KANO MODERN FURNITURE INDUSTRY
(NOISE & VIBRATION IN FURNITURE INDUSTRIES)

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(ND, HND, Bsc, ARCH.)

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OCTOBER, 1998

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DECLARATION

I, USMAN MUHAMMAD ADAMU of the Department of Architecture, Faculty of Environmental Design A.B.U. Zaria hereby declare that this thesis work has been a personally undertaken and researched by me under the supervision of my mentor Architect SALISU of the Department of Archtitecture A.B.U. Zaria and all quotations and information utilized and their sources, have been acknowledged by use of references.

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IV

D E D I C A T I O N.

This peace of work is dedicated to my parents

ACKNOWLEDGEMENT

I wish to acknowledge with gratifude the willing cooperation and assitance as well as priceless advise to me by my memtor Arch Salisu of the department of Architecture.

I also reserved gratitude to the members of staff of the department as well as friends in the class and other students as well who has in one way or the other help in the achievement of this project.

Special gratifude goes to my wife and children for the patience they have endure during my absence to the school.

Above all my thanks goes to the almighty Allah who is my greatest source of inspiration.

ABSTRACT.

Furniture are certainly needed by all human beings in order to facilitate their struggle for human existence.

As we are now witnessing a tremendous increase in human Habitations, the need for furniture industries are very much needed and indeed everywhere.

Though some furniture industries are existing, but still more organised ones are needed as large part of the population rely on self employed artisns of which are most unreliable and cannot marshy produce the highly demanded items.

On the economic point in view, upon all the availability of the raw materials furniture are still being imported into the country which gives a clean indication of well needed industries in order to produce skillful items needed.

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CHAPTER ONE

1. INTRODUCTION

Furniture are certainly needed by all human beings in order to facilitate their struggle for human existence.

As we are now witnessing a tremendous increase in human Habitations, the need for furniture industries are very much needed and indeed everywhere.

Though some furniture industries are existing, but still more organised ones are needed as large part of the population rely on self employed artisans of which are mostly unreliable and cannot marshy produce the highly demanded items.

On the economic point in view, upon all the availabilities of the raw materials furniture are still being imported into the country which gives a clean indication of more needed industries in order to produce skillful items needed.

1.1 NEED FOR THE INDUSTRY

The justifications behind this proposal are

1. Due to rapid increase in human Habitations that led to high demand of furniture.

2. Few availability of such industries in Kano.

3. To replace unemployment

4. To cut down inflation

5. To save the scarced foreign exchange.

1.2 AIMS AND OBJECTIVES

The aims to be achieved are as follows:

1. A unique and purpose approach to the factory design.
2. Flexibility and future expansion consideration.
3. A good and well related working environment
4. A safely working environment
5. A good accessibility and circulation network
6. Effective utilization of site and natural resources
7. A scaled form that will give harmony and interest.
8. Proper use of materials with quality and economy.

The project intends to find a satisfactory solution for the intended purpose.

The buildings environment, the machines and other tools that are involved in the process as well as the materials involved are going to be organised properly within the building.

The project also intends to come with a suitable construction techniques and proper use of materials as well to harmonise with the activities to be taking place.

1.3 METHODOLOGY

The research method adopted are listed below.

1. Employment of primary sources such as field work, interviews etc.

2. Employment of secondary sources such as case studies of related industries, and

3. Literature review.

1.4 SCOPE AND LIMITATIONS

The aim is to provide a well researched solution to proper design of the industry putting in mind the relationship between the productive hall, storage, workers facilities, administrative and other supporting facilities.

Though the proposal has been limited to the programmes as mentioned below, future expansion has been given a room.

1.5 PRODUCTION PROGRAMME

The production programme of the industry comprises of:

1. All types of furniture i.e Residential, Schools, Hospitals, Recreational etc.
2. Panelled doors and windows.
3. Wall panelled and cladings
4. Ceilings and interior decorations

CHAPTER TWO

2.0 DEFINITION

Furniture can be defined as household items use for relaxation, storage, working etc. They can be moveable or free standing i.e. chairs, tables or beds and may be fixed such as wardrobes, cupboards, cabinets etc. and made from wood, metal, plactic or composite.

2.1 HISTORICAL BACKGROUND

History is generally regarded as a recorded narrative of past events connected with the course of human affairs, especially concerning those of a particular period, nation or individual.

But there are other ways in which history can be recorded such as in architecture, musci, literature and furniture and each of these reflect the life and feelings of the people concern.

As our homes and material possessions reflect our scientific age and our way of life so as the furniture of different periods portray the search for a satisfactory way of life of the people.

There is no certainly on when furniture were started, but the fact is that even in the early days people used to produce furniture items to define their use such as the peculiar earth bed used in the Egyptian pyramid or the row sits in Greeks Agoras - we can say that it is as old as human existence.

2.2 FURNITURE DEVELOPMENT

If we are to understand the development of furniture, we should have to examine the underlying factors related to changes

rather than appreciating the artistic and technical skills of the crafts men. This factors are:-

1. Purpose of the article, which is determined by the needs peculiar to the way people live at different times - how they eat, sleep, work etc.

2. General technical knowledge:- availability of tools and materials.

3. Different materials: Which gives guides to the construction method and treatment.

Other factors are social structure, intellectual level, religion etc.

Also as the demand for material comforts increased according to new living standard, the need for new buildings for new purposes led to different types of work being allocated to builders with special qualifications and hend the gradual development of furniture to suit man's needs and this led to invention of new items for new purposes.

2.3 GROWTH OF MODERN FURNITURE

Just like in architecture this movement can be traced back to about the middle of 19th century when several progressive thinkers rebelled against the tasteless and ostentations products of commercial production.

These reformers believed that industrial techniques and arts and craft were incompatible, and that the low standard of

design and excessive ornamentation displayed by the revived style was partly due to the creative spirit being directed to technical achievement and the wealth it produce and partly due to the lack of aesthetic ability of the industrialist to distinguish between good and bad designs.

About 1860 William Morris led a group of designers And artist and established a firm "William Morris" and company which specialise in producing hand made furniture and furnishings made from their own design.

Morris' work study the beauty in nature and its simple forms, then work its materials by hand so that "human touch" could express not only the quality of the materials, but also the character of the designer crafts-man. This influence of Morris is as a result of his inspiration of A.W. Pugin and John Ruskin theories which are medievals.

2.4 **ARTS AND CRAFT MOVEMENT** (1882-1910)

This movement was carried out by some of the followers of Ruskin and Morris who still insist on humble hand made articles than machine made. They use to sell this ideas through exhibition and publicizing their designs.

Their designs were simply constructed, plain, heavy and usually made of oak clearly showing that they are hand made with decorations of floral onrament rather than the conventional symbol of the middle ages.

Later Sir Ambrose Heal also a disciple of Morris school and

also a member of the Arts and Craft Movement applied the use of machines for producing furniture on a commercial scale at an affordable price to the public, his design was simple and functional and suitable for machine production.

2.5 **ART NOUVEAV MOVEMENT** (1895-1910)

This simply means "New Art" similar to the art and craft movement. The Nouveau movement was as the result of the reaction against the shoddy electicism of the 19th century furniture designs but in this case it is suitable for mass production.

Art Nouveau became a new style in art, architecture, furniture and furnishing.

Victor Hortar in 1892 initiated the change in England by designing a series of houses with furniture and fittings featuring the new style.

Henri Van de Velde also a Belgian architect also exhibited rooms furnished in similar style at Brussels in 1894 and in a shop in Paris called "Art Nouveau" in 1895.

The characteristics of the design was long sweeping curve lines with the structural features emphasized to show strength, and the whole decorated with paint or applied ornament based on elements symbolising nature.

2.6 **BAUHAUS SCHOOL** (1919-1937)

This is a complete break from the past. It was a school designed to train designers in all fields of arts and crafts

and for teaching experimental methods for designing for industries.

It was formed in 1919 from Werkbund School of Arts and Craft by Walter Grophius during the reconstruction of Germany after the World War I.

The students were taught to forget about the past and to search, experiment and invent new functional forms which were suitable to the materials and tools used.

Remarkable achievement on this is the development of steel tubalar from furniture by Marcel breurer, Mies der Rohe and Mart Stam in 1920s which were universely accepted with their functional and comfortable forms that can be produced with a minimum cost, material and effort.

CHAPTER THREE

3.0 MATERIALS INVOLVED

For the design of the industry to be successful, a good knowledge of the material to be dealt with in the industry must be gained.

In furniture factory the principal materials involved are timber and metal.

3.1 TIMBER

Is obtained from two botanical classes of trees.

1. **Angiosperms**:-

   This consists of seeds in fruits broad leaves and produces hard wood.

2. **Gymnosperms**:-

   Consists of naked seeds in cones with narrow leaves and produces soft wood.

3.1.1 Growth

Timber grows in form of tree and as other trees consists of roots which anchor the tree and obtain water and chemicals in solution from the soil, trunk, stem which support the crown that consist leaves, twigs and branches. P. 192

3.2 PROPERTIES OF TIMBER

The selection of timber for furniture purposes depends mainly on external appearance characteristics and the working

qualities of the wood, but consideration must also be given to density, mass, various strength, properties, shrinkage and durability.

3.2.1 **The Appearance Characteristics**

This relies on the visible nature and arrangement of the wood elements, which are characteristics feature of each species of timber.

(a) Colour:- Depends on the substances and chemicals in the cells and cell walls.

(b) Grain:- refers to the direction of the wood elements, and varies according to the position the board occupies in the tree and the conversion method used to cut it out of the log.

(c) Texture:- refers to the variation in size, quality, and distribution of the cells types present in the wood. The texture may be coarse, fine, even, uneven and either rough, smooth or oily to touch.

(d) Figure:- is a term used to timbers that give an unusual or attractive designs as the result of variations in colour, grain and texture, due to the natural arrangement of the elements, method of conversion or irregularities in the tree such as knots, burls and crotches.

3.2.2 **Working Qualities**

This refers to the ease or difficulty in dealing with i.e of sawing, planing, chiseling, carving, bending, turning, gluing

and nailing. These are influenced by the density, texture, grain, hardness and toughness of the wood and the presence of materials such as crystals of silica in the cells or oil.

Working qualities also include the ability of the timbers to take finishes such as paint, Stains etc.

3.2.3 Shrinkage

When the tree is fell the moisture or sap from the wood would be drying and the body stark to shrink - thus the dimension of the timber decreased due to the decreasing moisture content of the wood.

The wood will continue to shrink as it dries until it is in equilibrium with the relatice humidity of the environment.

3.2.4 Seasoning

About fifty percent of many freshly cut timbers consists of moisture or sap.

Large part of this moisture must be removed before the timber can be put to use. During seasoning the excess moisture from the wood are removed to a stage in equilibrium with the relative humidity of the atmosphere of the place the wood is to be used.

To avoid distortion and splitting before use, efforts are made to control the rate and degree of seasoning to ensure that all the shrinkage has systematically taken place.

3.2.5 Seasoning Types

There are two types of seasoning

1. **Natural Seasoning**

The timber is stacked on bearers raised about 450mm above the ground. Strips of wood of about 38 x 19mm are spaced 600 - 750mm apart between the layers of the wood or boards to allow for the circulation of air.

Water proof covering should be place over the stack to prevent weather and excessive sun which may cause surface checking. The moisture content of air seasoning is about 15-20%. (p. 220 seasoning)

2. **Kiln Seasoning**

The timber is stack as above and placed in special drying rooms or oven called kilns where the temperature, humidity and air circulation can be carefully contolled from outside the kiln manually or automatically. The moisture content of kiln seasoning is about 8-16%.

3.2.6 Conversion of Timber

Conversion is the process of sawing logs into square edged pieces of timber suitable for use by carpenters, joiners, etc. The logs are converted into commercial sizes as soon as the tree is felled in order to minimize shrinkage damage.

