APPRAISAL OF BUILDING MATERIAL ON RESIDENTIAL BUILDING AREA : CASE OF TOTO LGA, NASARAWA STATE OF NIGERIA

BY

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CERTIFICATION

This is to certify that this dissertation has been approved and submitted to the department of geography. In partial fulfillment of the requirements for the award of post graduate diploma (PGD) in environmental management.

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DEDICATION

This work is dedicated to my Beloved wife Halimatu (sadiya) and the entire people of Toto LGA.

ACKNOWLEDGEMENT

Writing a thesis of this magnitude involves a lot of rigour and tolls that were only overcome by the assistance of a number of public that cannot be completely listed out.

First of all, I am grateful to the Almighty Allah for giving me the grace and good health to withstand this rigorous academic programme. I also give thanks to Allah for His guidance, protection and supplying of my need.

My sincere gratitude goes to my father, Alhaji Adamu Ibrahim, my mother Hajiya Aishatu Adamu and my uncle, Mallam Ramalan Ibrahim II and my employer ToTo local government council for their moral and financial support through out my course of study. May Allah spare your lives to reap the fruit of your hands (Amen).

I commend the effort of my supervisor Prof. Adefolalu, my head of Department and Dr. Halilu for their devotion in the supervision of this project. They always wanted to see the progress of this thesis. May Allah reward you accordingly.

My thanks also goes to the entire lecturers of the department of geography, for their sincere desire to always know the progress of this work.

Finally, I own a dept of gratitude to all my friends and my fellow classmates. May the Almighty Allah grant you all your heart desire (Amen).

Thank you all.

Isa Adamu Ibrahim

ABSTRACT

This study is aimed at the evaluation and analysis of the type of building material used for residential building in Toto town.

In order to achieve this, two types of data were collected: that is primary and secondary data, and to determine the sample size, systematic simpling method was adopted by taking every 18th building at intervals after a random start. With this process a total of 327 buildings were societed.
In line with this, the existing building materials in the study area which are the factors responsible for the housing and environmental deterioration were examined.

This study measured the quality of housing in the study area in three major areas of structural materials and condition internal unit facilities provided and environmental facilities. However computations showed that inadequate facilities (internal) were greatest in the study area, internal facilities, structural condition and environmental facilities. All are due to the materials used.

The findings of this study will provide information on the present situation of housing quality in Toto town (LGA) with regard to material used.

Recommendations were advanced on solving building material quality problems in the study area.

TABLE OF CONTENTS

PAGE

CHAPTER FOUR PAGE

CHAPTER FIVE

CHAPTER SIX PAGE

LIST OF TABLES

TABLE

PAGE

PAGE

LIST OF FIGURES

FIGURE

LIST OF PLATES

PAGE

PLATE NO

LIST OF MAPS

MAP

CHAPTER ONE

1.1 INTRODUCTION

The quality of a building material, its characteristics, features and suitability for a particular application in construction cannot be studied without taking into account the conditions under which the material is to serve. The durability of a structure cannot be evaluated if it is considered as an isolated problem independent of the quality of materials and the conditions of construction, and also the service conditions for the materials.

The notion of a material or object is inseparable from its properties. Quality is determined by the chemico-mineralogical composition, external appearance, texture, structure and a combination of many properties by which one material differs from another.

The properties of a material are defined as its characteristic features manifesting themselves in interrelation with some phenomena or in the course of interaction with other materials. The properties of a material can be studied only on the basis of a comprehensive study of the properties of chemical elements and various chemical compounds, and this requires the knowledge of chemistry and physics. Materials that would suit a particular structure cannot be selected and high quality construction at a minimum cost is impossible without intimate knowledge of the great variety of properties of materials.

The totality of properties of various building materials is identified by the term engineering properties.

However, when dealing with a number of materials it is expedient to single out the properties that cannot be ignored without entailing an inadmissible decrease or change in the quality of materials in structures. This group of properties that should also be taken into account in selecting materials for a particular application are referred to as construction properties.

1.2 STATEMENT OF PROBLEM

Most of Nigeria's Local Government Headquarters of which Toto is inclusive are growing at an alarming rate especially during the present political era. It may be said that the rapid growth is due to the concentration of administrative, commercial, industrial, schools and others that may tend to attract population. Yet dilapidated buildings cracks and continuous replacement on the building becomes obvious. Because of the nature and type of material use in the construction. Thereby making housing inadequate for the growing population.

Toto where like some other Local Government, has districts and Towns of which Toto is inclusive. Toto is characterized with lose sanding soil, dangerous narrow and widening streets with no apparent urban plan. Buildings are built in haphazard manner by the developers without any planning standard. The vast majority of this

is dilapidating. It always calls for repair and replacement. General condition of the area is very appealing in terms of basic facilities and infrastructures.

The study therefore seeks to practically appraised the building material used within the study area (Toto town).

1.3 THE GOAL OF THE STUDY

The goal of the study is to assess the building material of the study area with a view of using the appropriate building material at improving the condition in the area.

1.4 STUDY OBJECTIVES

The objectives of this research project are:

I. To examine the existing building material in the study area
II. To identify factors responsible for the environmental deterioration in the study area.
III. To evaluate the type of infrastructural facilities in the study area.
IV. To recommend appropriate measures of using better standard building materials.

1.5 RESEARCH QUESTIONS

Specially, certain pertinent questions which the study attempts to answer areas follows:

I. What are the building materials found commonly in the study area.

II. What are the factors responsible for the environmental deterioration in the study area.

III. What are the infrastructural facilities available in the study area.

IV. What are the various measures and ways of implementing the suggested measures for better condition

1.6 SCOPE OF THE STUDY

The study will deal with the aspect of building material within the study area and how to improve the building structure. These cannot be done without knowing the existing condition in the area and the factors responsible for the environmental condition. After the data collected has been analysed, then recommendation can be made as regards the appropriate measures of providing a better standard of building structure.

1.7 LIMITATION OF THE STUDY

Toto town is the capital of the Local Government Area. A considerable percentage of people are concentrated there and this factor prompts its choice as the study area.

The study is limited to toto town alone because of the following reasons:

I. The largeness of the traditional area and its population

II. Lack of sufficient fund to carry out the research work

III. Lack of man power that can assist in the research work and the limited time

IV. It has been considered effective and efficient to narrow the study area to the smaller facet of the entire area, so as to allow a detailed and thorough research work.

1.8 JUSTIFICATION OF THE STUDY

Toto town being one of the oldest parts of the Local Government in terms of settlement is deteriorating in nature, which required public attention toward revitalizing the area so as to avoid climatic unhealthy, dangerous and other social and physical problems that are common to some Local Government Headquarter in Nigeria.

In view of the above, this project attempts to direct the public and Government attention toward protecting and providing a healthy, convenient and comfortable environment for human habitation in the study area.

CHAPTER TWO

2.1 THE STUDY AREA

The study area falls within Toto L.G.A. of Nasarawa State, dominated by Egbira, one of the major tribe in the area. The rate at which the population of this area increases, is by immigration and natural increase (that is through birth).

The growth rate is estimated to be 2.5% per year (statistic unit of the area was 12,146). Through annual increase of 2.5%. at the end of 19996 the projected population was 13,000

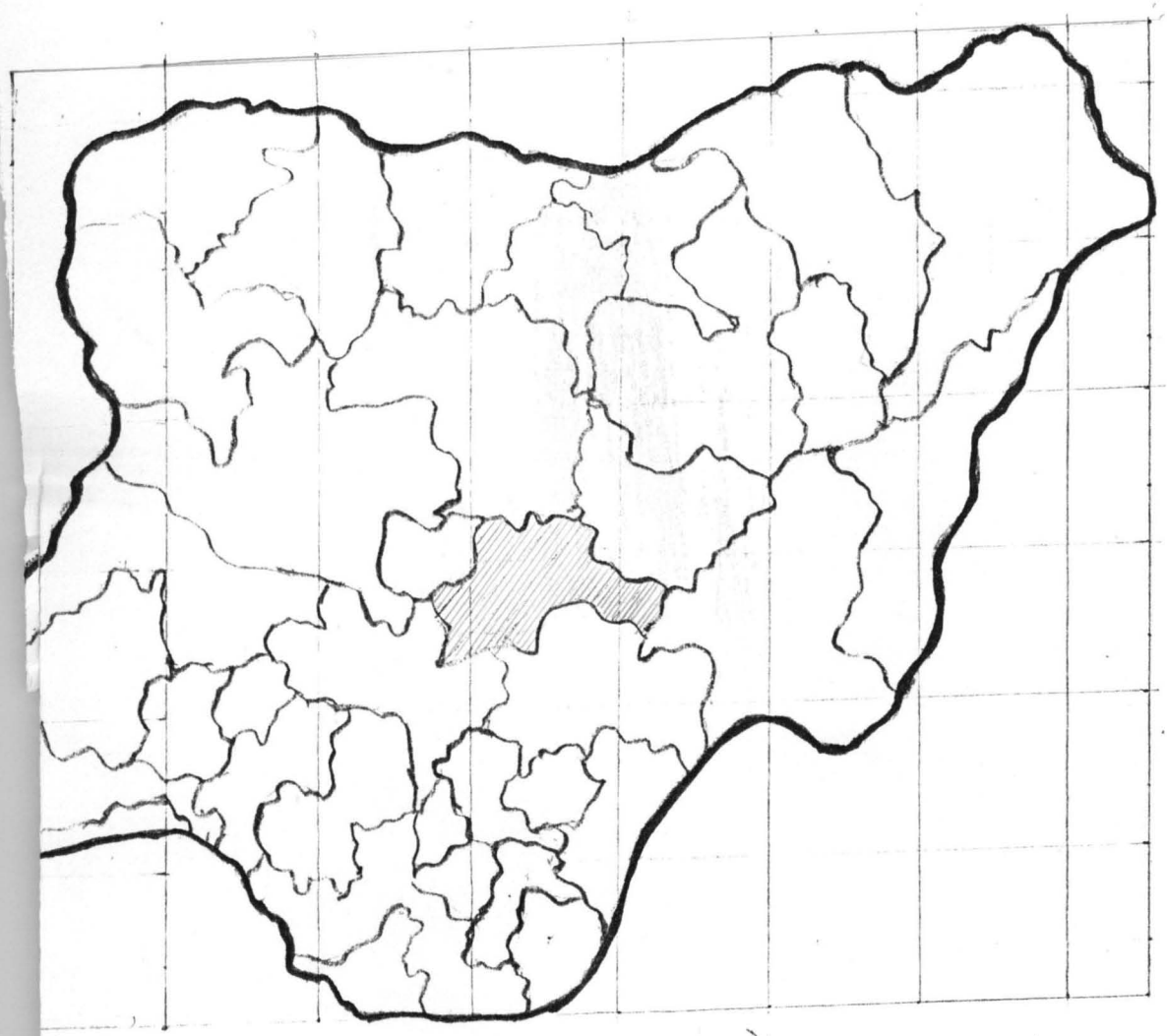
Toto town is bounded on the west by Rafin Kumama (stream), on the south by Rafin Lili (stream), on the North by Federal Capital Territory (F.C.T.) and East by a town call Gbodi.

(See Map 0n the Next Page).

