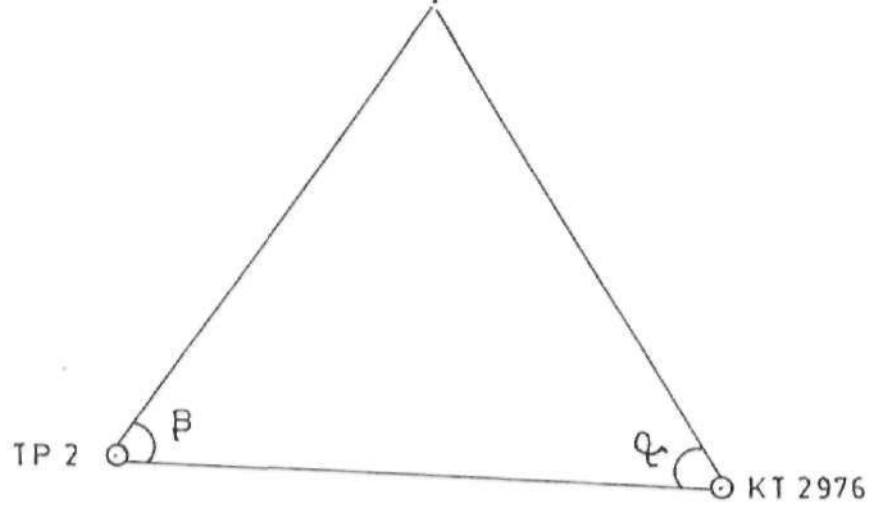


Fig. 31: Co-ordinating PBKT 2978

N = 1398 548.212

KT 2976

E = 346 769.677

N = 1400 090.793

TP 3:

E = 347 407.478

α = 117° 40' 20"

β = 19° 45' 25"

$$KT\ 2978 = \begin{vmatrix} 1398\ 548.212 & 346\ 769.677 & 1400\ 090.677 & 347407.478 \\ -1 & \frac{2.7842}{2.2598} & 1 & -0.5244 \end{vmatrix}$$

$$N = \frac{315859.195}{2.2598} = 1397\ 908.008$$

KT 29/8:

$$E = \frac{784\ 829.973}{2.2598} = 347\ 304.297$$

Check on Contangents

$$\begin{vmatrix} \text{Cot } 117^{o}\ 40'\ 20'' & \text{Cot } 19^{o}\ 45'\ 25'' & \text{Cot } 42^{o}\ 34'\ 15'' \\ -\text{Cot } 42^{o}\ 34'\ 15'' & \text{Cot } 19^{o}\ 45'\ 25'' & 0\ \text{Cot } 117^{o}40'\ 20'' \end{vmatrix}$$

$$\begin{vmatrix} -0.5244 & 2.7842 & 1.0886 & 1 \\ 1.0886 & 2.7842 & 0 & 0.5244 \end{vmatrix}$$

$$-1.4600 + 3.0309 - 0.5709 = 1.0000 = 1.000$$

7.6.7 List of Co-ordinates of Control Extention Points

STATION	NORTHINGS	EASTINGS
FP 517	1397 811.879	348 967.87
TP3	1393 777.796	346 617.330
TP2	1400 090.793	347 407.478
PBKT 2976	1398 548.212	346 769.677
PBKT 2977	1398 396.875	346 935.783
PBKT 2978	1397 908.008	347 304.297

Table 11: Co-ordinates of Control Extension Points

ABSTRACT OF ADJUSTED ANGLES (FROM FIELD BOOK)

STATION	SIGHT	MEAN OF ADJUSTED OBSERVED ANGLE	ANGLE	DIAGRAM
TP3	MC151			
	KF 12	119 55 53.25	26	
	TP 2	69 53 12.5	27	
	KP517	23 05 37.5	28	
	MC151	149 05 16.75	29	
		360 00 00.00		

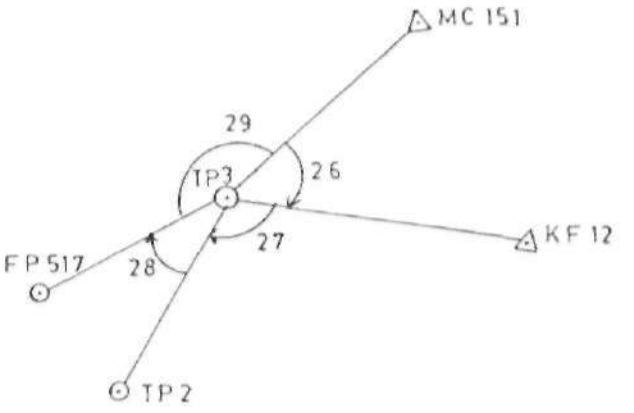


Fig 17 Station TP3 (1)

TP3	FP517			
	KT 2976	331 36 02	30	
	KT 2977	02 06 57	31	
	FP517	26 17 01	32	
		360 00 00		

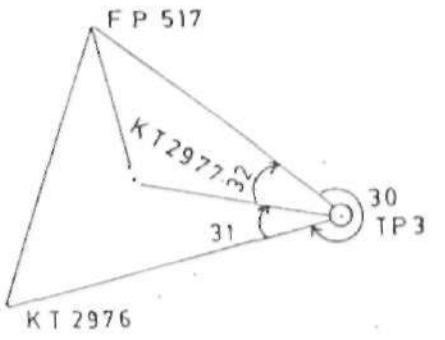
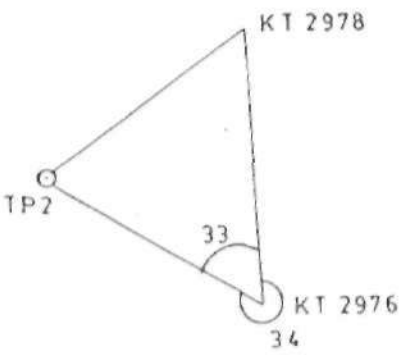


Fig 18 Station TP3 (2)

KT 2976	TP2			
	KT 2978	117 40 13	33	
	TP3	242 19 47	34	
		360 00 00		



(Sub-Triangulation)

Fig.19 Station KT 2976

ABSTRACT OF ADJUSTED ANGLES (FROM FIELD BOOK)

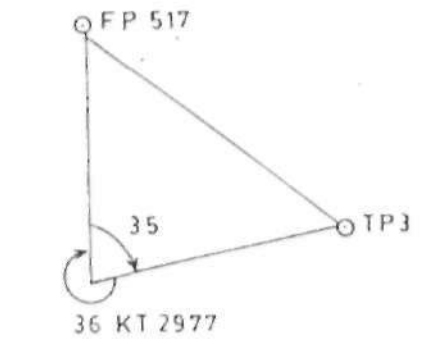
STATION	SIGHT	MEAN OF ADJUSTED OBSERVED ANGLE	ANGLE	D I A G R A M
KT 2977	FP517			
	TP3	77 52 57	35	
	FP517	282 07 03	36	
		360 00 00		

Fig 20. Station KT 2977

KT 2978	TP 2			
	KT 2976	317 25 53	38	
	TP3	42 34 07	39	
		360 00 00		

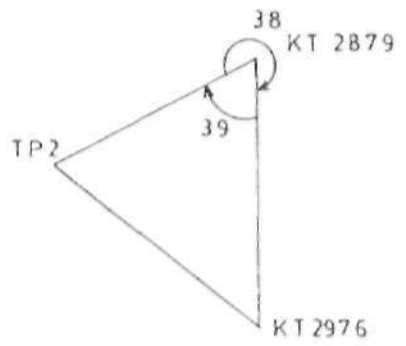


Fig 21 Station KT 2978

Table 10: Abstract of Adjusted Angles.