This converted timber is in green rough sawn state, and has to be seasoned and dresses before use. (p. 226 conversion).

3.2.7 **Defect in Timber**

This refers to any irregularity that man entertains With the strength, durability or utility value of the timber.

Defects may be "natural" or "artificial". Natural defects are those which are characteristic of the wood and are present in the growing tree i.e growth defects, grain irregularities and shakes.

Artificial defects are caused by careless handling, incorrect conversion and seasoning techniques and inadequate protection or preservation of the timber.

Some can also be caused by lighting, strong winds, fire, diseases and parasites such insects, marine organism and fungi.

Many of the defects can be avoided by proper conversion and seasoning methods and by careful selection of the timber in relation to its subsequent manufacture into commercial article. (p. 236 defect in timber).

3.2.8 **Preservation of Timber**

Preservation is the process used to prolong the serviceability state of the timber.

The deterioration of wood may be caused by fungi, insects, weather and fire.

Fungal and insect attack are prevented by the use of highly poisonus insecticides to insects and fungi readily absorbed preservatives which remains effective for many years.

3.3 PROPERTIES OF METALS

The selection of metals for furniture purposes depends mainly on the functional and structural use.

Appearance of metals mostly does not count as it is usually painted to the required colour needed.

In terms of working quality metals components used in furniture are mostly easy to hand le and can easily take finishes.

3.4 TIMBER AND METAL FINISHES

Finishing is the term used in describing the coating or polishing that is usually applied to the finished item in order to give it its final appearance.

There are many types of finishes applied to wood work and metal. Each type is designed to satisfy certain requirements considering the type of material to be finished, the use of the article, whether for external or internal use, degree of gloss or lustre required, method of application and durability.

Some finishes are more suitable for certain purposes than others; and some because of their composition, are more difficult to handle and apply than others.

Surface finishes are applied to wood and metal items for the following reasons:

1. **For Protection of Surface**

   Finishes in forms of paints, varnishes and enamels form a

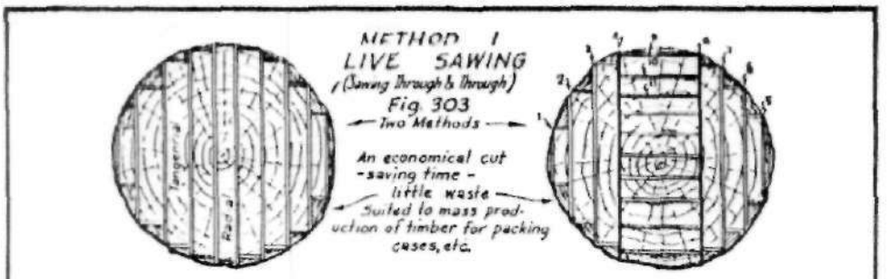
protective film or coating against dirt, moisture, abrasion and some chemicals.

2. For **Decorative Purposes**

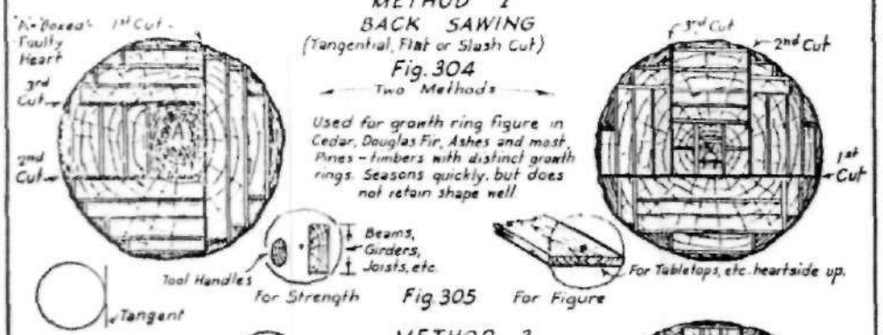
Beauty is one of the fundamental purposes of any design. Finishes are used to bring out the appearance of the items which largely depend on the material used as well as the use of the article, for example opaque finishes can be coated on the materials of which its texture needs not to be seen and on the other hand stained transparent finish can be applied to items of which its natural beauty of the grain needs to be appreciated.

3. **For Hygenic Reasons**

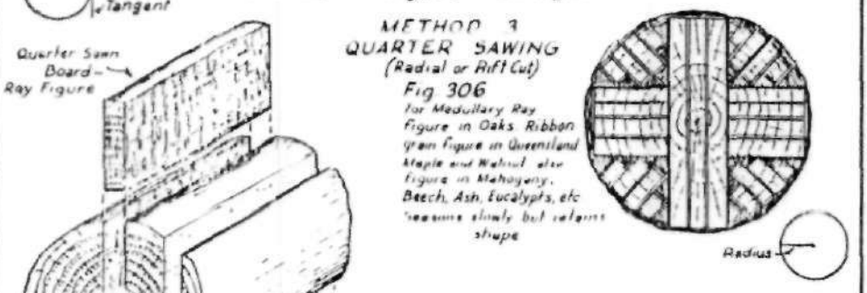
Metal or timber surfaces that are coated or protected with a smooth film are easier to clean and keep free of dust, stains etc than those left uncovered



METHOD 1
LIVE SAWING
(Sawing Through & Through)
Fig. 303
Two Methods
An economical cut
- saving time -
little waste
Suited to mass production of timber for packing cases, etc.



METHOD 2
BACK SAWING
(Tangential, Flat or Slash Cut)
Fig. 304
Two Methods
Used for growth ring figure in Cedar, Douglas Fir, Ashes and most Pines - timbers with distinct growth rings. Seasons quickly, but does not retain shape well.
"Re-Boxed" 1st Cut - Faulty Heart
3rd Cut
2nd Cut
3rd Cut
2nd Cut
1st Cut
Beams, Girders, Joists, etc.
Tool Handles
for Strength
Fig 305
For Figure
For Tabletops, etc. heartside up.
Tangent



METHOD 3
QUARTER SAWING
(Radial or Rift Cut)
Fig 306
for Medullary Ray figure in Oaks. Ribbon grain figure in Queensland Maple and Walnut also figure in Mahogany. Beech, Ash, Eucalypts, etc
Seasons slowly but retains shape
Quarter Sawn Board - Ray Figure
Back Sawn Board - Ring Figure
Radius
Radial
Radial
Wearing Qualities
Quarter sawing for pieces required to retain shape.
1. Door frames
2. Mouldings, etc.
3. Window sashes
4. Flooring boards, etc.
5. Wooden plane stocks.
Showing Back Sawn and Quarter Sawn Boards
Fig. 307

Figs. 303-307

CONVERSION OF TIMBER

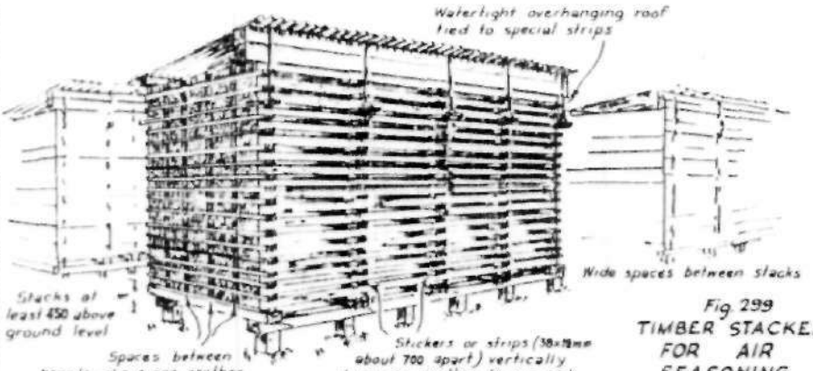
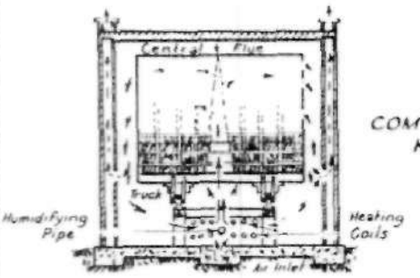


Fig 299
TIMBER STACKED FOR AIR SEASONING



COMPARTMENT KILNS

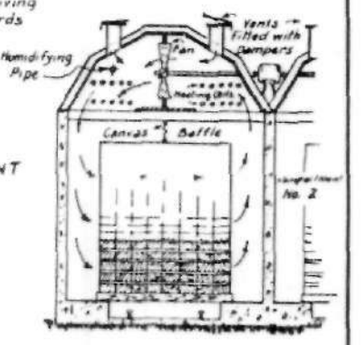
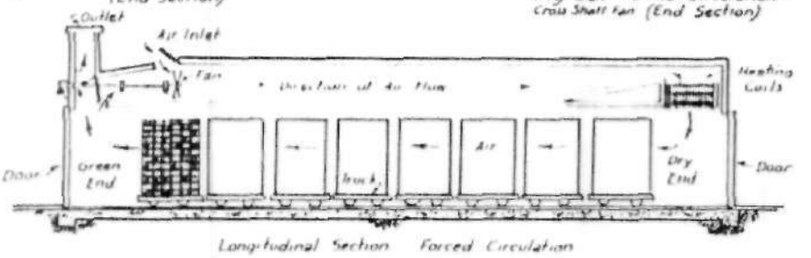


Fig 300 Natural Circulation (End Section)

Fig 301 Forced Circulation - Cross Shaft Fan (End Section)



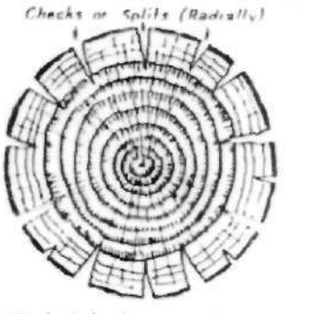
Longitudinal Section Forced Circulation

Fig 302 PROGRESSIVE KILN

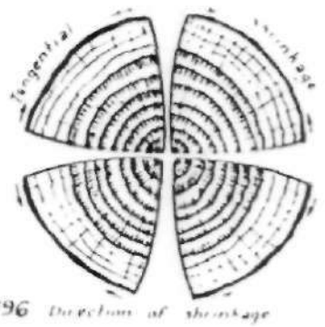
TWO METHODS OF 'ACCELERATED' SEASONING

SEASONING OF TIMBER

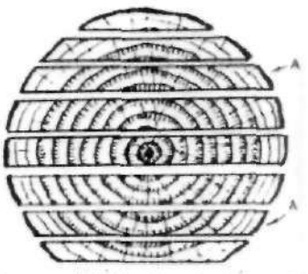
Figs 299-302

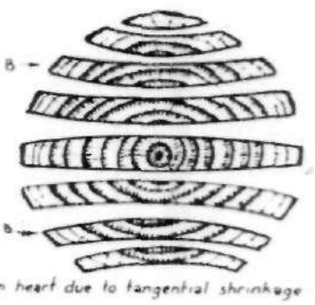


295 Effect of shrinkage on a log



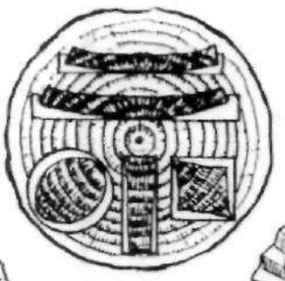
296 Direction of shrinkage



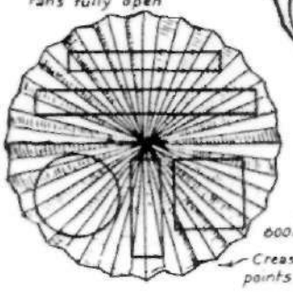


297

Showing at B how boards at A CUP away from heart due to tangential shrinkage



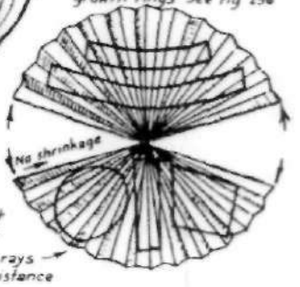
Various shapes marked with brush and ink - fans fully open



298

Effects of shrinkage on shaped pieces

Shapes when fans are slightly closed i.e shrinkage around growth rings See Fig 296



Paper fans made from folded paper strips about 600mm long and 150mm wide

Creases represent medullary rays - points on these remain same distance from centre

Figs. 295 - 298

EFFECTS OF SHRINKAGE

PLATE 66.