2.1 GEOGRAPHICAL LOCATION OF TOTO L.G.A.

It is located in the western part of Nasarawa L.G.A. of Nasarawa state at a longitude of 4^0 East and latitude of 8^025^1 North. Bounded in the South by Kogi state while in the North and East by capital Territory Abuja (F.C.T.) and is fairly flat plain with sandy soil in most part of the area.

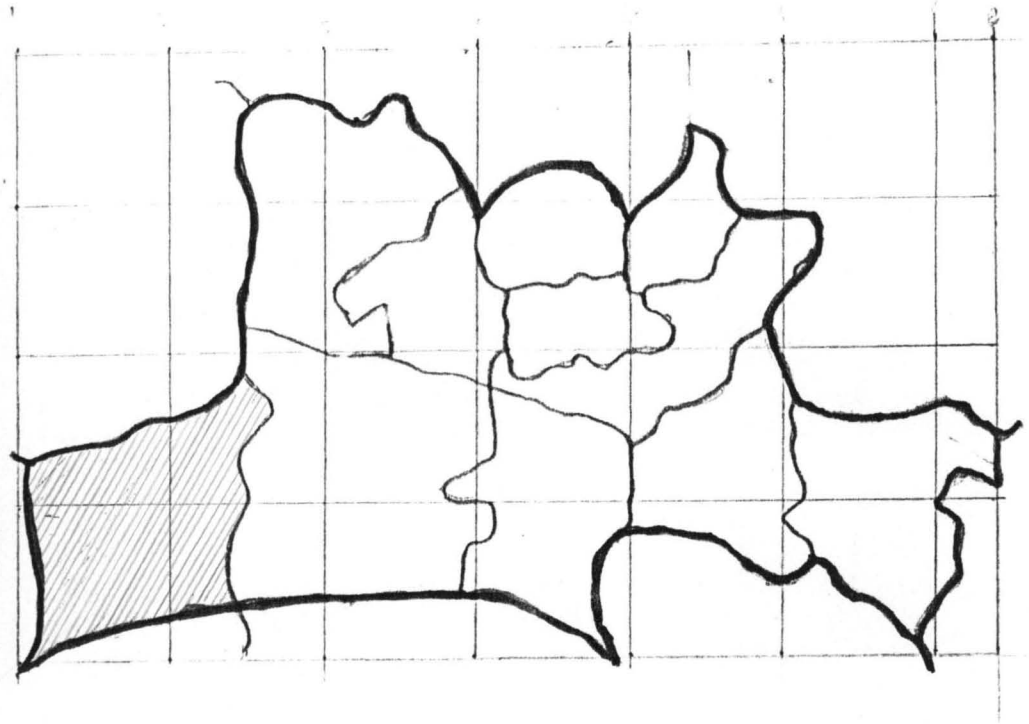
Toto L.G.A. is 135 miles away from the state capital (Nasarawa state) and 11 miles away from the Federal Capital Territory Abuja (F.C.T.)



P OF NIGERIA SHOWING NASARAWA STATE

(Source: Land Survey and Planning, works Dept. Toto L.G.C.)

SCALE 1:200000



MAP OF NASARAWA STATE SHOWING TOTO L.G.A.

(Source: Land Survey and Planning, works Dept. Toto L.G.C.)

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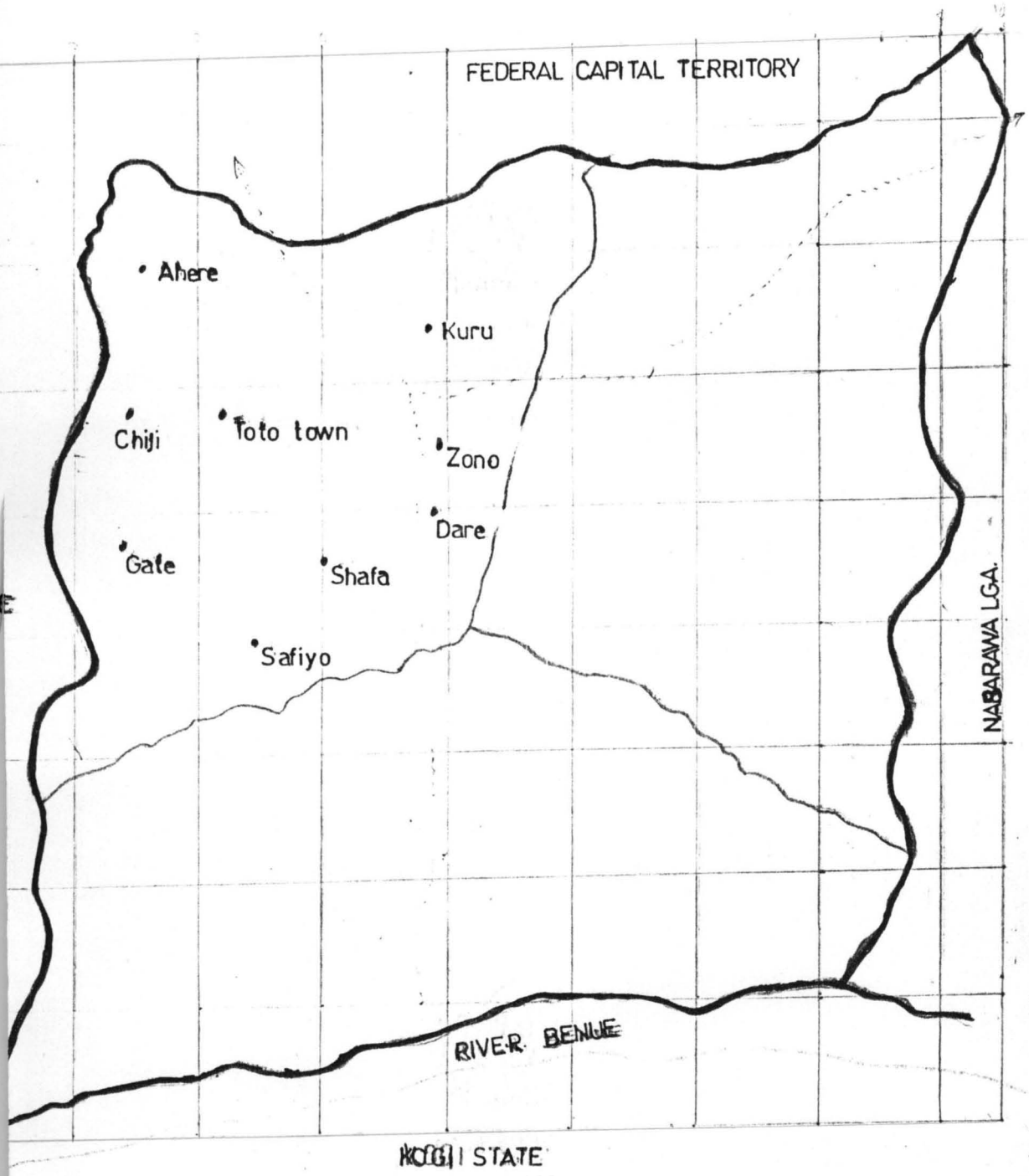

MAP OF TOTO LGA SHOWING TOTO DISTRICT

(Source: Land Survey and Planning, works Dept. Toto L.G.C.

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TILE

MAP OF TOTO TOWN

SHOWNING ROUTES,

AND STRUCTURES.

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Survey and

ing, works

Toto L.G.C

Three main river flow in the vicinity of Toto L.G.A Shege river flows in the North – South direction at a distance of about 20 miles East of the town. Umaisha River, which is the flow of river Benue crosses the Local Government on the south bound course, while Rafin Kunama passes about 2 miles west of the town.

There are few rounded hills in the east and west of the local Government. Which are 30- 50ft and thick forest in the North East.

2.2 HISTORICAL BACKGROUND OF TOTO TOWN

The city state of OGYE (Toto as called by the Hausa) was founded in about 1650 A.D by GANA, the son of WALI DAN MARINA of kastina. Gana named the place OGYE, which was derived from UGYI, that is a place occupied by pocupines. Right deep in the forest was a hunting camp established by ONA who deserted idah because he failed to win the throne of Attah of Igala. The descendants of GANA are saluted as ONYOHU, and the descendants of ONA are saluted as ONYETE. The inter-marriage between the Oriyohu and Onyete resulted in cordial relationship between the later and the former. Consequently the Onyohu identified themselves as Egbira.

The Ohinoyis of OGYE (Toto) that is the paramount rulers of Toto were very powerful. The glaring evidences for these were the construction of the fosse (WALLS) whose remains could still be seen today. This fact is well documented in the National Archives in Kaduna, Keffi Division in file number 365.

Also the opposition of the Ohinoyi Ogye to the expansionist policy of the Hausa feudal Lords by driving Makama Dogo (Ruler of Nasarawa away is quite glaring because they (OGYE) had acquired a canon. The rulers of Ogye purchased the canon at the bank of river Niger at koton-Karfe and was brought to Ogye (Toto) by human porters. This canon is called 'OGBENDU' by the Egbira ethnic group. A song to commemorate this event run thus : 'Ogbendu oi banwo ogye, Odogo oi zeki yo'- that is 'the canon has entered Toto, Dogo has fun away'.

Similarly the Ohinoyi Ogye (ruler of Toto) vehemently drove away the ruthless Abuja (New Suleja) Habe ruler after a very fatricidal Toto-Abuja war, which lasted three years, three month, three days.

Thus the city of Ogye (Toto) could therefore be assumed as one of the main forces, which did not allow Islam to cross to Benue and hence penetrate into Eastern states of Nigeria. Consequently the Hausas called Ogye "Toto totuwai Duma mai Daci" meaning "Toto, the inner part of the guard which is very bitter." The city state of Ogye (Toto) achieved this epithet because of the fact that the town had never been conquered by any force from anywhere.

Based in the very rich past of Toto, and for administrative convenience, the British colonial master made Toto a District Headquarter.

Also by 1982 the then Governor of former Plateau state created Toto Local Government and upgrade the traditional institution of the Ohinoyi Ogye to a fourth class status. But alas, the local Government was a short-lived as the then Gen. Mohammadu Buhari administration dismantled it in 1983. However, by in

1992, the Gen. Ibrahim B. Babangida administration redressed this situation by reconstituting Toto Local Government. Thus, Toto is one of the Local Government Headquater in Nigeria and hence a node for development.

2.3 EXISTING LANDUSE OF TOTO TOWN

Land Use

Table 2.1

LANDUSE	AREA COVERED IN HECTARES	PERCENTAGE
Residential.	33.0	30.0
Commercial	2.9	3.6
Public	3.6	4.0
Service industry	0.4	1.0
Road Network	10.8	11.6
Open space	50.0	50.1
Total	100.7	100.0

Source: Land survey and Planning works Dept. Toto L.G.C.

Residential Land use.

Obviously, Toto town is predominantly or residential area after open space. It covers about 33.0 hectares which is30 percent of the total area.

In the town majority of the residential buildings are built in compound form with inferior Local building materials, inadequate set5 back between buildings. Thus preventing fresh air to houses. Also windows are very small, thereby leading to poor ventilation.

Commercial Landuse

In most Nigeria Local Government Headquarters, it is uncommon to find a whole building reserved for commercial use in a residential enclave. And where buildings are always in smaller proportion to other Landuse. This same principle is reflected in this study area. The major place for commercial activities is the main market, which operate in every four days. While others like food canteen, provision store, medicine store, clinic e.t.c. found within the residential covered 2.9 hectares which is 3.6 percent of the total area.

Public Landuse.