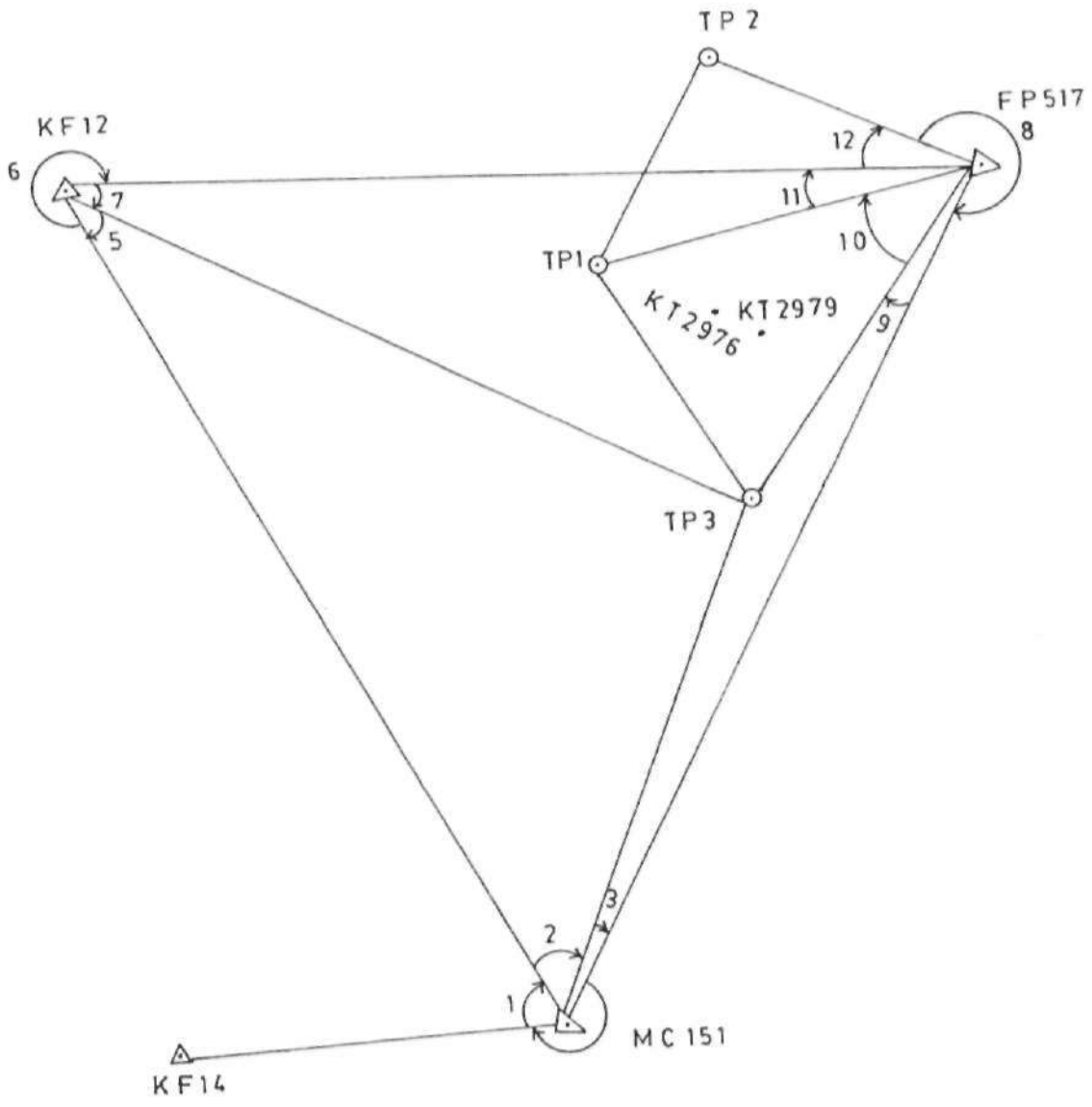


Fig. 23 MAIN – TRIANGULATION SCHEME

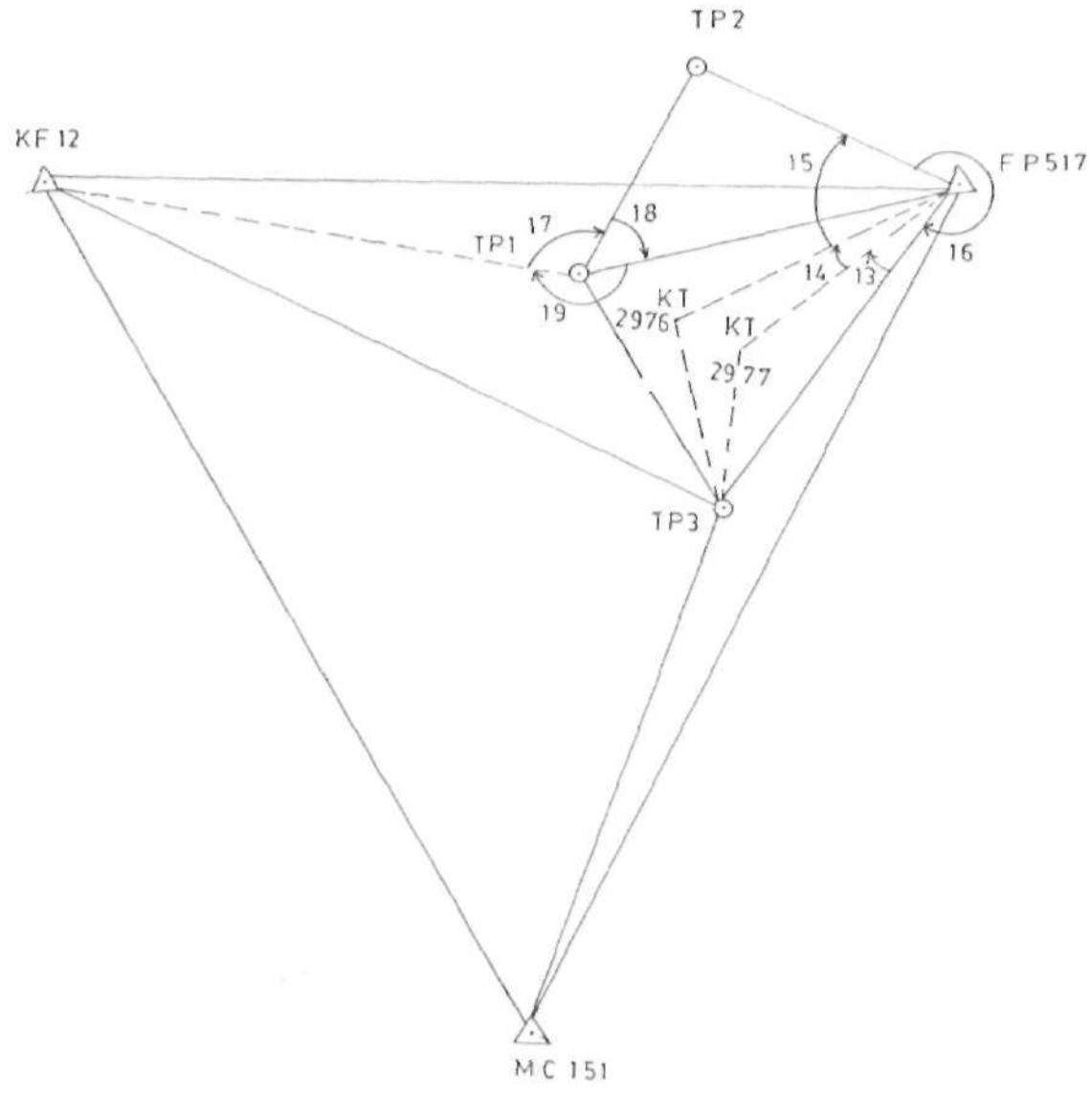


Fig. 24 SUB-TRIANGULATION SCHEME (i)

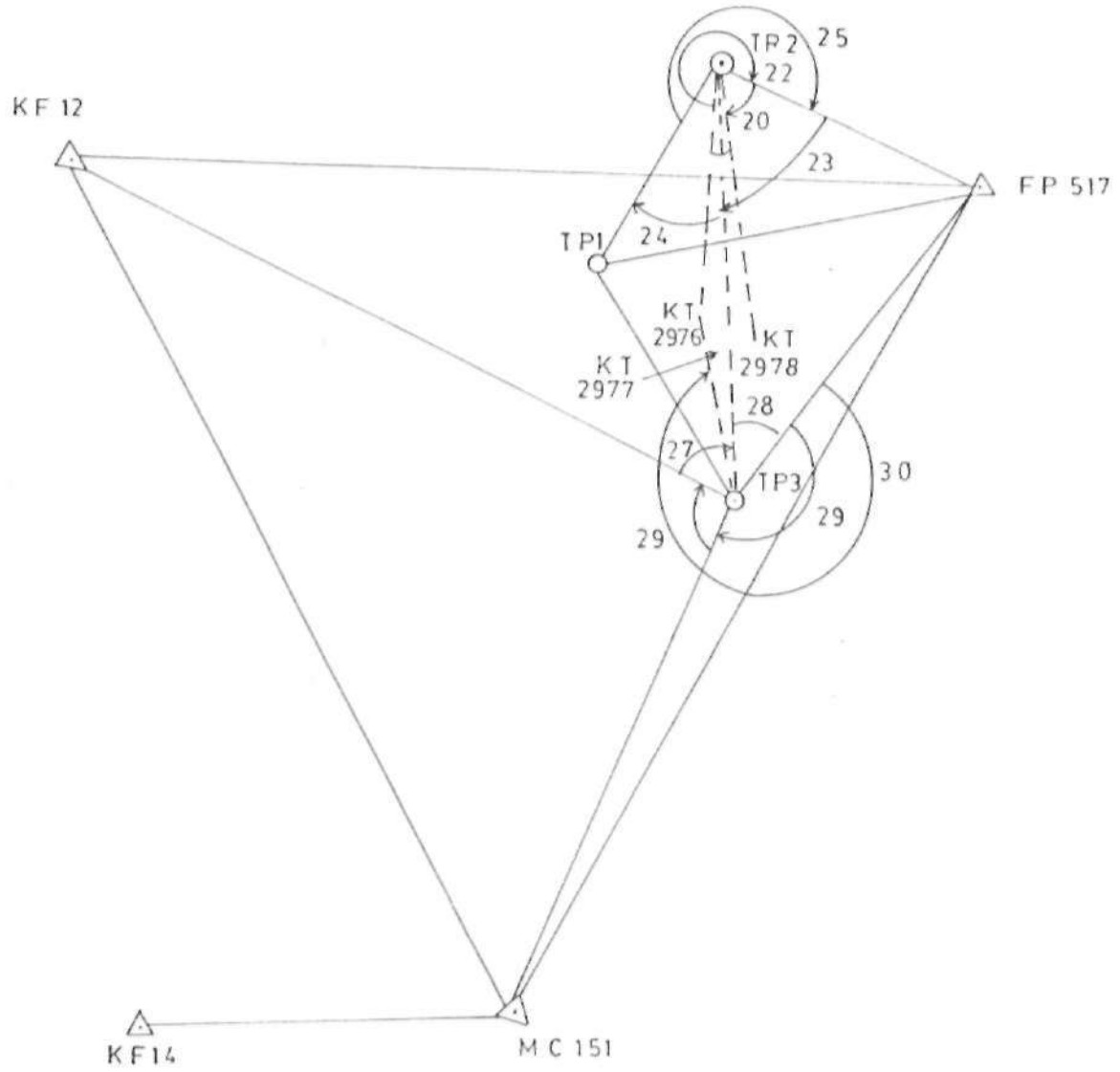


Fig 25 SUB- TRIANGULATION SCHEME (ii)

CHAPTER VIII

8. PERIMETER SURVEY AND LEVELLING

8.1 Perimeter Survey

The perimeter survey of the reservoir boundary started on control extension point PBKT 2977 with line PBKT 2977-PBKT 2976 as opening bearing. The perimeter traverse was run in a closed loop and closed back on control extension point PBKT 2976 with line PBKT 2976-PBKT 2977 as closing bearing. Thus the traverse started on PBs with a prior determined co-ordinates and ended on similar ones.

The linear misclosure for the perimeter traverse is 5.19m and the total distance for the perimeter is 33725.118m. The maximum cummulative error, therefore is 5.19/33729.12 = 1/6493 = 1/6,500.

8.2 Angle and Distance Measurement

Linear measurement of the traverse legs were made with electromagnetic distance measuring instrument (EDM).

One set of "face left" and "Face rights" with one zero were observed. The difference between the extracted angle in F_L and F_R must agree within 30". A combined 1" theodolite and EDM called Reg Elta was used for the angular and linear measurement.

One set of vertical angles were measured for the purposes of slope correction.

8.3 Astronomical Observations

Astronomical observations were made at an average of every 30 traverse station. This was necessary to control the swing of the traverse. Six azimuth stations were selected immediately after demarcation. The R.O. for each station is at least 300m away from the station. For each azimuth station, 5 sets of sun observation on different zeros were made to ensure that at least 3 sets of observations come within the range of 30". A set of sun azimuth observation involves an F_L horizontal readings to R.O. an F_L bubble, horizontal and vertical readings to sun in the fourth quadrant and time, an F_R bubble, horizontal, vertical and time to sun in the second quadrant and F_R horizontal reading to R.O.

At least three(3) sets of morning and evenings sun observations were paired. The means of each east and west observations were corrected for convergence in second is given by:

C = (difference in longitude from central Meridian (CM) Sine of Latitude.

The Azimuth lines are made of the following:

(i) DM 2491-DM 2492 with azimuth closure of - 02'24" distributed over 28 stations.

(ii) DM 2514 - DM 2515 with azimuth closure of + 01'44" distributed over 25 stations.

(iii) DM 2537 - KT 29999 misclosing at - 02'28". This is also distributed over 25 stations.

(iv) KK 563 - K 564, a misclosure of -02'15" distributed over 34 stations.

(v) KK 590 - KK 591 a misclosure of - 02'26" and distributed over 28 stations.

(vi) KT 2948-KT 2949, a misclosure of -01" in 26 stations.

The traverse co-ordinates errors are obtained by comparing the computed provisions; co-ordinates of a known control point at end of a traverse with the given co-ordinates. The error in Easting and Northing, DE and DN, are then distributed respectively to each provisional co-ordinates by the "Bowditch Adjustment", corrections to the orovisional co-ordinate are given by

$$e_{x_j} = \frac{\sum_{i=1}^{j} Xi}{\sum_{k=1}^{n} X_k} E$$

$$e_{y_i} = \frac{\sum_{i=1}^{j} Y_i}{\sum_{k=1}^{n} Y_k} N$$

where

e_{x_y} = correction to Esting of station j

e_{y_j} = correction to Northing of station j

8.4 Traverse Computation

Traverse computation consists of four parts;

- Deduction and correction of bearing (grid azimuth)
- Computation of co-ordinates
- Adjustment of co-ordinates
- Back computation (Final bearings and distances).

8.4.1 Deduction and correction of azimuths (grid azimuth)

The traverse starts with a known azimuth. The azimuth of consecutive legs of the traverse is obtained thus (see figure 32):

$$O_i = O_i - 1 + B1 \pm 180^o$$

where

O_i = Azimuth of i^{th} leg of the traverse,

B_i = Angle measured at the i^{th} traverse station.

