DESIGN OF FARM MACHINERY AND AND IMPLEMENT SHED FOR LOCAL GOVERNMENT AREAS OF NIGER STATE.

BY

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Certification

CHRISTOPHER .S. UMARU, a post graduate student in the Department of Agricultural Engineering with Reg. No PGD/AGRIC/98/99/34 has satisfactorily completed the requirements for the course and project work for the award of post graduate Diploma (PGD) in Agricultural Engineering.

The work embodied in this project report is original and has not been submitted in part or full for any other Diploma or Degree of this or any other University.

PROJECT SUPERVISOR. ENGR. DR. D. ADGIDZI.	02.10.2000 DATE
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Dedication

This project is dedicated to my father **MR. MICHAEL DATO UMARU,** who trained me educationally to be what I am now. His good efforts will never be forgotten as I exist in my lifetime. May the Almighty God shower his blessing on him and give him long life and prosperity.

Christopher S. Umaru

Acknowledgement

I wish to express my sincere gratitude to my project supervisor **ENGR. DR D. ADGIDZI** for his constant supervision, criticism and guidance through out the duration of this project.

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ABSTRACT

A Farm machinery and implement shed of a total space Area of 31416m2.

is designed for twenty seven machinery and implements.

It consists of Reinforced concrete columns, beams Foundation and floor.

The roof trusses are of steel and long span Aluminium.

The estimated cost of the project is N50,050,165,20.

The Local Government areas should source for funds from the Federal, States, Government and other Agencies, they should improve their revenue base, e.g.. Their (T.H.U) Tractor Hiring unit so as to be able to invest N000.00each year to complete the project in Fv. years.

CHAPTER ONE

1.0 Introduction

In fulfillment of Post–Graduate Diploma award of the Federal University of Technology, Minna.

I have chosen to solve the problems of farm machine and implements protection against rains and harsh weather sunshine after the operational period to prolong their life span and reduce maintenance cost.

The farm machines, consists of Tractors, Bulldozers, Harvesters, Planters, Tipping Trailers, Shellers. Implements consist of Ridgers, Ploughs, Harrows, Bound formers, and ditchers.

These equipment are very costly to purchase, so there is need to secure and protect these machinery and implements, by providing a farm shed.

The local government can not afford to be buying these equipment, as their financial resources is very limited.

They also depend on federal government revenue allocation. Their internal revenue is very meager.

The need to preserve the ones already procured can never be over emphasized.

Objective of Study

The objective of the study is to produce a standard farm machinery and implement shed to house all the agricultural machines and implements of all the twenty five local government areas of Niger State.

It is uniformly designed to be adapted by all the local government areas. This will protect machinery and implements from rain, sunshine, which in turn reduces maintenance cost and prolong the life-span of the equipment.

The use period of tractors, ploughs, harrows, ridgers, planters are as from the month of May–August. Their storage period is from the month of September–December.

Trailing, Harvesting and Shelling is from the month Of September–February, The use period of these machines. While March–August is their storage period. See Appendix. 6

1.1 Importance Of Project

This project is very important, most especially in conserving funds for the local governments in terms of maintenance and spare-parts.

The rate at which maintenance will be carried out while these machines are left open to weather effects will be more than when they are protected.

In turn, there will be more savings. These savings can be conserved for the purchase of additional machinery and implements, hence improving agricultural food production for the local government areas of Niger State.

The importance of these projects can never be over emphasized as benefits of providing farm machinery and implement for these equipment outweighs that of just leaving them on open air for destruction.

CHAPTER TWO

2.0 Literature Review

It is very important to preserve these machinery and implements, to increase their life span. Maximizing long term profit, maximizing a level of service.

Minimizing operational cost subject to a specified level of service. Prevent frequent breakdowns resulting in expensive downtime and rapid degradation of the equipment and machinery.

A very important factor responsible for destruction is corrosive effect of the atmosphere. The presence of chemical substances, like minerals, crop protection chemicals and the product of decay of biological residue stimulate the effect of the atmosphere.

The effect of rain causes destruction by corrosion, which starts from the surface and continues to the interior of the parts caused by chemical and Electro-chemical effects of the environment. (YISA 1999)

Nigeria's population is rapidly increasing necessitating the need for increased food production as a result, more emphasis are being laid on higher productivity which demands for a greater agricultural mechanization. KAYODE (1986).

Corrosion affects not only metals and their alloys but other materials like ceramics.

Most construction metals alloys have thermodynamic potential grater than minimum under normal conditions. In view of this the tendency is always there to have a change of state from metallic to the ionized form if only this would reduce thermodynamic potential.

Corrosion can affect a surface Uniformly or affect only the most vulnerable parts on the surface.

Corrosion of metals could be considered primarily with the winning of the metals from the ore and refining or alloying the metals for use. Most iron ores contains oxides of iron and rusting of steel by water oxygen corrosion, although many other metals form their oxides when corrosion occurs.

Practically all environments are corrosive to some degree. Some examples are air and moisture, fresh distilled, salt and mine water. Rural, urban and industrial atmosphere. Steam and other gases, such as chlorine, ammonia, hydrogen sulfide, sulfur dioxide, and fuel gases. Mineral acids such as hydrochloric, sulfuric and nitric. Organic acids such as naphthenic acetic, and formic, alkalis and soils solvents.

Corrosion has been classified in many different ways. One method divides corrosion into low temperature and high temperature corrosion.

Another separate corrosion into direct combination (or oxidation) and electro-chemical corrosion. The preferred classification here is wet corrosion and dry corrosion.

1. Wet corrosion occurs when a liquid is present. This usually involves aqueous solutions or electrolytes and account for the grater amount of corrosion so far.

2. Dry Corrosion occurs in the absence of a liquid phase or above the dew point of the environment. Vapor and gases are usually corrosive. Dry corrosion is usually associated with high temperature.

3. The most dangerous part of corrosion is inter-crystalline corrosion. It covers only the boundary of crystallite but penetrates deep into the material.

4. Trans-crystalline corrosion attacks the crystallite from outside. It causes sudden destruction of machines.

5. Chemical corrosion takes place due to absorption of gases into the outer layer of a metal.

6. Electro-chemical corrosion takes place when potential difference exists between metals.

7. Pitting is a form extremely localized attack that results in holes in the metals. These holes may be small or larger in diameter, but most cases they are relatively small. Pits are sometimes isolated or close together they look like a rough surface. Pitting is one of the most destructive and insidious forms of corrosion. It causes equipment to fail because of perforation with only a small percent weight loss of the entire structure.

8. Weld decay is associated with welded parts. The weld decay zone is usually a band in the parent plate somewhat removed from the weld. The "sugary" appearance is due to the small protruding grains that are about to drop off.

9. Erosion corrosion is the acceleration or increase in rate of deterioration or attack on a metal because of relative movement between a corrosion fluid and the metal surface. Generally this movement is quite rapid, and mechanical wear effects or Abrasion are involved. Metal is removed from the surface as dissolved ions, or it forms solid corrosion products that are mechanically swept from the metal surface. (G. Fontana, Corrosion Engineering (1987).

Metallic corrosion is the surface wastage that occurs when metals are exposed to reactive environments. The chemical compounds that constitute the product of such wastage are close cousins of the metallic ferrous cause metals to revert to their original ores.

At temperature above 200^0C, there is usually significant reaction of most metals in dry air, and the rate and extent of reaction progressively increase, either as the temperature is raised or the air is contaminated by other gases.

In general, it may be said that the corrosion product, when this is present as a solid scale, and by its mechanical strength and adherence to the underlying metal. The study of high temperature corrosion is, therefore, a study of semi-conducting oxides, sulfides and so on, and the influence of temperature,

pressure and ionic contaminants on their mechanical coherence, stability and permeability. (M. West, Basic Corrosion and Oxidation, 1086).

To prevent corrosion, corrosion-resistant coating can be equally applied viz. oil and greases on the implement most especially after use period and most importantly building a shed.

CHAPTER THREE

3.0 Methodology

The first approach was to source for both published and unpublished information relevant to the study.

Data and information on the quantity of farm machinery and implement as well as other information relating to make, type, specification weight and engine capacity of these equipment model, were sourced from the study, involving fifteen local government areas of Niger State. See Tables (1-23).

A questionnaire was designed and administered on the fifteen local government areas. In addition, oral interviews were conducted on selected Heads of Agric. Department of these local government areas namely, MINNA, SHIRORO, PAIKORO, BOSSO, SULEJA, WUSHISHI, BIDA, MOKWA, LAPAI, AGAIE, KONTAGORA, MAGAMA, AGURA, RAFI and LAVUN, See Appendix (10-14)

The local government having the highest machinery and implements were picked:

MAGAMA	(10) ten Tipping trailers tractor
WUSHISHI	(7) Seven ploughs.
WUSHISHI	(5) five harrows
BOSSO	(2) two plough
WUSHISHI	(3) three

The total length and breadth of each machinery and implement was calculated Length 93.0m..... Breadth 40.00m....., and the average height of 3m and multiplied by their total. See Appendix (I - 5) and page 13

These were followed by computation of the design space thus:-

$$F = [F_1 (1 + \delta/_{100} + F_2] \, {}^{1}/_{Kav} + F_3 + F_4$$

Where F_1 = Space Area.

F_1 = Area for keeping machines based on the dimension in m2

δ = maneuvering space between machines in percentage of F_1, i.e. $\delta = 0.05 F_1$

F_2 = Area needed for servicing of machines during storage in m2.

$F_2 = a_n (l_{ar} + b_{ar} + a)$

Where a = the distance between machines given as 0.4m-0.8m.

The distance from a machine to a control line, i.e. an edge is ${}^{a}/_{2}$

n = Number of space for storage of machines

$$l_{ar} = \frac{\sum l_I}{r = n}$$

$$\frac{}{n}$$

$$b_{av} \quad \frac{\sum b_1}{n}$$

Kav = average coefficient based on use of space for all machines.

$$Kav = \frac{F_1}{SB}$$

S = length of all the machines

B = total width of all the machines

$$S = \sqrt{[F_1 (1 + \delta/_{100} + F_2] \varphi/K_{ar}}$$

φ = the ratio of length and width of space for keeping machines.

φ = taken between 2 and 3

$$B = Sb'_{ar} (p + 1) + 2.4b \text{ maximum } [B + b'_{av} (p + 1)]$$

$$F_3 = Sb_{av}(p + 1) + 2.4b \text{ maximum } [B + b'_{av}(p + 1)]$$

b maximum = maximum width of machine

b'_{av} = average with o f pathway

$$b'_{av} = \frac{b'_1 + b'_2 + b'_3 + \text{---------} + b'^{+}_{p} 1}{p + 1}$$

Where b_1 b_2 b_3 -------- $b'_p + 1$ is the width of pathway between 6m – 12m of machines

$$P = {}^{B}/_{M (lar + a)}$$

M = 1 for single line arrangements

M = 2 for double line arrangements.

$$F_4 = 2_c (5 + 2.4\ b_{maximum} + 2_c) + 2_c [B^{+} b_{av} (p + 1)]$$

Where C = given between 3m – 4m

Where L = total length of space for storage of machines

$$L = S + 2.4\ b_{maximum} + 2c$$

The breadth of space M = F/L.

Based on the data obtained from above detailed design work on a farm shed involving the Columns, Beams, Floor, Foundation and roof based on BS8110 and BS CP117 design specifications.

External columns of sizes 400mm x400mm where designed and internal columns of 600mm x 600mm were also designed carrying a total Axial load of 106KN and 135KN respectively.

Beams 400mm x 400mm external and 600mm x 600mm internal spanning (10m) ten and 22.2m carrying a total axial load of 221.65KN and 259KN respectively.

The floor is carrying a total load of 110KN. From the machinery and implement with an assumed imposed load to take care of human and some other material load live or dead that could be brought into the shed. The floor is designed with a soil bearing capacity of 200KN/m2 obtained from the Ministry of Housing and Environment, Niger State as the standard used applicable to all parts of the local Government. The foundation i.e. 3000mm x 3000mm reinforced and depth of 700mm base.

The roof is of steel spanning 89m in double span at a King post of 3m. the trusses are at 45^0 angle at a spacing of 4.5 each. The rafters are 75mm x 75mm, the purling are Z.