CHAPTER FOUR

4.0 DESIGN CONSIDERATION OF INDUSTRIES

In designing an industry certain factors or elements have to be considered in order to achieve a well design one.

These factors can be discussed under planning and design concept.

4.1 PLANNING

Factors under planning include:

4.1.1 Physical Factors

This aspect includes the choice of site and its merits and demerits. That is the site has to be properly located and in accordance with the physical planning authority policies. It has to be easily accessible for convenience of supply of raw materials and the distribution of finished goods.

4.1.2 Economic Factors

Industries have to be designed to a minimum cost as possible in order to quickly realise the profit which is the purpose of its implementation, but this should not be over emphasized so as not to impere with durability.

4.1.3 Climatic Factors

Climatic analysis of the area of location must be done. Climatic conditions such as rainfall, relative humidity, temperature etc have effect on the durability or serviceability of some materials hence this factors have to be analysed in order to control them. For example high relative humidity can

cause wood to absorb moisture from the atmosphere and swell, also metal can rust when it falls under the same condition.

4.1.4 Topography

This has very important role to play in choosing correct site for an industry a very slopy site can make movements of materials and goods difficult.

In addition to the above the site must contain stable subsoil to contained adequate foundation and plants without undue expensive ground work.

It must also be unswampy devoid of ground erosion.

4.2 DESIGN CONCEPT

The design concept must consider the followings:

(a) **The Apron:**

The distance from the street to the buildings inside the site.

(b) **Vehicular Movement:** In and out including maneuvering area of tructs as well as loading and off loading.

(c) **Storage Facilities**

For both the raw materials and finish items.

(d) **Type of Materials:**

The materials to be dealt with must be analused so that they can be used to aid the design of the production hall and storage.

(e) **Production Process**

This must be known so as to establish a good working relationship between the buildings.

(f) **Main Layout**

The layout of various units of the industry must be properly placed without intermingling of activities.

CHAPTER FIVE

5.1 NOISE AND VIBRATION

The noise is factories should be the concern of everybody in the design and layout, from the very beginning.

As the method of manufacture largely determines the amount of noise, the initial decisions are important.

Moreover, responsibilities are derided; noise reduction at source is the concern of the mechanical engineer while sound absorption is that of the Architect, and personal protection i.e the use of ear muffs will need to be administered by management.

Before I go further, to the sources of noise and vibration which would be my focus of discussing, it is pertinent to expantiate some of the definitions that are of paramount importance towards understanding the subject matter.

5.1.1 Acoustics

Is the science of sound in relation to the source of hearing which is normally through the ear, inside which motions are scrutinize and communicate to the brain for analysis.

5.1.2 Sound

Can be defined as a vibration in an elastic medium - solid, liquid or gaseous. This vibration induces pressure to the surrounding media which lead to the formation of wares that guided the sound to the ear.

As we can see from the above we can conclude every acoustical situation interms of only but the three thus source, path and receiver, yet the most uncompromising effect is that in most cares sound is translated as abominable to somebodies hearing.

So the basic task on us as designers is therefore not only to start thinking of how to provide a satisfactory acoustical environment for the building type under consideration but firstly identified the sources of the noise.

5.1.3 **Noise**

Can be defined as a jumble of may sound of differents quality which produces unwanted effect to the hearing. In addition it can cause temporary or permanent defirmation to the receiver and can cause structure borne sould at the sametime causing discomfort to workers.

5.1.4 **Vibration**

Sand waves are capable of being reflect on hiting structures and this recflection could cause parts or whole of the structure to shake to considerably.

In other hands Rotating Machineries Mould solidly to its supporting structure transmits all its vibrational forces to that structure. This can result in damaging or isturbing displacement of the floor, depending on the magnitude of displacement and frequency.

5.2 SOURCES OF NOISE & VIBRATION.

Funiture factories generated a great deal of noise and vibration due to the act of installing machinery and equipment.

This action at the same time causing discomfort to workers and even neighbours.

Since noise and vibration are the direct result of the production process which is the prima rose, therefore the factory has to be design to eliminate them or at least to minimise or refuce to the lowest land so the workers productivity, will be improves.

There are innumerable sources of noise and vibration but for the purpose of this project I am discussing the followings.

1. **IMPACT**

Noise caused by impact is the most intense and widespread of all industrials noise.

common sources are hammering, ruveting, chipping, pressing and tumbling.

Intense impact noise may also be produced by building of materials. The spect van of the noise depends on the nature and size of the object being worked on as well as on the tool. Impact noise is usually impulsive in character but can be continous, as in tumbling.

2. **RECIPROCATING**

This type of noise is produce where part of a machine is required to reciprocate or vibrate at a frequency above the lower audible limit and this led the moving surface to radiate noise directly.

3. **FRICTIONAL**

The amount of noise produce by friction in such process as griding and sanding is not all that great compared with that produced by many other industrial operations.

In furniture factories frictional forces due to contact of raw materials and machines causes intense noise i.e "2000D" planer and thickness.

4. **AIR TURBULANCE**

Noise can be generated by rapid variations in air pressure caused by turbulence from high velocity air or steam.

5. **NOISE FROM MECHANICAL SERVICES**

Mechanical services for heating, ventilation and pluming are also potential sources of noise. Such sources are from fans, ducts, cooling tower and compressors.

5.3 EFFECT OF NOISE

The main consequences is noise will obviously be borne by the occupants of the factory, and will influence their welfare, safely and indirectly their efficiency.

As the level of noise increases, its effect on people will be first annoyance, then interference with communication and finally damage to hearing.

5.4 NOISE REDUCTION

The process employed in factory is the determinants of the noise.

Many of the noisy process have alternatives For example weeding instead of reviting, pressing instead of fugging and grinding instead of chipping.

5.5 REDUCING POTENTIAL NOISE ENERGY

The precautions that should be taken to keep the noise energy of a source to a minimum are grouped as follows:

1. **Impact**

   Where impact is essential to the process as in hammering or riveting, the possibilities of reducing noise are general and preventing unnecessary impacts.

2. **Reciprocations**

   If reciprocation is part of the process, the ampitude of vibration should be kept as small as possible. When the rate of reciprocations is not important decreasing the speed will reduce the noise. Provided that loose parts are not excited to vibrate at high frequency.

3. **Friction**

Frictional noise from the cutting action of tools and saws is reduced by sharpening tools and proper lubrication of machine parts.

4. **Air Turbulence**

Noise from air and steam exhaust car effectively be reduced using silencer that lowers the escape velocity of the exhaust.

5.6 VIBRATION ISOLATION

The reslient material used for vibration isolation may be in a form of a pad or of a proprietary mounting.

The materials commonly used are feit, cork, glass wool, systhethic rubber and stell spring.

5.7 LAYOUT NOISE

Buildings and high walls between the noise source and the receiver will act as screens, especially for high frequency noise, which is more directional.

Zonning in the layout can also be used to solve noise problems i.e office space should be completely separated from the production area.

5.8 CONCLUSION

Conclusively, it can be seen that noise and vibration are the direct result of the production process.

These problems can be uncompounded by proper layout, detailing of the structure as well as interlocation of the machines involved.

So it is pertinent to mention that designers must appreciate the problems, causes and remedy of noise and vibration in factories so that they can find satisfactory solution to the problems of the aforemention in order to prevent the workers proficiency, metnal and physical fitness as well as the structure from collapse.

CHAPTER SIX

6.0 CASE STUDIES

6.1 IMPORTANCE OF CASE STUDIES

As people are fond of saying "One thing led to another" this is quite true, but in most cases to an even better.

Case study is the study of existing similar items in order to understand properly the materials involved and the processes so that it can be utilised in coming up with better concept of the new scheme.

Case study can be taken as a short cut to successful design.

The purpose of case study is:

1. To study and examine the principles involved in the design of similar proposals.

2. To analye and learn how the exiating acheme han been working.

3. To analyse the merits and demerits of the existing scheme so that the proposed similar one be devoid of such demerits and utilise the merits.

6.2 CASE STUDIES UNDERTAKEN

For the purpose of this project I have taken a case study of the following companiès based on their size and promixity.

6.2.1 A Case Study of "FAWAZ" Metal and Wood Industry

a) **Site Location**:

This industry is located in the heart of "Bompai" industrial Estate in Kano Municipality, and is one of the largest in the country.

b) **Merits**

i. Adequate zoning of activities

ii. Good utilization of space by introducing mezzaning floor for storage.