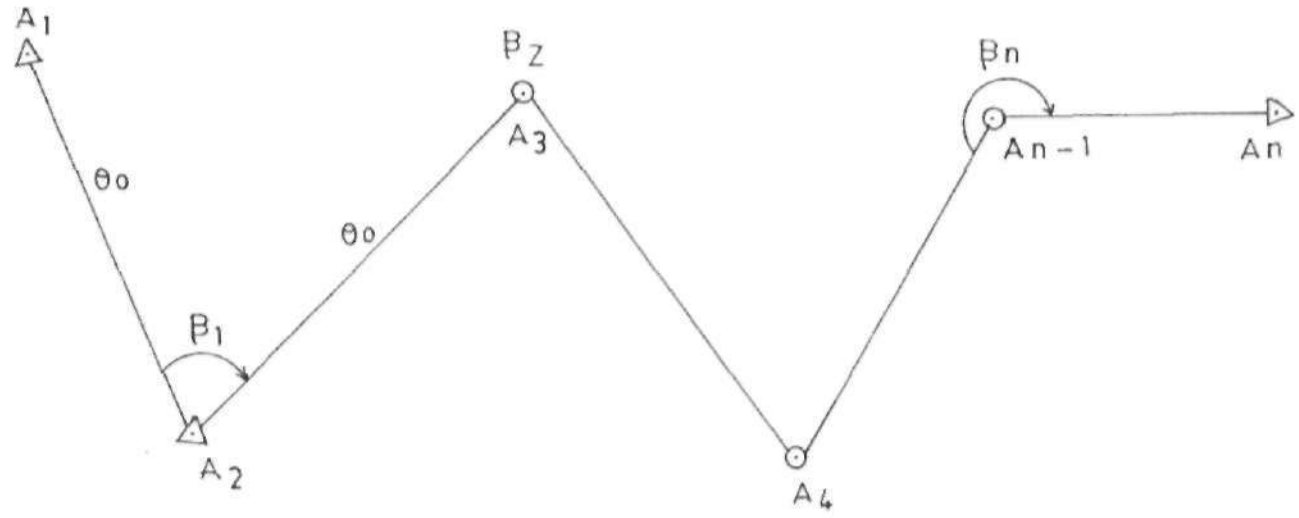


Fig. 32 Deduction of Azimuths

This procedure is carried forward unitl an azimuth control line is encountered. The azimuth obtained from sun astro is then distributed cumulatively amoung the deduced azimuths; assuming all measurements are of equal precision.

8.4.2 Computation of co-ordinates

Starting from a station with known co-ordinates, a control, point, the co-ordinates of consecutive stations are computed using the corrected azimuths and distances as illustrated in Figure 33 below.

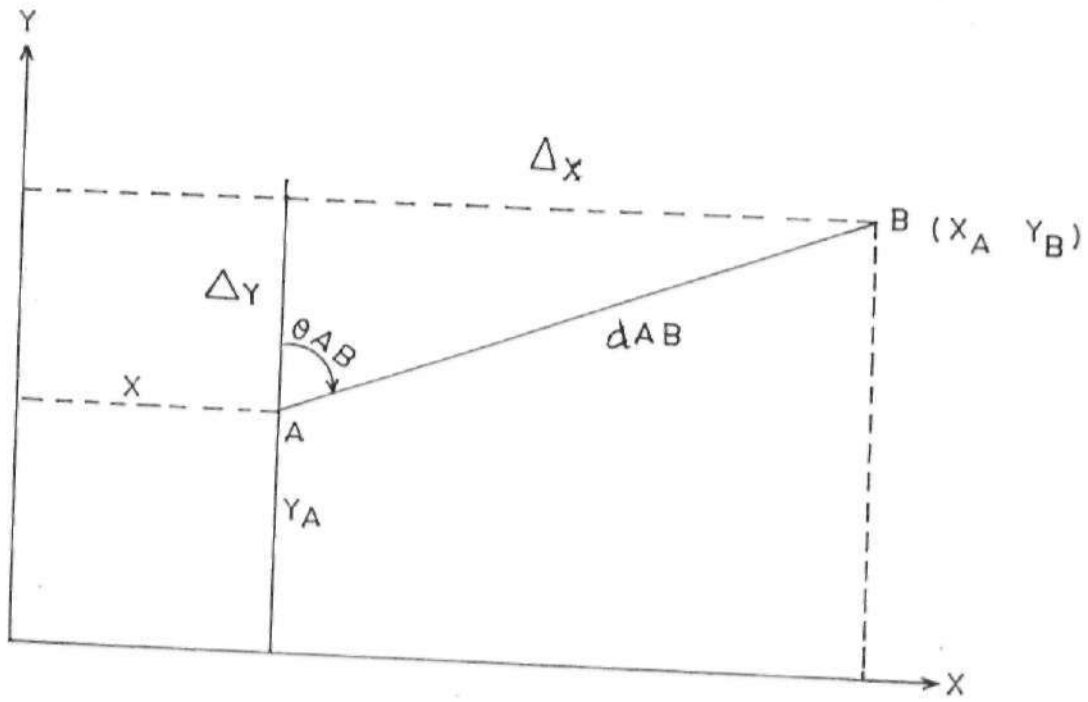


Figure 33 Computation of Co-ordinates.

In Figure 33 the co-ordinates of points A; XA; YA; azimuth of line AB, Θ_{AB}; and the distances of line AB, d_{AB}, are all known. The required co-ordinates of point B, is given by

$$X_B = X + DX$$

$$Y_B = Y_A + DY$$

where:

$$DX = Sin_{AB}$$

$$DY = Cos_{AB}$$

The above procedure is repeated for each consecutive leg of the traverse, until the end control points and azimuth are reached. These are "Provisional co-ordinates" which are adjusted as described in

X = Difference in Eastings of two consecutive stations.

Y = Difference in Northings of two consecutive stations.

E = Traverse error in Easting.

N = Traverse error in Northing.

8.4.4 Computation of final azimuths and distances

The position of each boundary pillar is defined in the National Grid System by its adjusted co-ordinates. These adjusted co-ordinates are then used to obtain the azimuth of, and distance between any two consecutive boundary pillars in the National Grid System thus:

$$\Theta_{i,\ i+1} = \text{Arc } \tan^{-1} \frac{D_{xi,\ i+1}}{D_{Yi,\ i+1}}$$

$$d_{i,\ i+1} = (x^2_{j,\ i+1} + Y^2_{i,\ 1+1})^{\frac{1}{2}}$$

where:

Xi, 1 + 1 = X_{i+1} - Xi is the difference in Northing

Yi, i + 1 = Y_{i+1} - Yi is the difference in Easting

$d_{i,\ i+1}$ is the distance between two consecutive pillars.

8.5 Traverse Accuracies

The traverse was computed and adjusted as described in sections 8.4.2 and 8.4.3. The linear accuracy of a traverse is given by:

$$(E^2 + N^2)^{\frac{1}{2}}/L.$$

where:

L = Total traverse length

The accuracy attained by the traverse is 1:40,000.

8.6 Area Computation

This was directly obtained from the final boundary pillar co-ordinates, applying the double latitude and departure method. The computed reservoir area is 2175.368 hectares.

8.7 Loaction of the Positions of the Angle Iron Post

The position of the angle iron posts were located by pillar co-ordinate method. Each angle iron post was fixed by measuring the distance from a boundary beacon to the iron post and also the angle to the iron post with reference to a traverse leg, as shown in Figure 34, below:

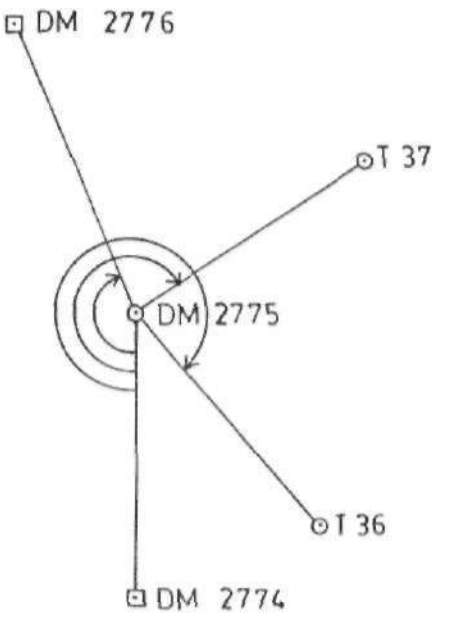


Figure 34: Location of Angle Iron Posts with Respect to Boundary Beacons.

8.8 Levelling of Boundary Beacons

The heights of the boundary beacons were determined by spirit levelling. A closed level circuit was run from and back to TBM 8 established at the dam site; as pointed out in section 6.1. The levelling route covered a distance of 26km and has a closing errorr of 82mm. The heights of the beacons were determined to within a third order accuracy given by

M = 16mm K, where K is the distance in kilometers of the levelling route. For a distance of 26km the misclosure is 82mm which is equal to the misclosure of 82mm obtained.

8.9 Plotting

The positions of the reservoir boundary beacons and the angle iron posts were plotted at a scale of 1:10,000. Although the initial conception by the Authority was to plot it at a scale of 1:50,000 in view of the extent of the area surveyed, the scale was reduced to 1:10,000 so that the finished plan could be of a reasonable size. The plan is oriented on UTM North. The position of the angle iron posts demarcating the HFL are plotted. The HFL contour is also plotted. The heights of the boundary beacons are also indicated on the plan.

8.10 Field Technique for Angle and Distance Measurement

To reduce errors arising from defective centering of the theodolite and targets, the three tripod equipment was used for the survey. Hence the tribrach of the theodolite can be separated from the main body of the istrument. In place of the theodolite a signal can be placed in the tribrach, the accuracy of the centering being automatic. In exchanging the theodolite and accessories, utmost care was taken to ensure that no disturbance was made to the tripod. The procedure of operations is shown in the diagram.

The three tripod equipment consists of a theodolite two target, three tribraches with optical plubbing device and three tripods. A target was set on tribrach on the back station A while the other target was set on a levelled tribrach set over the forward station C. The instrument was set over the station B and was levelled. The angle between forward and backward stations was measured. Two rounds of angles were observed at each station. Target A was then transferred to station B. The instrument was transferred and fitted into the tribrach at station C while the tripod with target at station A was then set and levelled over station E. The angle between station B and D measured. Another set of transfers were made. The process was continued to the end of the traverse.

8.10.1 Distance measurement

DI 10 distomat was used to measure all the distances. The theodolite on a tripod was set over a station and levelled. The aiming head of the DI 10 was set on the adapter of the telescope and fastened by turning the locking lever. The protective covers of the plugs were removed and the cables plugged to their sockets and fastened by turning the collers on the plugs. The DI 10 was now ready for use.

The three prism reflector was set directly into a levelled tribrach on a tripod which has been set over a station. Alignment of the reflector towards the aiming unit was made.

Using the theodolite, the centre of systems of the reflector was bisected. The forward line (distance) was measured. Instructions for measurement are as laid out in Section 8.12.4.

The reflectors and the theodolite with DI 10 were interchanged. The backline (distance) was measured. Two measurements were made on each line. The mean was accepted as the uncorrected slope distance provided that the readings do not differ by more than 1cm. The temperature was recorded after each reading. The atmospheric pressure which remained unchanged throughout the period of the survey was noted. The vertical angle was recorded.