The most noticeable public Landuse in the area are the Local Government office Headquarter, Primary and Secondary schools, Mosque, which are numerous and are indication that majority if them are Muslims. There are some Government and private owned clinic/maternity and other essential services. This type of Landuse accounts for 3.6 hectares, which is 4 percent of the total area of the Land.

Industrial Landuse.

Some light industries are located within the town. These include furniture workshop, sawmill, block- making industry, mechanical workshop e.t.c. It accounts for 0.4 hectares, which is 1.0 percent of the total areas.

Road Network.

Most of the buildings in the town are accessible by road either by untarred motor road or fool path. Some that are not accessible by road is due to erosion that cut some street with the other street.

The network covers 10.8 hectares, which is 11.6 percent of the total area. The road categories are major road, streets and footpaths.

Open Space.

The major part of the Land is the open space since the area is yet to be developed. It covers 50 hectares, which is 50.1 percent of the total area.

CHAPTER THREE

3.1 LITRATURE REVIEW

Building Material is those ingredients or components that are integrated to form a composite structure. Owing to their physical properties, building materials can suitably be integrated to produce complex and composite structures .For example concrete and steel. Concrete is good in compression while steel is good in tension.

These materials sometimes influence the cost or the aesthetic posture of a structure. The choice of materials for a structure in most cases depend on their behavior under serviceability. The main objective of a structure is stability; therefore materials used are normally subjected to international standards.

Building materials are in different varieties, some occur naturally while others are fabricated or prefabricated. Their important properties that are being considered are durability, texture and suitability for the purpose they are intended for.

The type of building material for construction purpose can be classified based on the conventional construction method, which are

(1) Flooring Materials

(2) Walling Materials

(3) Ventilation Materials

(4) Painting Materials

(5) Roofing Materials

(6) Sanitary materials

Flooring Materials –consist of sand and granite (of various grades per load) Cement, iron rods, tiles and terrazzo.

Walling Materials – These consist of various sizes of concrete and clay products.

Ventilation Materials – These comprise windows and doors whose components include wood, louvers, plywood and Metal frames.

Roofing and Ceiling Materials – These include Iron sheet, asbestos sheet, Long span aluminium sheets, ceiling tiles and wooden planks of various sizes

Painting Materials – Painting materials include gypsum line, under coat, wood primer, Emulsion and gloss paint.

Sanitary Materials – These include water closet, wash hand basin, shower, sinks, shower trays and baths as well as galvanized pipes, polyvinyl chloride (P.V.C) Pipes and asbestos pipes of various sizes.

The quality of building material depend on the mode of construction and manufacture. Today's new methods of construction and manufacture require greater attention to detail and closer on – site supervision than the older, tried and tested traditional methods. However, the desire to earn more and more money appears to be prime consideration more often and pride in the job and craftsmanship seem to have gone (Scott, 1976).

Poor construction and manufacture can arise from the following factors:

i) Lack of adequate supervision during construction and manufacture of material.

ii) Lack of skill

iii) Lack of understanding of specifications.

Spedding *et al* (1995), stressed the importance of considering the life cycle of building components when they described the rapid building boom of the 1960s and 1970s in Britain which resulted in a maintenance time bomb as the building components came to the end of their twenty to thirty year life – cycle.

ORBIT 2(1985) Identifies four main components of buildings and their average life spans.

a) Building shell – which includes elements such as structural frame floors, the building envelope and vertical transportation/service core. These have a life span of 0 to 60 years.

b) Building services – these include mechanical and electrical services, telecommunications and data, lighting and interior transportation systems their life spans range from 5 to 25 years.

c) Furnishings – comprising desks, chairs work surfaces, cabinets. These may last much longer.

From studies carried out by NBA construction consultants (1985), the life expectancy of the following external wall materials are listed in the table below.

EXPECTED LIFE OF SOME COMMON EXTERNAL WALL MATERIALS

Table 3.1

MATERIAL	EXPECTED LIFE (YEARS)
1. Brickwork	90 – 100
2. Stone masonry	90 – 100
3. Reinforced concrete	100
4. Concrete block	65
5. Timber framing	50
6. Aluminium panels	50
7. Asbestos sheeting	40
8. Curtain walling generally	30 to 35
9. Timber cladding	30 to 35
10. Mud block	25 to30

Source: NBA Construction consultants.

Maintenance intervals vary depending on effects of weather over time and natural decay, normal wear and tear, and extent of vandalism or misuse. NBA construction consultants (1985), in a study, outlined average maintenance intervals for building components due to normal wear and tear. The life expectancies and maintenance intervals vary with materials as shown in Table below.

LIFE CYCLE AND MAINTENANCE INTERVALS OF COMMON FLOOR

Table 3.2

MATERIAL	LIFE (YEARS)	MAINTENANCE INTERVAL (YEAR)
1. Carpet	10	3 – 4
2. P.V.C tiles	15 – 20	5
3. Linoleum	15 – 25	5
4. Woodblock	45 – 60	Polish yearly, re – sand $ re – seal every 10yrs
5. Wood strip	60 – 65	" " "
6. Terrazzo	50 – 65	9 – 10
7. Granolithic	50	9 – 10
8. Quarry tiles	50 – 65	6 – 7

Source : NBA construction consultants.

LIFE AND MAINTENANCE INTERVALS OF COMMON ROOFING

Table 3.3

MATERIAL	LIFE (YEARS)	MAINTENANCE INTERVAL (YEAR)
1. Built – up felt	15 – 20	3 – 4
2. Asphalt	20 – 60	6 –7
3. Clay tile	25 – 70	4 – 5
4. Concrete tile	20 +	very durable
5. Asbestos cement	26 – 40	generally 6 – 7 depends on air pollution
6. Zinc	20 – 40	"
7. Aluminium	50 – 60	"

Source : NBA construction consultants.

Electrical Installations – Any wiring that is more than 35 years old is out of data and should be replaced (NBA, 1985). The expected life of wiring is 20 to 30 years light should be inspected at least every six month.

CHAPTER FOUR

4.1 RESEARCH METHODOLOGY.

Considering the fact that this study is more of a systematic and empirical inquiry into the subject matter, "Appraisal of building material".

The approach to data collection and the procedure are described below under some sub – topics.

4.1 Types of data collected.

Two major types of data were collected for the purpose of this study. They are, primary and secondary data.

a) Primary Data – this is also called first hand data. It's the statistical materials originated from the investigator. These are done by

i) Observation of the existing structural condition of building.

ii) Photograph of the features

iii) Direct interview of residents and local builders

iv) Questionnaire administration

b) Secondary Data: the questionnaire or the primary data were supplemented by data collected from the relevant ministries, parastatals like the town planning and Development Authority, Nasarawa State and library sources, where data and works of the various authors available and relevant to the study were utilized. All these were combined with the first hand information obtained through the fieldwork conducted to prepare this thesis.

4.2 Sampling Designs

This study area is so large that it will be practically impossible to undertake a complete survey for this project purpose. Therefore sampling method was adopted for a reliable information.

However, the total number of residential building within the study area were known to be 327 and more than 100 dilapidated structure. Although some were re – erected (Town Planning, works Department TOTO L.G.A) while the total population of the area is 13200 in 1996 (statistic unit TOTO L.G.C). these information were collected in other to determine the type of sampling to be used and the sample size.

Having known these, the method adopted was systematic sampling. By definition, a i/k systematic sample is a sample constructed by selecting every Kth element in the sampling frame (that is taking every K item after a random start). This was done along the main roads, streets and on compound basis within the study area and every 8^{th} buildings were taken at intervals after a random start. In a building, an elderly person like the landlord or household head was interview. The sample size is 127 dwelling units.

4.3 Questionnaire Designs.

Based on the definition given by the construction textbook called strength of material, questionnaire was designed to obtain necessary information on a

duration of the structure in the study area. These include the structural materials and the condition of the building, internal facilities and environmental facilities. The questions were prepared to cover all the attribute of building materials and the chosen sample size. The questionnaire was administered in the month of November, 2001 with the assistance of enumerators. The Data collected remain the primary data of the study.

CHAPTER FIVE

5.1 DATA PRESENTATION ANALYSIS AND FINDINGS

The primary aim of his survey work is to collect information on the living aspect of the people in the study area and to use the data as a yard sticks for which future development of the area could be based.

The presentation of the data collected in the process of this study shall go together with their analysis so as to thoroughly explain the end of the presentation. Analysis and the results of these findings will be given in a systematic way.

Thus, the data are presented and analysed in the following manner.

5.1 TYPES OF BUILDING

Table 5.1

BUILDING TYPE	FREQUENCY	PERCENTAGE
Traditional compound	200	61.2
Storey Building	17	5.2
Bungalow	110	33.6
TOTAL	327	100.00

Source: - Author's Field work, 2001

Three types of building can be identified in the study area. They are Traditional compound, storey building and Bungalow. The predominance of ground floor structures can mainly be attributed to be Limitations of Mud and other local material used in construction which make it difficult to go beyond the first floors.

From the survey conducted, 6.12 percent account for traditional compound housing type, 5.2 percent of the dwelling units surveyed are storey building, while the bungalow type account for 33.6 percent. It was noted that he traditional compound type are predominantly in the study area.

Storey buildings are not common and the next common building type is the bungalow, which are occupied either by owner or tenants.

Types of Building

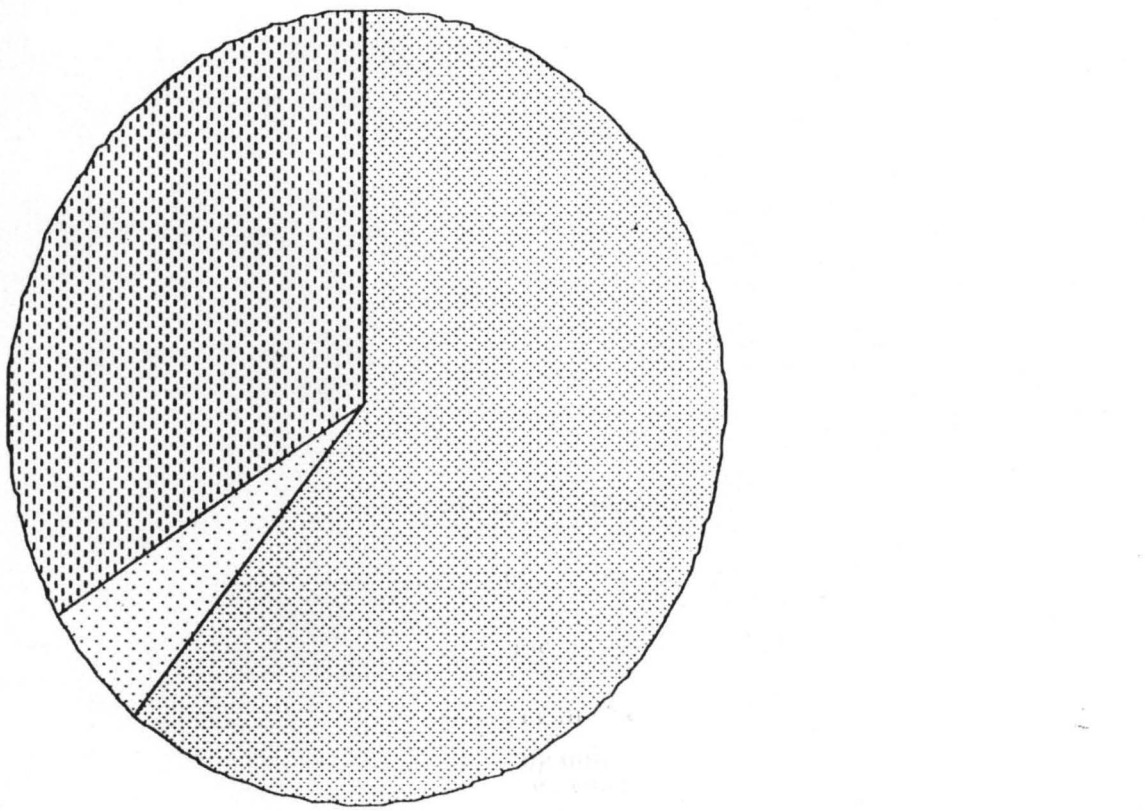


Figure 5.1

5.2 AGE OF BUILDING

Table 5.2

BUILDING AGE	FREQUENCY	PERCENTAGE
1 – 5 years	70	21.4
6 – 10 years	140	42.8
11 – 15 years	55	16.8
16 – 20 years	38	11.6
Over 20 year	24	7.4
TOTAL	327	100.0

Source: Authors field work, 2001

With constant exposure to the harsh tropical environment, not only exterior decorations but also the concrete works of houses eventually show their ages. The rate of deterioration of course, is influenced mostly by the choice of materials, and construction method. Highly qualitative materials and good construction takes longer year before deteriorating. While among others are type of units, and the motivation to maintain the properties.