iii. Flexibility of siting machines

iv Showroom directly facing main road

v. Separation of wood and metal shops

vi. Case of transportation of workers

vii. Adequate natural lighting

c) **Demeits**

i. Related activities taking place at different locations which is uneconomical

ii. Inadequate or no storage facilities

iii. Inadequate spraying room

iv. Less future expansion potentials

v. Non availability of First Aid equipment

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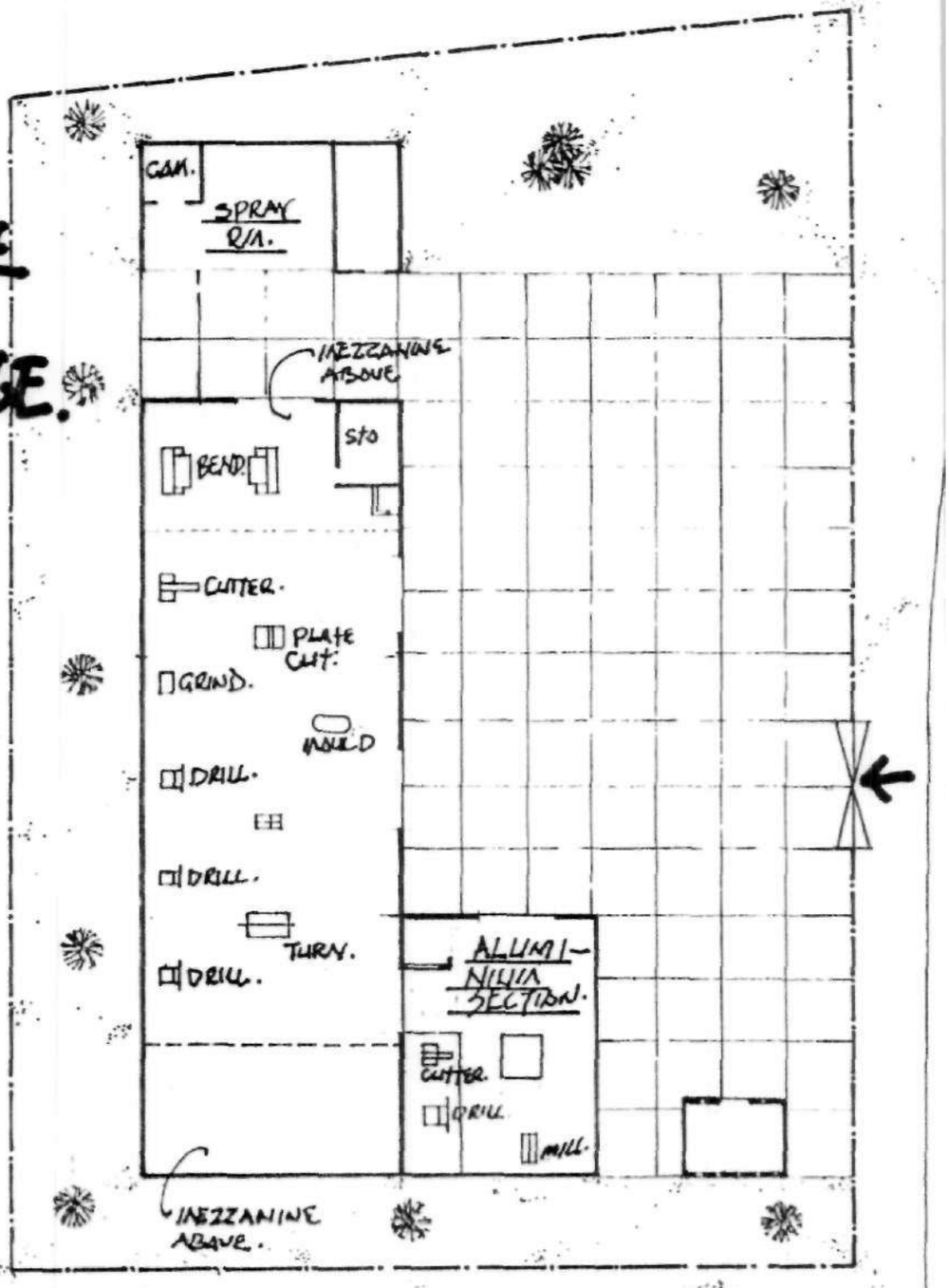
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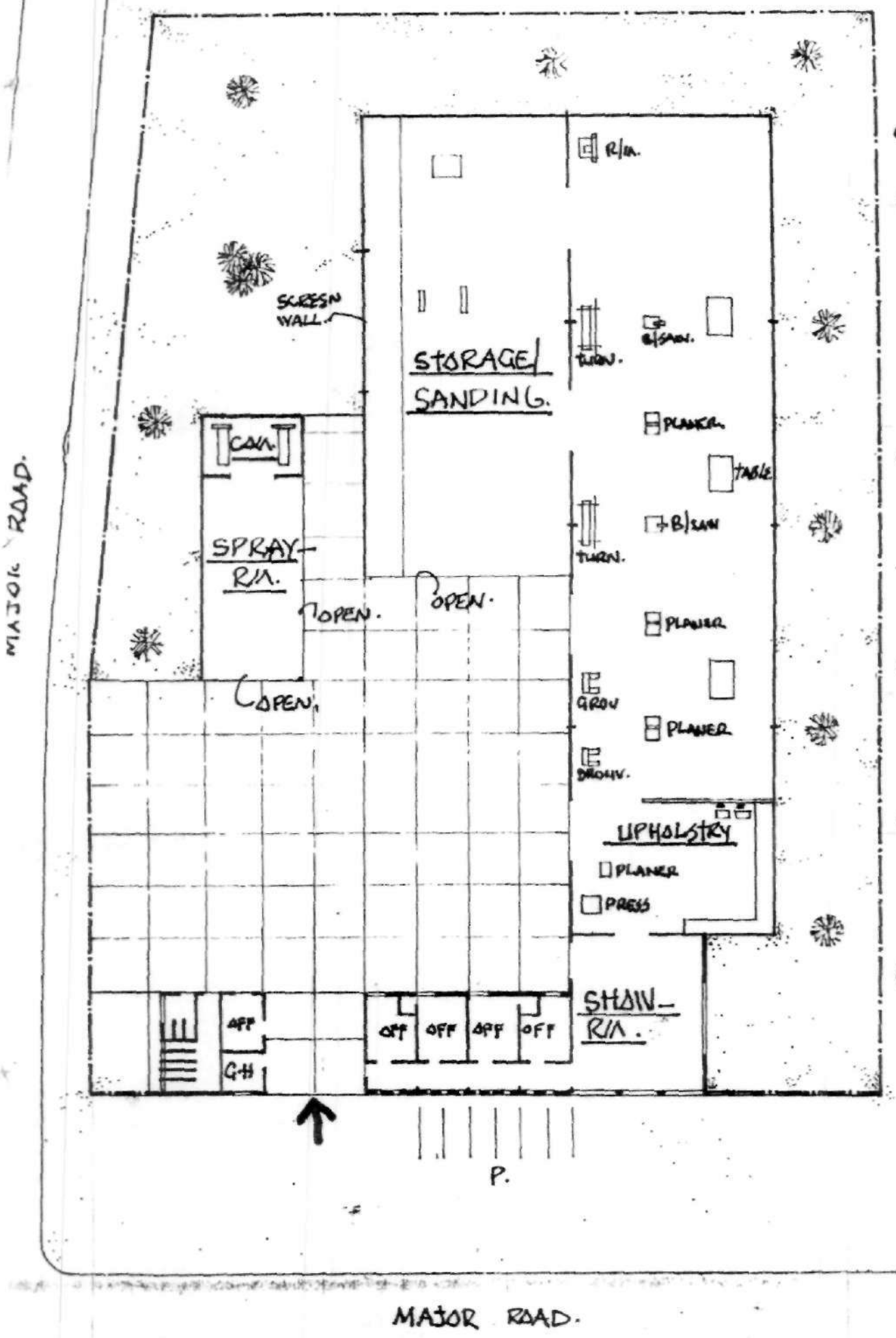
WOOD

STATION

RAL



2.



MAJOR ROAD.

MAJOR ROAD.

6.2.2 **A Case Study of "INDIGROID" Furnishings Ltd.**

a) **Site Location**

This industry is located along Hadejia Road also in Kano Municipality. It is also one of the largest industries in Nigeria dealing with all sorts of furnishings.

b) **Merits**

i. Functions adequately arranged
ii. Good interelations of activities
iii. Good storage facilities for raw materials
iv. Average room for future expansion
v. Ease of transportation for workers
vi. Space availability

c) **Deerits**

i. non availability of metal working machines
ii. no seasoning provision
iii. undetined space for storage of finished items
iv. inadequate workers facilities
v. showroom hidden by wall fencing and trees
vi. no provision for First Aid equipment
vii. no adequate natural ligting at the centrally placed assembly section.

ARRANGED.

CTIVITIES.

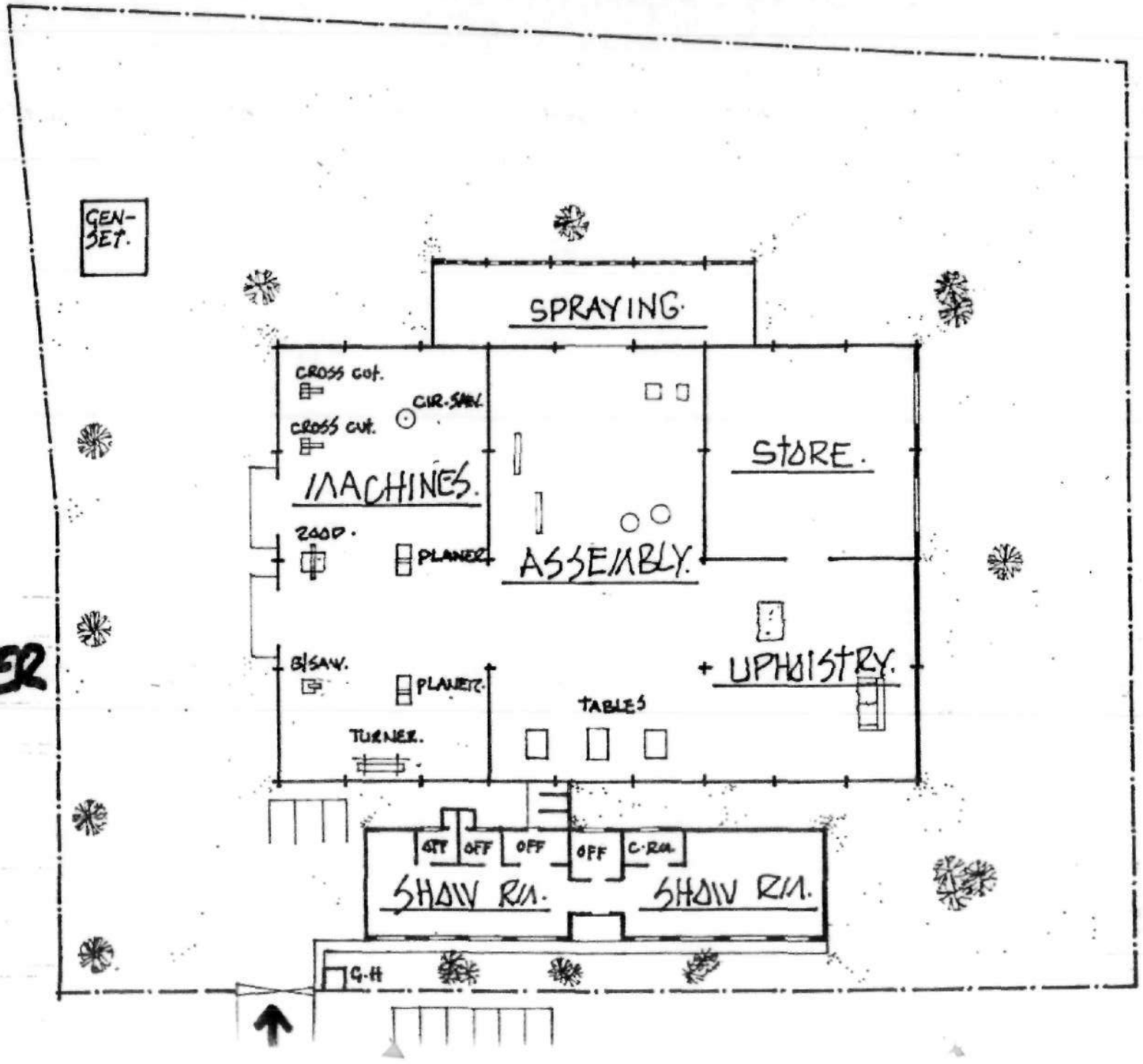
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CHAPTER SEVEN

7.0 SITE ANALYSIS

7.1 LOCATION

The proposed scheme is going to be located in Kano Municipality about 10Km along Zaria Road.

Though the location is not within the industrial estates available in the town, but it falls along the area in which industries are allowed to be sited as indicated in the location map (fig. 7.1).

7.2 DESCRIPTION OF SITE

'.2.1 Vegetation

The site is located in the hot-dry zone of the tropics and the vegetation is characterised by grass land and shrubs with few scattered trees among them are locust beans, neams and mahogany.

.2.2 Geology

The soil coverage of the site is mainly laterite subscriata of undiggrential basement complex of metarmorphic nature.

A geological survey and relative comprising of existing buildings around shows that it is capable of receiving structure that is heavy with little or no special foundation.

The soil region appears to have been uplifted mainly in the territory to recent times and has undergone weathering and slight erosion to produce the superficial sediments of the present landscape.

7.3 CLIMATE

The climate of the area is influenced by two major wind currents, the north east trade winds that occur between the month of December and February with harmanttan, dry and dusty winds and the south westerlies that occurs between the month of May and September that brings damp wind and rain.

7.3.1 Rainfall

Kano has about 120mm/day rainfall in the wet season with an average per year of about 140mm.

Electric thunderstorms occurs during the raining season, and since the prevailing wind direction is south west and it is rain bearing, taking its origin from the sea, the direction of the wind is north to south in the raining season. The force of the driven rain is usually high with no permanent direction.

7.3.2 Temperature and Relative Humidity

The monthly daily temperature ranges from 29°C to 45°C while the minimum daily temperature ranges from 15°F to 20°F.

Humidity is between 9% during harmattan and 45% in the wet season. The rate of evaporation is very high during the harmattan And very low during the humid period.

Care must be taken during selection of construction materials and the way of storing products and raw materials.

7.4 PROBLEMS AND SOLUTIONS

Since Kano lies in the hot dry zone of the tropics with its compounding problems of high temperature, sun and glare and moderately high rainfall with its accompanied driven wind. The structure has to be designed solidly to withstand the Rain and the wind, and provision has to be made to prevent glare and intense solar radiation penetration.

Sufficient ventilation as well as light must be provided.

Layout and form of building, must be separated and scattered as much as possible to allow for free spaces between to encourage air flow.