8.11 Reduction of Distance

Each forward and backward distance was reduced to horizontal plane after applying the necessary corrections and the mean was accpeted as the correct distance. The corrections applied are as follows:

8.11.1 Atmospheric correction: were obtained from the chart on Fig. 36 using the average height of the area. This was applied to the measured distance to obtain the corrected slope distance. Subsequently, the horizontal distance was obtained by multiplying the corrected slope distance by the cosine of its vertical angle. For example, let the atmospheric correction taken out from the chart be DI. Let observed slope distance be DO.

Corrected slope distance $\bar{D}$ = DO + DI. Horizontal distance DH = $\bar{D}$ cos B, where B is angle of elevation on depression.

8.11.2 Reduction to mean sea level: the horizontal distance was reduced to the mean sea level before use in the computations.

The formula used is

$$D = DH = DH \cdot \frac{Hr}{R}$$

where Hr = height of the reflector above sea level

R = radius of the earth

D_H = horizontal distance

D = sea level distance.

8.12 Description and Instruction of The Use of DI 10

8.12.1 Functional principle

The DI 10 emits an infra-red beam which is modulated by a continous sine wave. This reflected beam of infra-red radiation of 0.875mm frequency is received and the phase shift of the modulation which is proportional to the distance is continously measured. The phase-shift of the received reflected wave may fluctuate as a result of noise and atmospheric shimmer, hence in order to attain an accuracy of 1.00cm inspite of these fluctuations it is necessary to measure a mean value over many circles of the 15 MHz frequency. In the Wild Distomat DI 10 the phase shift is measured automatically by means of a flow-up serve consisting of a resolver, a phase defector and a D.C. motor. This field induces alternating voltages in the coils and the same amplitudes of these voltages are proportional to the Sine and Cosine wave respectively.

8.12.2 Internal calibration

The aiming head has a built-in calibration line. By switching a lever the beam of the transmitting diode is then directly reflected via two mirrors and a lens on the receiving diode.

8.12.3 The instrument

The whole set consists of:

(i) Aiming head-which can be set and locked on the

Telescope of the T2 theodolite. It contains two optical systems, one for transmission and the second for reception.

(ii) The control unit- This contains the electronic system, the display unit and the interval, exchangeable battery and on the panel the operating and on the procedures.

(iii) The T2 theodolite with an adapter to take on the aiming head.

(iv) The pole reflector-which has glass prism used to return the infra-red beam. The lateral displacement after reflection is required to correspond to the horizontal displacement between transmitting and receiving objectives.

8.12,4 Instruction for use

The theodolite and tripod are set and levelled as usual. With the telescope in face right position, the aiming head is then relevelled. The leading cables are connected to the control unit. The single pole reflector is attached to the top of the plumbing pole. The pole is then extended to a suitable height corresponding to the height of the aiming head before taken to the ground mark to be measured. It is more important to keep the circular bubble centred (pole support) than to keep an exact alignment since misalignment does not affect the accuracy of the measurement. Brief Instruction for DI 10 is as laid out in the manual.

8.12.5 Checking calibration (for calibration and start value. The determination of the start value is as follows:

(a) Connect cables and check battery strength.

(b) Switch to Point

Lever to M. (Point to reflector, the horizontal and vertical drive turned for maximum deflection).

(c) Lever to C.

(d) With knob CAL set last three digits to calibration value. Press knob START. Read start value to one interval on index.

(e) Lever to M.

Press knob start and set start value on index.

Switch to Measure (after 15 seconds read the recorded distance). The start value was det determined at the beginning of each days' work. The start value was each time found to be 90.1 as against 90.2 written on the control unit. However, the CAL value of 9.94 does not change unit. However, the CAL value of 9.94 does not change easily since it taken care of eccentricities in the aiming head and reflector.

8.12.6 Special occurrence

If the control unit is switched on but after about 15 seconds the coarse and fine circles do not stop, the season may be as follows:

(a) Cables are not properly connected

(b) Voltage of the battery is too low

(c) Aiming head is not aligned to reflector.

(d) Reflector is not aligned properly to the aiming head. This often happens when the distance is very short.

(e) The line to be measured is disturbed by obstacles. Other factors which are important to improve accuracy are protecting the aiming head from intensive sum says by an umbrella because with excessive heat the efficiency of the emitting diode and therefore the ranges decrease. Also, the instrument should be handled with care during transportation, packing and storage after each day's work.

8.1 Sources of Errors in the Theodolite Traverse

Errors arise in each line of a theodolite traverse from the measurement and adjustment of angles, and from the measurement and adjustment of distance. Angular errors produce a displacement at right angles to the direction of the line and linear errors produce a displacement along the direction of the line. The various sources of errors and precautions taken to guard against them in the field are considered.

8.13.1 Errors in the measurement of traverse angles

Defective centrering of the theodolite

To ensure an accurate centering, a cross mark was made on the iron rods which were inserted on the concrete pillars. After the initial centering of the theodolite over the cross mark on the iron rod, with the pumb bob optical plummet attached to the tribrach was used to center the instrument exactly at the center of the cross mark on the iron rod.

Defective centering of the signal

This was carried out exactly in the same was as the centering of the theodolite above.

Defective levelling of the theodolite

Through imperfect levelling a theodolite main axis is inclined to the vertical by a small angle IV. The error introduced in the horizontal circule reading is IV. tan H, where H is the vertical angle. To offset this error, the theodolite was perfectly levelled before observing the horizontal angle. The levelling was done in the usual way.

Defective operation of the theodolite

The error from this source is eliminated by the following measures:

(a) The theodolite was properly secured to the tripod.

(b) The shifting head was properly secured and clamped.

(c) The horizontal circle turning knob was covered while the theodolite was in use.

(d) The correct target screws were used. Errors from any of the operations lead to values of different faces not agreeing.

8.13.2 Residual parallax

An error will occur if the adjustment to eliminate parallax in the telescope is not completed before observation. When the instrument is not correctly focussed and adjusted the image formed by the object glass should fall exactly in the plane of the diagram. to test whether this condition is satisfied, whenever the instrument was set for use, eyes were moved up and down while viewing the target. If the adjustment is correct, there will be no relative movement occured, the eye-piece was first adjusted by moving it in or out of its sleeve until an exactly sharp view of the cross hair was obtained. The telescope was then refor-cussed if necessary to the clear image of the target. The test was repeated and adjustment made where necessary until there was no parallax.

8.13.3 Observational errors

The necessary precautions were taken to ensure that errors arising from observations were eliminated. The following precautions were taken.

(a) the signal was properly bisected.

(b) the signal was always planned vertical. This was achieved by levelling the target properly.

(c) the circle reading was taken properly.

(d) care was taken in booking to ensure that the correct figures observed were put in the book. The observations were reduced in the field-whenever there was any inconsistency in the reduced values, the observation was repeated.

8.13.4 Errors due to normal causes

These errors arise from:

(a) Shimmer.

(b) Refraction

(c) Wind

(d) Unequal heating of the instrument. These errors were minimised by carrying all measurements under good weather. The instrument was shaded from the direct rays of the sun.

8.13.5 Personal bias

Each observer when bringing the vertical cross hair into coicidence with the centre of the signal has a tendency to work the target screws either too far or not far enough. In all the angle measurements, the vertical cross hair and signal were brought into contact from the opposite sides with differnt faces.

Errors in angular measurements also arise due to maldjustment of the theodolite. Due to wear, change in structure of materials in construction and sometime rough usage, the relationships between the various parts of the theodolite undergo slight changes in the course of time. Before using the instrument for the survey,

it was checked to ensure that its maladjustments were tolerable. Large instrumental discrepancies arising from distrubance of the relationships between the carious parts will give errors which are not automatically cancelled out even by a systematic observing procedure. The major adjustment carried out was plate level adjustment, the purpose of which is to secure verticality of the main axis of rotation.

8.13.6 Adjustment procedure

Levelling of the instrument was performed in the usual way. After levelling, the instrument was turned to various positions completing a full rotation. Any perceptible movements of the buble was indicative of non-verticality of the main axis. It was found that the bubble took up the same though not central position for all the direction of the instrument. Adjustment was then made, as follows:

The bubble was brought to a central position by means of the plate level adjusting screws. The bubble now remained in the same central position for all directions of the alidade.

The instrument was now ready for use in the field. Only one adjustment was performed throughout the period of the survey.

8.13.7 Errors in distance measurement

The DI 10 was used for the measurements of all the lines. The accuracy of the instrument as stated by the manufacturers is 1cm. To maintain the specific

accuracy different sources of errors must be guarded against.

It is important/to high-light some source of errors which occur in the E.D.M. equipment. It is to be noted that no tests were carried out to eliminate some of these errors but discussing them will help to remind us that equipment is not error free.

8.14 Some sources of Errors in EDM Equipment

8.14.1 Frequency drift

In order to guard against these errors due to changes from the normal value, frequency check should be made at periodic intervals.

8.14.2 Calibration and instrument constants

For high precision results to be maintained, it is imperative that EDM instruments be tested over taped base lines. This is necessary to guard against systematic errors which can occur during continous use of instrument.

8.14.3 Ground swing errors

This type of error occurs with EDM insiruments operating on microwave signal. This errors are due to ground reflections of the signals. They vary depending on the terrain over which the lines are measured. Ground swing does not cause problem in infra-ray instrument. This is because the beam width is narrow and there is not room for scattered rays.

8.14.4 Errors due to inaccurate elevation differences

In the reduction of slope to horizontal, the elevation

difference is critical when measurements are made over steep lines. It is noted that a change of one unit in the elevation difference will produce a change — in the slope correction of H/D, where H is the elevation difrerence and D is the slope distance.

8.14.5 Refractive index error

The uncertainty in the meteorological data is one of the largest sources of errors in the measurement of distance with EDM equipment. The data for refractive index corrections are temperature pressure and humidity. The relative humidity has a very small effect on results of infra-ray instrument. The temperature and pressure were read during the measurements. With the data, the correct distance was deduced.

8.14.6 Cyclic error

In microwave instruments, zero error appears to change with frequencies used. Frequencies omitted vary during the period of measurements. This cause cyclic error. In infra-rays, the lines are relatively short. Therefore the variation of frequency is not much. The cyclic error is negligible.