The table shows the distribution of sampled dwellings by age. Toto being one of the oldest settlement in the local government, is characterized by aged building and dilapidating buildings from the survey conducted, it was discovered that building within 20 years and above account for percent, building within 11 – 15years amount to percent, building within 6—10 years amount to percent, while building within 1—

5year are percent. Most of the building were characterized with failing windows, cracks in walls, falling roof and lacks the basic housing facilities.

Building Age

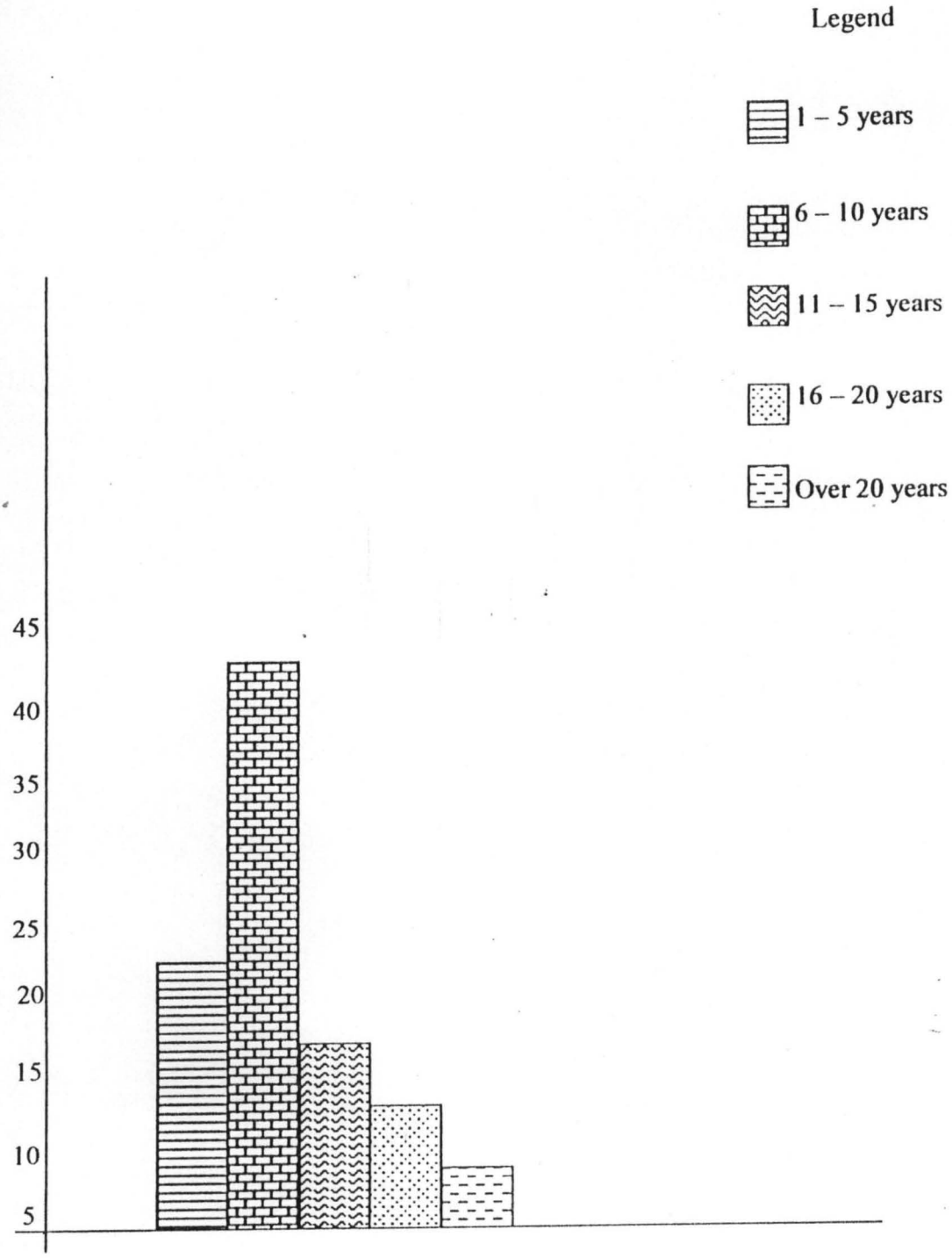


Figure 5.2

5.3 TYPE OF BUILDING MATERIALS FOR CONSTRCTION PURPOSE.

The type of building material for construction purpose can be classified based on the conventional construction method, which are.

i) Flooring materials

ii) Walling materials

iii) Ventilation materials

iv) Painting materials

v) Roofing materials

vi) Sanitary materials

Flooring materials; consist of sand and granite (of various grades per load), cement, Iron rods, tiles and terrazzo.

Walling materials. These consist of various sizes of concrete and clay products.

Roofing and ceiling materials: - These include Iron sheets asbestos sheets long span aluminium sheets, ceiling tiles and wooden planks of various size.

Painting materials- painting materials include gypsum line, undercoat, wood primer emulsion and gloss paint.

Sanitary materials- There include water closet, wash hand basin, shower, sinks, shower trays and baths as well as galvanized pipes, polyvinyl chloride (P.V.C.) pipes and asbestos pipes of various sizes.

5.4 TYPE OF BUILDING MATERIALS USED IN THE STUDY AREA

5.4.1 WALL MATERIALS

A very high percentage of the buildings studied are built of mud block and mud construction. This is so because the materials for walling can easily be produced, available on site or nearly site and simply processed with an expertise at relatively minimal costs.

Table 5.3

WALL MATERIALS	FREQUENCY	PERCENTAGE
MUD Block	170	52.0
MUD	11	27.5
Sandcrete block	56	17.1
Timber/ Iron sheet	11	3.4
TOTAL	327	100.0

Source- Authors field work, 2001.

The table above shows the percentage distribution of sampled dwelling according to the type of material used for the wall in the study area. However, house built of mud block and plastered account for 52.0 percent, house built of mud wall unplastered amount to 27.5 percent, 17.1 percent of houses was found to be build of sandcrete block and plastered, while 3.4 percent are built of timber and Iron sheet. It is generally believed that house built of sandcrete block are of good structure because of it resistance to the whether and soil condition. While mud block plastered should be the minimum. The use of corrugated sheet for walls is largely scarce for residential

building and mostly restricted to commercial and some light industries and it is considered as temporary, when use for dwellings.

Wall Materials

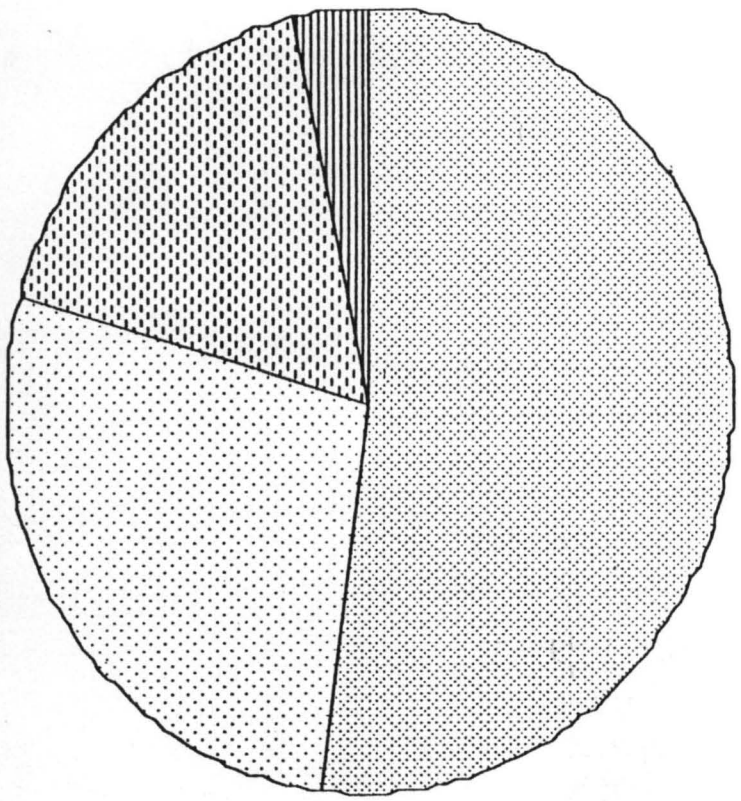


Figure 5.3

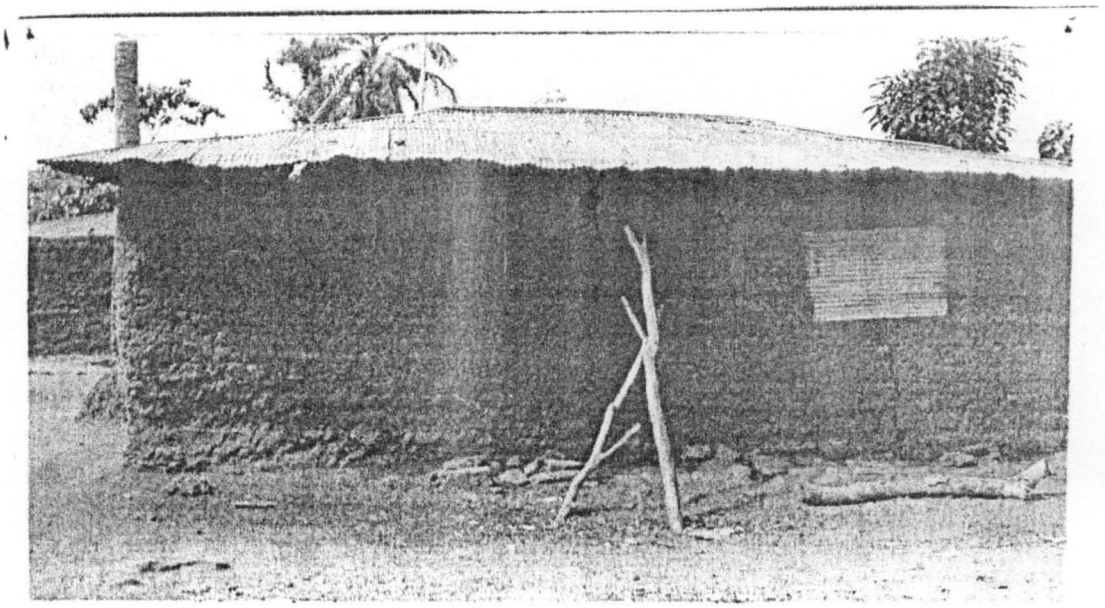


plate I Picture here shows a typical example of cracking walls in a study area. (Source: Author's Field Photograph)

plate II Front part of the house falling, with doors and stick

5.4.2 ROOFING MATERIALS

Tables 5.4

ROOFING MATERIAL	FREQUENCY	PERCENTAGE
Corrugated Iron Sheet	310	94.8
Asbestos	17	5.2
TOTAL	327	100.0

Source- Author field work, 2001

The use of corrugated iron sheet seem to predominate with a very high percentage. This has replaced thatch roofing in most Nigeria capitals. Its lightness in both transportation and handling has further increase the usage. The two major roofing material identified here is the corrugated iron sheets. But the uses of asbestos roof are not common in the traditional core area in toto town. This mainly because of its comparative heavier in nature, high cost, difficult in handling and because of the local materials used for walling. In toto town, building that are roofed of corrugated iron sheet account for 94.8, percent while only 5.2 percent of the houses are roofed of asbestos sheet.