7.4.1 Orientation

North-south elevation is ideal to keep buildings in shade and to receive maximum air flow. Rooms should have openings on both wind ward and lee ward directions.

Heat producing areas should as much as possible be separated and ventilated alone.

Out door should be shaded and planted, but vegetation should not be allowed to block free passage of air. Storm and water drainage should be adequately provided.

7.4.2 Windows

Windows for ventilation should be large enough with adjustable

inlets to control the flow of the air. Adjustable louvres, screens and grills are useful controllers of air flow And provides protection against glare, noise and rain.

7.4.3 **Walls**

Kano has a relative high thermal value therefore moderately heavy weight construction materials with high thermal capacity could be utilized. Height of wall should be moderate to allow protection for rain and shade. Walls must be insulated and have reflective outer surfaces.

7.4.4 **Roof**

Roof should be pitched to provided rain protection with wide overhangs to prevent glare.

Roof coverings should be light in weight to reduce imposed load on the structure.

7.4.5 **Exposed surfaces**

Roots and exposed walls should be reflective, and light coloured so that it can be able to reflect incidental solar radiation and its heat.

7.4.6 **Choice of Materials**

For the hot dry zone care must be taken in choosing the adequate materials and advantage must be taken during the design of the materials.

For the purpose of this proposal concrete, reinforced concrete

and steel stanchions were choosen, the use of wood were only limited to the hidden roof structure.

Roof structure is simple using lattice steel trusses with overhangs for rain protection.

7.4.7 Choice of Site

Choice of site depends on the following factors.

1. **Proximity to Raw Materials**

   Furniture are items that are needed everywhere whether the largest used raw materials are available there or not.

   Therefore the most impostant point here is that it is easier and cheaper to transport the raw materials than the finished furniture items.

2. **Future Expansion**

   The site is large enough to take the initial development with about 75% of the area left for future expansion.

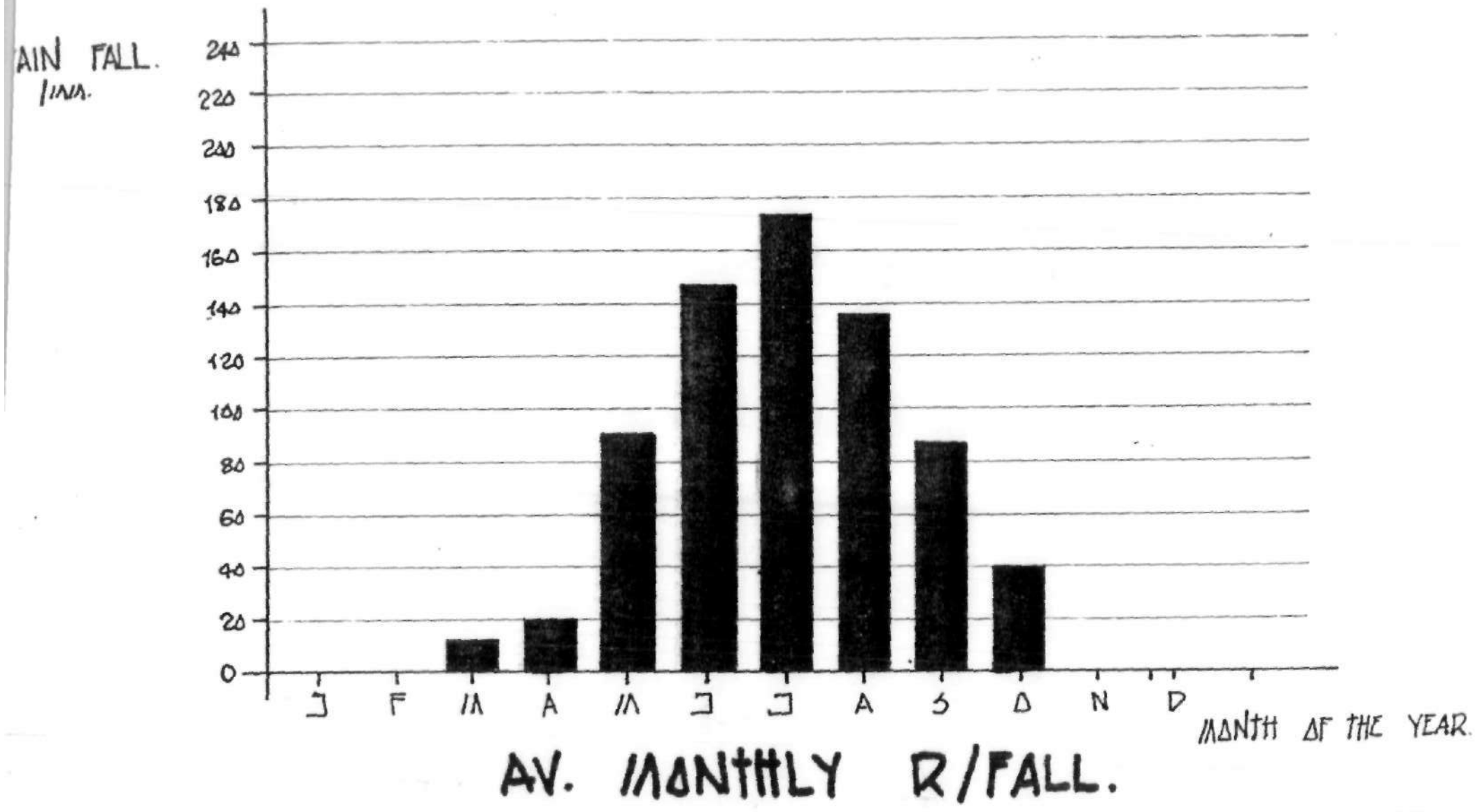
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3. **Infrastructure/Services**

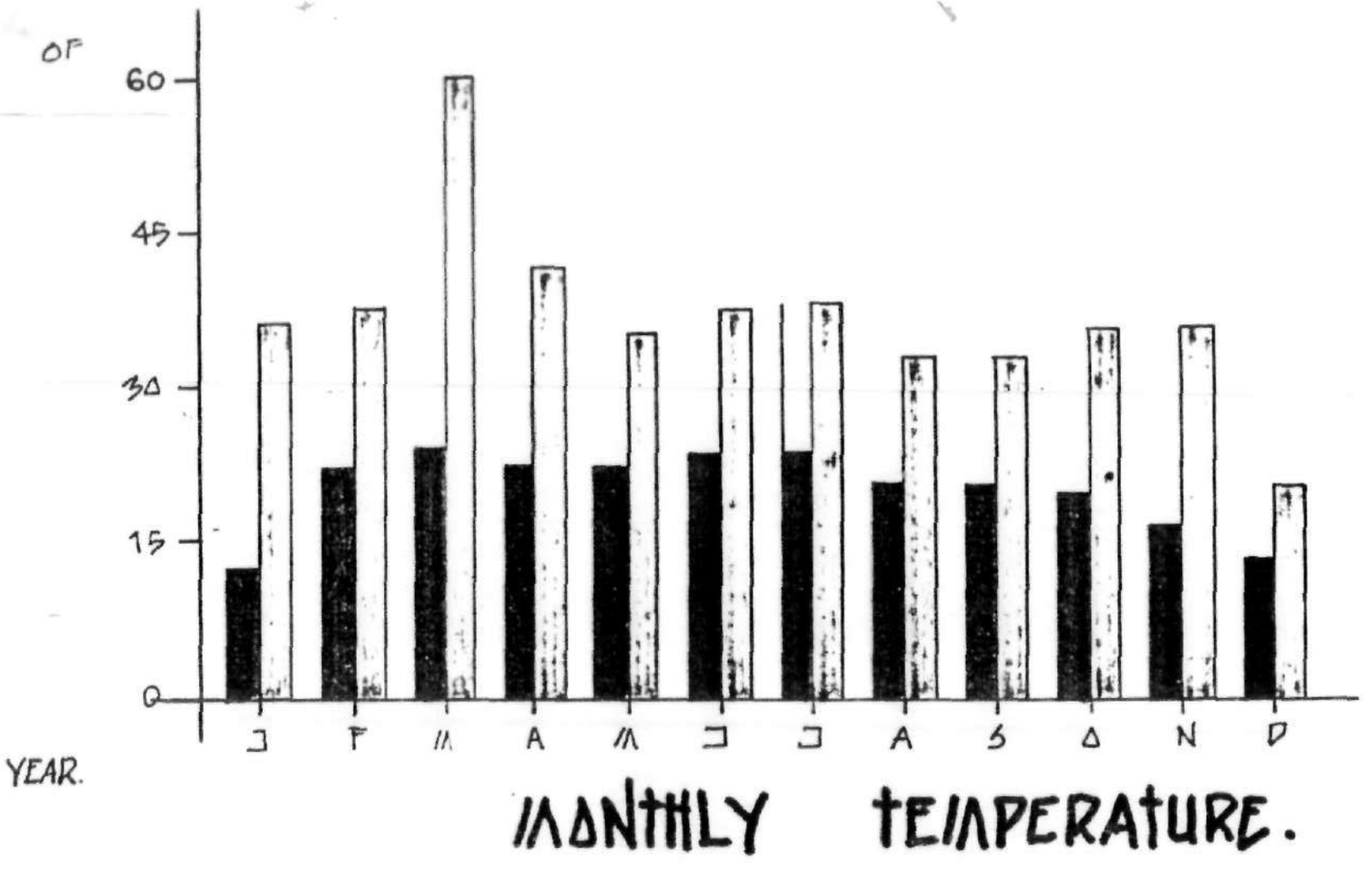
   Services such as electricity, water are already available due to the already existing industries in the environment.

4. **Communication Routes**

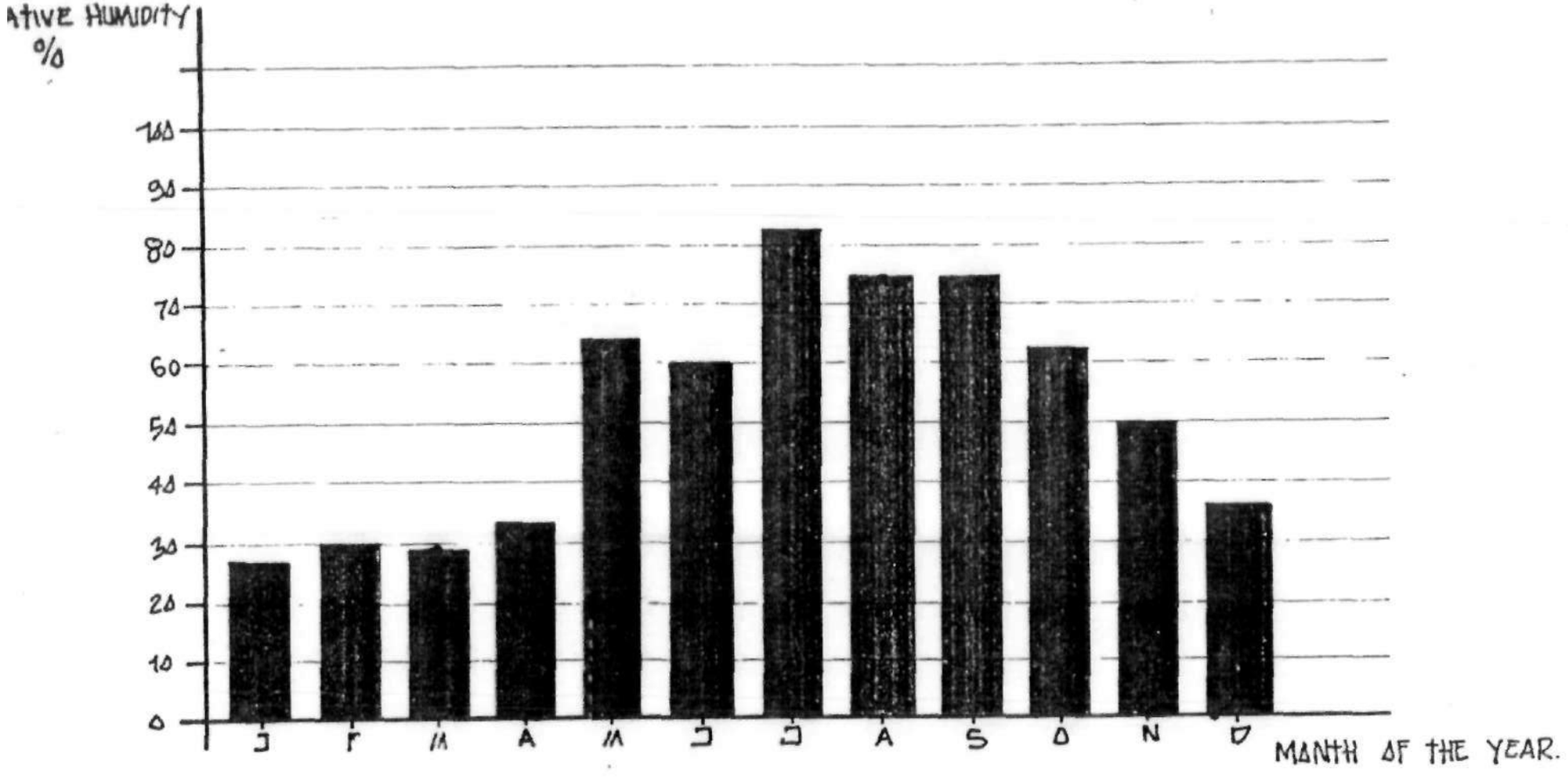
   The site is facing the dual carriage way which is the major road leading to Kano together with telephone cables that passed by.