Distance correction due to pressure and temperature
for the Wild DI10 (cm per km or mm per 100 m)

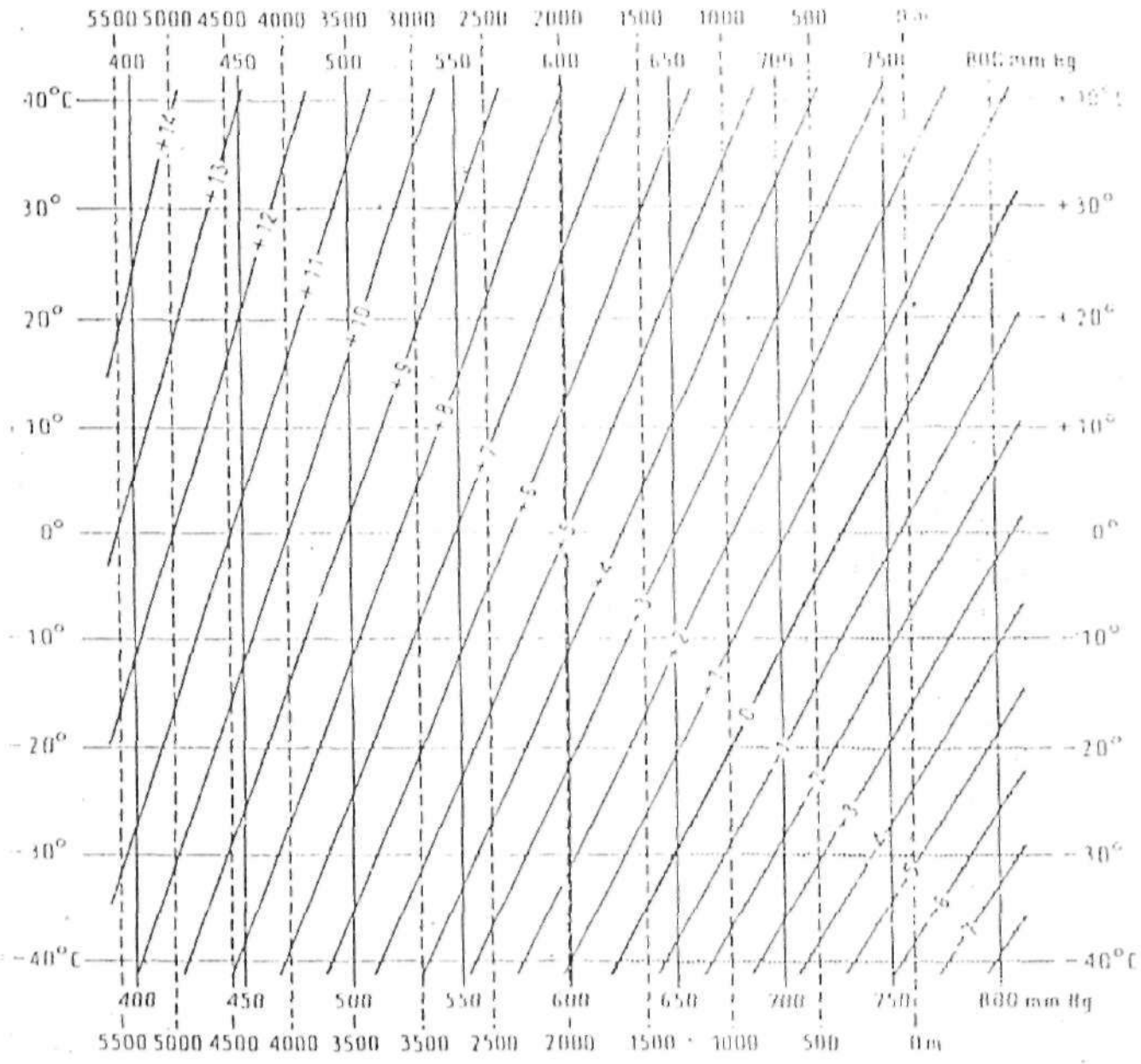


Fig. 36. Atmospheric Correction DD1

Source: DI 10 Manual

CHAPTER IX

LAND TENURE SURVEY

9.1 Concept Involved

The Land Tenure Survey (as often referred to in official circle) is basically Acquisition or Claim Survey. It consist of delineation and survey of farm-plot within the surveyed reservoir area, counting of the economic trees and the recording of the crop types. Each farmer was issued with an identity card (as is shown in Appendix C) for recognition during payment of compensation. The Land Tenure Sheets (or more appropriately the acquisition survey plans) show all the farmlands enclosed by the perimeter survey along contour 510.00m. It shows the farms and all the other physical features as they exist on the date of the survey. A final contour trace was carried out along contour 506.00m to show the limit for the dam project - the normal flood level.

The existing farm plots at the date of the survey were identified, located and surveyed with reference to the Reservoir Area Maps. The farm plots were given distinct serial numbers identifying their location on the plan sheets. The farm plots were numbered as the survey was made. This means that the numbering of the plots does not follow strictly their representation on the plans. The Benye village in Katsina Local Government area has 693 farms numbered from zero through 699. Five numbers were not allocated

farm plots (143, 144, 145, 335, 336) and one was given to a farm already numbered (No. 180). A similar system of numbering applied to the Barkiya, Rawayau and Birchi villages in the Dutsin-Ma Local Government Area. The results of the survey were plotted on scale of 1:2,500.

9.2 Methods of Survey

According to Simpson(1976), the various methods used in undertaking cadastral surveys are:

(i) Annotations of existing topographic maps of aerial photographs
(ii) Plane Table
(iii) Compass and chain
(iv) Tacheometry and substense
(v) Theodolite and Tape
(vi) Air Survey.

Dashe(1981) states that the method to be adopted for claims survey will depend upon the accuracy required, the extent and value of the land, the urgency of exercise, the nature of the land and availability of such material as topographical map sheets of the area etc. Therefore, it is important to discuss the operational concepts of each of the above (pointing out their merits and demerits) so that the justification for the method chosen can be fully appreciated).

9.2.1 Annotations of existing topographic maps or aerial photographs

The main advantage of this method is that the requirement of controlling scale and consistency has already been met. Once the boundaries and other land marks can be identified unambigously from the plotted or photographic detail, the method can be regarded as highly satisfactory. The records of this method can be regarded as index to the Land Tenure Sheets; i.e. the method can be used in conjunction (or auxiliary) with others below.

9.222 Plane table

This method provides itself with the necessary control of scale and consistency. The positions of all control points in the area are plotted at the desired map scale on gridded paper. This blank paper is then divided up into a series of squares of a size convenient to fit on plane-tables, which are merely drawing boards mounted on portable tripods which can be adjusted to a convenient height. The index map is then built up graphically by field surveyors who erect their plane-tables successfully over the monuments marking the control points and with the aid of sight rules, or alidades, first establish the correct orientation of the board by aligning it on the nearest control point, and then draw pencil lines to all other salient points of boundary detail

they wish to record. As the work proceeds the intersections of the radiating lines mark the relative positions of each of the features sighted, at a uniform map scale. Additional boundary detail between these fixed positions is then sketched in.

Although the method is simple and effective; its major draw-back according to Simpson(1976) is:

> "It is rather tedious and slow requiring a large number of surveyors. The method is also limited in its effectiveness to those areas where physical boundary features are prevalent and where individual properties are relatively small in size".

9.2.3 Compass and chain

In areas where conditions such a tree cover a lack of physical boundary features preclude the use of plane table, a graphical representation of parcel boundaries can be built up by direct measurement between boundary marks or monuments. The necessary bearings and distances can be measured by compass and chain. It is necessary to treat the work systematically ensuring that the main traverses fit between the control points previously established, before building up the network of individual property boundaries. The plotting can be carried out directly by protractor and scale on gridded map sheets like those used in plane tabling or alternatively, the field

records of bearing and distances can be converted to rectangular co-ordinates by simple trigonometry prior to plotting.

Unlike the plane-table method, the compass and chain method is sensitive to uneven terrain. Provision must therefore be made to record both distances and angle of slope in order to reduce the ground distances to the horizontal plane. The method is time-consuming and prone to mistakes.

9.2.4 Tacheometry and substense

Tacheometer is used in conjunction with a levelling staff to measure distances by optical means. The same instrument could be used to measure angles.

Predetermined points, which could be either traverse stations or fixed plot boundary points, can be used as the reference objects (R.O.). Then from a known station, another known station would be sighted as R.O., and rays shot out to staves on farm plot boundaries to obtain horizontal angles and tacheometer readings.

Horizontal distance, S, between stations is obtained by:

$$S = 100 \times d \times \text{Cos}^{Q}$$

where d = difference between lower and upper stadia readings

Q = is the slope angle.

However, the instrument can be so constructed that the distances measured are true horizontal distances ragardless of the slope of the ground, and this is additional advantage.

The instrument is fairly expensive and require more skill to use, the method require less labour and plotting can be easily automated.

9.2.5 Theodolite and tape

Angles to one second are measured by theodolite. Distances may be measured by steel tapes, often suspended in catenary and corrected for the effects of thermal expansion, slope sag and height above sea level. Alternatively, the distance may be measured by electromagnetic distance measurement (EDM) equipments.

The theodolite traverse method of bearing and distance requires that every corner piece of each farm plot would be co-ordinated horizontally and later plotted on the area Reservoir Map. Since the co-ordinates of each point will be unique, the chances of a swing error or the crossing of farm plot boundaries are eliminated. Wooden peg serially numbered would be used in demarcating each farm holding. The field work may proceed as follows:

Each farmer is asked to identify and locate his own holding in the presence of other adjoining farmers, after which the corners are pegged and his name address and the number of economic trees taken.

A sketch of such farm plot with the numbered pegs marking his boundary is made. In this way a number of farmers can be dealt with to cover a substantial area. The surveyor then co-ordinates each pegged point by observation of angles and distance to them from the co-ordinated boundary pillars. It might be found necessary to ran subsidiary traverses within the reservoir boundary to co-ordinate pegged points which are not visible from the boundary beacons. It would be sufficient to carry out angular measurement on only one face and measure distances with EDM equipments. The resulting accuracy of the computation would still be higher than 1:1,000 accuracy required for compass traverse.

Office computations would involve the direct co-ordination of the pegged points, the plotting of all these points on the reservoir map and with the aid of the initial sketch taken (in the field in the presence of the farmers), the corresponding points are joined to demarcate each farm plot on the plan. From the demarcated farm-holding and using the co-ordinates of each point of the plot, the area of each plot would then be computed and written against the farmer's names with the register of the type and number of economic trees within the plot, as well as the type of crops or vegetables found within such plots.

9.2.6 Air survey method by use of aerial mosaic background information

Wolf(1974), explained that an Aerial Mosaic is an assemblage of two or more individual overlapping photographs to form a single continous picture of an area. Mosaics are most commonly constructed from vertical aerial photos, although oblique photographs and terrestrial photographs, have also been used.

Mosaics are not true planimetric representations. Rather, they are an assembly of numerous individual photographs, each of which is subject to image displacements and variations are caused by variations in the terrain elevation, tilting of camera axis, and variations in the flying heights.

The effects of tilt and flying height variations can be eliminated by rectifying the photographs and rationing them to a common scale. Rectification does not remove effects of topographic relief however, and as a result the scale of a mosaic is never constant throughout unless the area shown is perfectly flat. Relief displacements can be minimized by using a high flying height, while at the same time the decrease in scale is compensated for by using longer focal length camera.

Kinds of mosaics

Aerial mosaics generally fall into three classes:

(i) controlled

(ii) Semi-controlled

(iii) Uncontrolled.

Controlled Mosaic - is the most accurate of the three classes. It is prepared from photographs which have been rectified and rationed, i.e. all points are made into equivalent vertical photographs which have the same scale.

Uncontrolled Mosaic - is prepared by simply matching the image details of adjacent photos. There is no ground control, and vertical photographs which have not been rectified or rationed are used. Uncontrolled mosaics are more easily and quickly prepared than controlled mosaics. They re not as accurate as controlled mosaics, but for many qualitative uses they are completely satisfactory.

Semi-controlled Mosaics- are assembled utilizing some combination of the specifications for controlled and uncontrolled mosaics. A semi controlled mosaic may be prepared, for example by using ground control but using photos that have not been rectified and rationed photos but no ground control. Semi-controlled mosaics are a compromise between economy and accuracy.

Mosaics are frequenctly categorized according to their use: Index mosaic and strip mosaic.

Index Mosaic (or photo index) - is an uncontrolled mosaic which has been laid to very rough specifications It serves as an index for correlating photo numbers and photo coverages.

Strip Mosaic - is the assembly of series of photographs along a single flight strip. Strip mosaics are extremely useful in planning and designing linear projects. Strip mosaics may be controlled, uncontrolled or semicontrolled.

9.2.7 The whole of this conntry is covered by aerial photograph on one scale or another. Small scale indexes giving scale, cover and date of photograph can be obtained from the Director of Federal Surveys and sometimes from the Surveyor Generals of the States. For Land Tenure Surveys (i.e. claim surveys) it is not necessary to order fresh photography.