5.4.3 DOOR MATERIALS

Table 5.5

DOOR TYPE	FREQUENCY	PERCENTAGE
Wood	230	70.3
Metal $ glass	77	23.6
Iron sheet	20	6.1
TOTAL	327	100

Source- Authors field work,2001

The uses of wood materials for door seems to predominate with a very high percentage. These are being used because of its cheapness that the metal and glass types and its also durable if well treated. In toto town, amount to 70.3 percent, metal and glass materials account for percent while percent is for the building that use iron sheet for doors.

5.4.4 CEILING MATERIALS

Table 556

CEILING MATERIALS	FREQUENCY	PERCENTAGE
Asbestos	80	24.5
Mat	65	19.9
Cardboard	127	38.8
None	55	16.8
TOTAL	327	100.0

Source- Authors field work, 2001

The table above shows the type of ceiling material used by the sample dweiling units. The choice of materials for the ceiling has also undergone some change over the years. As a result, the age of building sometime carry some implication for the type of ceiling material used. The materials used for ceiling include mat, cardboard and in some places none. It can be seen that asbestos type amount to 24.5 percent, 199 percent for mat, 38.8 percent for cardboard, while dweiling without ceiling materials account for 16.8 percent.

Type of Ceiling Materials

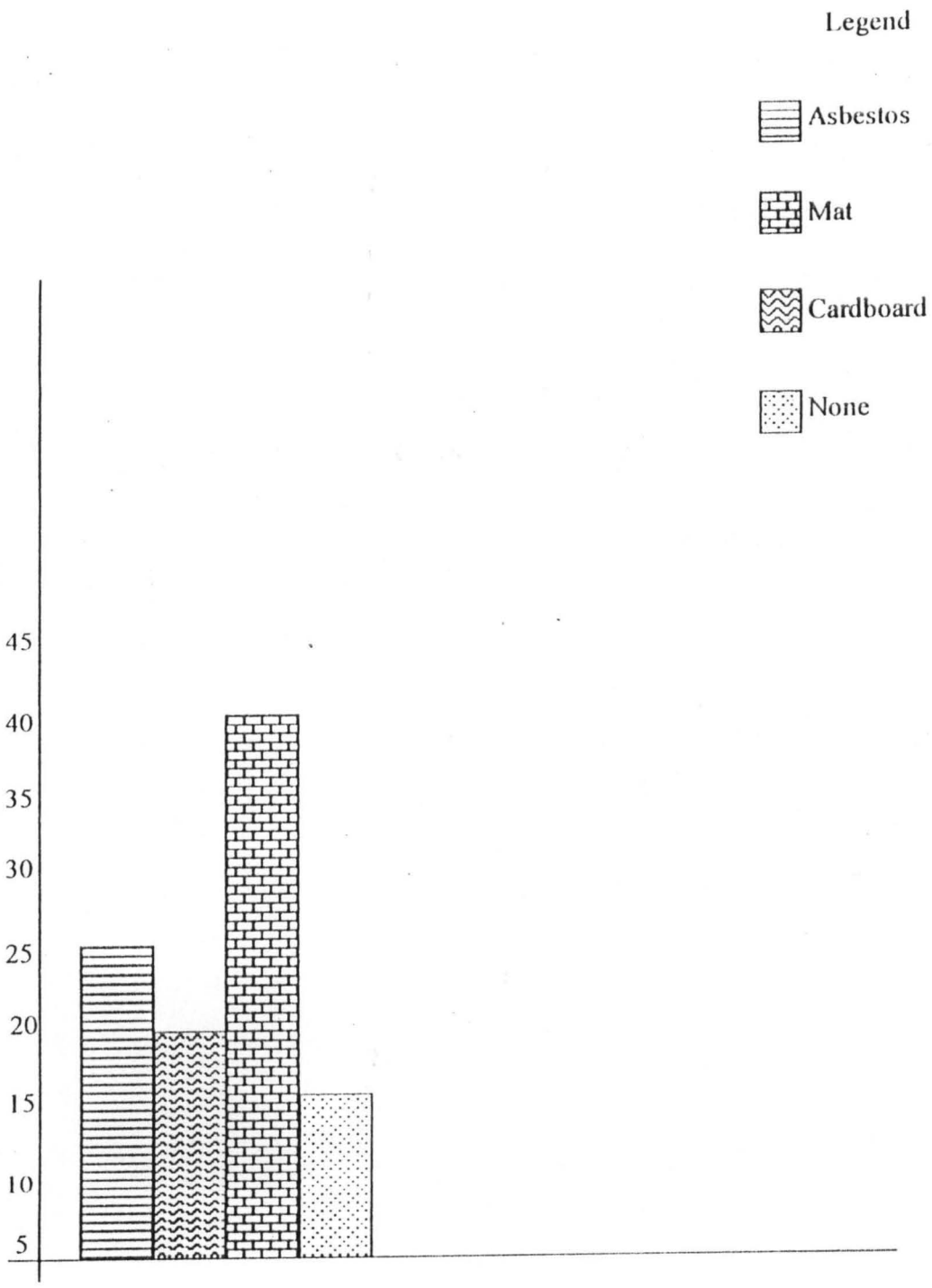


Figure 5.4

plate III Many houses in this area are falling and sticks are used to support the roof while people still living in. (Source: Author's Field Photograph)

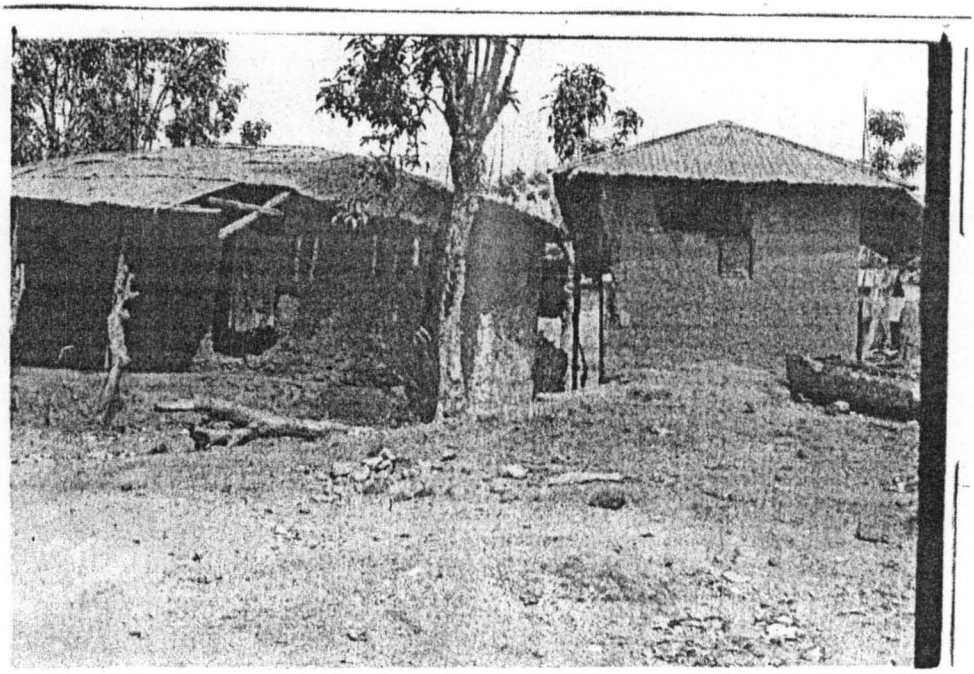


plate IV Picture shows a dilapidating traditional coumpound with no doors & windows. (Source: Author's Field Photograph)

5.5 BASIC HOUSING FACILITIES

The necessary equipment and facilities for convenient living in any environment can be group into the following categories.

(a) Sanitary services, which may be sub-divided into five points

i) Toilets

ii) Bathrooms

iii) Cooking space

iv) Water supply

v) Refuse storage and disposal facilities

(b) General facilities, which include

i) Electricity supple

ii) Accessibility

iii) Parking facilities

The provision of good housing and its related facilities depend on the materials, and type of building. The availability and adequacy of facilities in buildings are indirectly determinants of the quality of the dwellings. This few has to do with the principle of complementarily of facilities according to which the absence of one facility may adversely affect the functioning of one already present. For instance, a dwelling may be supplied with pipe borne water and yet is deficient in the disposal of human waste due to the absence of water closet. Similarly, the adequacy of facilities may be compromised by the high human occupancy of the dwelling unit. Despite the importance of good housing and its related facilities,

evidences shows that majority of the buildings within the study area are devoid of the necessary equipments and essential facilities.

SANITARY SERVICES: - Sanitary services are essential for health living. The importance of toilets, bathrooms and cooking spaces cannot be over-emphasised. In this section, detail information will be given on the available sanitary services in the study area.

5.51 TYPE OF TOILET FACILITIES

Table 5.7

TOILET TYPE	FREQUENCY	PERCENTAGE
Water closet	34	10.4
Pit latrine	202	61.4
Near by bush	91	27.8
TOTAL	327	100.0

Source: - Author's Fieldwork, 2001.

In the study area three types of toilet can be identified. They are water closet, pit latrine and nearby bush. The water closet type is the most ideal, although, its usefulness can be affected by the regularity of water supply. Far less satisfactory facilities are pit latrine, which are shared by many households, while other type are not fit for human environment. It can be seen that water closet amount to 10.4 percent, 61.8 percent for pit latrine, while dwelling without any toilet, whereby near by bush is adopted, account for 27.8 percent.