Purling of 125mm, The king post is 75mm x 75mm 20mm & 14mm bolts and nuts used for the joints. Long span aluminum sheet is used at 900mm spacing.

CHAPTER FOUR

4.1 Data Presentation

Table 24 below shows the Local Government with the present number of machinery and implements in the order of highest. Magama Local Government have ten tractors. Wushishi Local Government have seven Tipping Trailers. Wushishi Local Government equally have the highest number of ploughs five. Bosso Local Govenment Government have two Harrows and Wushishi Local Government have the highest number of Ridgers three in number.

LOCAL GOVERNEMENT PRESENTLY HAVING THE HIGHEST NUMBER OF FARM MACHINERY AND IMPLEMENTS.

TABLE 24

S/No	Machinery & Implements (Local Govt).	Present No. In order of Highest	Total Length (M)	Total Breadth (M)	Height (M)	Height (KG)
1.	Tractors (Magama)	10	43.00	17.00	2.40	3800kg
2.	Tipping trailers (Wushishi)	7	28.00	14.00	1.00	920kg
3.	Ploughs (Wushishi)	5	11.20	4.90	1.20	462kg
4.	Harrows (Bosso)	2	4.80	1.50	0.70	1216kg
5.	Ridgers (Wushishi)	3	9.30	2.60	1.00	680kg
	TOTAL	**27**	**96.30m**	**40.0m**	**3m Average**	**7078kg**

DATA ANALYSIS

DESIGN OF STORAGE SPACE

$$\text{Space Area } F = [F_1 (1 + \frac{\delta}{100} + F_2] \frac{1}{kav} + F_3 + F_4$$

F_1 = Area for keeping machines based on their dimension in M^2.

This is obtained by considering the actual length of the machinery and Breadth multiply together to give the area.

The space or Area the machines can occupy there is

Area = Length x Breadth.

Area = 95.30m x 40.00m

Therefore $F_1 = 3852m^2$

δ = Maneuvering space between machines in percentage of F_1 Normally 5% is allowed for maneuvering.

i.e. $\frac{5}{\%}$ of $F_1 = 0.5 \times F_1$

$\delta = 0.05 \times 3852$

$\delta = 192.6m^2$

F_2 = Area needed for servicing of machines during storage in M^2

It is given as $F_2 = an\ (lav + bav + a)$

Where a = the distance between machines ranging between machines ranging Between 0.4 – 0.8m

However, the distance from a machine in the shed to a control line ie edge is given as $\frac{a}{2}$ there adopt a = 0.7m

Then the distance from machine to control line is $\frac{0.7}{2} = 0.35m$

n = Number of space for storage of machines

n = 27

Lav = average length of machines. It is given

$$= \frac{\Sigma li}{n}$$

Where n = number of machines

$$Lav = \frac{96.30}{27}$$

$$= 3.60m$$

bav = average breadth of machines

$$bav = \frac{\Sigma bi}{n}$$

$$bav = \frac{40}{27} = 1.48m$$

$$F_2 = an\ (Lav + bav + a)$$

$$= 0.7 \times 27\ (3.60 + 1.48 + 0.7)$$

$$= 18.9 \times 6.0$$

$$F_2 = 109.24m^2$$

Kav = average coefficient based on use of space for all machines.

Given as $kav = \frac{F_1}{SB}$

Where S = length of all the machines.

B = Total width of all the machines.

S = 96.30

B = 40.00

$$Kav = \frac{3852 \quad m^2}{96.30 \times 40\ m^2} = 1$$

F_3 bav (PH) + 2.4b maximum [B+ bar (P+1)

Where bav (P+1) + 2.4b maximum width of machine

Bav = average width of pathway is given

$$Bar = \frac{b_1 + b_2 + b_3 + \_\_\_\_\_ bp+1}{P+1}$$

Where $b_1 + b_2 + b_3 + \_\_\_\_\_$ is the width of partway between 6 – 12m of machine.

Adopt 8m

$$P = \frac{B}{M\ (lav + a)}$$

M = 1 for single line arrangement.
M = 2 for double.

For the purpose of this design we use M = 1 ie we single line arrangement.

$$P = \frac{B}{M\ (lav + a)} = \frac{2}{1\ (3.60 + 0.7)}$$

P = 0.5 or preferable we use the maximum allowable partway of 12m = p

$$So,\ bav = \frac{b_1 + b_2 + b_3 + \_\_\_\_\_ b\,p + 1}{P + 1}$$

$$Bav = \frac{28 + 22 + 11.5 + 11.8 + 10.6}{12.1}$$

$$bav = \frac{83.9}{1}$$

bav = 6.45m

$$S = \sqrt{[F_1\ (1 + \delta) + F_2] \frac{\alpha}{kav}}$$

$$\chi = \frac{96.3}{40} = 2.4$$

$= 178.6$

$Kav = 1$

$F_1 = 3852m^2$

$F^2 = 109.254m^2$

$$S = \sqrt{[3852(1 + \frac{192.6}{100}) + 109.24] \frac{2.4}{1}}$$

$$S = \sqrt{[11270.95 + 109.24] 2.4}$$

$$S = \sqrt{27312.46}$$

$S = 165m$

$$B = \frac{F_1 (1 +) + F_2}{Skav}$$

$$B = 3852 (1 + \frac{192.6)}{165} + 1\text{-}9.24$$

$B = 66$

F_3 Sb$'$av (P + 1)+ 2.4bmaximum [B+Sb$'$av(P+1)]

$F_3 = 165x6.45 (12+1)+2.4x2.0[66+6.45(12+1)]$

$F_3 = 13835.25 + 719.28$

$F_3 = 14554.53m^2$

$F_4 = 2_c (S + 2.4\ b\text{maximum} + 2_c) + 2_c[\{B + bav\ (P + 1)]$

Where C = given between 3m – 4m

L = Total length of space for storage of machines.

It is given by $L = S + 2.4\ b\ \text{maximum} + 2_c$

$L = 165 + 2.4\ (2.0) + 2(4)$

$L = 165 + 4.8 + 8$

$L = 178\text{m length.}$

$F_4 = 2(4)\ [165 + 2.4(2.0) + 2(4)] + 2(4)\ [66 + 6.45(13)]$

$F_4 = 1422.40 + 1198.8$

$F_4 = 2621\ .2\text{m}^2$

Therefore the space Area for the machinery implements is

$$F = [F_1 (1 + \frac{\delta}{100} + F_2] \frac{1}{kav} + F_3 + F_4$$

$$= 3852(1 + \frac{192.6}{100}) + 109.2.4)\ \frac{1}{} + 14554.53 + 2621.2$$

$= 11270.95 + 109.24] + 17175.73$

$F = 29497.2\text{m}^2$

$$\text{Breadth } M = \frac{F}{L}$$

$$M = \frac{29497.32}{} = 168\text{m}$$

Breadth = 168m

For the purpose of this design

(Lenght) L = 178m.

(Breadth) B = 168m. See FIG. 1

4.2 Design of Columns

Design information

Self weight of concrete $24KN/m^3$

External columns use 400mm x 400mm square columns

Total numbers of columns: 271(external 152 + internal 119)

F_{cu} = 30KN/m characteristic strength of concrete cube

$F\gamma$ = $460KN/m^2$ characteristic strength of concrete steel.

Estimated of roof load = $0.75KN/m^2$

Design Height of columns = 6m

Estimated roof load = 0.75 x total area (168m x 178m)

= 0.75 x 29904

= 22428KN

∴Each column is expected to carry a maximum roof load of $\frac{22428KN}{271}$

= 83KN

Self weight of beam = 0.4 x0.4 x 6 x 24 = 23.04KN

Total axial load = 83 + 23.04 = 106KN

Area of steel reinforcement is given by

$$N = 0.4F_{cu}bh + Asc(0.75f\gamma - 0.4F_{cu})$$

$$106 \times 10^3 = 0.4 \times 30 \times 400 \times 400 \times Asc(0.75 \times 460 - 0.4 \times 30)$$

$$106 \times 10^3 = 1920 \times 10^3 + Asc\ 333$$

$$Asc = \frac{(1920 - 106)10^3}{333}$$

$Asc = 1920mm^2$

$4\gamma 25mm$ @ $1920mm^2$

T10mm @ 250mm stirrups

See appendix (7-8).

Design of internal columns 600mm x 600mm square columns.

Self weight of concrete = $24KN/m^3$

Self weight of columns = 600x 600 x 6 x 24 = 51.84KN

Load acting on each column 83Kn

Total axial load = 51.8 + 83 = 135KN

Area of steel reinforcement is given by

$N = 0.4F_{cu}bh + Asc(0.75F\gamma - 0.4F_{cu})$

$135 \times 10^3 = 0.4 \times 30 \times 600 \times 600 + Asc(0.75 \times 460 - 0.4 \times 30)$

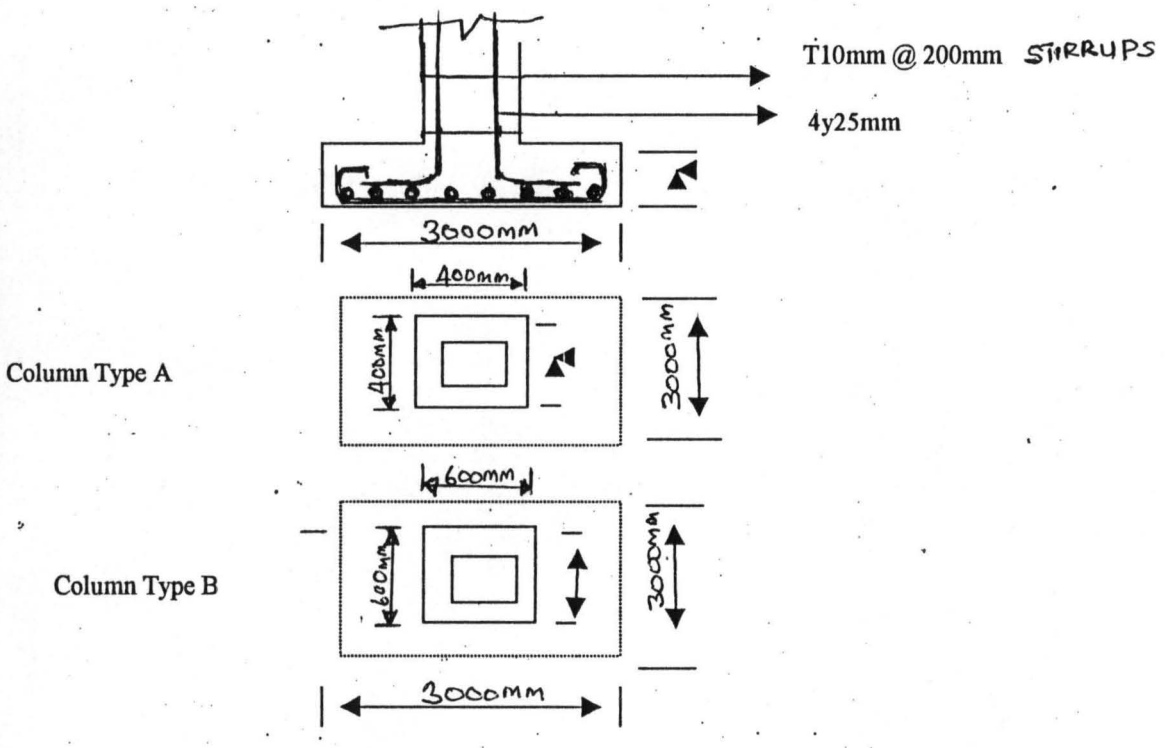
$135 \times 10^3 = 432 \times 10^3 + Asc(345\text{-}12)$

$$Asc = \frac{(1920 - 135)10^3}{333}$$

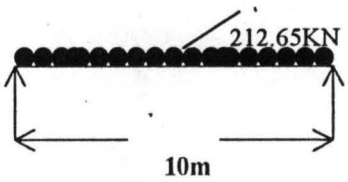
$Asc = 1879mm^2$

$4\gamma 25mm$ @ $1920mm^2$

T10mm@ 200mm spacing stirrup.