The film rolls are normally in the custody of the Federal Surveys. A check should however be made with the nearest office of the flying agency- Kenting Africa, Kano, for Northern States. Photographs can be ordered with either glossy or matte or semi-matte surface and on single weight or double weight paper or as disapositive on film. For most use contact prints are needed. It may, however, somtimes be necessary to order enlargements (especially for aerial mosaics). Glossy prints are very useful for interpretation purposes and for preparing mosaics. In the case of the aerial mosaics for Land Tenure Survey where the names of the farmers are to be recorded on the photo-face, matte or semi-matte prints should be obtained. Doubles weight prints need to be ordered since the photographs are to be used

in the field. Such prints are also useful in case mosaics are to be made without hard backing.

Using the photo-index, the appropriate mosaics covering the area to be Land Tenured are sorted out. The control extension points are plotted on the mosaic so as to define the entire limit of the reservoir. The mosaics on scale 1:2,500 have been obtained by the enlargement of the available photo mosaic on 1:10,000. Individual farmlands are identified measured and drawn on the farm plot boundaries on dyline prints of 1:2,500 controlled air photo mosaics. The plots user's name was inserted on the mosaics and also on the field register.

9.3 Identification and Survey of Farmlands

9.3.1 Methods of Survey

Two of the methods described under section 9.2 were employed. These were:

(i) The plane table

(ii) and the compass traverse methods.

The Plane Table Method

With the plane table, the plan was prepared directly in the field without the measurement of angle and without the rigours of computations. The production of complete maps is done by filling in the details relative to a network of control points which should have been plotted in before hand and/or filling in the details after the control points had been established. The plane table survey is oriented

to the perimeter traverse line and the distance scaled off. The farm surveys are then carried out using these as baselines. In this way, the survey up to the River Basin has a consistent and uniform relationship with the perimeter traverse. The main reasons for the choice of this method are:

(i) the plan was made directly in the field without the need for the taking of important details being left out.

(ii) the rapid sketching of details is possible and there are less chances of important details being left out.

(iii) the scale of the map was fixed before work began on the project.

Compass traverse method

This was used for the farm survey where the terrain makes it difficult for the plane table to be used for the compensation work. In this method, the survey is done first as in the case of theodolite traverse. The observations made in the field are recorded in a field book which is later used to plot the farm plots. In the same manner that the plane table was oriented to the traverse lines and traverse stations, the compass traverse takes its bearing from the traverse stations and traverse lines.

9.3.2 Description of the acquisition plans

As was explained in section 9.1, the acquisition plans were tied to the traverse lines and pillars. The plans were plotted to the scale of 1:2,500. The acquisition plans were divided into eleven sheets covering the entire reservoir Area Maps which include Benye, Barkiya, Birchi and Rawayan villages. These are as shown from Appendix O, P, Q, R ..... X to Y.

Two registers are for the two administrative districts for which the acquisition is being made. The register is a schedule of holding which show the names of farm plots owners serially, the area of farm plots, the total number of economic trees, the amount payable for the farm plots and for the economic trees and the total amount payable to farmers.

A schedule of holdings and entitlements was prepared for each farmer for compensation for land and economic trees for the purpose of compensation and/or for the purpose of resettlement. The register for the Benye village is in three volumes while those of Barkiya, Rewayan and Birchi villages combined are in four volumes.

An identity card, was also issued to the individual farmers. The identity card carries recent passport sized photograph of the farmers, his/her village, Local Government Area, his/her farm

number, date of issue, name and signature of issuing authority. A sample copy of the identity card is shown in Appendix C. The number of cards issued corresponds with the number of farm plots surveyed.

Benye village in Katsina Local Government Area

On the Benye side, there are five sheets made up of Benye sheet, with 197 farms; Benye sheet 2-53 farms. Benye sheet 3-271 farms, Benye sheet 4-37 farms; and Benye sheet 5-132 farms. The total number of farms on the Benye village; Katsina Local Government Area is 693 covering an area of 832.777 hectares.

Barkiya Rawayan and Birchi Villaages in Dutsin-Ma Local Government Area

On the Barkiya side, there are six sheets made up of the following:-

Barkiya sheet 1-119 farms Barkiya sheet 2-192 farm plots;

Barkiya sheet 3-190; Barkiya sheet 4-112 farms; Barkiya sheet 5-76 farms, and Barkiya sheet 6-144 farms. The total number of farms on the Barkiya side and the area covered by the farms are 842 farms and 727.034 hectares respectively. The 842 farm plots are made up of Barkiya 556 farm plots, Rawayan 252 farm plots and Birchi 34 farm plots.

The overall number of farms on the Reservoir Area maps are 1535. River Gada is the boundary line between the Benye and the Barkiya ends of the proposed

project area. The inland boundaries are the traverse lines along contour 510.00m.

The compensation cost for farmlands is fixed at six hundred and fifty Naira per hectare, the land being on the rural area. The data below show a sample determination of the compensation due to a farmer whose farmland and the economic trees are to be acquired.

Name of farmer: Isa Na Mada of Benye village, Area of farm plot - 0.5 872 hectares at N650 per hectare is N3,816.80: 79 economic trees made up of 3 Kuka at N60 each which is N180; 1 Ganji at N40; 3 Marke at N5 each is N15; 1 Dorawa at N90 is N90; 3 Neaam at N5 is N15; 10 Goruba at N10 is N100; 3 Tsatsagi at N2 is N6; 4 Kargo at N2 is N8; 17 Magurya at N5 is N85 1 Bagaruwa at N15 is N15; 28 Lalle at N6 is N168, 2 Baure at N20 is N40, 3 Kanya at N20 is N60.

The total amount payable to Isa Na Mada is therefore N4,638.80. In this way, the compensation due to the individual farmers and the results are shown in the registers referred to in Appendix A and B.

9.3.3 Plotting the acquisition plans

The compass traverses were plotted using the distances and bearing (magnetic bearings) obtained in the field. The protractor method of map plotting was used for this purpose. The original plans (those obtained directly from the field using the plane table and those made with the compass) were transferred to the tracing paper forthe purpose of mocking up the field sheets of

/adjacent plans. The method was used to ensure that no farm plots was left out and also to ensure an absolute relationship between the plan in different papers made by different persons. The final copies are made on tracing films. These are referred to as Appendices O, P. Q upto X and Y.

9.3.4 Area computation and farm valuation

The area computation was done using aristo planimeter. The instrument is used to follow the boundary lines and then noting the difference between the initial and final readings and multiplying by the constant of the planimeter setting based on the scale of the plan which area is being computed.

The economic trees found in the area under consideration as well as the amount payable for each tree area as set out in the Kaduna State Land and Economic trees (compensation) Law, 1981-C 28 K.D.S. Bill No. 7 and discussed under section 4.6; that is Mangwaro N60, Kadanya N40; Tsamiya N30; Gwanda N15; Kanya N20; Lemon Tsami N80; Ganji N40; Rimi N60; Goba N5; Neem N5; Durami N35; Giginya N60; Kuka N60; Kwina N10, Kirya N30; Magarya N5; Kargo N2; Chediya N35; Goruba N10; Kawari N5; Lalle N6; Zogalla N20; Dinya N30; Zuwe N5; Baura Lamba "20; Matsatsagi N2; Gwandar Dawa N2; Dorawa N90; Bagaruwa N15; Gawo N40; Marke N5; Aduwa N5, Dutse N5; Katsina N5; Sausam N5; Danya N5.

9.4 Farming

Farm products in the area are in variably food crops. They include maiza, millets, guinear-corn, rice beans, groundnuts, potatoes and cassava. Some citrus and tobacco are also grown.

Evidently, farmlands are seriously fragmented and each unit is small. Consequently, households claim to number of farmlands tend to be very large. As shown in Table 13, only 6.8 percent of the households do not lay claim to any farmland while only 23 percent claimed to have between 1 and 5 farmlands. As high as about 38 percent of the households claim to have between 5 and 10 farmlands. The most common number of farmlands purportedly possessed by households is 10 this being claimed by as many as about 13 percent of the households. About 82 percent of the population claimed to have not more than 15 farmlands.

Given the serious fragmentation of farm holdings, as the cadastral survey has shown, ownership of as many as 15 farmlands within a household might not be eyebrow raising as these are not likely to amount to much in terms of overall hectarage. There are however some households that claimed to possess numbers of farmlands which appear preposterous. About 17.8 percent claimed to have between 16 and 30 farmlands while about 3.0 percent claimed to have over 30 farmlands with some even claiming to have over 100 farmlands.

Farmlands	Percentage of household owing number of farm lands	% of households cultivating number of farmlands
0	6.8	18.0
1.5	23.1	21.2
6.10	37.9	31.5
11-15	14.2	12.4
16-20	9.6	7.9
21-25	2.8	2.4
26-30	2.6	1.5
Above	3.0	1.9

Table 13: Farmland owned and Cultivated.

Land utilisation appear intensive as about 84.5 percent of farmlands owned are being cultivated. This intensive cultivation is permitted partly because, for climatic reasons, only one planting can be done per annum and partly because some form of fertilisers are being used by farmers.

9.5. Land Acquisition

The reason for intensive fragmentation of farmland becomes obvious when one looks at the predominant system of farmland acquisition. As high as 78.3 percent acquired their farmlands by inheritance. Only 2.7 percent acquired by purchase while only 1.1 percent acquired through gift. A very minute proportion-accounting for only 0.3 percent, acquired farmlands by clearing virgin land and similarly 0.1 percent got farmlands by borrowing. The remaining 7.4 percent of which 6.8 percent laid no

claim to any farmland gave no responses.

Heavy reliance on inheritance for acquisition of farmlands invariably leads to intensive fragmentation. This is more so as both male and female children are entitled to inherit farmlands. Further, dispersal of farmlands is inevitable since land could be inherited from either parent. However, the author's findings show that virtually all farm-lands are very close to the respective villages. In only about 13.5 percent of the cases do farmers have to go more than 2 kilometers to get to their farms. This is a very important factor to bear in mind in planning resettlement site/s.

Another important point to bear in mind in planning resettlement is the villagers concept of who owns and controls lands. As much as 86.8 per cent of the respondents believe that ownership of family land is vested in the household head. However, about 75 per cent believe that it is the government that has overall ownership of all lands while about 5 percent believe that the land is owned by the people. These could be interpreted as villagers belief in household ownership but government control of land. Furthermore, villagers believe in the sacredness of family land boundaries. Consequently quarrels hardly arise on infringement. The only quarrel which occassionally

arises is against herdsmen who allow their animals to stray into planted farmlands. From these evidences, one could conclude that while the villages might not be averse to deprivation of their existing farmlnads by the government, they would certainly kick if commensurate size of farmland is not re-allocated (or paid in cash) to them.

CHAPTER X

10.1 Survey Costs

As in Engineering, the cost of executing survey works depends not only on market trends that is on cost of materials, cost of equipments, cost of labour and services but also on vaious other parameters which include:-

10.1.1 Nature of the work-Traversing, Triangulation, aerial photography, accuracy requirements, corrections so on.

10.1.2 The type of topography

10.1.3 Size and coverage of land

10.1.4 Transportation or accessibility.

The principles of economy requires that the accuracy of a survey should be to necessary and sufficient standards which satisfy practical requirements rather than levels of attainable accuracy. The latter must be clearly distinguished from the claims of accuracy and precision implied in many co-ordinate systems.

Chrzanowski(1972) has shown that if points are to be established even to a relative accuracy of 1cm from different control stations, the quality of control must be far higher than anything that has yet been established in any city of the world.

