LEATHER PROCESSING INDUSTRY (TANNERY) ZARIA

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ABSTRACT

This scheme is purely academic exercise but with practical aims.

The theme is on "LEATHER PROCESSING INDUSTRY (TANNERY), ZARIA"

It is a common awareness that one catalyst that can bring faster rate of economic growth to any nation is the application of modern Science and Thechnology.

The aim of industrial revolution and self reliance should start from industries that the basic raw materials are readily available, such industries include leather since all nations possess hides and skins from the animals consumed daily.

To achieve this transition period to industrialization architectural disciplines will be employed to provide the following objectives:-

A source of revenue for the nation

- To create more job opportunities
- Maximising daily production and provision for further expansion.
- Easy flow of raw materials and finished goods
- To provide adequate, efficient and safe communication system through the space relationship within the whole complex.,

- To harmonize the available area functionally, structurally and against fire outbreak.

The 1st phase of the scheme is the designing of tannery for 600 hides 6,000 skins (3,000 as wet/blue 3,000 as finished skin) and glue as a by-product. The 2nd phase will focus on the expansion of the production hall.

In my design concept, I have heated industrial design problem with great interest and particular consiera-tion to the users as primary and material/machineries as secondary in my architectural solutions.

I believed the scheme has thrown more rays of light in the right direction toward my desire as an industrial designer during my archictural practice.

THANKS

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D E D I C A T I O N

DEDICATED TO: ALMIGHTY GOD AND

MY GRANDMOTHER FOR HER

PERSISTING LOVE.

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

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The Kaduna State Ministry of Trade & Industries and Federal Livestock Co-operation furnished me with essential statistical datas of available skins and hides within the country. Visits to some Tanneries-namely Holts International Nigeria Ltd. Kano and Intertan Nigeria Ltd. Kano has made it possible for me to see myself the production procedures and know their factory policies. To these sections I owe my gratitude.

My thanks also go to Mr, Segun Onabolu of Leather Research Institute who has contributed greatly to my success by furnishing me with any information on leather processing and for his inspiring discussions.

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CHAPTER 1

INTRODUCTION: General Information and Motivation

General Information (Historical)

Leather is animal hide or skin that has been coverted by chemical treatment and processing, known as tanning, to a stable and non-putrescibe state, where - by the skin or hide becomes more durable and capable of being used for a wide range of purposes.

The objectives of tanning are to render hides and skins resistant to decomposition or bacterial decay, particularly when wet, to improve certain physical properties, such as tensile strength, flexibility, resilence, abrasion resistance and permeability to water vapour.

The making of leather is one of the oldest crafts practised by mankind. The production and use is indentified with earliest artifacts and recorded history of every known culture. E.G. Egyptian carving dating to 3,000 Bc. depict leather dressers at work. The literature and history of classic Greece contain abundant evident of tanning with chrome salts introduced at the end of 19th Century was probably the first change in the Chemistry of leather manufacture in at least 2,000 years. Chrome tanning shortened the process from weeks to days.

Man has worm leather for several thousand years and today no article is more familiar than leather, thus leather has a long tradition of service and today, inspite of the world-wide

trend to exploit alternative material derived from other sources, the commondity still finds widespread use.

Scientific principles have transformed leathe production from an art to an industrial process that can be carried out whereever suitable raw materials are available. The present methods of leather manufacture are result of many centuries of experience i.e. they have a large empirical content.

The principal hides and skins used in the manufacture of leather are sheep, goat, cattle, horse, camel etc. These types represent more than 90% of the world production of leather. Other hides and skins used ecomomically includes those of reptiles, donkey etc. depending on the area.

The activities that come under leather industry can clearly be classified into three main categories namely:

(a) Leather Tanning Industry

(b) Shoe making Industry

(c) Leather goods manufacturing Industry.

The theme of my thesis concentrates on the first part, leather tanning industry which I framed as "Leather Processing Industry".

The major thing that makes leather industry a special and unique one is that since all countries possess some hide and skin supplies, leather industry is one of the first or foundation industries to be established in areas or nation undergoing the transition to industrialization.

INTRODUCTION TO INDUSTRIES

One of the things that can be said about industries in this age is that they have become an integral part of the environment. It can also be said that they will continue to magnify in importance in the environmental context. The reason being that as new technologies for the development and production of new products are discovered, new process and manufacturing plants will be built.

It must be appreciated that industries await this age certain advantages. The industrial process make possible standardisation modularity and mass production of components.