Section of column, External and Internal



4.3. **Design of Beam.**

Design Information (TYPE A)

d = 600mm

b = 400mm

d_1 = 550mm

Fcu = 30kn/m^2

Fcy = 460 km/m^2

Total Number of Beams. 160 (32external & 128 internal)

Load on Beams = 0.7kn x Root Area

= 0.7 x 168m x 178m

= 20932.80KN

$\therefore \frac{20932.80}{160}$ = 131KN

Self weight of Beam = 10x24x0.60x0.40 = 57.6KN

Total load acting on Beam = 131KN + 57.6KN =188.43KN

Moment at lever arm = $M = \frac{WL^2}{12}$

$$\frac{188.43+10^2}{12} = 1570.25\text{KNM}$$

Moment at mid span

$$M = \frac{WL^2}{24}$$

$$M = \frac{188.43x10^2}{12}$$

$$M = \underline{785.13}\ \text{KNM}$$

For lever Arm

$$\frac{M}{bd^2\ Fcu} = \frac{785.13x10^6}{400x600^2\ 30} = 0.2$$

From Lever A table la = 0.807 under the

Area of compression Reinforcement.

$$As = \frac{M}{0.87\ fyz}$$

$$As = \frac{188.43.x10^6}{0.87x460x(0.087x600)} = 981mm^2$$

6J 16mm @ $1210mm^2$

110 @ 200mm stirrup.

Design Of Beam (TYPE B)

Load on Beam = 131 KN

Self weight of Beam = 22.2 x 0.6 x 0.4 x 24 = 128KN

Total load acting on Beam = 132 + 128 = 259KN

$$\text{Moments } M = \frac{WL^2}{12}$$

$$M = \frac{259410^2}{12}$$

$$= \underline{2158.33}\text{KNM}$$

Moment at mid span

$$M = \frac{WL^2}{12}$$

$$\frac{259410^2}{24}$$

$$= \underline{1079.16}\text{ KNM}$$

For lever arm $\frac{M}{Bd^2\ Fcu}$

$\frac{10179.16x10^6}{400\ (600)^2 \text{ x } 30} = 0.24$

From Lever arm table la = 0.84 See Appendix (9)

$As = \frac{M}{0.87\ fyz}$ where z = 0.84 x depth

$As = \frac{259x10^6}{0.87x640(600 \text{ x } 0.84)}$

$As = 923mm^2$

Compression Reinforcement.
8 T 16mm @ $1610mm^2$
T10 @ 200mm spacing stirrups

Normal Links

$$\frac{ASV}{SV}$$

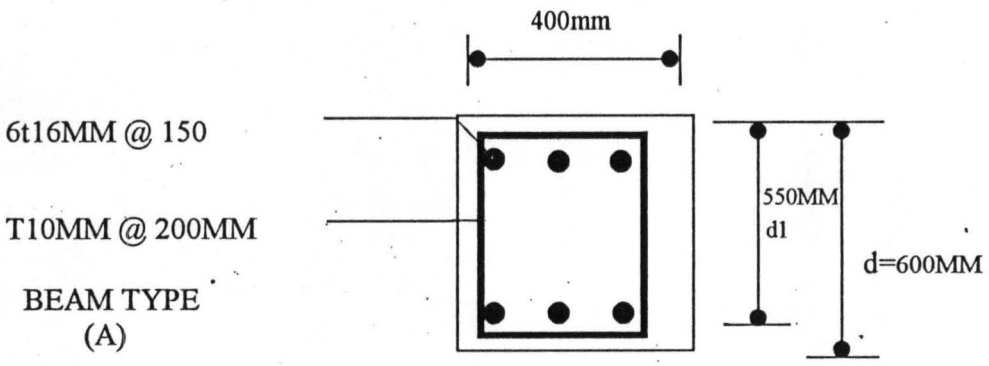
Where ASV = Cross Sectional area of the stirrup
SV = spacing of the stirrup.

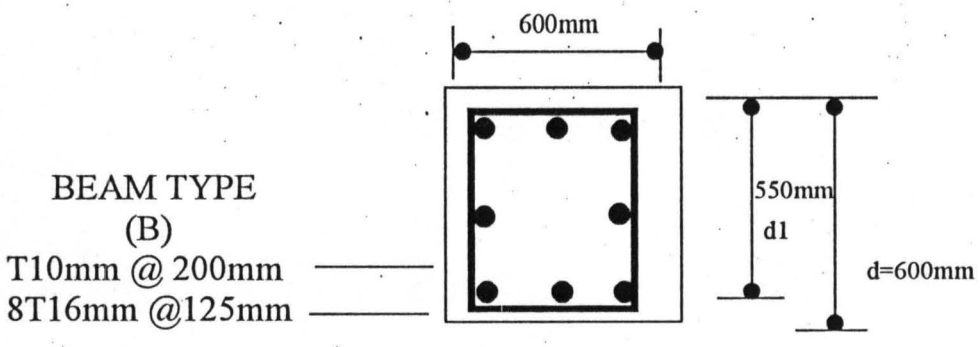
$$\frac{ASV}{SV} = \frac{0.4 \times breadth}{0.87\ fyv}$$

where fyv = characteristic strength of the like Reinforcement

$$\Rightarrow \frac{0.4 \times 400}{0.87 \times 250} = 0.736mm^2$$

Provide T10mm @ 200mm spacing.





CROSS – SECTION OF BEAMS.

4.4 Design of Floor

Design Information

Slab span = 178m

Live load from Tractors & implements = 10KN

Assumed imposed load	=	100KN
Design depth of concrate	=	300mm
Total load	=	110KN

Fcu = 30 N/mm^2

Fu = 460 N/mm^2

Concrete mix 1:2:4 20mm aggregates crush stones.

Bending moment (BM) = $\frac{M}{Bd^2}$

$\frac{}{Fcu}$

$BM = \frac{110 \times 10^6}{300 \times 178^2 \times 30} = 0.36$

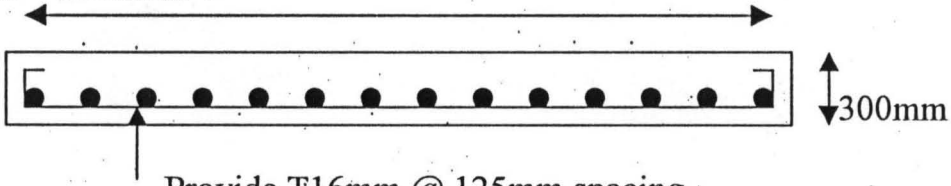
From the lever arm curve la = 0.93

Area of steel As = $\frac{M}{0.87fyz}$

Reinforcement

$As = \frac{110 \times 10^6}{0.87 \times 460 \times (0.93 \times 178)}$

As = 1660mm^2



Provide T16mm @ 125mm spacing
I78m by 168m.

4.5 Design of Foundation

Pad Foundation

These may be circular, rectangular or square in section. The most common types are square. They may be of mass concrete or reinforced concrete, but reinforced concrete pads are reserved for the larger types of structures. They are generally used to support isolated loads. Such as those in columns, piers and heavy machinery in factories.

DESIGN INFORMATION

Axial load on column = 325.29KN

Tractors & Implements = $\frac{29762 \times 9.81}{168 \times 178}$

= 9.76KN

Assume Imposed load = 100KN

Total load = 325.29 + 9.76 + 100

= 435.05KN

The bearing pressure of soil is 200KN/m^2

Characteristic strength of concrete f_{cu} = 35N/m^2

Characteristic strength of steel $f\gamma$ = 460N/m^2

∴ For the serviceability state design

Total design axial load = 1.0GK + 1.0 QK

= (1.0 x 435.05) + 1.00 x 100)

= 435.05 + 100

= 535.05KN

Required Base Area A = $\frac{\text{Axial load}}{\text{Safe pressure}}$

$$A = \frac{535.03}{200}$$
$$= 2.7m^2$$

For the ultimate limit state of the columns

1.4 GK + 1.6QK

(where GK = dead-load on beams

QK = live load on beam)

= 1.4(354.49) + 1.6(100)

= 496.29 + 160

= 656.29KN

Earth Pressure $= \frac{656.29}{3^2}$

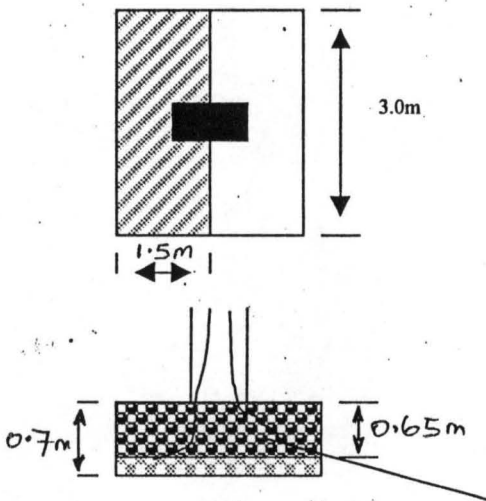
$= 73KN/m^2$

Assume footing depth of 650mm constructed on a blinding layer of contact with minimum cover of 50mm

Effective depth = 650-50-20

= 580mm

Bending Reinforcement



$$\text{Moment } M = \frac{wL^2}{2}$$

$$= \frac{(73 \times 3) + (1.5)^2}{2}$$

$$= 246.38\text{KNm}$$

Cross-section of foundation concrete blinding → 10mm γ @ 200mm spacing

$$M_u = 0.156\, F_{cu}\, bd^2$$

$$= 0.156 \times 35 \times 3000\ (580)^2$$

$$= 551023.2\text{KN/m}^2$$

The design moment is greater than the ultimate moment, so the foundation is very safe.

Area of steel reinforcement is given

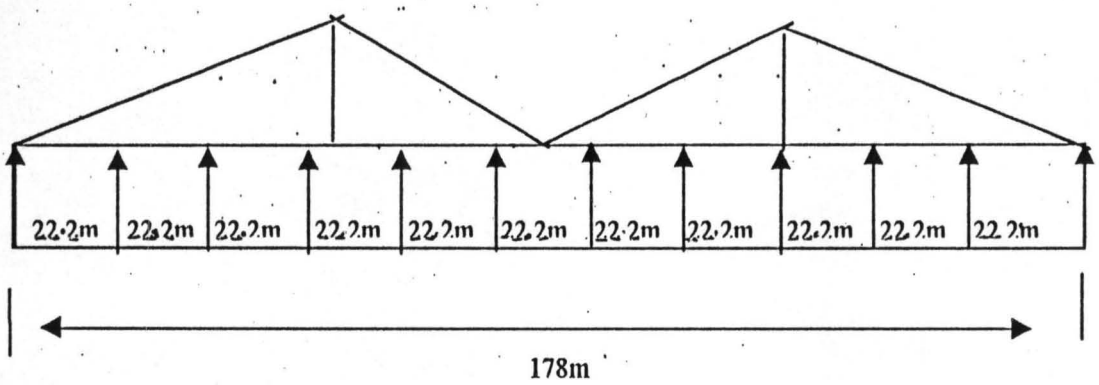
$$N = 0.4bh + Asc(0.75f\gamma - 0.4F_{cu})$$