Presently, there is not hard and fast rule regarding valuation of survey jobs. Actually, the final sum-charges will be calculated and depend on tender basis and the ability to negotiate.

10.2 According to the Surveyor Generals recommended scale of fees: a document published by Federal Surveys in 1978, titled "Fees payable by public sector-Execution of Survey Works", the execution of survey work has been divided into various categories, as follows:-

10.2.1 Category A - Property Survey (including layouts)

This consist of surveys for plans to be attached to registrable instruments, surveys for defining the perimeter of boundaries of any land, subdivisions of any parcel of land into plots in accordance with approved layout plans.

10.2.2 Category B - Topographical Surveys (excluding Surve

This includes spot heighting and/or contouring, detail surveys of national and man-made features. Preparations of maps and plans, and so on.

10.2.3 Category C - Contorl Surveys

This is sub-divided into:-

(a) Vertical controls

(b) And Horizontal Controls.

Vertical Controls

This includes benchmarking and spirit levelling

at first, second, third or fourth order of accuracy etc.

Horizontal Controls

This includes traverses at first, second third or fourth order of accuracy; triangulation and/or trilateration.

10.2.4 Category D - Engineering Surveys

This includes setting out of roads, rails, centreline, curve ranging, cross section, right of way demarcation, survey at constructional sites such as dam site, bridge and site.

10.2.5 Category E - Special Surveys

This includes land in dispute surveys, claim survey, astronomical observation, re-establishment of beacons etc.

10.3 Costing

As has been stated, some of the parameters for costing surveys work include type of terrain. The terrain may be rugged or flat. Cost may therefore be considered under any or some of the following types of terrain.

(a) Thick grass, orchard bush, light forest
(b) Open or lines property cleared by the client
(c) Thick grass, orchard bush, light forest
(d) Swamp land
(e) Medium forest
(f) Heavy forest with dense secondary growth.

In addition to this, the major factors to be considered for costing the work done in each category are as follows:-

(i) Investigation and searching fees

(ii) Recce and beaconing fees

(iii) Labour charges

(iv) Materials needed for survey

(v) Transport costs

(vi) Instrumentation costs

(vii) What to deliver to client and presentation

(viii) Clearing and cutting (where necessary)

(ix) Connections to government beacons

(x) Overheads and contingencies.

10.4 Surveyors Cost Estimate for the Demarcation/ Perimeter and Land Tenure Survey or Gada Benye Project

The estimate is based on the Surveyor General's recommended scale of fees duly endorsed by the Federal Surveys in 1978. Basically, the job descriptions are as laid out in section 1.3 and has the following main components;

(a) Demarcation and perimeter survey

(b) Contour trace and levelling

(c) Land Tenure Survey (i.e. Claim Survey).

The total reservoir area as initially envisaged from the feasibility and detailed engineering design reports = 2,000 hectares, As part of the reconnaisance and planning, it was also established that the contour 504.6m contour was not going to give the required area. Hence, the 510m contour was adopted for the demarcation of the highest flood level and gave the required 2,000 hectares. For the purpose of computing costs, it will be reasonably assumed that the total reservoir area is 2,000 hectares since we can only have approximate idea of the size of the reservoir from the available map 1:10,000 enlarged from 1:50,000 topographic sheet; prior to commencement of the traverse.

10.4.1 Cost of perimeter survey

Cost of demarcating 1 hect. of land = ₦1,500.00

Cost of demarcating 2 hect. - ₦2,300.00

Cost of demarcating 3 hect. (₦2,300 at 60% of ₦1,500) = ₦3,200.00

Cost of demarcating 4 hect. of land

(₦3,200 + 60% of ₦900.00)

= ₦3,800.00

(i) Cost of demarcating 5 hect. = ₦4,125.00

(ii) Next 5 hect. @ ₦500.00 per hect= ₦2,500.00

(iii) Next 10 hect @ ₦300.00 per hect= ₦3,000.00

(iv) Next 20 hect @ ₦200.00 per hect= ₦4,000.00

(v) Next 60 hect @ ₦100.00 per hect= ₦6,000.00

(vi) Next 100 hect @ ₦80.00 per hect= ₦8,000.00

(vii) Next 200 hect @ ₦60.00 per hect=₦12,000.00

(viii) Next 300 hect @ ₦40.00 per hect=₦12,000.00

(ix) Next 300 hect @ ₦30.00 per hect= ₦9,000.00

(x) Next 100 hect @ ₦10.00 per hect=₦10,000.00

Cumulative total from (1) to (x) Total Cost

Total Hecatarage =₦70,625

- 2,000 hecates

Thus the total cost for the perimeter survey of 2,000 hect. = ₦70,625.

10.4.2 Other Costs

The cost for contour trace and levelling; as well as that for the land Tenure Survey are drawn in Table

Type of Survey	Description of Survey Job	UNIT RATE	Quantity	Amount
A Demarcation Perimeter Survey	i) Perimeter Survey (as provided in the scale fees	-	2,000Ha	₦70,625
	ii) Clearing Lines of Sight etc	₦150/km	18km(Perimeter	2,700
	iii)Control Extension from Nation Triangulation System to project Area	₦600/km	9km	5,400
Sub-Total 87,725	iv)Beaconing, Azimuth and Preliminary Investigation etc.	₦500/km	18km	9,000
LEVELLING AND TRACING OF CONTOUR	i) Levelling the perimeter of ₦2,000 Ha (3rd order levelling)	₦300/km	18km	5,400
	ii) Triangulation and Contour tracing	₦400/km	18km	7,200
- ₦18,000	iii) Estimating on an Average of Farmholding of 0.25 Ha	₦300/km	18km	5,400

Type of Survey	Description of Survey Job	Unit Rate	Quantity	Amount
C LAND TENURE	i) Estimating on an Average of farmholding 0.25Ha	₦10.00	8,000 Holdings	₦80,000
SURVEY/CADASTRIAL SURVEY OF FARM LANDS Sub-Total ₦100,400	ii) Detail Survey and Crop Enumeration			₦20,400
D FACILITIES	i) Vehicles/Transportation			₦20,000
	ii) Office and Residential Accommodation			2,400
SUB-TOTAL ₦28,400	iii) Typing, Printing, Binding and Stationaries			₦ 6,000

Grand Total = ₦87,725 + ₦18,000 + ₦100,400 + ₦28,400

= ₦234,525 **₦234,525**

The above costs should serve as a guide line for costing execution of demarcation. Perimeter and Land Tenure Surveys. Although in compliance with Government regulations, competitive or slective tendering procedure may be adopted, negotiated contracts would be adopted also, since there is room for negotiation on certain items for example, under "Facilities" Sub-head.

9.4.2 The Nigeria Institution of Surveyors adopted its own scale of fees in 1973 for the demarcation and survey of land throughout the Federation.

In 1978 the institution in collaboration with the Survey Departments produced a scale of fees which superseded the 1973 edition. The current edition of the scale of fees by N.I.S. was adopted at the 17th Annual General Meetings of the Institution on Friday 23rd April, 1982. However, the authors estimate has not been based on the NIS scale of fees, because the River Basin Authority being a Federal Government agency prefers to use the 1976 Surveyor Generals recommended scale of fees as duly endorsed by Federal Surveyors.

CHAPTER XI

SUMMARY AND CONCLUSION

11.1 Summary

11.1.1 This Thesis/Project Report contains a concise assessment of the practical situation concerning land matters facing the KKRBDA in acquiring the 2,175.368 Ha impound d by the reservoir and the development of 2,500 Ha required for irrigated agriculture; in conformity with the existing laws of this country. It is important to make such an assessment now that land is rapidly becoming a marketable commodity in many development areas of this country.

Every land development project is concerned primarily with land and the people who occupy and use it. The foundation of every project rests on:

- how the land is owned and who holds rights in it,
- how the land is used and who occupies and uses it.

In the case of the Gada Benye Project, successful implementation depends on the satisfactory adjustment of these factors to suit the needs of the resettlement and post-irrigation environment.

The decision to endertake the project has involved changes in the land situtation in three spheres:-

- in the structure of the Government machine concerned with land administration;
- in the proprietorial structure of the project area to accommodate the new irrigation infractucture and
- in the settlement pattern and unit of farm management to facilitate the fullest use of the irrigated land.

The creation of KKRBDA as a body capable of holding land in its own name has created a new tier in the hierarchical structure of the Governments administrative machine. There are, therefore, a number of agencies having jurisdiction over the project area-the state government, the local government, the KKRBDA, and private persons; the responsibilities and spheres of operations of each have to be clarified if confusion is to be avoided.

11.1.2 Although by virtue of the Land Use Decree, the State Government, together with the Local Government in respect of rural land, may grant rights of occupancy, in practice exisiting rights of occupancy have assumed the character of a freehold estate with the right of ultimate reversion remaining in the State Government. Over the years, statutory provision has been made in respect of Land in Urban and rural areas whereby it may be lawfully sold, leased or mortigaged, and in the case of customary rights of occupancy to the approval of the relevant Local Government over rural land. Nevertheless it is generally recognised that unofficial dealings of a variety of kinds have occured.

11.1.3 As in all other countries the character of the land tenure system in the Northern States has evolved to a very large extent from the community's responses to economic change over long periods of time. The implementation of the project depends on bringing about

tenurial changes to suit the new circumstances. To do this at Benye is difficult because the formation of land policy is a state responsibility whereas the project itself is being mounted by the KKRBDA which as a Federal Agency, has no jurisdiction over the land affected. Furthermore, by virtue of the nature and strength of the private rights which have emerged, even the jurisdiction of the state (or local) government is limited. For any unauthorised agency to try to bring about any tenurial adjustment without due process would be unconstitutional, and beyond their powers under existing laws.

11.1.4 The functions and powers of the KKRBDA (or strictly speaking SRBDA) are prescribed in the River Basins Development Authorities Decree, 1976. The KKRBDA is legally involved at Benye in three distinct but interconnected operations, each of which involves different land problems:-

- To construct and maintain dams, irrigation and drainage systems, etc, - for theses pruposes, the authority clearly require full ownership or the lands involved.
- To develop irrigated agriculture and to lease irrigated land to farmers for a fee; this implies that the authority most have proprietorial status so as to enable it to function as lessor;
- To resettle person affected by the works and schemes involved by the two functions listed above. However, the Land Use Decree specifically invests only the State Government with the power of revocation of rights and theRBDA decree specifically excludes the SRBDA from acquiring land without the agreement of the State Government.

11.1.5 The Land Tenure Survey has provided base information in the form of a census of fields, trees, crops and farmers, in the reservoir area. The farmers recorded in registers as rightfully working a plot are the "owner", that is those who have the right to determine who shall use their lands, how the lands shall be used and indeed whether the land should be used for productive purposes at all.

11.1.6 In order to physically identity the boudary of the reservoir it has been necessary to carryout the demarcation and perimeter survey. The reservoir area enclosed by contour 510m was demarcated by permanent survey beacons fixed at suitable intervals. The location of the beacons was referred to the National Framework and heights surveyed to third order accuracy. The reservoir boundary survey was done along the highest flood level (H.F.L.) which had earlier been determined to be 510m. The results of this survey was then plotted at a horzontal scale of 1:2,500 and the area enclosed by the reservoir computed to be 2,175.368 hectares. The location and elevation of survey beacons was also indicated. The area enclosed by the reservoir boundary was sub-divided and surveyed according to the existing land tenure and other usufract rights prevailing on the land. Thus all existing farm holdings were identified, located and surveyed with reference to the reservoir boundary.