The tradinational attitude of the public toward industries has been no less than that towards a bogeyman. People go to industries because they have to. These to work to earn their daily living. The rest of the public are not really interested in what goes on in an industry. It is too dangerous, it is too ugly, it is too noisy they will tell you. It baffles me to think that some one who used leather goods for example, does not find it interesting to visit a leather industry or an architect as part of interior decoration (furniture) of the house will not find it interesting to visit a leather industry. In my thesis I am faced with who is to blame. Has the architect any thing to offer so as to make these stigma a forgotten one.

The Architect and Industry:

The design of industries has been that ascribe no particular aestetic values. The designs are summarity to perform the functions of sheltering the machinery for production. "This is an enginners domain". The author design is a cross-road between industrial Engineering and Architecture, since industries form parts of the landscape which falls within architecture. Our industries, should cease to be a maize of machinery haphazardly arranged to serve tech -economical purposes only. With that conviction I advocate that architect can fully contribute his quota. Since there are many fields or examples of where this co-operation between the engineers and architects has yielded dividends, then, I see no reason why this co-operation can not occur in industrial design.

MOTIVATION GOALS AND OBJECTIVES

The industry as looked upon through the public eye is dirty, ugly, dangerous and only a necessary evil. These opinions are been expressed since the industrial revolution in Britain. I believe the architects can contribute their own quota in making the public to really feel that industry is part of the environment that surround them and not a necessary evil.

In this thesis therefore I have attempted to turn - right round and to encourage the cultivation of interest in industries of our days. Since industries have becme part and parcel of our environment they should be seen as such and be given their rightful place.

Why Leather Industries:

As earlier written leather industry is a special one in the sence that all countries posses hide and skin supplies, this makes Leather industry to be one of the first industries to be established in a nation undergoing the transition to industrialization. It is cristal clear that Nigeria is one of the countries struggling hard to industrialization. Then since the raw material for large quantity with little or no importation of raw material why then can this type of industry not be encouraged. Infact Nigeria has got all the basic raw material yet they still import leather and leather goods until of recent when there was ban on the important because effective.

Industries for these banned products are not sufficient to fulfill the market demand hence there is need for establishing new and mordern leather industries to cater for the demand. There is need for establishing more and modern leather industries because the products of leather industries in Nigeria as of now can not compete with advanced countries.

How are some factors must be borne in mind before we can make Nigeria one of the best leather manufacturer To achieve my objectives as far as industrial design is concern (with reference to leather processing industry) I believe that architectural disciplines will be employed.

My Objectives:

(i) To propose a site location and layout bearing in mind the following (a) safety from disaster and pollutin the neighbouring community.
(b) The necessity to be human in Layout

(ii) Easy flow of raw materials and finished goods.

(iii) Maximising daily production and provision for future expansion.

(iv) A source of revenue for the country and improve the well being of the people.

(v) To design the social omenities on the site to allow for maximun interaction between workers, both in the production area with the machinery and during the short break at the social facilities wing.

This social facilities for the workers as form of incentire is highly enssential. As earlier written the 1st phase will concentrate on the leather industry for skin and hides with daily production of 500 skins and 4,000 hides with Glue production as by-product. The 2nd phase will focus on expansion of the production hall.

The thesis does not attempt to pre-touch the chemical technologies of the processes from which only a half-baked thesis will emerge as I am not a chemical technologist but an aspiring architect. Nor does I intend to dabble into the domain of the leather-technologist.

With these studies and proposals, I hope that the goal which I set to attain, that is establish a leather processing industry as a meaningful part of the environment (inducive place) and to cutivate in the reader an interest in inustries with particular attention to leather industry, an industry which provided us with some necessary products which make our lives more tolereble.

CHAPTER 2

HIDES AND SKINS THE MATERIAL FOR UTILISATION

Basic Raw Material (Hides & Skins)

The working material presominantly in the production of leather are dry or freshly flayed hides and skins from slaughtered cattle, sheep and goats. It must be noted that the presence of cattle, sheep, goats etc. in large scale is of great importance as far as the raw material is concerned

From the slaughtered animals consumed daily, hides and skins are produced for use in the proposed industry. Experiments has shown that well treated dry hides and skins can be stored for a long period of time without deteriorating. The utilising hides and skins are produced from different parts of the country.

Most of my raw materials will be within Udduna state where my industry is located. Current dates from the Ministry of Trades and Industries shows that Nigeria has a production of over one million cattle, hides one million goats skins, two million sheep skins annually.