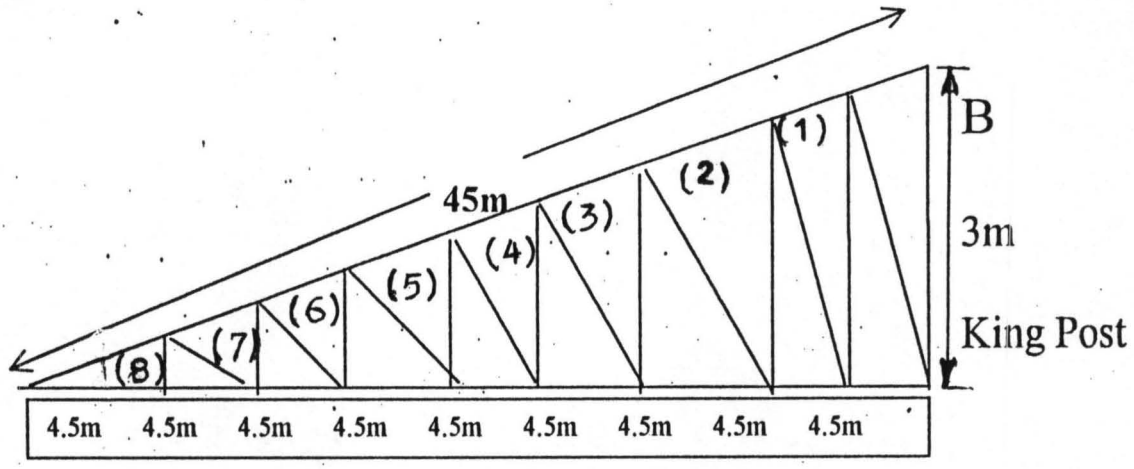
$$656.29 \times 10^3 = 0.4 \times 30 \times 3000 + Asc(0.75 \times 460 - 0.4 \times 30) + Asc(345 - 12)$$

$$ASC = 3243\text{mm}^2$$

10mmγ @ 200mm spacing 393mm^2

4.6 Design of Roof





A

$$H^2 = A^2 + B^2$$

$$= (45.5)^2 + (3)^2$$

$$= \sqrt{1908 + 9}$$

$$= 45.6\text{m}$$

Roof Members

1. = $\frac{3}{4.5}$

= 0.67m = 3 – 0.67 = 2.3m

2. = $\frac{2.3}{4.5}$

= 0.51 = 2.3 – 0.51 = 1.8m

3. = $\frac{1.8}{4.5}$

= 0.41 = 1.8 – 0.41 = 1.4m

4 = $\frac{1.4}{4.5}$

= 0.31 = 1.4 – 0.31 = 1.10m

5 = $\frac{1.10}{4.5}$

= 0.24 = 1.10 – 0.24 = 0.86m

6 = $\frac{0.86}{4.5}$

= 0.19 = 0.86 – 0.19 = 0.67m

7 = $\frac{0.67}{4.5}$

0.15 = 0.67 – 0.15 = 0.52m

8 = $\frac{0.52}{4.5}$

= 0.12 = 0.52 – 0.12 = 0.4m

Roof Trusses

1. Use angle iron rafters 75mm x 75mm size.
2. Angle iron for upper rail of rafter 50mm x 7mm size.
3. Angle iron for rafter bracing 50mm x 50mm size.
4. 125mm Z purling
5. use 20mm bolts and nuts for tie beam
6. use 20mm bolts and nuts for rafter joints
7. use 14mm polling bolts.
8. King post 75mm x 75mm angle iron.
9. Use aluminum long span sheet @ 500mm spacing.

4.7 BILL OF QUANTITIES

Estimate for the Construction of Farm Machinery and Implements Shed for Local Government Area of Niger State

S/No.	Description	Qty	Unit	Rate	Amount ₦
1.	Allow provisional sum for preliminaries	Sum	--	50,000	50,00
2	Allow provisional sum for setting out.	Sum	--	20,000	20,00
					70,00
3	**Foundation**				
a.	Excavation of foundation base 0.3mx0.3mx0.9m.	30	m^3	1,500	10,50
b.	Hard core filling 0.35m good laterite materials. Compacted in layer of 50mm with a vibrator.	785	m^3	400	314,00
c.	Concrete in fdn of mix 1:2:4 for column base.	17.10	m^3	6,000	102,43
					426,93
4.	**Columns**				
a.	Provides high yield reinforcement base 4y16mm column footing	6.08	Tons	98,000	595,84
b.	Provide T10mm @ 200mm spacing	4.05	Tons	98,000	396,90
c.	Provide binding wire	20	Roll	1,000	20,00

d.	Provide concrete bisket	500	No	20	10,00
e.	Provide form work for casting of columns	1026	m^2	200	205,20 **1,227,94**
5.	**Beams**				
a.	Provide 6T16mm steel reinforcement for Beams (external)	3.0	Tons	98,000	294,00
b.	Provide 8T16mm steel Reinforcement bars (internal)	12	Tons	98,000	1,176,00
c.	Provide T10mm at 200mm spacing	4.3	Tons	98,000	417,87
d.	Provide concrete Biskets	700	No	20	14,00
e.	Provide binding wire	10	Rolls	1,000	10,00 **1,911,87**
6.	**Floor**				
a.	Provide concrete 178mx168mx0.2m mix 1:2:4	1794.24	m^3	6,000	10,765,20
b.	Provide T16mm 125mm spacing	6	Tons	98,000	588,00
c.	Provide concrete biskets	1000	No	20	20,00
d.	Provide binding wire	10	Rolls	1,000	10,00 **11,383,20**

7	**Roofing**				
a.	Use 0.55 thick white aluminum load span roofing sheets.	29904	m	820	24,576,38
b	Ridges cap 600 mm	336	m	600	201,60
c	Barg board 450 mm	692	m	356	246,35
d	Hook's felt and washer	50,000	no	1,000	500,00
e	Provide rafter 75 mm x 75 mm angle iron at 10 m	34	no	3,200	108,80
f	Provide angle iron for the rafters	64	no	1,200	76,80
g	Provide Z purline of 125 mm at 0.9 m spacing	200	no	2,300	460,00
h	Rafter bolts and nuts	500	no	50	25,00
i	Tie beam bolts and nuts 20 mm	500	no	50	25,00
j	Wall plate beam	504	no	9,000	453,60
k	Polling bolts 14 mm	500	no	30	15,00
					26,688,53

SUMMARY

1.	Preliminaries (setting out)	₦70,000.00
2.	Foundation	₦426,938.00
3.	Columns	₦1,227,940.00
4.	Beams	₦1,911,872.00
5.	Floor	₦11,383,200.00
6.	Roofing	₦26,688,536.00
	Sum	**₦41,708,468.00**
	Add 10% labour/supervision	₦4,170,848.60
	Add 10% Transportation and contingencies	N4,170,848.60
	Total Sum	**₦50,050,165.20**

See Fig. (2-4)

CHAPTER 5

CONCLUSION AND RECOMMENDATION

The local government areas of Niger State should as a matter of fact and urgency constructs a farm machinery and implement shed in heir local government headquarters to house these machinery and implements.

This is to prevent further damage and destruction on the machinery and implements. This will further boost agricultural production of the state.

Recommendation

The amount involved in the construction of the farm machinery and implement shed is very substantial, most especially for the local governments.

However, the local governments should solicit for funds from the federal/state governments and other agencies to finance the project. They should equally try to increase their revenue base, most especially from their Tractor Hiring Services so as to generate more funds for the execution of the project.

Each local government should try to save N10,000,000.00 (Ten million Naira) each year for the project construction. In Five years, the project will be completed. The local government should also acquire additional land for future expansion. I recommend a period of twenty-five years at a growth rate of 5%. The total land to be acquired is 23,189.4m^2.

The local government should also acquire additional land for future expansion. I recommend a period of twenty five years at a growth rate of 5%. The total land to be acquired is 23,189.4m^2.

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TABLE 1

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVTS	TRACTORS							
	MAKE	NO	MODEL	WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	ENGINE CAPACIT (H/P)
MINNA	FIAT	3	80.66	3430	3.50	2.0	2.6	80 H/P
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	2	"	"	"	"	"	"
BOSSO	"	1	"	"	"	"	"	"
SULEJA	"	1	"	"	"	"	"	"
WUSHISHI	"	1	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	1	"	"	"	"	"	"
LAPAI	"	1	"	"	"	"	"	"
AGAIE	"	1	"	"	"	"	"	"
KONTAGORA	"	3	"	"	"	"	"	"
MAGAMA	"	2	"	"	"	"	"	"
GURA	"	0	"	"	"	"	"	"
AFI	"	5	"	"	"	"	"	"
AVUN	"	0	"	"	"	"	"	"

TABLE 2

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVTS	TRACTORS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	ENGINE CAPACITY (H/P)
	MAKE	NO	MODEL					
MINNA	M F	2	375 E	2488	3.50	2.0 0	2.60	80 H/P
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	2	"	"	"	"	"	"
BOSSO	"	1	"	"	"	"	"	"
SULEJA	"	1	"	"	"	"	"	"
WUSHISHI	"	1	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	1	"	"	"	"	"	"
LAPAI	"	1	"	"	"	"	"	"
AGAIE	"	1	"	"	"	"	"	"
ONTAGORA	"	4	"	"	"	"	"	"
ZAGAMA	"	2	"	"	"	"	"	"
GURA	"	0	"	"	"	"	"	"
AFI	"	8	"	"	"	"	"	"
AVUN	"	2	"	"	"	"	"	"

TABLE 3

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVTS	TRACTORS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	ENGINE CAPACIT (H/P)
	MAKE	NO	MODEL					
MINNA	FORD	0	4630	3250	4.30	2.0	2.60	55 H/P
SHIRORO	"	0	"	"	"	"	"	"
PAIKORO	"	0	"	"	"	"	"	"
BOSSO	"	0	"	"	"	"	"	"
SULEJA	"	2	"	"	"	"	"	"
WUSHISHI	"	0	"	"	"	"	"	"
BIDA	"	1	"	"	"	"	"	"
MOKWA	"	1	"	"	"	"	"	"
LAPAI	"	0	"	"	"	"	"	"
AGAIE	"	1	"	"	"	"	"	"
KONTAGORA	"	0	"	"	"	"	"	"
MAGAMA	"	0	"	"	"	"	"	"
AGURA	"	0	"	"	"	"	"	"
RAFI	"	0	"	"	"	"	"	"
LAVUN		0	"	"	"	"	"	"

TABLE A

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVTS	TRACTORS							
	MAKE	NO	MODEL	WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	ENGINE CAPACITY (H/P)
MINNA	NEW HOLLAND	2	4635	3300	4.30	2.0 0	2.60	60 H/P
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	2	"	"	"	"	"	"
BOSSO	"	2	"	"	"	"	"	"
SULEJA	"	2	"	"	"	"	"	"
WUSHISHI	"	2	"	"	"	"	"	"
BIDA	"	2	"	"	"	"	"	"
MOKWA	"	2	"	"	"	"	"	"
LAPAI	"	1	"	"	"	"	"	"
AGAIE	"	2	"	"	"	"	"	"
KONTAGORA	"	2	"	"	"	"	"	"
MAGAMA	"	2	"	"	"	"	"	"
AGURA	"	2	"	"	"	"	"	"
RAFI	"	2	"	"	"	"	"	"
LAVUN	"	2	"	"	"	"	"	"

TABLE 5

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVTS	TRACTORS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	ENGINE CAPACITY (H/P)
	MAKE	NO	MODEL					
MINNA	STEYR	5	8075	3800	3.20	1.70	1.80	70 H/P
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	1	"	"	"	"	"	"
BOSSO	"	1	"	"	"	"	"	"
SULEJA	"	0	"	"	"	"	"	"
WUSHISHI	"	5	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	1	"	"	"	"	"	"
LAPAI	"	2	"	"	"	"	"	"
AGAIE	"	1	"	"	"	"	"	"
KONTAGORA	"	0	"	"	"	"	"	"
MAGAMA	"	10	"	"	"	"	"	"
AGURA	"	4	"	"	"	"	"	"
RAFI	"	3	"	"	"	"	"	"
LAVUN	"	2	"	"	"	"	"	"

TABLE 6

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVTS.	RIDGERS							
	TYPE	NO	MAKE	WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
MINNA	BAMFORD	0	BAMFORD	460	3.70	0.8	0.9	2 ROW 4 DISC
SHIRORO	"	0	"	"	"	"	"	"
PAIKORO	"	0	"	"	"	"	"	"
BOSSO	"	0	"	"	"	"	"	"
SULEJA	"	2	"	"	"	"	"	"
WUSHISHI	"	0	"	"	"	"	"	"
BIDA	"	2	"	"	"	"	"	"
MOKWA	"	0	"	"	"	"	"	"
LAPAI	"	0	"	"	"	"	"	"
AGAIE	"	0	"	"	"	"	"	"
KONTAGORA	"	0	"	"	"	"	"	"
MAGAMA	"	0	"	"	"	"	"	"
AGURA	"	0	"	"	"	"	"	"
RAFI	"	2	"	"	"	"	"	"
LAVUN	"	0	"	"	"	"	"	