Type of toilet Facilities

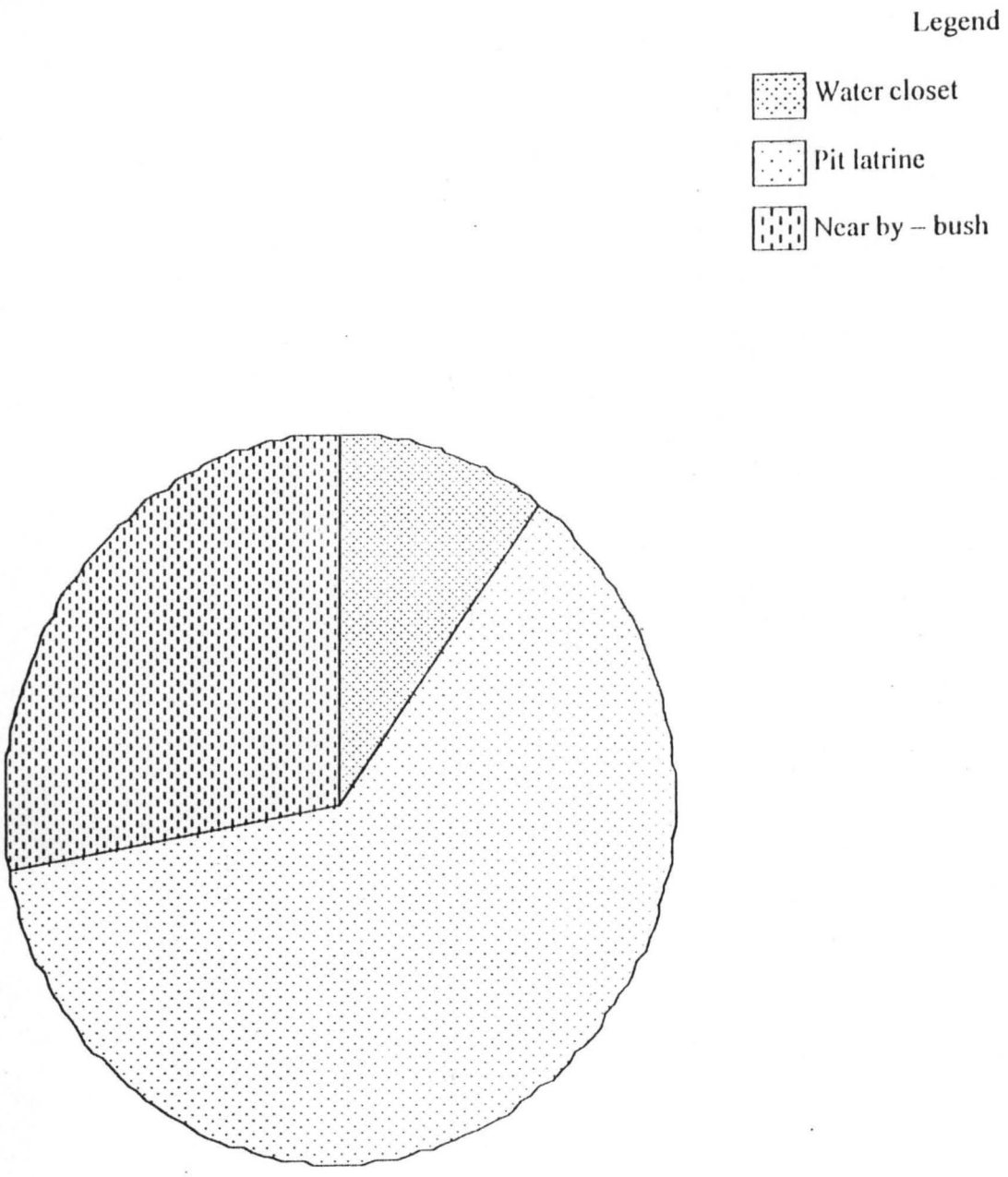


Figure 5.5

5.52 BATHROOM FACILITIES

Table 5.8

BATHROOM FACILITIES	FREQUENCY	PERCENTAGE
Shower (within the house)	34	10.4
Bath (separated from the house)	142	43.4
Temporary structure	60	18.4
None	91	27.8
TOTAL	327	100.0

Source: - Author's Fieldwork, 2001

Bathrooms are very essential yet very little attention is given to their provision. Though a good percentage of the people interviewed have bathrooms, but they are not rightly located. Only 10.4 percent of the dweilings surveyed have bathroom within the building, 43.4 percent built bathroom within the compound, 18.4 percent make use of the temporary structure, while the rest dweiling unit lack bathroom facilities and this amount to 27.8 percent. Many of these bathrooms located within the yard are made of corrugated iron sheets in a small enclosure. And this material get rusty, has a result of effect of weather on them.

5.5.3 TYPES OF KITCHEN

Table 5.9

TYPES OF KITCHEN	FREQUENCY	PERCENTAGE
Kitchen space within the house	55	16.8
Kitchen space separated	63	19.3
Open fire space	164	50.1
Temporary structure	45	13.8
TOTAL	327	100.0

Source: - Author's field work, 2001

From the study conducted, it was discovered that about 16.8 percent of the households interviewed have their kitchens within the house, 19.3 percent of households have their kitchens space separated from the house, 50.1 percent of the households have their cooking space outside in the open air, when the weather is good or at the verandah of the building , while 13.8 percent of households cooked under a temporary structure outside their dweiling. Constructed either by iron sheet or thatch materials. And cooking in the house corridor or open fire space reduces the quality of the building and its environment.

Types of Kitchen

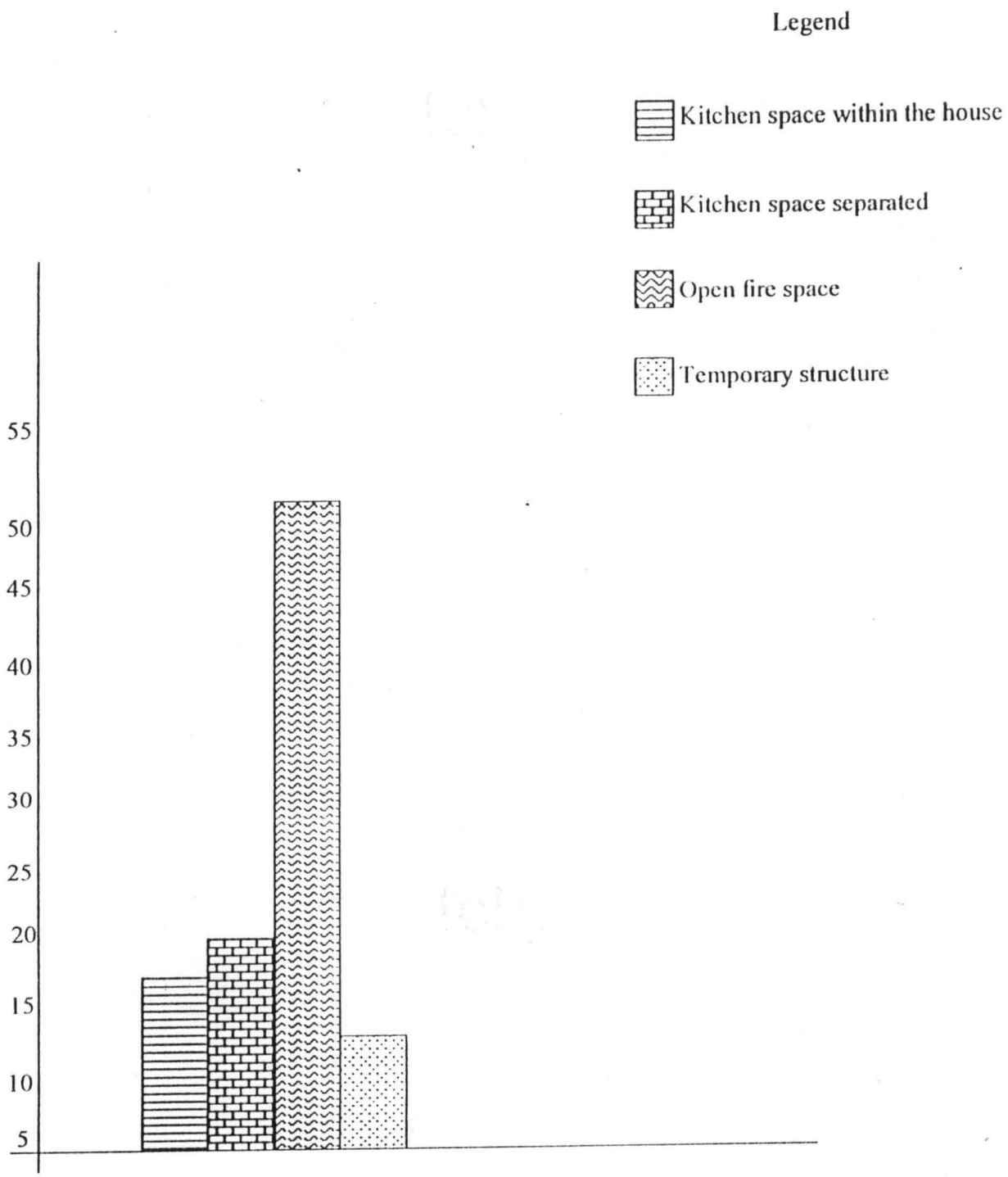


Figure 5.6

5.5.4 SOURCES OF WATER SUPPLY

Table 5.10

SOURCES OF WATER SUPPLY	FREQUENCY	PERCENTAGE
Tap	53	16.2
Stream	76	23.2
Well	198	60.6
TOTAL	327	100.0

Source – Authors Field work, 2001

There are three major means of source of drinking water in the study area. They are Tap , Stream and well water. The Tap water is either public or privately owned in the compound. None of the public and private tap have adequate supply of water due to the failure of the water works. Most of the household interviewed, gets their drinking water from the well and stream. It account for 16.2 percent for Tap, 23.2 percent for steam while amount to 60.b percent for well.

5.55 METHOD OF REFUSE STORAGE AND DISPOSAL

Table 5.11

METHOD OF REFUSE STORAGE	FREQUENCY	PERCENTAGE
Drum	56	17.1
Dustbin	70	21.4
Basket	30	9.2
Bucket	14	4.3
Unkept	157	48.0
TOTAL	327	100.0

Table 5512

METHOD OF REFUSE DISPOSAL	FREQUENCY	PERCENTAGE
Stream	70	21.4
Open burning	254	78.6
Authorized place	–	–
TOTAL	327	100.0

Source: Author's Field work 2001.

In terms of refuse storage, most of the dwellings refuse were thrown around. Making the environment unclean also affect the quality of the buildings. Only 17.1 percent were kept in drums, 21.4 percent account for dustbin, 9.2 percent account for basket, 4.3 percent account for bucket. While most of the household interviewed, unkept their refuse and this amount to 48 percent.

Refuse disposal, can be identify in three major ways namely stream, open burning and authorized place. It account for 21.4 percent stream, 77.7 percent account for open burning while none percent amount for Authorised place.

5.56 SOURCES OF POWER SUPPLY

Table 5.13

Sources of power supply	FREQUENCY	PERCENTAGE
NEPA	12	38.8
Gas lamp	11	3.4
Kerosene lamp	189	57.8
TOTAL	327	100.00

Author's Field work, 2001

Most of the household interviewed have electricity through NEPA supply. But only it is not efficient. From the surveyed conducted. It was discovered that about 38.8 percent of the household interviewed have their power supply through NEPA; only 3.4 percent of household have their power supply through gas lamp, while 57.8 percent of household have their power supply through Kerosine lamp.