Registers and identity cards of the farm owners were prepared in respect of each farm holding to show holding identification numbers, types and sizes of buildings and other structures and, the owners name and photographs. A schedule of farm-holdings and entitlements for each individual farmer for compensation of farmholdings, economic trees, structures etc, was prepared for the purposes of payment of compensation and/or resettlement. However, due to the very sentitive nature and secrecy surrounding resettlement figures, the author is not permitted to publish costs relating to the overall total amount of compensation to be paid to the farmers.

The results of the survey will be used jointly by the Kaduna State Government, Katsina and Dutsin-Ma Local Governments along with other data; to extinguish any customary and/or statutory rights of occupancy in existence, payment of compensations and resettlement, and to finally confer onto KKRBDA unimpeachable title over the said parcel of land.

11.2 Achievement of the Study

11.2.1 In this study, the author has examined the features of the Land Tenure systems of the villages to be displaced by the Gada Benye Dam from the angles of demarcating the highest flood level of the reservoir, record for assessment of compensation of the farms, economic trees and buildings which will be inundated and, gathering further information relevant towards the

rehabilitation, resettlement/or relocation of the affected communities. The research approach has been highly quantitative as is demanded by nature of this research. Information and data gathering were done by a combination of questionnaire administration, informal discussions with village heads and elders and of course direct field observations. Based on the anlysis of data, the following major findings and achievement are obvious; (1) The acquisition plans were divided into eleven sheets covering the entire reservoir area maps which include the villages of Benye, Barkiya, Birchi and Rawayan. The register for the Benye village is in three volumes which those of Barkiya, Rawayan and Birchi villages combined are in four volumes. A total of 693 farm-holdings spread over 832.777 hectares have been recorded against Benye village in Katsina Local Government. While a total of 842 farm-holdings spread over 727.034 hectares have been recorded against Barkiya village (comprising of Barkiya, Rawayan and Birchi). Therefore, the overall number of farm-holdings recorded is 1,525, as per shown in Table 14 showing details of a acquisition plans.

Local Government	Village Name	Sheet	Number of Farm-Holdings	Total Per Village	Area (in Hectares)
Katsina	Benye	5 Sheets Benye Sheet 1 2 3 4 5	 197 53 271 37 132	693	832,777
Dutsin-Ma	Barkiya	6 Sheets 1 2 3 4 5 6	 119 192 190 112 76 144	842 (Barkiya-556 Rawayau-252 Birchi-34 Total Overall Holdings = 1,535	727,034

Table 14: Details of Acquisition Plans.

(2) The cost of carrying out the demarcation/ perimeter and Land Tenure Surveys of the reservoir area of about 2,000 hectares would be within the neighbourhood of ₦234,525.00.

(3) A total of six (6) control extension points were established. They are F2517, TP3, TP2, PBKT 2976, PBKT 2977 and PBKT 2978.

(4) A total of 182 property beacons were established and heighted. The number are:
KT 2926 to KT 3025
KK 561 to KK 292
DM 2488 to DM 2537

(5) Methods of acquisition of farmlands are largely through inheritance, gift or purchase. Heavy reliance on inheritance for acquisition of farmlands invariably leads to intensive fragmentation.

(6) The village which are going to be submerged by the reservoir dam are Benye, Barkiya, Birchi and Rawayan.

(7) The size and economic trees of each farmland has been recorded in the register and the entitlement for each farmer computed. The overall total amount of money for the compensations has also been calculated but figures concerning this cannot be published here,,for security reasons.

(8) A call for a drastic revision of the Land Use Act to conform with present day realities.

11.3 Implications and Recommendations

11.3.1 On Resettlement General

(i) There must be effective management for policy formulations on and implementation of resettlement programme;

(ii) Selection of site must be acceptable to the people to be resettled;

(iii) Socio-psychological factors must be respected as much as practiceble in planning resettlement;

(iv) Mode of compensation - whether in kind, cash or a combination of the two - must be carefully worked out to prevent a defeat of the main objectives of the whole project;

(v) As part of the measures to minimise adverse psychological effects of locational movement housing structure must, as much as possible, reflect the aspirations and maintenance ability of the people to be resettled;

(vi) The phasing and logistics of movement of people must be done in a way to cause minimum disruption to the economic life of the people to be resettled;

(vii) For predominantly agrarian communities problem of land tenure concerning those to be resettled and those in the resettlement locality must be properly worked out and reconciled to avert conflicts;

(viii) Having ensured all round support for its resettlement policies and implementation programmes, the management in charge of resettlement should be firm in executing the programmes;

(ix) Finally, resettlement of people affected by land development projects should always be seen as a joint co-operative endeavour between the State Government, on one hand and the acquiring authority on the other hand. As a matter of fact a Resettlement Co-rdinating Committee should be set-up by the State Government for such purpose. Membership can be drawn from all relevant ministries (especially Lands and Survey), Local Government Officials and representative of the local community concerned.

11.3.2 <u>On implications of land Survey Works under the Land Use Act</u>

(i) Areas within 10 kilometer radius of urban area are still classified as urban, whereas anything outside this range is considered rural. This situation calls for the physical demarcation of urban and rural areas for effective land

administration by Land Use and Allocation Committee and Land Allocation and Adisory Committee, respectively.

(ii) There is the need for provision of adequate control survey pillars all over the country for the purposes of charting and subsequent issuance of land certificate of occupancy.

(iii) Preparation of basic maps with control marks for the area concerned so that parcels of land could be unambiguorsly located.

(iv) Registration of all titles to land.

(v) The Survey Decree, 1977 provides that a copy of any survey plan made for the registration of an instrument relating to land must be deposited with the Surveyor General. Since the certificate of occupancy is a land instrument, tne Licensed Surveyors are not (with the introduction of Land Use Decree, 1978) compelled to implement the survey Decree. Therefore, any survey plan received by the Chief Lands Officer would be sent to surveyor General and if no corresponding copy had earlier been forwarded by the Licensed Surveyor, the Chief Lands Officer would reject the application.

(vi) Compulsory acquisition of land by Government for over-riding public interest necessarily calls for land tenure and registration of records to determine individual entitlements to compensation for land and economic trees (that is, claim surveys).

(vii) According to the Land Use Act, it is the duty of Occupier of Statutory right of occupancy to maintain the beacons, failing which the Land Survey Department could be asked to define the boundaries which the occupier has neglected to define, and then surcharge him accordingly. This is an added responsibility to the Survey Department.

11.3.3 Problems met during the implementation of Land Use Decree

(i) Lack of adequate large scale and medium scale maps for planning and acquisition of land for development purposes.

(ii) Lack of adequate National and Township Control points which contributes in delay of surveys.

(iii) Lack of adequate man-power in the Survey Departments to carryout all governments surveys, those of private organisations and individuals.

(iv) Insufficient funding by Government. This resulted in lack of equipment and working materials. The Survey Departments were thus

faced with non-performance and could not give out survey jobs to Licensed Surveyors.

11.4 Suggested Amendments

11.4.1 A Land Use Decree Section be set-up in each state Survey Department, comprising of field inspection unit and investigation unit. The former checks the plans in the field against the situation on the ground and any discrepancies located are reported to the applicant for rectification. In case of encroachment, the investigation unit carries out a proper survey.

11.4.2 Because of the pressure of the government on the Chief Lands Officers and Surveyor Generals in the issuance of certificate of occupancy, the latter officer has to reduce to barest minimum the rigour of survey inspection.

11.4.3 The Decree should be rewritten in simple English language to the general understanding of layman for whom the Decree is meant to serve.

11.4.4 It is far better that all land in Nigeria be vested in the Federal Government rather than the current situation in which the Decree vests the land in each state in the Governor of the State. This would be a major boost for national wareness and allegiance.

11.4.5 Absolute upper limit should be placed on the amount of developed urban or rural land and on the magnitude of undeveloped rural land which any one person can be allowed to hold. Such developed or under-developed land should not exceed 500 hectares per person for farming; 5,000 hectares for grazing or 400 hectares for extraction of building materials.

11.4.6 The Federal Government should spell out criteria for urban delimitation which should binding on all the states, and that those states which have already declared their urban location should revise their decisions in the light of these new Federal specifications.

11.4.7 In addition to the function of Land Use and Allocation Committee, the Committee should receive and process for the Governors approval all applications for certificate of occupancy. The composition of the Committee should also be broadened to include the Surveyor General and the Chief Town Planning Officer.

11.4.8 Anyone who applies for and is denied land should seek legal redress or seek some official channel for obtaing justice.

11.4.9 The Decree is not a Land Use Policy and there is major conceptual and operational distinction between utilization and tenure. There is need for a real Land Use Law in Nigeria.

11.4.10 There is need for cadastral survey of the whole country. Since in virtually all instances; a person applying for a right of occupancy is expected to submit a formal survey plan or an "acceptable" sketch or/or description of the land, there is an excellent cartographic opportunity for nation-wide cadastral survey. Such survey shall furnish more needed and reliable framework for periodic land use investories, regional and national planning, Land Use monitoring and control, and future land policies.

11.4.11 There is need to establish a National Land Research Board comprising of membership drawn from a wide spectrum of academic and professional fields. The body should supervise the cadastral survey and prepare for the Federal Government detailed guidelines for a nation-wide land utilisation policy.

11.4.12 While the good intentions of the Decree were no longer in doubt, such questions the answers of which could help buttress the harmonious working of land reform ought to be raised.

(a) How can land values be built up to serve as a Credit base for agriculture?

(b) Are the powers conferred on to the state and local governments not capable of being misused by unscrupulous political adversaries?

(c) The rural land situation in many parts of the

states is in complete disarray. Hardly could any one say who uses what - what boundaries are either completely absent or ill-defined? What could be done about this?

(d) Civil Servants who were entrusted with land administrationin the urban areas were known to be styly in their work, should they continue to handle this function; for example land registration.

11.5 Conclusion

A nation without public land would ask itself such question as whether to acquire land for public purposes and if so what class of land, how much and by what means? Similarly one with land ownership is faced with such policy question as to what extent of land should be acquired and retained and how much is to be used and managed? The general questions are summed-up thus: Could public ownership of land serve as a device for attaining some desireable public welfare goal or not? Public land policy is only an aspect in many instances that influence general welfare.

The Federal Military Government made an unparalleled attempt in the history of this country, through the promulagation of the 1978 Land Use Decree to control the use and management of land in Nigeria. Before the Land Use Decree, the price of land was getting out of control, but immediately afterwards it

escalated to an alarming proportions. Land ownership has been dangerously drifting into fewer hands in many parts of this country.

It is only experience that could decide what system are workable and what are not, which systems are suitable to which conditions, what problems would have to be faced. As Nigeria moves from tribal to a national state, from a traditional to a modern society, a fundamental revolution of land reform is inevitable.

Nigeria had long been experiencing and still is, intermittent land reform efforts. A five tier trial periods of the "1978 Land Use Decree" should have been the minimum targets which, political commitment notwithstanding, would have done little more than to nibble at the edges of the Problems. Reform attempts without basic changes in the social structure a unlikely to succeed.

The inter-relationship between land utilization schemes and land tenure arrangements made it desirable to provide appropriate means for discussing land policy questions on the national level. If the "1978 Land Use Decree" was not acceptable to the State Governments of the Federation, it is therefore recommended that the policy be repealed and instead a "Land Use Act" be enacted establishing a National Commission for Land policy embracing representatives from all the 19 states to advice the Federal Government both the needs of

agricultural development, and also on details of methods of implementation of the new policy.

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