TABLE 7

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVTS	RIDGERS							
	TYPE	NO	MAKE	WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
MINNA	BALDAN	0	BALDAN	680	3.7	0.8	0.9	2 ROW 4 DISC
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	0	"	"	"	"	"	"
BOSSO	"	0	"	"	"	"	"	"
SULEJA	"	0	"	"	"	"	"	"
WUSHISHI	"	1	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	0	"	"	"	"	"	"
LAPAI	"	0	"	"	"	"	"	"
AGAIE	"	0	"	"	"	"	"	"
KONTAGORA	"	I	"	"	"	"	"	"
MAGAMA	"	0	"	"	"	"	"	"
AGURA	"	0	"	"	"	"	"	"
RAFI	"	0	"	"	"	"	"	"
LAVUN	"	0		"	"	"	"	"

TABLE 8

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVTS	RIDGERS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
	TYPE	NO	MAKE					
MINNA	MF	2	MF	460	3.10	1.20	1.0	2 ROW 4 DISC
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	1	"	"	"	"	"	"
BOSSO	"	0	"	"	"	"	"	"
SULEJA	"	1	"	"	"	"	"	"
WUSHISHI	"	1	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	1	"	"	"	"	"	"
LAPAI	"	0	"	"	"	"	"	"
AGAIE	"	1	"	"	"	"	"	"
KONTAGORA	"	2	"	"	"	"	"	"
MAGAMA	"	0	"	"	"	"	"	"
AGURA	"	2	"	"	"	"	"	"
RAFI	"	0	"	"	"	"	"	"
LAVUN	"	1	"	"	"	"	"	"

TABLE 9

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVTS	RIDGERS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
	TYPE	NO	MAKE					
MINNA	PERMITER	0	PERMITER	594	3.10	1.20	1.20	2 ROW 4 DIS
SHIRORO	"	0	"	"	"	"	"	"
PAIKORO	"	1	"	"	"	"	"	"
BOSSO	"	0	"	"	"	"	"	"
SULEJA	"	0	"	"	"	"	"	"
WUSHISHI	"	3	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	1	"	"	"	"	"	"
LAPAI	"	2	"	"	"	"	"	"
AGAIE	"	0	"	"	"	"	"	"
KONTAGORA	"	0	"	"	"	"	"	"
MAGAMA	"	0	"	"	"	"	"	"
AGURA	"	0	"	"	"	"	"	"
RAFI	"	0	"	"	"	"	"	"
LAVUN	"	1	"	"	"	"	"	"

TABLE 10

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVTS	RIDGERS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
	TYPE	NO	MAKE					
MINNA	FIAT	0	FIAT	460	3.10	1.20	1.0	2 ROW 4 DISC
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	0	"	"	"	"	"	"
BOSSO	"	0	"	"	"	"	"	"
SULEJA	"	0	"	"	"	"	"	"
WUSHISHI	"	0	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	0	"	"	"	"	"	"
LAPAI	"	1	"	"	"	"	"	"
AGAIE	"	0	"	"	"	"	"	"
KONTAGORA	"	0	"	"	"	"	"	"
MAGAMA	"	2	"	"	"	"	"	"
AGURA	"	0	"	"	"	"	"	"
RAFI	"	0	"	"	"	"	"	"
LAVUN	"	0	"	"	"	"	"	"

TABLE 11

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVT.	PLOUGHS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
	TYPE	NO	MAKE					
MINNA	STEYR	0	STEYR	452	0.70	1.2	462	3 DISC PLOUGH
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	1	"	"	"	"	"	"
BOSSO	"	2	"	"	"	"	"	"
SULEJA	"	0	"	"	"	"	"	"
WUSHISHI	"	0	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	1	"	"	"	"	"	"
LAPAI	"	1	"	"	"	"	"	"
AGAIE	"	0	"	"	"	"	"	"
KONTAGORA	"	0	"	"	"	"	"	"
MAGAMA	"	2	"	"	"	"	"	"
AGURA	"	2	"	"	"	"	"	"
RAFI	"	0	"	"	"	"	"	"
LAVUN	"	0	"	"	"	"	"	"

TABLE 12

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVT.	PLOUGHS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
	TYPE	NO	MAKE					
MINNA	FORD	2	NEW	462	1.60	0.70	1.2	3 DISC PLOUG
SHIRORO	"	1	HOLLAND	"	"	"	"	"
PAIKORO	"	0	"	"	"	"	"	"
BOSSO	"	2	"	"	"	"	"	"
SULEJA	"	1	"	"	"	"	"	"
WUSHISHI	"	2	"	"	"	"	"	"
BIDA	"	2	"	"	"	"	"	"
MOKWA	"	2	"	"	"	"	"	"
LAPAI	"	2	"	"	"	"	"	"
AGAIE	"	2	"	"	"	"	"	"
KONTAGORA	"	2	"	"	"	"	"	"
MAGAMA	"	0	"	"	"	"	"	"
AGURA	"	2	"	"	"	"	"	"
RAFI	"	2	"	"	"	"	"	"
LAVUN	"	2	"	"	"	"	"	"
			"					

TABLE 13

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVT.	PLOUGHS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
	TYPE	NO	MAKE					
MINNA	BAMLETT	1	BAMLETT	455	1.60	0.70	1.1	3 DISC PLOUG
SHIRORO	"	0	"	"	"	"	"	"
PAIKORO	"	2	"	"	"	"	"	"
BOSSO	"	1	"	"	"	"	"	"
SULEJA	"	0	"	"	"	"	"	"
WUSHISHI	"	0	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	1	"	"	"	"	"	"
LAPAI	"	1	"	"	"	"	"	"
AGAIE	"	0	"	"	"	"	"	"
KONTAGORA	"	2	"	"	"	"	"	"
MAGAMA	"	2	"	"	"	"	"	"
AGURA	"	0	"	"	"	"	"	"
RAFI	"	0	"	"	"	"	"	"
LAVUN	"	2	"	"	"	"	"	"

TABLE 14

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVT.	PLOUGHS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
	TYPE	NO	MAKE					
MINNA	BALDAN	1	BALDAN	455	1.70	0.70	1.10	3 DISC PLOUGH
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	0	"	"	"	"	"	"
BOSSO	"	0	"	"	"	"	"	"
SULEJA	"	0	"	"	"	"	"	"
WUSHISHI	"	0	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	0	"	"	"	"	"	"
LAPAI	"	0	"	"	"	"	"	"
AGAIE	"	1	"	"	"	"	"	"
KONTAGORA	"	0	"	"	"	"	"	"
MAGAMA	"	0	"	"	"	"	"	"
AGURA	"	0	"	"	"	"	"	"
RAFI	"	0	"	"	"	"	"	"
LAVUN	"	0	"	"	"	"	"	"

TABLE 15

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVT.	PLOUGHS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
	TYPE	NO	MAKE					
MINNA	MF	2	MF	462	1.60	0.70	1.20	3 DISC PLOUGH
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	2	"	"	"	"	"	"
BOSSO	"	2	"	"	"	"	"	"
SULEJA	"	3	"	"	"	"	"	"
WUSHISHI	"	5	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	2	"	"	"	"	"	"
LAPAI	"	1	"	"	"	"	"	"
AGAIE	"	0	"	"	"	"	"	"
KONTAGORA	"	3	"	"	"	"	"	"
MAGAMA	"	3	"	"	"	"	"	"
AGURA	"	2	"	"	"	"	"	"
RAFI	"	3	"	"	"	"	"	"
LAVUN	"	2	"	"	"	"	"	"

TABLE 16

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVT.	TIPPING TRAILERS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEI((n
	TYPE	NO	MAKE				
MINNA	STEYR	4	STEYR	920	3.2	2.0	1.8
SHIRORO	"	1	"	"	"	"	"
PAIKORO	"	0	"	"	"	"	"
BOSSO	"	1	"	"	"	"	"
SULEJA	"	0	"	"	"	"	"
WUSHISHI	"	0	"	"	"	"	"
BIDA	"	0	"	"	"	"	"
MOKWA	"	1	"	"	"	"	"
LAPAI	"	0	"	"	"	"	"
AGAIE	"	1	"	"	"	"	"
KONTAGORA	"	0	"	"	"	"	"
MAGAMA	"	4	"	"	"	"	"
AGURA	"	0	"	"	"	"	"
RAFI	"	0	"	"	"	"	"
LAVUN	"	0	"	"	"	"	"

TABLE 17

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVT.	TIPPING TRAILERS			WEIGHT (kg}	LENGTH (m)	BREADTH (m)	HEIGHT (m)
	TYPE	NO	MAKE				
MINNA	FIAT	2	FIAT	762	4.0	2.0	1.0
SHIRORO	"	1	"	"	"	"	"
PAIKORO	"	0	"	"	"	"	"
BOSSO	"	0	"	"	"	"	"
SULEJA	"	1	"	"	"	"	"
WUSHISHI	"	0	"	"	"	"	"
BIDA	"	0	"	"	"	"	"
MOKWA	"	0	"	"	"	"	"
LAPAI	"	1	"	"	"	"	"
AGAIE	"	0	"	"	"	"	"
KONTAGORA	"	1	"	"	"	"	"
MAGAMA	"	0	"	"	"	"	"
AGURA	"	0	"	"	"	"	"
RAFI		2	"	"	"	"	"
LAVUN		1	"	"	"	"	"

TABLE 18

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE .

LOCAL GOVT.	TIPPING TRAILERS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGH (m)
	TYPE	NO	MAKE				
MINNA	FORD	0	FORD	762	4.0	1.8	1.0
SHIRORO	”	1	”	”	”	”	”
PAIKORO	”	0	”	”	”	”	”
BOSSO	”	0	”	”	”	”	”
SULEJA	”	1	”	”	”	”	”
WUSHISHI	”	0	”	”	”	”	”
BIDA	”	0	”	”	”	”	”
MOKWA	”	0	”	”	”	”	”
LAPAI	”	1	”	”	”	”	”
AGAIE	”	0	”	”	”	”	”
KONTAGORA	”	0	”	”	”	”	”
MAGAMA	”	0	”	”	”	”	”
AGURA	”	0	”	”	”	”	”
RAFI	”	0	”	”	”	”	”
LAVUN	”	0	”	”	”	”	”

TABLE 19

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVERNMENTS	TIPPING TRAILERS			WEIGHT (Kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)
	TYPE	NO	MAKE				
MINNA	MF	1	MF	762	4.0	2.0	1.0
SHIRORO	"	1	"	"	"	"	"
PAIKORO	"	1	"	"	"	"	"
BOSSO	"	1	"	"	"	"	"
SULEJA	"	0	"	"	"	"	"
WUSHISHI	"	7	"	"	"	"	"
BIDA	"	1	"	"	"	"	"
MOKWA	"	2	"	"	"	"	"
LAPAI	"	1	"	"	"	"	"
AGAIE	"	1	"	"	"	"	"
KONTAGORA	"	1	"	"	"	"	"
MAGAMA	"	1	"	"	"	"	"
AGURA	"	0	"	"	"	"	"
RAFI	"	3	"	"	"	"	"
LAVUN	"	2	"	"	"	"	"

TABLE 20

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVTS	HARROWS							
	TYPE	NO	MAKE	WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
MINNA	FORD	0	FORD	1216	2.40	1.90	1.50	2 ROW/8 DISC HARROW
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	0	"	"	"	"	"	"
BOSSO	"	0	"	"	"	"	"	"
SULEJA	"	1	"	"	"	"	"	"
WUSHISHI	"	0	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	0	"	"	"	"	"	"
LAPAI	"	1	"	"	"	"	"	"
AGAIE	"	0	"	"	"	"	"	"
KONTAGORA	"	0	"	"	"	"	"	"
MAGAMA	"	0	"	"	"	"	"	"
AGURA	"	0	"	"	"	"	"	"
RAFI	"	2	"	"	"	"	"	"
LAVUN	"	0	"	"	"	"	"	"

TABLE 21

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

OCAL GOVTS.	HARROWS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
	TYPE	NO	MAKE					
MINNA	STEYR	0	STEYR	1216	2.40	1.90	1.50	8 DISC HARRO
HIRORO	"	1	"	"	"	"	"	"
AIKORO	"	0	"	"	"	"	"	"
BOSSO	"	2	"	"	"	"	"	"
ULEJA	"	0	"	"	"	"	"	"
WUSHISHI	"	1	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	0	"	"	"	"	"	"
LAPAI	"	0	"	"	"	"	"	"
AGAIE	"	1	"	"	"	"	"	"
KONTAGORA	"	0	"	"	"	"	"	"
MAGAMA	"	2	"	"	"	"	"	"
AGURA	"	0	"	"	"	"	"	"
RAFI	"	0	"	"	"	"	"	"
LAVUN	"	0	"	"	"	"	"	"