Out of this Kaduna State alone produces about

15% cattle hides = 150,000 hides

15% goats skins = 150,000 skins

10% sheep " = 200,000 skins

coincidentally, during my research, I learnt that the Federal Government of Nigeria is planning to establish a tannery in Zaria because of the availiability of abundant raw materials.

The Kaduna state Government is also proposing to set up leather tannaries in Katsina and Kafanchan, where there are existing livestock production which will cater for the demand. It is also the intention of the State government to encorourage cattle rearing both at the cottage and animal husbandry treatment so as to meet the increasing demand, thus providing more raw materials for my factory. These is similar proposal by other state governments.

DESCRIPTION AND SOURCES:

1. FRESH HIDES AND SKINS FROM ABATTIOR

Fresh hides and skins will be got within Zaria abattior and the slaughter slabs around Zaria everyday. The fresh hides and skins will come from animals consumed daily. I proposed that arrangements will be made with the abattior managements so that they can supply the industry with fresh skins and hides. Tanning process can be started immediately these fresh skins and hides come into the factory and if not the fresh skins and hides can be treated against bacteria attack. Methods of treatments are:-

(a) By salting - common salt is applied on the flesh side of the fresh/raw hide so that bacteria causing decay will not attack the hides.

The reated fresh skin can be retained fresh for 8 - 12 days without decaying.



STORAGE / SALTING SECTION.

(b) Fresh flayed skin and hides can be treated by dipping in ascenic acid and then well dry, to prevent bacteria attack. This method is used when the hides and skin will not be tanned immediately. In my design, I have provided an ascenic acid pit where the dipping inn will be done and a drying shed for drying the hides and skins.

2. DRY HIDES AND SKINS FROM INDIVIDUAL AND FAR DISTANCE ABATTIOR/SLAUGHTER HOUSES.

I proposed that buying agents for the factory will go outside the town or state especially the northern part of the country to buy dry skins and hides. The skins and hides will be inspected there to make sure they are well dried.

This buying agents will be throughout the country because animals are consumed daily throughout the country. It is this system that the existing factories in Kano, Maiduguri and Sokoto depend on and there is never shortage of raw material. Im fact Nigeria still export a good number of hides and skins every years to Western European countries. The finished leather and leather goods are imported. If we can encourage the establishment of new tanneries with high quality products Nigeria will be able to combact the adverse shortage of leather and leather products in the country. Infact with the present

production of hides and skin, if we can consume most locally it will surely increase the country's foreign reserve. Infact up to recent times, the leather, leather goods and leather footwear industries have been concentrated in the developed countries of the world with the developing countries acting mainly as suppliers of the raw materials. The total trade of these industries is today worth approximately 2.3 billion dollars.

It is within the last decade that developing countries have made great efforts to make better use of their natural resources so that now the percentage of goods exported in the raw state is somewhat lower than it was previously.

PROBLEMS OF LEATHER INDUSTRY

Like any other industry, tannery too has got its own problem especially as per number of the output of finished goods is concerned.

The problems are:

(a) Insect attack on the raw material

(b) Effluent treatment

(a) INSECTS

Insects may have direct and not inconsiderable effect on leather production. Beetles, dermestes and certain weevils can cause considerable damage on stored goods - including store hides and skins. Insects can cause damage through attacking living animals and in

tropical regions much productivities is lost through activities of mosquitoes and tsetse flies which act as vectors to such diseases as hypanosomiasis in cattle. Ticks too are wide spread and in addition to punctuting skins can also spread diseases among cattles. The pest of most concern in the leather industry is undoubtedly "waebles". Small holes or slits in the hide, sometimes enlarged by secondary, bacteria infection. The main solution to this problem is that all the hides and skins are well sorted out to ensure the elimination of already damaged hides and skins by these desastrons insects.
Another problem is mould growth on the skins and hides. General cleanliness of hide stores with frequent inspection and handling of goods can undoubtedly help to minize risk. The universal remedy - "some insectide or other" - is probably insufficient, especially in stores inhabited by resistant strain. The best treatment is to ensure that skins when baled are properly protected. The simplest, safest and cheapest preservative is naphthalene which is sprinkled on in flake form.

(b) Effluent Treatment:

Effluent treatment in the tannery perhaps to the tanner constitutes a major problem to the tanner. This can be said to be because in a large tannery no matter where situated, uses a daily average of 100,000 gallons of water. Where as the tanner gets clean soft water from the tap, he however dispense this same water

murky, hard and smelly due to chemicals used in the tannery.