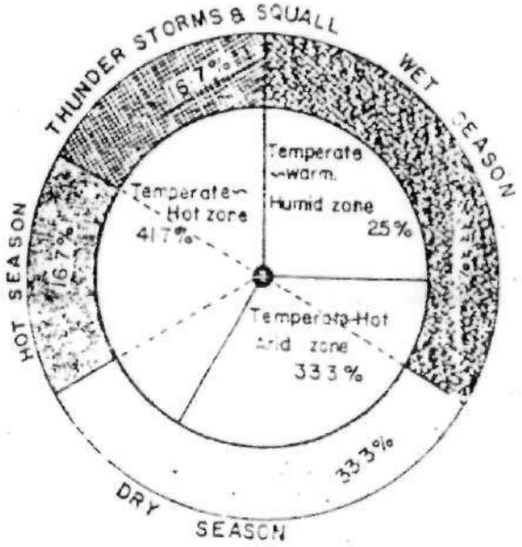
AV. MONTHLY R/FALL.



MONTHLY TEMPERATURE.



MONTHLY RELATIVE HUMIDITY.

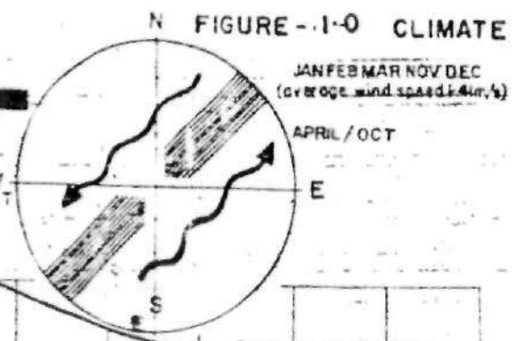


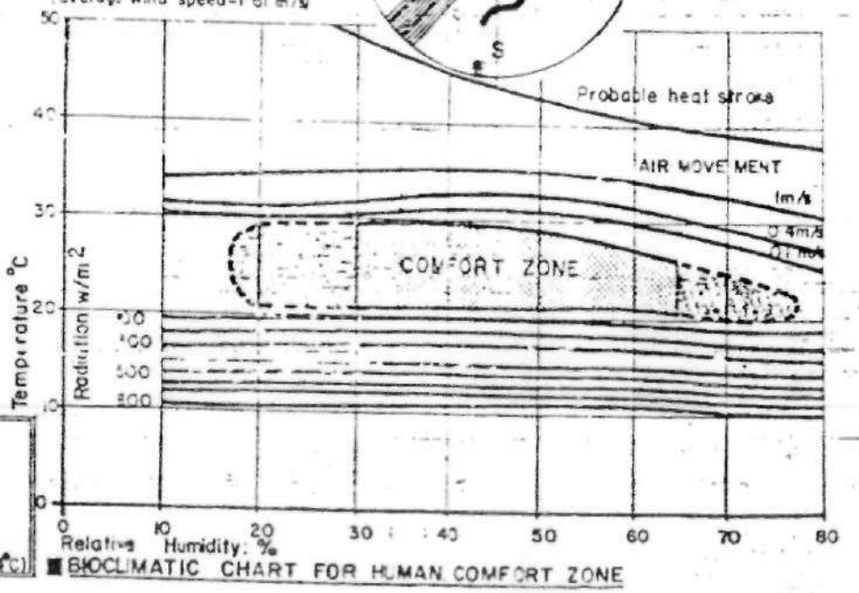
■ ANNUAL AVERAGE CLIMATIC CONDITIONS & CORRESPONDING SEASONS AT [redacted] kano.



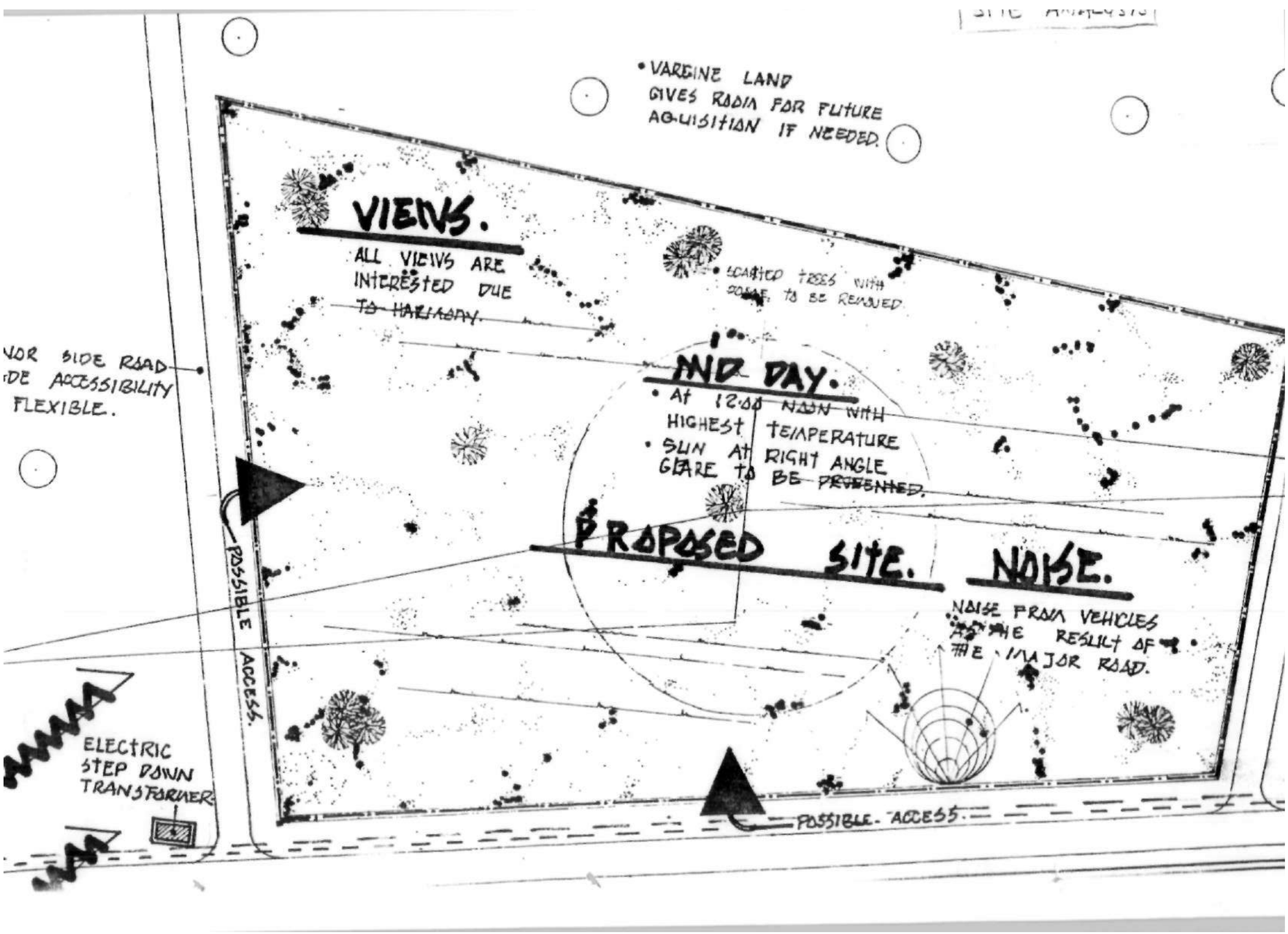
■ PREVAILING WIND DIRECTION & AVERAGE WIND SPEED, AT [redacted] kano.

FIGURE - 1-0 CLIMATE





■ BIOCLIMATIC CHART FOR HUMAN COMFORT ZONE


SITE ANALYSIS
• VACANT LAND GIVES ROOM FOR FUTURE ACQUISITION IF NEEDED.
VIEWS.
ALL VIEWS ARE INTERESTED DUE TO HARMONY.
• SCATTERED TREES WITH SOME TO BE REMOVED
MID DAY.
• At 12.00 NOON WITH HIGHEST TEMPERATURE
• SUN AT RIGHT ANGLE GLARE TO BE PREVENTED.
PROPOSED SITE.
NOISE.
NOISE FROM VEHICLES AS THE RESULT OF THE MAJOR ROAD.
NOR SIDE ROAD
DE ACCESSIBILITY FLEXIBLE.
POSSIBLE ACCESS.
ELECTRIC STEP DOWN TRANSFORMER
POSSIBLE ACCESS.

CHAPTER EIGHT

8.0 DESIGN REPORT

8.1 DESIGN CONCEPT

The concept behind this proposal is "A Simple" but functional solution to the industry of its kind and type, putting in mind the relationship between the trucks and vehicular movement in and out of the site, the production hall, storage, administration and worker facilities.

In developing the concept of the design, orientation with regards to the prevailing winds and solar radiation, functional relationship were considered And tackled to harmonize with the site zoning criteria.

The site zoning criteria is considered under the following:-

1. **Functionality Zoning:-**
   i.e buildings arranged in order of similarity.

2. **Privacy Zoning**
   i.e buildings arranged in order of public - semi public and private.

3. **Circulation Zoning**
   i.e heavy traffic and light vehicles

4. **Noise Zoning**

i.e noisy, semi noisy and quite areas. The administration and sales department were immediately placed due to the fact that they are accessible to customers or the public in order to serve their immediate needs.

8.2 OTHER DESIGN CONSIDERATIONS

In the design of an industry other considerations taken are those that can compare with functionality or the method of production.

Such factors can be truck parking and maneuvering area, storage facilities for raw materials etc.

8.3 DESIGN BRIEF

The project consists of the following sections of departments:-

1. Administration and sales department
2. Workers facilities
3. Production Unit
4. Technical section
5. Entrance gate

KASHIM IBRAHIM LIBRARY
RECEIVED
- 3 FEB -
ZARIA NIGERIA
Ahmadu Bello University

8.3.1 Administration and Sales Department

This consists of a showroom, sales office, Cashier and reception all on the ground floor.

Placing the showroom on the ground floor makes its accessibility easier and the displayed items could be viewed through the large glass windows.

The Managing Director's office, Accountant, Manager, conference room etc are placed on the upper floor but sharing the same entrance.