TABLE 22

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFTEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVT.	HARROWS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
	TYPE	NO	MAKE					
MINNA	MF	1	MF	1016	1.90	2.10	0.70	2 ROW 8 DISC HARROW
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	2	"	"	"	"	"	"
BOSSO	"	0	"	"	"	"	"	"
SULEJA	"	0	"	"	"	"	"	"
WUSHISHI	"	0	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	2	"	"	"	"	"	"
LAPAI	"	2	"	"	"	"	"	"
AGAIE	"	1	"	"	"	"	"	"
KONTAGORA	"	1	"	"	"	"	"	"
MAGAMA	"	0	"	"	"	"	"	"
AGURA	"	2	"	"	"	"	"	"
RAFI	"	2	"	"	"	"	"	"
LAVUN	"	2	"	"	"	"	"	"

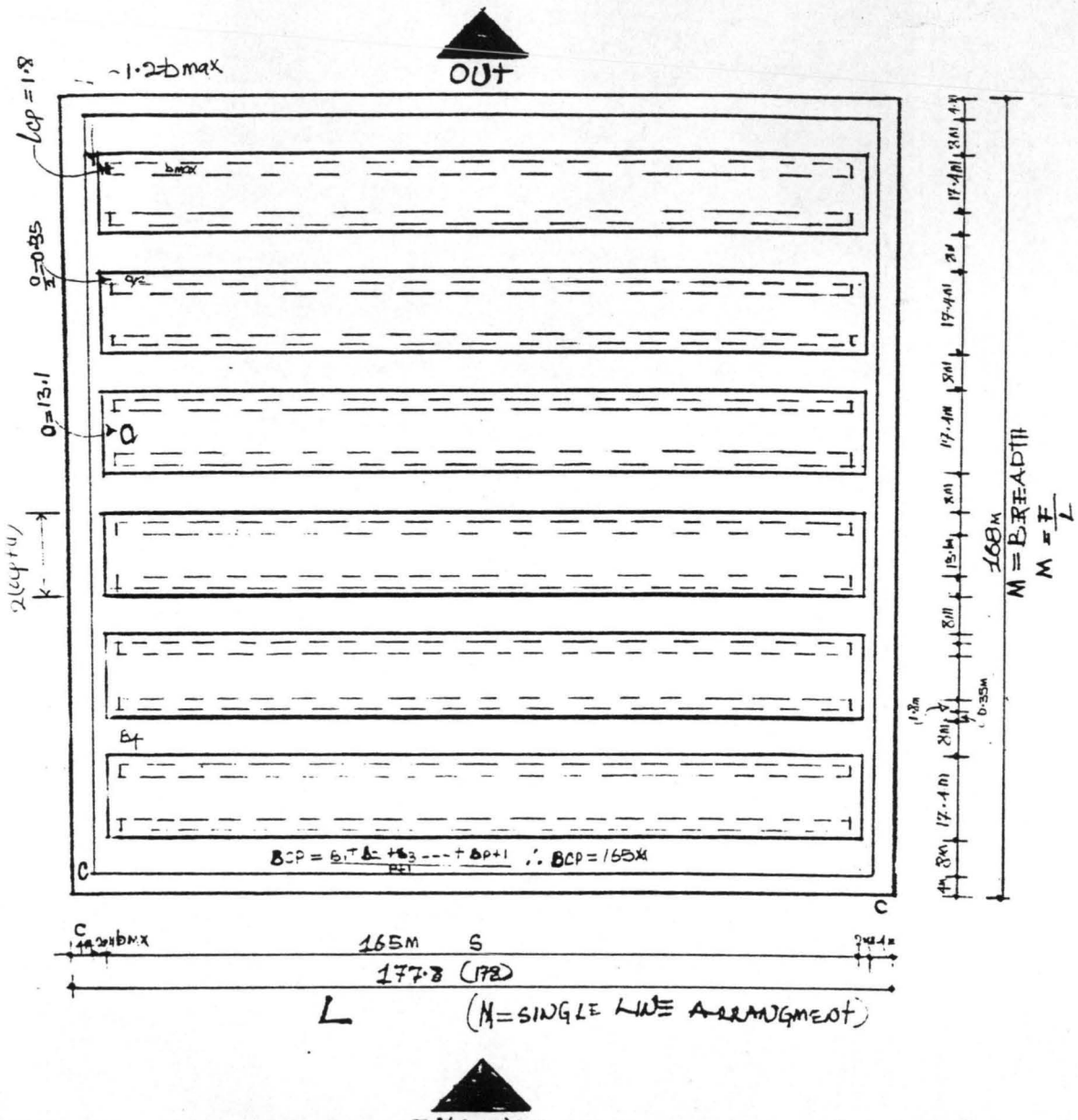
TABLE 23

SURVEY REPORT FOR FARM MACHINERY AND IMPLEMENTS OF FIFEEN LOCAL GOVERNMENT AREAS OF NIGER STATE.

LOCAL GOVTS	HARROWS			WEIGHT (kg)	LENGTH (m)	BREADTH (m)	HEIGHT (m)	SPECIFICATION
	TYPE	NO	MAKE					
MINNA	FIAT	0	FIAT	1216	2.40	1.90	1.50	2 ROW 8 DISC HARRO
SHIRORO	"	1	"	"	"	"	"	"
PAIKORO	"	1	"	"	"	"	"	"
BOSSO	"	0	"	"	"	"	"	"
SULEJA	"	1	"	"	"	"	"	"
WUSHISHI	"	0	"	"	"	"	"	"
BIDA	"	0	"	"	"	"	"	"
MOKWA	"	0	"	"	"	"	"	"
LAPAI	"	1	"	"	"	"	"	"
AGAIE	"	0	"	"	"	"	"	"
KONTAGORA	"	0	"	"	"	"	"	"
MAGAMA	"	0	"	"	"	"	"	"
AGURA	"	0	"	"	"	"	"	"
RAFI	"	0	"	"	"	"	"	"
LAVUN	"	0	"	"	"	"	"	"

Table ……24…… BAR SIZES

S/No	Bar Size	Conversion factor Kg/m
1	10mm	0.617
2	12mm	0.888
3	14mm	1.208
4	16mm	1.579
5	18mm	1.998
6	20mm	2.461
7	32mm	6.313



THE FORMULA USED	
1	$L = S + 2{\cdot}4\, b_{max} + 2C = 177{\cdot}8\ (178)$
2	$BCP = \frac{b_1 + b_2 + b_3 \text{ ---} + b_{P+1}}{P+1}$
3	$b_{max} = 1{\cdot}2$
4	$l_{CP} = 1{\cdot}8$
5	$\frac{o}{2} = 0{\cdot}35$
6	$o = 13{\cdot}1$
7	$2(l_{CP}+o) = 17{\cdot}4$
8	$M = \text{BREADTH } 168 \quad M = \frac{F}{L}$
9	$8M = B_4$
10	$1M = C$
11	M = SINGLE LINE ARRANGMENT
12	

MACHINERY AND IMPLEMENTS SPACE ARRANGEMENT.

FOR LOCAL GOVERNMENT AREAS OF NI/STATE

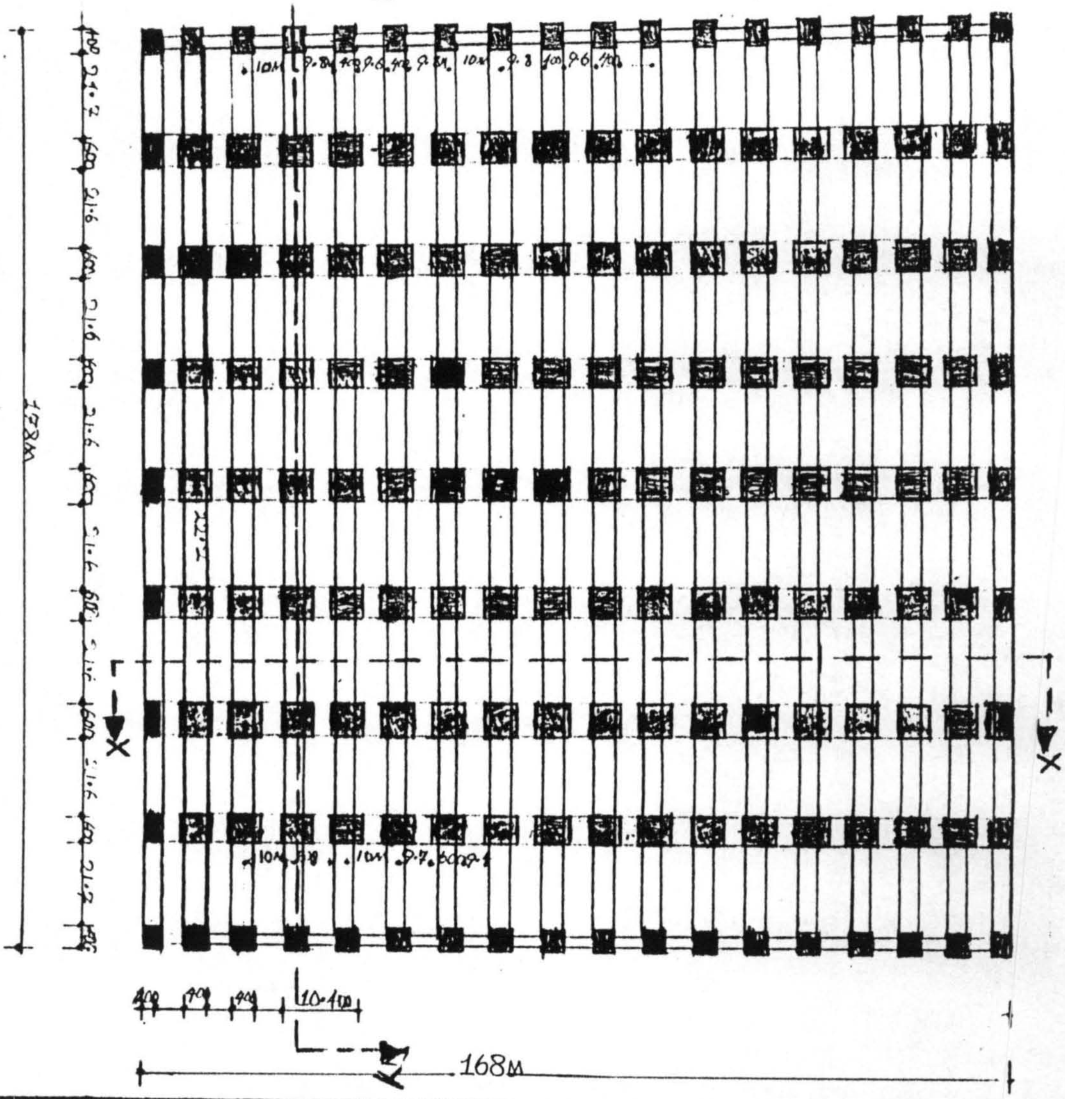
DATE: YEAR 2000

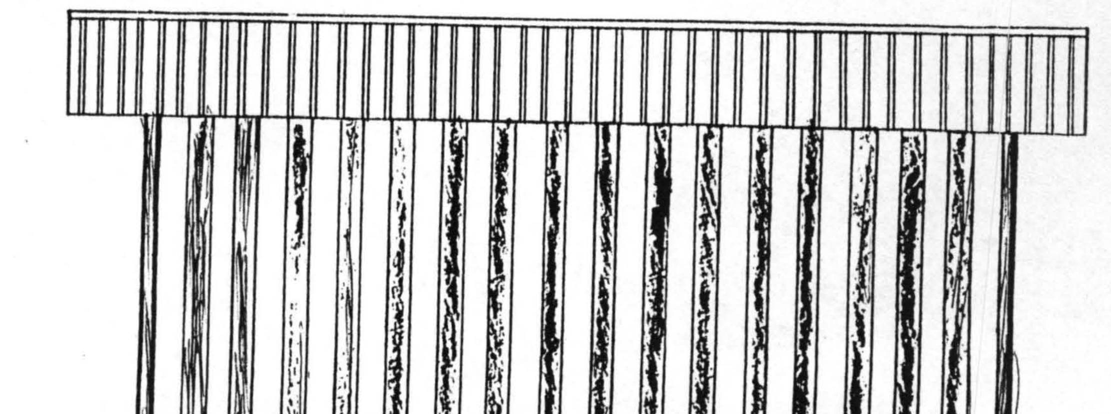
SCALE: 1:100

FIG. (1)