5.57 ACCESSIBILITY

Good accessibility to residential areas is very important not only for the convenience of the occupants alone, but also for safety purposes. Good accessibility is required for use in cases of emergency like fire fighting in case of fire out break or for other purposes. Like removal of refuse or delivery of mails and goods. Many of the houses in the study area were built without planning approval. They are haphazard built and some of the place were cut off from the others by heavy erosion as a result of diversion of channel, due to waste disposal on the path, erecting of structure on the path And dilapidated building falling on the path. So there is hardly provision for access roads or garage facilities.

ACCESS TO DWEILING AND THE QUALITY OF ROADS

Table 5.14

QUALITY OF ROADS	FREQUENCY	PERCENTAGE
Foot path	257	78.6
Tarred Road	20	6.1
Untarred Road	50	15.3
TOTAL	327	100.0

Source:- Author's Field work, 2001.

The use of Footpath seems to predominate with a very high percentage. Three major access to dweiling identified here are Footpath, Tarred and untarred road. 78.6 percent for Footpath, only 6.1 percent amount for Tarred road while dwelling that have their access through untarred road amount to 15.3 percent.

Types of Access to Dweiling

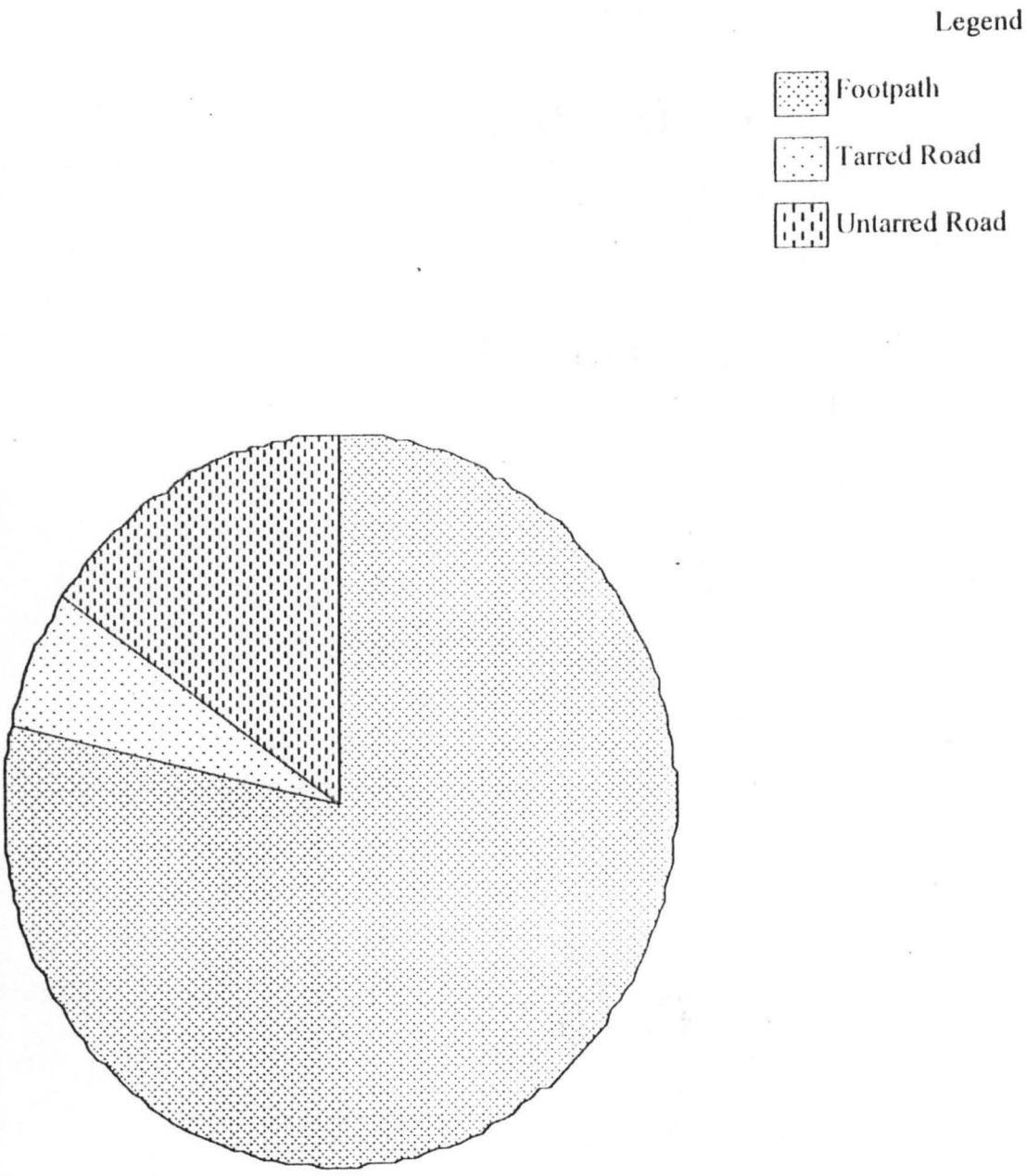


Figure 5.7

5.58 PARKING FACILITIES

Availability of good parking space in a dwelling also added to the quality of the building material, particularly buildings with garage within the house. Parking facilities identified in the study area are garage within the house, open space in front of the house an – street parking.

While in some places, parking space is not available at all. Only percent of the total household surveyed have parking facility, within the building, percent have theirs infront of the house, percent have no – street parking. While those dwellings without parking facilities amount to percent (see the table below).

Table 5.15

PARKING FACILITIES	FREQUENCY	PERCENTAGE
Garage within the house	37	11.3
Infront of the building	56	17.2
On – street parking	91	27.8
Not – available	143	43.7
TOTAL	327	100

Source – Author's field work, 2001

5.6 MARKET PRICES OF SOME BUILDING MATERIAL AT TOTO MARKET.

Table 5.16

MATERIAL	QUANTITY	AMOUNT
Wall		
Mud Block	1blk	₦25.00
Sandscrete Block	1blk	₦ 55.00
Timber/Iron Sheet	1m^2	₦ 550.00
Roof		
Corrugated Iron Sheet	1 sheet	₦ 250.00
Asbestos	1 sheet	₦ 600.00
DOOR		
Wood	1 door	₦ 1700.00
Metal & Glass	1door	₦ 3500.00
Iron Sheet	1 door	₦ 1600.00
CEILING		
Asbestos	1 sheet	₦ 450.00
Mat	1 sheet	₦ 150.00
Cardboard	1 sheet	₦ 480.00
OTHERS		
Cement	1 bag	₦ 900.00
Gravel	1 strip	₦ 6000.00
Sand	1 strip	₦ 3000.00
Iron rod	3.6m	₦ 450.00
Water closet	1	₦ 3500.00
Shower	1	₦ 2500.00
Tile	1ps	₦ 300.00

Source: - Author's Field work, 2001.

Majority of people in the study area are predominantly low-income earners. So the list cost materials are used in the area. And those that have no alternative are left like that.

5.7 STRUCTURAL CONDITION OF BUILDINGS

The structural condition of a building cannot be discussed in isolation from the quality of the material used.

Because of the effect of weather. The technology and the durability of material use in construction is of an immeasurable importance. Maintenance of a building cannot be ignored too. For instance a thatch roof house could be of better condition if well maintained, than a house built of iron roofing sheet in want of repair.

However, building conditions of the study area shows the extent of the poor material and the environment quality. Houses are built mostly with mud block, mud and few with sandcrete block and Timber/Iron sheet. Added to it, is the poor construction and inadequate maintenance. Buildings are seen with crack walls dilapidating walls, while some have dilapidated already. Structural soundness of building, walls determines the quality of the entire parts of the building. Because it is the wall that carries the entire load of the building. A total of 49.2 percent of all the dwellings surveyed were characterized with crack walls, 28.5 percent account for dilapidating walls, 15.6 percent already dilapidated, while only 6.7 percent of the whole dwellings surveyed are in good condition (No defect).

Another important part of the building considered is the roof. Condition of roof and the material used is a good variable for measuring housing quality. However, from our study, it was discovered that 55.7 percent of the sample taken were of rusting roofing iron sheet, 25.1 percent account for the roofs that are leaking in some areas, part of the roofing materials were missing and this amount for 13.1 percent, while only 6.1 percent of the total dwellings surveyed have good roofing materials. Type and poor maintenance of the roofing materials has contributed greatly to the housing degradation in the study area.

Turner (1972), pointed out in his study that a house is not a house if it dose not guarantee the Minimum of privacy, protection and access to essential facilities, no matter its degree of aesthetic quality.

From his view, two things will be consider, privacy and protection. Among those part of the building that perform the function include, Doors, Windows and Ceilings.

In this study, it was discovered that non of these building parts or components performs its functions satisfactorily due to their physical conditions. Doors and windows create privacy for the dweilers and at the same time protect them from direct physical attack and climatic into three categories. Broken, falling off and good. From the survey conducted, 48.9 percent are broken, 21.7 percent are falling while those in good condition account for 29.4 percent. For window condition, a sizeable proportion of 47.7 percent indicate that their windows are

falling off, 19.6 percent of the total dwellings have a broken window, while 32.7 percent are good.

Finally, ceiling condition cannot be ignored too, in determining the structural soundness of building. Though a good percentage of the houses interviewed, ceiling their roof with one material or the other but they are either good, leaking or falling off. Only 6.1 percent of the total dwelling surveyed have good ceiling, 6.8 percent belongs to those that are falling off, while 25.1 percent are characterized with leaking.

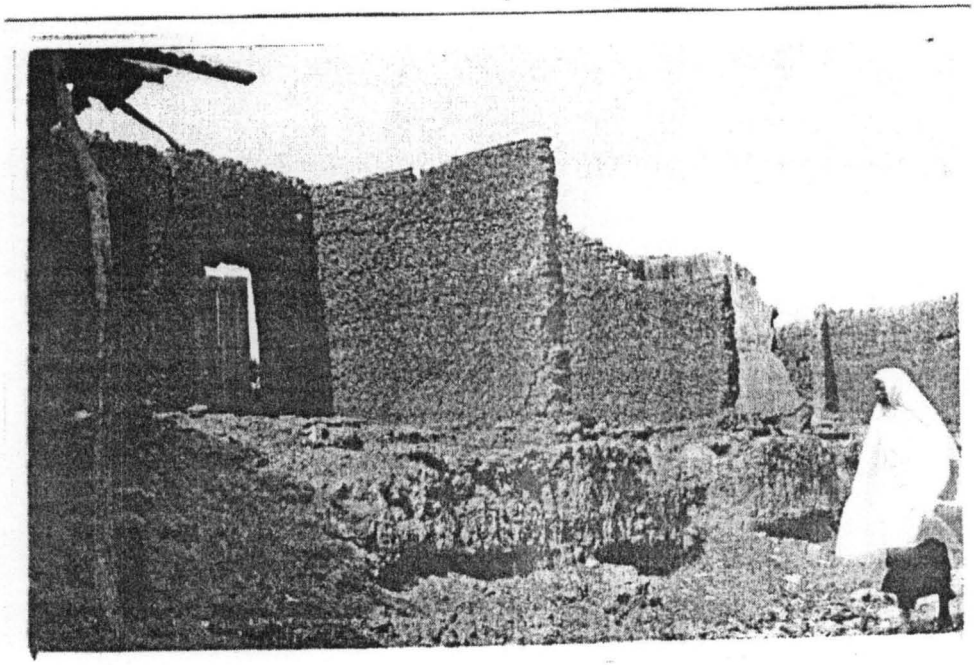
STRUCTURAL CONDITION OF BUILDING

Table 5.17

VARIABLES	FREQUENCY	PERCENTAGE
WALL CONDITION		
Cracking	161	49.2
Dilapidating	93	28.5
Dilapidated	51	15.6
No defect	22	6.7
	327	100
ROOF CONDITION		
Rusty	182	55.7
Leaking	82	25.1
Part missing	43	13.1
Good	20	6.1
	327	100
CEILING CONDITION		
Falling off	225	68.8
Leaking	82	25.1
Good	20	6.1
	327	100
DOOR CONDITION		
Broken	160	48.9
Falling off	71	21.7
Good	96	29.4
	327	100
WINDOW CONDITION		
Falling off	156	47.7
Broken	64	19.6
Good	107	32.7
	327	100

Source: - Author's Field work, 2001

ate V Many Traditional compound have dilapidated.
(Source: Author's Field Photograph)



ate VI Picture here shows a typical dilapidated and discarded houses. (Source: Author's Field Photograph)

CHAPTER SIX

6.1 SUMMARY OF FINDINGS

The analysed data collected in the study area revealed some facts about the type of building material and environmental quality in the area. These are grouped in three major areas: Structural characteristics, internal facilities and environmental conditions. The findings of the study can be summarized as follows.