Even though 25 years ago, it might have been possible for the tanner to dispense the water into the field near his tannery, it is becoming impracticable to do same in present days. Futher more the increasing need for water both in urban and rural area makes the former most impossible. It is important to note that if the tanner needs a constant supply of pure, clean and soft water and the water he dispenses is hard, dirty and muky, he must find a solution to the problem of where to dispose it and how to minimize the use of water.

Solution to Effluent Problem:

To reduce this harzards the tanner must build in the tannery premises series of settling tanks which are built as to be able to settle all or almost all the suspended solids. For this reason I have provided an "EFFLUENT TREATMENT PLANT" within the premises of the proposed industry, I also proposed that part of the treated water will be successfully recirculated in the production hall, this will even minise the water wastage.

CHAPTER 3

SITE ANALYSIS

LOCATION AND SITE:

The ideal location for any industry is determined principally by economic factors. At this moment in time (in Nigeria) the site of a leather processing industry is highly of great importance. The market demand is very high (locally and internationally), that any high quality leather will sell in large quantities in any part of the world or country.

The choice of a site in Zaria, a more central urban area with natural grief of good site, nearness to the basic raw materials (hides and skins) The nearness to the Leather Research Institute, Zaria is also an advantage since the aim of establishing the Institute was to train workers in tanneries, carry out research on problems facing tanneries in Nigeria with possible solution and to give advices to the existing tanneries on how to improve both quality and quantity of the daily production.

SITE:

From research carried out and the advices from town planners and related profesions, I can conclude that the site in Zaria is most suitable places for leather processing industry because:

(a) It is a virgin land with gentle gradient (relatively flat land).



UNIFORMLY FLAT SITE CHOSEN.

SITE ANALYSIS

(1) The site is with gentle gradient and few landscaping features like shrubs, short bushes 7 trees which could be preserved depending on the landscape. But I will try as much as possible to preserve the existing trees.

(2) The road to my site is been proposed by me, which I have tapped from the existing 2 lane Zaria-Jos road. I moved away from the Zaria-Jos road (likely population concentration) because of the offensive nature of the industry (bad odour).

The raffic flow in feature to my site will necessitate a need for clearly shown proposal of a bus stop. As some workers will come by buses when the place becomes industrial area in heality. (My proposed road will also serve other industries in the sorrounding).

(3) The site is located in such a strategic place where there is possibility of effective orientation of the whole complex to best achieve any aim of an industrial building design with the site and thereby design with climate.

BELOW ARE THE ZARIA CLIMATIC DATA USED:

MEAN MONTHLY TEMPERATURE AND OTHER METHROLOGICAL DATA RECORDED AT 10°C EACH MORNING AT ZA
(11° 11'N, 07° 38'E, 685M ALTITUDE IN 1978)

MONTHS	MEAN MONTHLY AIR TEMP. (°C)	MEAN MONTHLY MAX AIR TEMP. (°C)	MEAN MONTHLY SOIL TEMP. (5cm) (°C)	MEAN MONTHLY RELATIVE HUMIDITY °(o	RAINY DAYS No	TOTAL RAIN-FALL (mm)	MEAN MONT SUNSHINE (HRS)
JAN	13.2	29.3	22.1	17.0	/	/	9.4
FEB.	17.5	33.0	27.2	17.5	/	/	8.8
MARCH	18.7	34.8	30.2	24.5	/	/	8.6
APRIL	20.2	35.1	30.9	30.5	6	86.9	8.0
MAY	21.1	32.2	29.0	58.5	9	135.5	8.1
JUNE	19.5	29.5	28.6	60.5	14	206.8	7.3
JULY	19.4	27.7	25.5	68.0	17	226.4	6.5
AUGUST	19.1	27.8	24.9	75.3	15	188.1	6.0
SEPT.	19.2	29.2	26.2	18.1	15	190.0	7.6
OCT.	19.3	29.4	25.5	75.0	15	162.2	7.0
NOV.	12.9	29.9	23.3	40.6	/	/	9.5
DEC.	11.4	29.8	21.5	20.6	/	/	8.8

Above are the Zaria climatic data used:-

(a) Maximum) mean Rainfall 1978 - August = 226.4mm

(b) (Maximum) mean air Humidity - 1978 - september, 81.1%

(c) (Maximum) mean sunshine - November = 9.5 hrs.