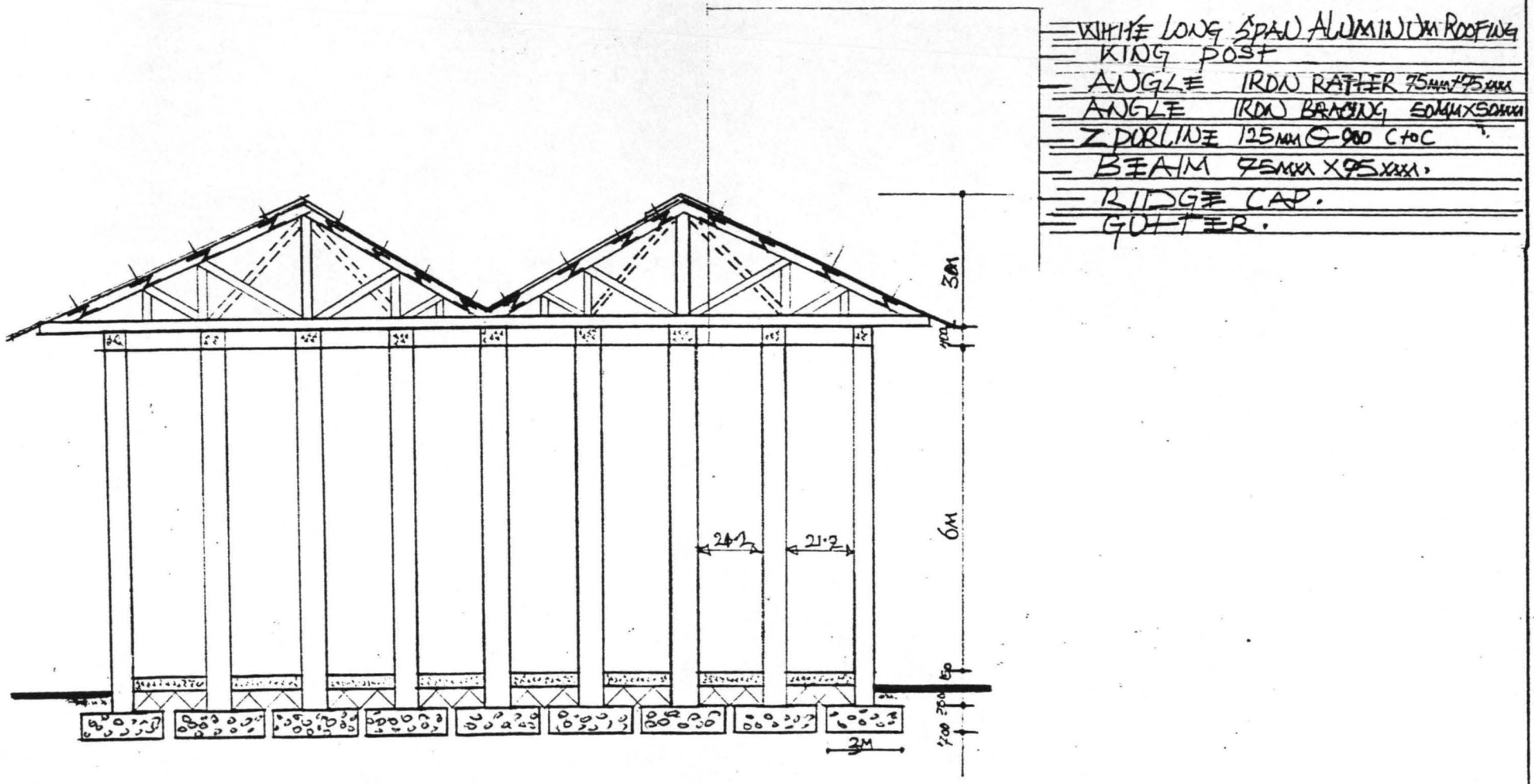
PLAN DRAWING, FOR THE FARM MACHINERY & IMPLEMENTS SHED FOR LOCAL GOVERNMENT AREA OF NIGER STATE.

FIG (2)



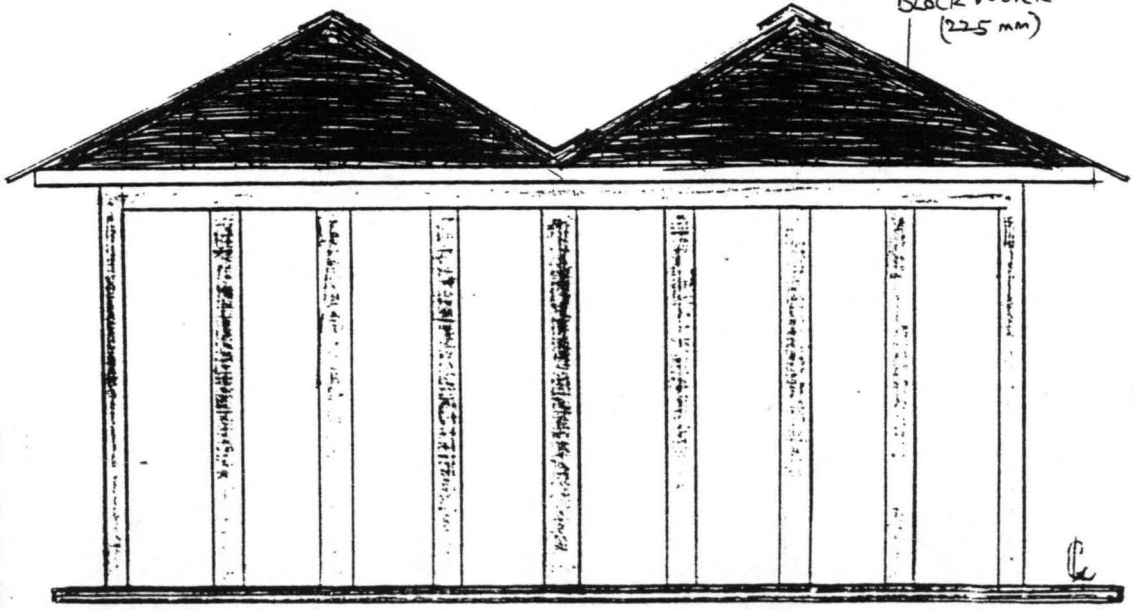


SIDE VIEW DRAWING FOR THE FARM MACHINERY & IMPLEMENTS SHED FOR LOCAL GOVERNMENT AREA OF NIGER STATE.



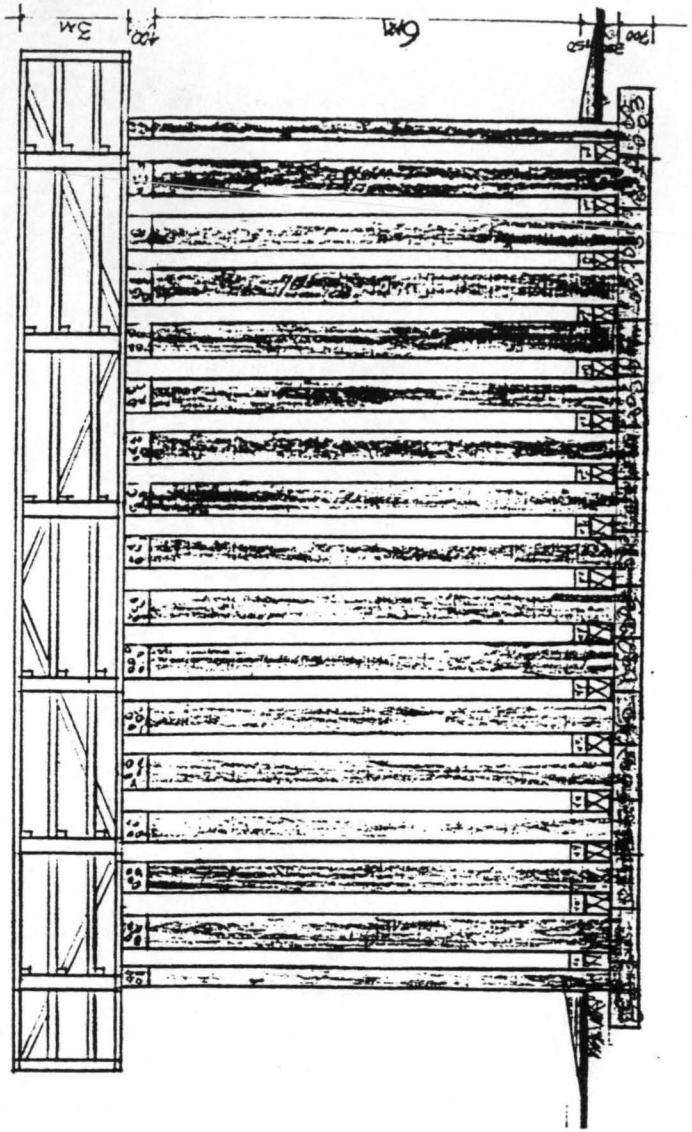
SECTION Y-Y DRAWING

FIG. (3)



FRONT VIEW DRAWING.

FIG. (4)



CROSS SECTION X-X DRAWING

APPENDIX 1: COMPUTATION FOR DESIGN SPACE OF FARM MACHINERY AND IMPLEMENT SHED.

LOCAL GOVT	TRACTORS	TOTAL NO	LENGTH (M)	BREADTH (M)	HEIGHT (M)	WEIGHT (Kg)
RAFI	MF 375 E	8	3.6 X 8 =29m	2.0 X 8 = 16m	2.6m	2488 Kg
MAGAMA	STEYR 8075	10	3.6 X 10 =36m	1.7 X 10 = 17m	2.4m	3800kg
SHIRORO	NEW HOLLAND	2	4.3 X2 = 8.6m	2.0 X 2 = 4m	2.6m	3300Kg
SULEJA	FORD 4635	2	4.3 X2 = 8.6m	2.0 X 2 = 4m	2.6m	3250Kg
KONTAGORA	FORD 4630 FIAT8066	3	3.5 X3=10.2m	2.0 X 3 = 6 m	2.6m	3430Kg

APPENDIX 2

LOCAL GOVT	TIPPING TRAILERS	TOTAL NO	LENGTH(M)	BREADTH(M)	HEIGHT(M)	WEIGHT (Kg)
WUSHISHI	MF	7	4.0 X 7 =28m	1.0 X 7 = 14m	1.0m	762 Kg
MINNA	(BAMFORD)	4	3.2 X 4 = 12.8m	2.0 X 4 = 8m	1.8m	1920 Kg
MINNA	FIAT	3	4.0 X 3 =12m	1.8 X 3 = 5.4m	1.0m	762 Kg
MOKWA	FORD	2	4.0 X 2 = 8m	1.8 X 2 = 3.6m	1.0m	762 Kg

APPENDIX 3

Local Govt.	Ploughs	Total No	Length (m)	Breadth (m)	Height (m)	Weight (kg)
BIDA	BAMFORD	3	1.6 X 3 = 4.8m	0.7 X 3 = 2.1m	1.2m	462kg
WUṢHISHI	MF	5	1.6 X 7 = 11.2m	0.7 X 7 = 4.9m	1.2m	462kg
MAGAMA	STEYR	2	1.7 X 2 = 3.4m	0.7 X 2 = 1.4m	1.2m	462kg
MINNA	FIAT	3	1.6 X 3 = 4.8m	0.7 X 3 = 2.1m	1.1m	452kg
MỌKWA	BALḊAN	2	1.7 X 2 = 3.4m	0.7 X 2 = 1.4m	1.1m	452kg
PAIKORO	FORD	3	1.6 X 3 = 4.8m	0.7 X 3 = 2.1m	1.2m	462kg