6.1 STRUCTURAL CHARACTERISTICS

Housing quality is a crucial issue in most of Nigeria Local Government Capitals. Which Toto town is inclusive. Most of the buildings within the study area are found to be structurally unsound. Houses are built mostly with Mud, Mud block, while few are sandcrete block and Timber/Iron sheet. Because of the material used, poor construction and inadequate maintenance, couple with the age of the buildings. Crack walls are seen on the building, while some are dilapidating. As weather play it role.

Corrugated iron sheet are the major materials used for the roofing. Although, majority of the building roofs are said to be leaking when it rains, some are rusty while some are falling – off.

Condition of windows, doors, ceiling and floors were another determinant of the material used. Most of the above mentioned variables are not in good conditions

because material used, poor construction and maintenance. These are already deteriorating in nature.

5.11 INTERNAL FACILITES

Certain housing facilities are basic and are indicative of the quality of life, which a household lives. They provide convenience, comfort and conditions useful for maintaining personal hygiene. For Toto town, the survey conducted have indicated deficiencies in conveniences and amenities in housing. These facilities include water, kitchen, bathroom, toilet and electricity.

Water is a basic necessity of life. Water supply in the study area is not adequate. Households have their sources of water from well and stream and this are not located within their compound, while taps was very few in the study area.

Health in the Kitchen requires clean utensils, which implies some effective way of cleaning and of keeping then save from contamination. In the study area, the type of kitchen facilities available include inbuilt kitchen, separated and open fire space. The most decent and hygienic type is the kitchen space located within the building and is just about 16.8 percent of the total dweilings surveyed, while others are found to carry the remaining percentage. The reason for this was mainly because of the material used and the construction type will not admit or cater for the kitchen facilities.

The type of toilet facilities available in the study area are water closet, pit latrine, nearby bush. The dominant of the types is the pit latrines, which are still shared in use with the neghbouring compound.

Majority of the inhabitants of Toto town used electricity as a source of power supply. But this occurring incidence on the households have made some many houses to change from electricity. The nature of walls never allowed conduct wiring. Lack of decent internal facilities shows the low quality of the material used in the study area.

6.12 ENVIRONMENTAL CONDITION

The liability of a house is influenced among other things, by the quality of material used and the environment in which the house is located. Poverty on the other hand not only limit ability to acquire life's basic necessities but also restricts choice of living environments. A filthy environment constitutes a danger to health. The absence of any regular system of refuse disposal, potentially renders an environment filthy. It has an effect on the foundation, by creating bacterials in and on the soil around, couple with the sandy nature of the area. Pure refuse disposal constitutes one of the major sources of environmental deterioration in the study area.

The problem of environmental sanitation is one of the most critical problems facing Toto town. The collection and disposal of sewage and other liquid and

solid wastes is a major public health problem and a vital factor affecting the quality of environment in the study area. It also affect the value of property.

6.2 STRATEGIES AND RECOMMENDATIONS

In view of the findings, the following recommendations are put forward and the various ways of achieving them. These suggestions are not limited to the study area alone but it could be extended to other part of the Local Government area of Toto.

The first to be considered is urban renewal exercise; Renewal exercise should be carried out in Toto town, in other to improve both building materials and environmental quality of the area. It does not necessarily mean total clearance (except for the unfit and dangerously dilapidating buildings) but providing means of renovating or un – grading the building, materials and provision of streets, drainage, water supply and provision of refuse dump in this area. It will be more feasible if the State Government could intervene in the situation by way of urban rehabilitation programme. Also the dwellers in this area should be actively involve in the programme.

Also, there is need for a vigorous health education programme by environmental agents to inculcate in people need for clean hosing environment. This will raise the level of personal hygiene, enlist popular participation in the maintenance of environmental standard and eliminate frequent arts of nuisance by the inhabitants. To achieve this, there is need for the creation of neighbourhood forums, which

will serve as meeting points between planners, health officials e.t.c. and the neighbourhood residents. It will also form a veritable forum for the exploitation of the traditional self – help spirit for environmental management. In addition to health education, population education is imperative to reduce future demand for social services.

Enforcement of planning laws demand if we are to protect and preserve our natural environment. Planning authorities in Toto town should be strengthen the more with development control exercise and the use of well constructed building material so as to create a healthy and comfortable environment for the people of Toto town. Planning should also be made a local affairs rather than State or Federal affairs.

To remedy the poor level of internal unit facility provision and general home renovation in the study area, soft loans should be given by the Federal Mortgage Bank to the low income earners for proper maintenance and re – equipment of their dwelling units. These low interest or even interest free loans could be recouped from rents paid by tenants.

The government should encourage the formation of local building material associations. These are similar to other consumer so-operatives but the objective in this case is to check the quality of the building material produce. Which will enhance better dwelling unit for the benefit of the members.

Government could also help the masses through intensifying efforts to increase the production of cheap building materials and the co-operative marketing organisations should be formed and encourage to establish building materials depot. These materials can be sold at a cheap rate to their members. Also all the available raw materials of the building industry in the country should be identified and conscious efforts should be made to exploit them.

6.21 SUGGESTION FOR FURTHER STUDY

For further study, other researcher can include in their work (study on Building Materials), maintenance of materials and occupancy ratio as part of parameters in measuring the quality of building materials, and the assessment of rooms in the dwelling unit to further ascertain the quality of the building materials.

CONCLUSION

In the Toto Local Government Headquarter, are the majority of citizens massing themselves in the unkept and often squalid hearts of the area. Living under conditions that are at times sub – human and sharing sub – standard houses in areas, which by any standard are slum.

Apart from their structural defects in terms of ventilation, aesthetics and soundness, most of the houses are poorly located and are lacking in community facilities not only limiting the occupants access to opportunities such as pipe – born water, electricity, refuse collection facilities and services but also leading to

poor, unhygienic or in short degraded environment that is highly susceptible to epidemics.

Inspite of the low level of the established minimum scores for the variables used in this study, it is quite clear that the quality of life of the inhabitants is threatened by good number of housing and environmental attributes. This may be as a result of the low income group that dominates the area. Thereby depriving them from using qualitative building materials. Also, poor maintenance of building contributes to its daily deterioration.

However, there is no problem without solution to it and solution can only be achieved by taking the appropriate step. Therefore, If the above stated problems are to be overcome the listed proposals in the preceding section should be adequately considered and implemented. It is hope that the findings and suggestions in this thesis will enable planners and decision makers to improve the quality and type of production methodin the building materials in Toto town.

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APPENDIX

UESTIONAIRE ON BUILDING MATERIAL ACCESSMENT IN TOTO L.G.A
NASARAWA STATE

OCATION:..... Toto Town ..... Date 2/12/2001

Please you are to read carefully and tick the approporate in each of the heads the giving option.

TYPES OF BUILDING

) Traditional Compound
) Storey Building
) Bungalow Detached
) Semi Detached Duplex

USE OF BUILDING

) Residential
) Commercial
) Industrial
) Public/Semi Public
Mixed (specify others)

ACCESSIBILITY TO BUILDING SITE

Footh path
Motorable Road
Others

CONDITION OF ACCESS

Tarred
Untarred
Cemented

DESIGN OF BUILDING

Row House
Block of Flat
Compound Housing

AGE OF BUILDING

1 - 5 years
6 - 10 years
11 - 15 years
16 - 20 years
Above 20 years

FLOOR TYPE

(a) Uncemented
(b) Cement concrete floors
(c) Terrazzo
(d) Timber Tiles
(e) Others Specify

FLOOR CONDITION

(a) Wet
(b) Dry
(c) Dusty
(d) Cracked
(e) No cracks

WALL MATERIALS

(a) Mud Block Plastered
(b) Mud Brick
(c) Sand crete block
(d) Timber/Iron sheet

WALL CONDITION

(a) Cracking
(b) Dilapidating
(c) Delapidated
(d) No defect

ROOFING MATERIALS

(a) Thatched roof
(b) Asbestor
(c) Corrugated Iron sheet
(d) Others

CONDITION OF ROOFING MATERIALS

(a) Leathing
(b) Rusting
(c) Sagging
(d) Part Missing
(e) Others Specify

WINDOW MATERIALS

(a) Glass
(b) Wood
(c) Mat
(d) Net
(e) Open

CONDITION OF WINDOWS

(a) Broken
(b) Failing off
(c) Small
(d) Good

TYPES OF DOORS

(a) Metal only
(b) Metal and Glass
(c) Open
(d) Wooden
(e) Others

CONDITION OF DOORS

(a) Broken
(b) Failing off
(c) Good

TYPES OF CEILING

(a) None
(b) Asbestors
(c) Mat
(d) Wood
(e) Carboard

CONDITION OF CEILING

(a) Good
(b) Leaking
(c) Failing off

NUMBER OF HABITABLE ROOM PER BUILDING

(a) Below 4 rooms
(b) 4 rooms
(c) 5 rooms
(d) 6 rooms
(e) 7 rooms
(f) 8 rooms
(g) 9 rooms
(h) 10 rooms
(i) Above 10 rooms

TYPES OF TOILETS FACILITIES

(a) Water closet
(b) Pit latrine
(c) Bush

BATHROOM FACILITIES

(a) Within the House
(b) Seperated from the House
(c) Temporary Structure
(d) None

DRAINAGE

(a) Open drains
(b) Cover drained
(c) None

CONDITION OF DRAINAGE

(a) Free
(b) Blocked

TYPES OF KITCHEN FACILITIES

(a) Kitchen space within
(b) Kitchen space seperated from the house
(c) Open fire space
(d) Temporary Structure
(e) None

SOURCE OF POWER SUPPLY

(a) NEPA
(b) Generator
(c) Gas lamb
(d) Kerosine lamp

SOURCE OF WATER SUPPLY

(a) Tap water
(b) Well
(c) Stream

PARKING FACILITIES

(a) Garage within the house
(b) Open space (infront of the building)
(c) on - street parking
(d) Not available

REFUSE STORAGE

(a) Drum
(b) Dustbin
(c) Basket
(d) Bucket
(e) Unket

REFUSE DISPOSAL

(a) Stream
(b) Open burning