8.3.2 **Workers Facilities.**

This consists of a cloak room, dining room, changing room with toilets and clinic.

It is placed next to the administrative but away from the public.

8.3.3 **Production Unit**

This consists of raw materials storage production halls for wood and metal, assembly, spraying room, upholstry, packaging and finish product store room.

The raw material storage has direct access to the production hall while the finish product storage To the loading bay and showroom.

8.3.4 **Technical Section**

The technical section is placed close to the production hall and consists of driers, technical office, store and generator room.

8.3.5 ***Entrance Gate***

This is referred To the main entrance to the industry which is placed near the street in order to control movement in and out of the place.

8.4 PRODUCTION PROCESS

The production process is in "U" shaped pattern starting from the raw material storage to the finished product storage.

The production hall are divided into two for wood and metal the size of the hall and the space between the machines involved were determined by the type and standard size of the raw materials that are involved in the process.

Lighting is one of the important aspects of factory design which requires about 25% light intensity. In the proposed scheme light were achieved inside the production hall by the use of large glaze windows placed between columns.

Some of the machines involved in the process are very noisy i.e 200D planer and thickner or grinding machine Which may give a sound pressure level of about 120 - 130 decibal which is above the 75 decibal max for inexcessive noise.

To reduce the noise inensity the production hall were enclosed and placed far away from other units.

Ventilation as another important factor has been taken into consideration. Large openings were provided on opposite directions and were adjustable to suit conditions.

8.5 SITE PLANNING

There is only one entracne to the industry this is in order of security and easy management.

The entrance serves both the customers, staff and delivery from or to the industry.

The administrative and sales department is very near to the main gate so that it can serve the public or customers well.

The production hall on the other hand is placed far away so that noise from its process would not disturb the occupants and visitors.

ACCOMODATION BRIEF

8.6.1 Labour force:

The number of people expected to work in the proposed furniture industry are calculated by number of the machines to be employed.

This comprises both the skilled and unskilled woekers and are categorised into

A. workers in the main production and maintenance

B. works in the administration and sales department.

Category A. includes :-

i Production staff - 60

ii Worker facility staff - 15

iii Technical staff 10

Category B. includes :-

i Admisistrative staff - 15

ii Sales staff - 10

This making total number of staff to 100.

8.6.2 Shedule of Accomodation

The proposed scheme cmprises of for basic sections; The Administrative, workers facilities, Production and Technical.

(a) Aministration Section:- The need for this section is to ensure the a smooth running of the industry with good management.

The space allocated depends on the number of workers occupying the space and the pieces of furniture needed.

A. Administrative and sales section.

Accomodation	AREA (m^2)	REMARKS
Entramce hall and reception	$30m^2$	Working space for 2 receptionist and teleponist. as well as corculation space
Show Room	$413m^2$	for the display of finish product, sales mens stand cashier and corculation space.
Sales Office	$25m^2$	Working spaces, sofa for visitors and sales promoters.
Sales Manager	$25m^2$	Working space, filing cabinet safa for visitors and book sheiver.
Toilet facilities as corculation		for males and females and corritors.
Maniging Director	$36m^2$	Working spaces, executive visitors sofa, coffee table, W.C and book shelves.
Manager	$30m^2$	Working space, semi executive table visitors sofa, wc and book shelves.
Accountant	$25m^2$	Working space, visitors chairs, filing cabinets and book shelves.
General Office	$30m^2$	Working space for 2 cleks, typists filing cabinets and corculation.

Secretery to made	$25m^2$	Visitors fofa, center table, filing cabinets, book shelves and corculation space.
Comference room	$90m^2$	Comference table and toolets with corculation space.
Cashier	$7.5m^2$	Working space, sale and customers stool counters
Store	$3m^2$	Counters
Kitchen/ store.	$7.5m^2$	Kitchen cabinet and counters

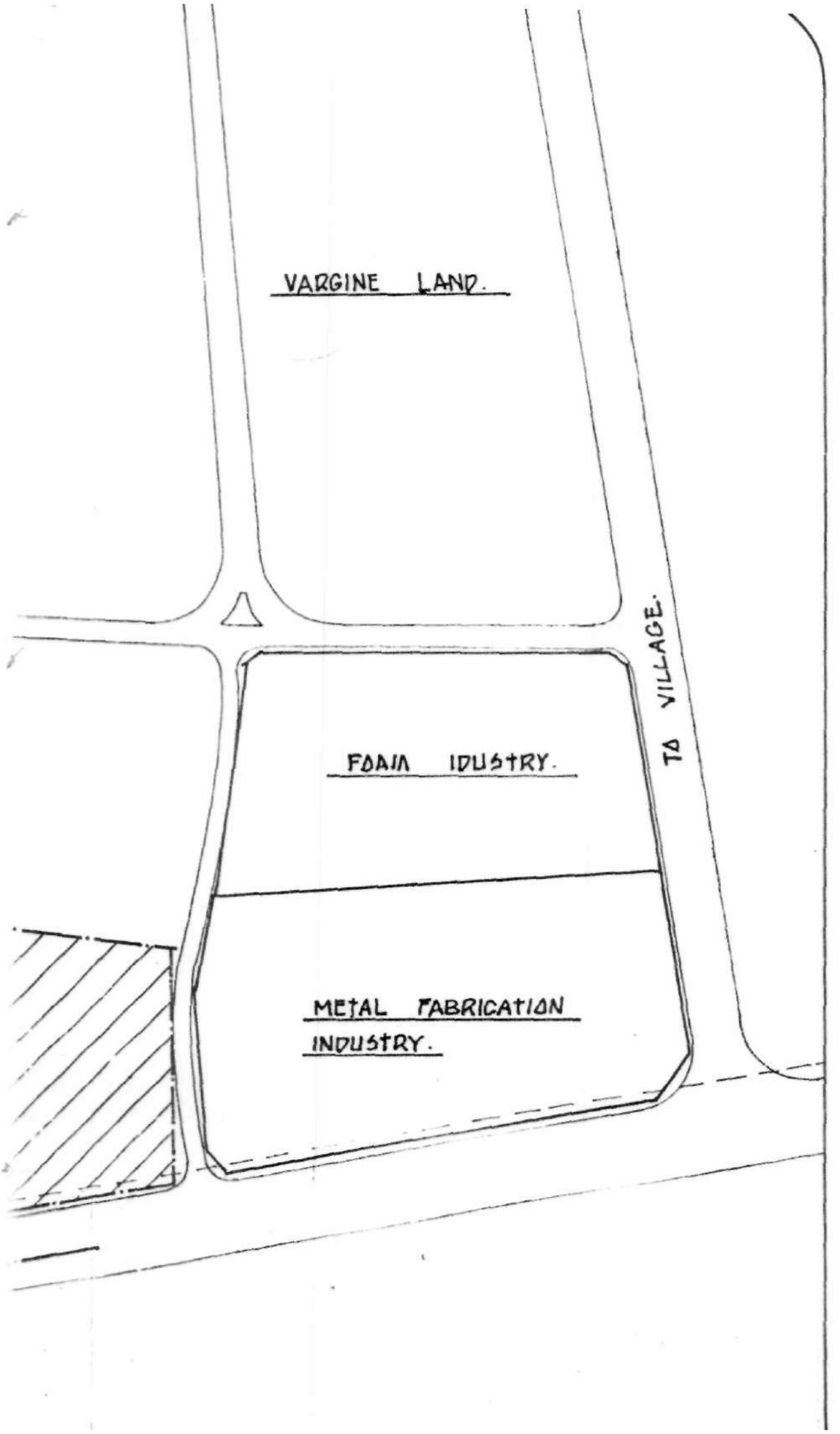
B. Worker facilities

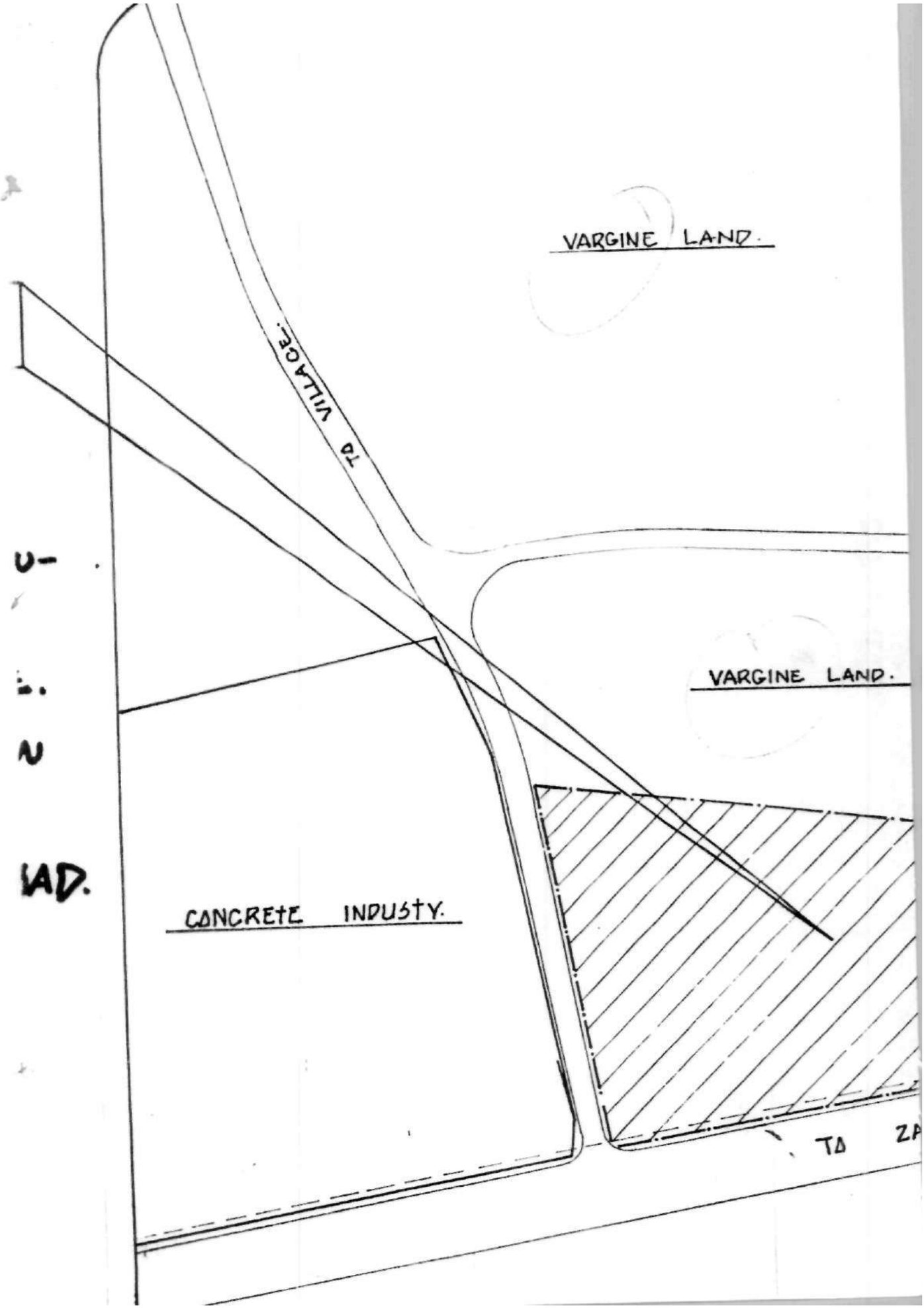
Changing rooms and toilets,	$150m^2$	Loavers, benches corculation space.
Dining room	$120m^2$	Tables and chairs, waity stools taps and corculation space.
Pharmacy store	$24m^2$	Counters, lockers, working space.
Consucting room	$24m^2$	Working space, bed, visitors chairs.
Cleark room and entrance	$35m^2$	A table / chairs and corculation space