APPENDIX 4

Local Govt.	Harrows	Total No	Length (m)	Breadth (m)	Height (m)	Weight (kg)
BOSSO	STEYR	2	2.4 X 2 = 4.80m	1.9 X 2 = 3.80m	1.5m	1216 Kg
AGWARA	FORD	2	2.4 X 2 = 4.80m	1.9 X 2 =3.80m	1.5m	1216 Kg
SHIRORO	FIAT	1	2.4 X 1 = 2.40m	1.9 X 1 = 1.90m	1.5m	1216 Kg
LAVUN	MF	2	1.9 X 2 = 3.80m	2.10 X 2 = 4.10m	0.70m	1016 Kg

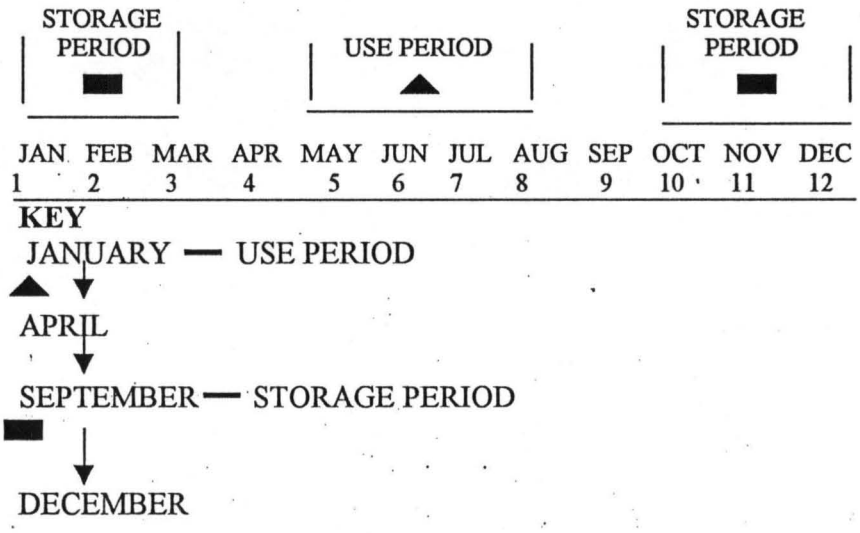
APPENDIX 5

Local Govt.	Ridger	Total No	Length (m)	Breadth (m)	Height (m)	Weight (kg)
KONTAGORA	MF	2	3.10 X 2 = 6.20m	1.20 X2 = 2.40m	1.0m	460kg
RAFI	BAMFORD	2	3.70 X 2 = 7.40m	0.8 X 2 = 1.60m	0.9m	480kg
WUSHISHI	PERMETER	3	3.10 X 3 = 9.30m	1.20 X 3 = 2.60m	1.0m	594kg
MAGAMA	FIAT	2	3.10 X 2 = 6.20m	1.20 X 2 = 2.40m	1.0m	460kg
SHIRORO	BALDAN	1	3.70 X 1= 3.70m	0.80 X 1 = 0.80m	0.9m	680kg

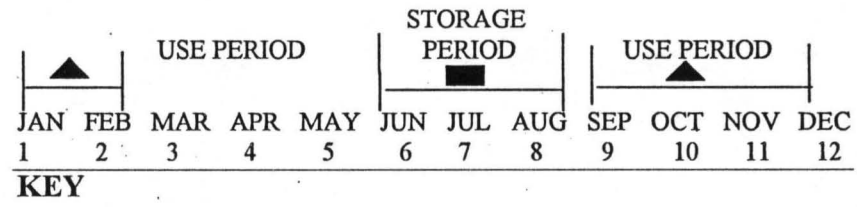
APPENDIX(5)

THE ANNUAL USE OF AGRICULTURAL MACHINERY AND IMPLEMENTS IN LOCAL GOVERNMENT AREAS IN NIGER STATE

A. TRACTORS/PLOUGH/I HARROWS/ RIDERS/I PLANTERS /DICHERS/ MOULD BOARD/ RIDGERS.



A. TRACTORS WITH TRAILERS/ HARVESTERS/ SHELLERS.



B. SEPTEMBER
USE PERIOD
FEBRUARY

MARCH — STORAGE PERIOD
AUGUST

APPENDIX (7)

Floor and Roof Loads

	kN/m²
Classrooms	3.0
Dance halls	5.0
Flats and houses	1.5
Garages, passenger cars	2.5
Gymnasiums	5.0
Hospital wards	2.0
Hotel bedrooms	2.0
Offices for general use	2.5
Flat roofs, with access	1.5
Flat roofs, no access	0.75

Bar Areas and Perimeters

Sectional areas of groups of bars (mm²)

Bar size (mm)	Number of bars									
	1	2	3	4	5	6	7	8	9	10
6	28.3	56.6	84.9	113	142	170	198	226	255	283
8	50.3	101	151	201	252	302	352	402	453	503
10	78.5	157	236	314	393	471	550	628	707	785
12	113	226	339	452	566	679	792	905	1020	1130
16	201	402	603	804	1010	1210	1410	1610	1810	2010
20	314	628	943	1260	1570	1890	2200	2510	2830	3140
25	491	982	1470	1960	2450	2950	3440	3930	4420	4910
32	804	1610	2410	3220	4020	4830	5630	6430	7240	8040
40	1260	2510	3770	5030	6280	7540	8800	10100	11300	12600

Perimeters and weights of bars

Bar size (mm)	6	8	10	12	16	20	25	32	40
Perimeter (mm)	18.85	25.1	31.4	37.7	50.2	62.8	78.5	100.5	125.6
Weight (kg/m)	0.222	0.395	0.616	0.888	1.579	2.466	3.854	6.313	9.864

Bar weights based on a density of 7850 kg/m³.

APPENDIX (8)

Sectional areas per metre width for various bar spacings (mm^2)

Bar size (mm)	Spacing of bars								
	50	75	100	125	150	175	200	250	300
6	566	377	283	226	189	162	142	113	94.3
8	1010	671	503	402	335	287	252	201	168
10	1570	1050	785	628	523	449	393	314	262
12	2260	1510	1130	905	754	646	566	452	377
16	4020	2680	2010	1610	1340	1150	1010	804	670
20	6280	4190	3140	2510	2090	1800	1570	1260	1050
25	9820	6550	4910	3930	3270	2810	2450	1960	1640
32	16100	10700	8040	6430	5360	4600	4020	3220	2680
40	25100	16800	12600	10100	8380	7180	6280	5030	4190

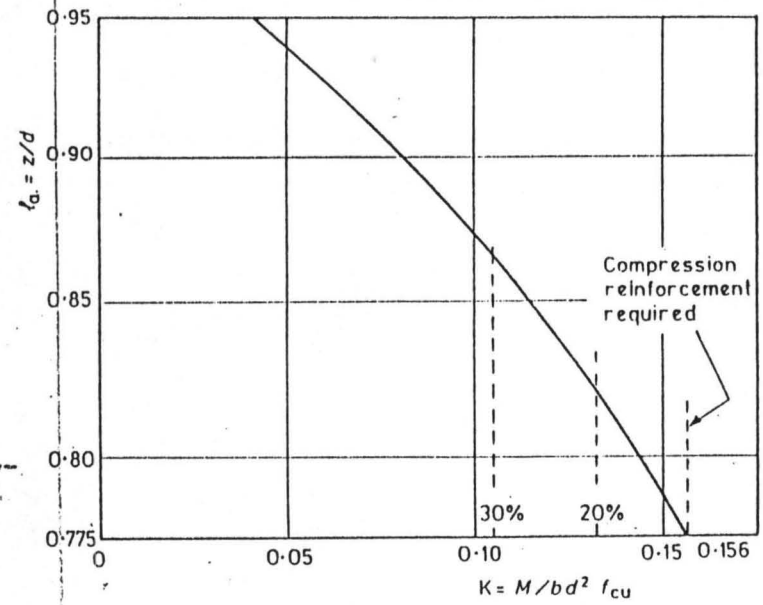
Shear Reinforcement

A_{sv}/s_v for varying stirrup diameter and spacing

Stirrup diameter (mm)	Stirrup spacing (mm)										
	85	90	100	125	150	175	200	225	250	275	300
8	1.183	1.118	1.006	0.805	0.671	0.575	0.503	0.447	0.402	0.366	0.335
10	1.847	1.744	1.57	1.256	1.047	0.897	0.785	0.698	0.628	0.571	0.523
12	2.659	2.511	2.26	1.808	1.507	1.291	1.13	1.004	0.904	0.822	0.753
16	4.729	4.467	4.02	3.216	2.68	2.297	2.01	1.787	1.608	1.462	1.34

APPENDIX (9)

$K = M/bd^2 f_{cu}$	0·05	0·06	0·07	0·08	0·09	0·10	0·11	0·12	0·13	0·14	0·15	0·156
$f_a = z/d$	0·941	0·928	0·915	0·901	0·887	0·873	0·857	0·842	0·825	0·807	0·789	0·775



The % values on the K axis mark the limits for singly reinforced sections with moment redistribution applied (see Section 4.7)

Figure 7.5 *Lever-arm curve*

APPENDIX (10)

DESIGN OF FARM MACHINERY AND IMPLEMENTS SHED

FOR LOCAL GOVERNMENT AREAS IN NIGER STATE

INTRODUCTION:-

The objective of this project is to design a farm machinery shed for the Local Government Headquater Areas of Niger State. In view of this, it will be very much appreciated if you will complete this questionnaire by providing a sincere respond to all the questions.

Whatever information given will be taken into confidence.

1. Local Government Area:_____

IMPLEMENTS:-

PLOUGHS

TYPE NO._____	MAKE	DIMENSIONS			SPECIFICATION	WEIGHT
1		LENGHT	BREADTH	HEIGHT		
2						
3						
4						
5						
6						
7						
8						

HARROWS

TYPE NO._____	MAKE	DIMENSIONS			SPECIFICATION	WEIGHT
1		LENGHT	BREADTH	HEIGHT		
2						
3						
4						
5						
6						
7						
8						

APPENDIX (II)

RIDGERS

TYPE NO._____	MAKE	DIMENSIONS			SPECIFICATION	WEIGHT
		LENGHT	BREADTH	HEIGHT		
1						
2						
3						
4						
5						
6						
7						
8						

SPRAYERS

TYPE NO._____	MAKE	DIMENSIONS			SPECIFICATION	WEIGHT
		LENGHT	BREADTH	HEIGHT		
1						
2						
3						
4						
5						
6						
7						
8						

BOUND FORMERS

TYPE NO._____	MAKE	DIMENSIONS			SPECIFICATION	WEIGHT
		LENGHT	BREADTH	HEIGHT		
1						
2						
3						
4						
5						
6						
7						
8						

APPENDIX(12)

MACHINES:-
TRACTORS

NO. TYPE	MAKE	MODEL	DIMENSIONS			ENGINE CAPACITY	WEIGHT
1			LENGHT	BREADTH	HEIGHT		
2							
3							
4							
5							
6							
7							
8							

HARVESTERS

NO. TYPE	MAKE	MODEL	DIMENSIONS			ENGINE CAPACITY	WEIGHT
1			LENGHT	BREADTH	HEIGHT		
2							
3							
4							
5							
6							
7							
8							

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DICHERS

APPENDIX(13)

NO. TYPE	MAKE	DIMENSIONS			SPECIFICATION	WEIGHT
		LENGHT	BREADTH	HEIGHT		
1						
2						
3						
4						
5						
6						
7						
8						

DISC RIDGERS

NO. TYPE	MAKE	DIMENSIONS			SPECIFICATION	WEIGHT
		LENGHT	BREADTH	HEIGHT		
1						
2						
3						
4						
5						
6						
7						
8						

MOULD BOARD RIGERS

NO. TYPE	MAKE	DIMENSIONS			SPECIFICATION	WEIGHT
		LENGHT	BREADTH	HEIGHT		
1						
2						
3						
4						
5						
6						
7						
8						

SHELLERS

APPENDIX (14)

NO. TYPE	MAKE	MODEL	DIMENSIONS			ENGINE CAPACITY	WEIGHT
			LENGHT	BREADTH	HEIGHT		
1							
2							
3							
4							
5							
6							
7							
8							