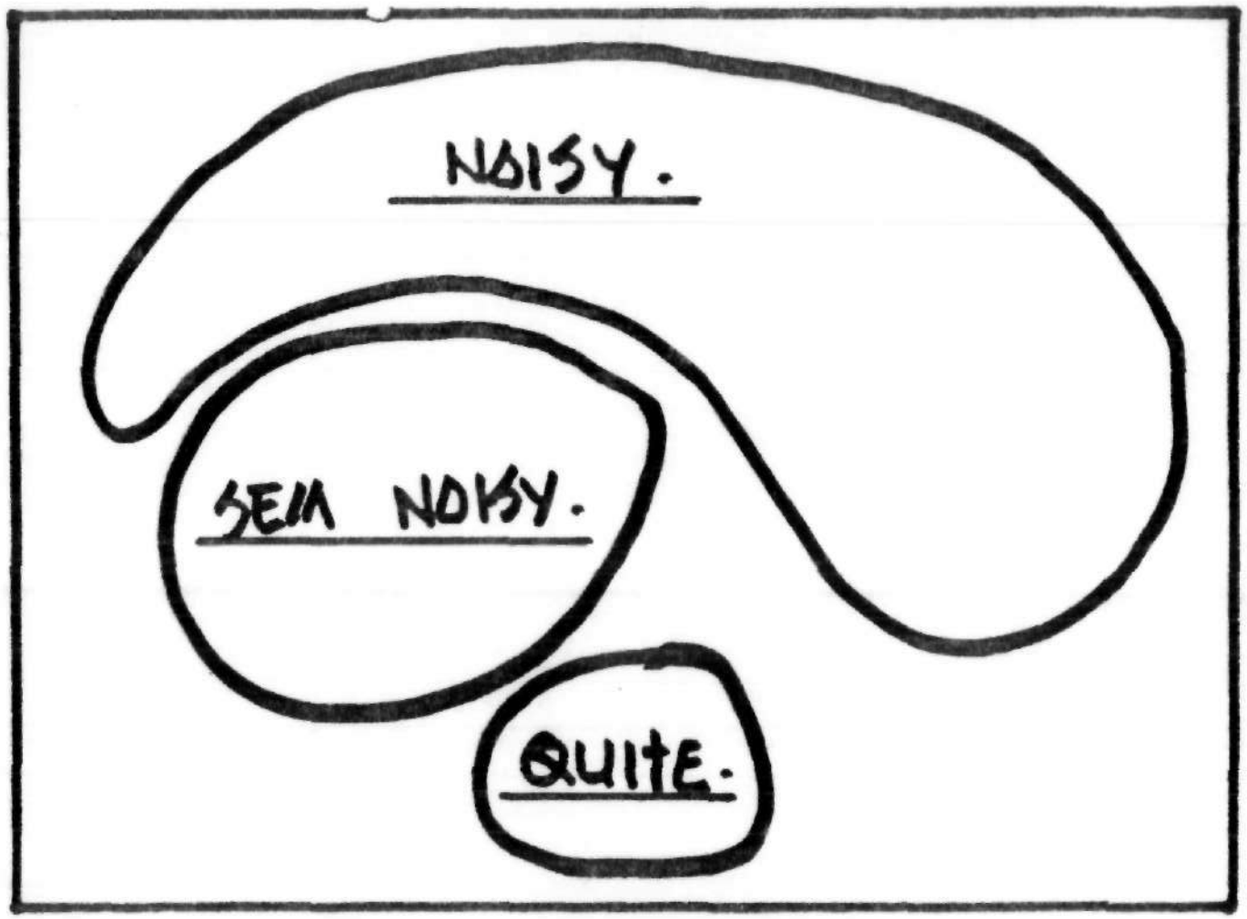
C. Production Section

Raw material store	1200m^2	Pallates and corculation space.
Production hall	5400m^2	Space for machnies, circulation space incidental storage, finishing space and packaging.
Finish product store.	1350m^2	Pallates and circulation space.
Truck maneuve ving and loadim ing auch	2400m^2	Pared area.

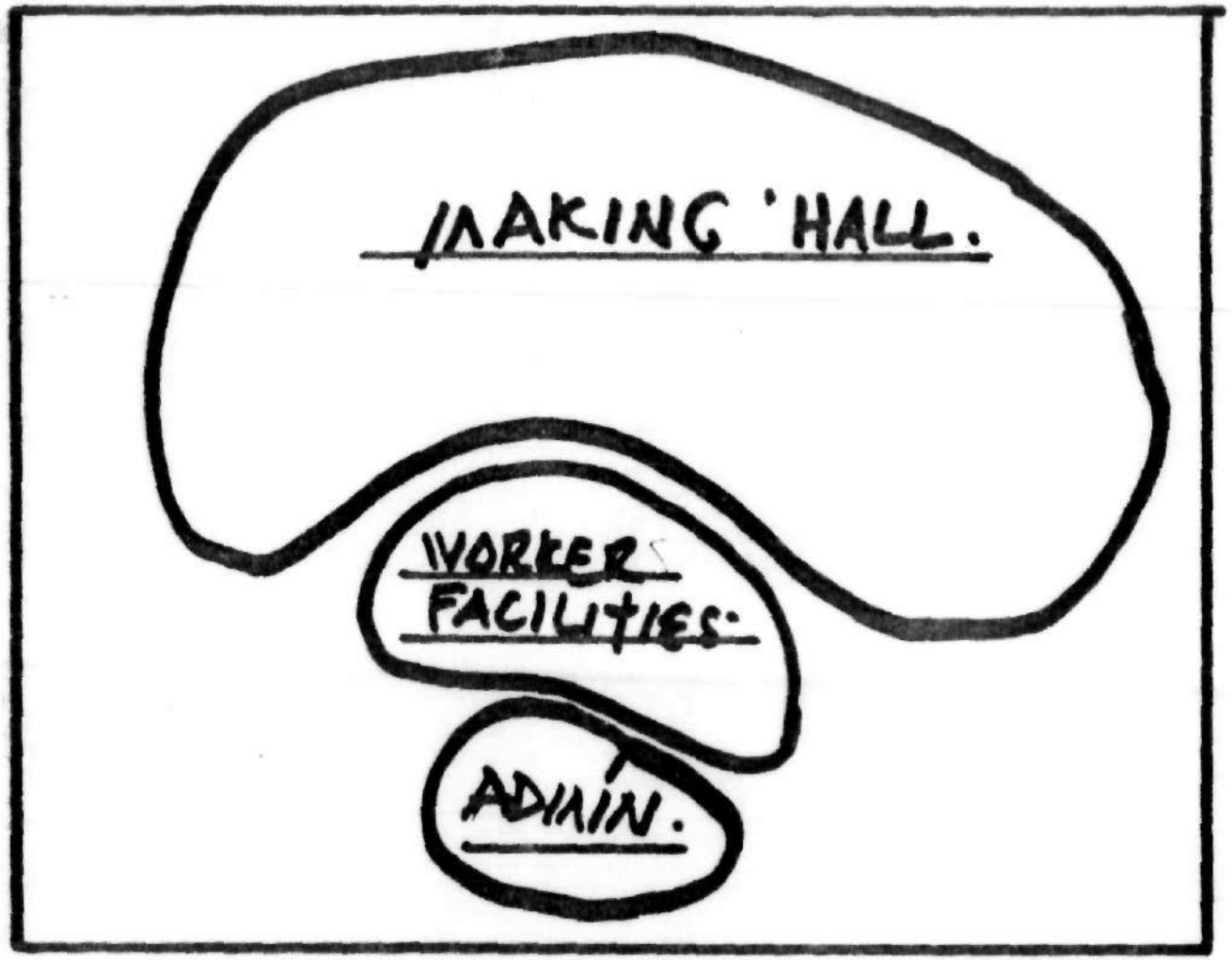
D. Technical	Section	
Dryers.	120m^2	Special equipment of circulatio space.
Parking shade	80m^2	Covered storing shade.
Technical Office	40m^2	Working space for technical manager. and sarbodinates and circulation space.
Store	24m^2	Lockers for tools and pallets.
Generatore house	40m^2	2 generator base and oil storage space.


VARGINE LAND.
FOAM IDUSTRY.
METAL FABRICATION
INDUSTRY.
TO VILLAGE.

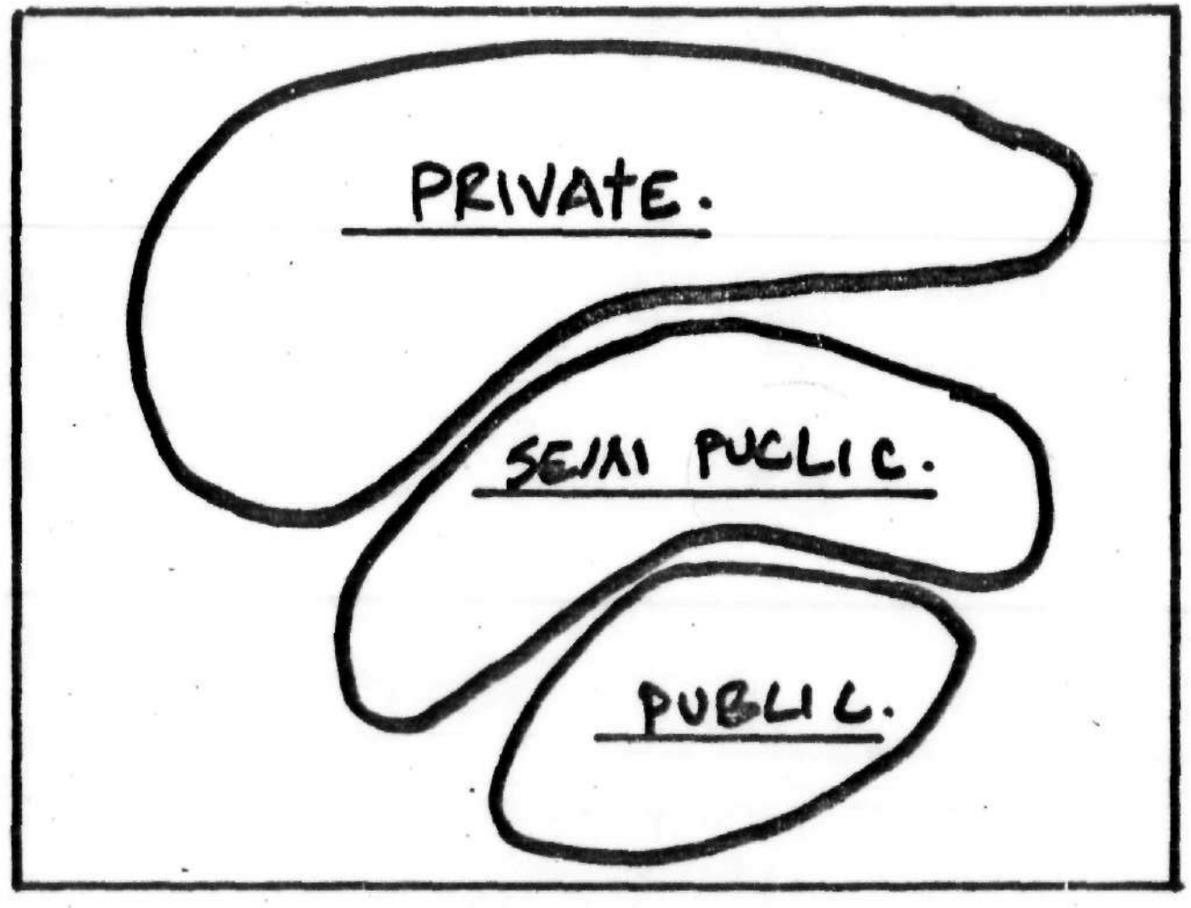

VARGINE LAND.
TO VILLAGE.
VARGINE LAND.
CONCRETE INDUSTY.
TO



NOIS ZONING.



FUNCTIONALITY ZONING.



PRIVECY ZONING.

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