(d) Average monthly raindays 1978 - July = 17

4. As of moment the site of my choice has no existing sewage and power lines. I have made a proposal for the treatment of the effluents from my factory and also I assumed the NEPA will supply electricity to the site but in case there is power failure on standby generator will be used. Infact as of moment in the country the source of light from the NEPA is not reliable even though there is notably constant supply! Thus this will need for the incorporation of a generator provision as the nature of the factory involve maximum use of electricity in machine operation.

5. The total area including future expansion is 6 Hectares. The compex will cover about 75-80% during the first phase and it iwll accommodate the production of 6,000 skins - 3,000 exported as wet/blue skins and the 3,000 will reach the finishing process. It will also produce 6,000 cow-hides per day and an integrated glue factory as by products.

During the 2nd phase the expansion of the main factory. Thus there is available lands as far as expansion is concerned.

CHAPTER 4

THE FACTORY

UNITS AND SERVICES

Functional Analysis of Units

Delivery/Storage

The raw materials are received and then store at this part of the production building. Storage section is divided into two major sections - one the storage for the dry skins and hides and the other the storage of the chemical used at the wet section of the production. Chemicals are - chrome, "Bagaruwa" and common salt for preservation.

Production Hall

The production hall does not include the space required for the auxiliary departments. The actual processing of leather starts with a wet process and ends up with a dry clean, and fine process.

Packing/Finished Leather Store

Close to the packing area is the storage for the finished leather which is next to the dispatch area.

Laboratory and Experimental Equipments

This section is within the auxiliary block. It is for tanning tests for the laboratry during the first phase I would suggest:

I experimental tanning drum 1.2mdia x 1m.

6. The site relationship with other or adjacent sites is clear. This is because the sites are all zoned for polluting and heavy industries i.e. Tobacco factory, Breweries etc.

7. Since the South-west wind can bring in odour from the drying section of the factory to the main road or the only access there is possibility of taking into account the screening of the area against the strong wind. The nature of the ground can allow for the growing of trees as landscape features to screen the leather drying and effluent treatment sections.

8. There is possibility of having two ENTRANCES INTO THE FACTORY.
Conceptnal approach towards my aim of achieving a complex with industrial standard but flexibility is possible. The conceptnal design approach zoning of the whole site taking into consideration 1st phase of the project & byproduct and the 2nd phase - expansion of the production area.
Also clear zoning in the concept of QUIET, NEUTRAL AND NOIZE ZONES OR ADMINISTRATION SOCIAL FACILITIES AND PRODUCTION AREA of the whole complex.

The urban siting of any industrial complex has advantages as regards accessibility existence of some necessary facilities like, water, pump, electricity, good sewage system etc. Zaria has all these facilities. There is good communication with zaria by the aid of the existing railway and road. The siting of the industry in Zaria will help to create job opportunity for the inhabitants.

ZONES WITHIN THE SITE:

The "Leather processing Industry, Zaria" (with integrated social facilities) is zoned so as to achieve the goal of having a self sufficient factory in one complex.
In my zoning concept I will define spaces as QUIET, NEUTRAL AND NOISY areas as clearly outlined.

(i) The administration wing (managerial) is within the quiet zone;

(ii) My social facilities also within the factory complex are within the neutral zone;

(iii) The production sections come within the noisy zone.

(iv) The production zone to make proximity close for machine maintenance and last making, storage of chemical and laboratories.



WATER OR EFFLUENT TREATMENT
SETTLING TANKS.

Workshop

A sufficiently equipped workshop has bee provided for maintaining the equipment of the plant. A suitable store-room is also provided for the spare parts delivered with the machines and those ordered for, since most of the machines will be imported ones.

Chemicals Store:

Where necessary shelves, palettes and scales are provided.

Waste Water Purifying Installation:

The waste water treatment plant is seperated from the production area. The following equipments are provided there:
I enroed rake for a comb with of 0.8m grid radius 2.0m and four cleaning arms.
I manually cleansed rake for chamber width 0.8 m.
Length of grid 1.0m
1 switch and control unit for the above curved rake.
* Part of the treated water will be recirculated and part disposed to the government plantation not far from the site.

SERVICES

Water and Heat Supply:

From my calculations and consultation the process will require approximately 600m^3 water per day, split up tinto:
480m^3 cold water 20-25^{o}C 90m^3 warm water 35^{o}C

20 m^3 warm water 50°C

10 m^3 " " 70°C

I have proposed that the water will be supplied to the complex by Zaria water works. Within the complex I have provided an over head water tank of about 800m^3 volume. In case of water shortage from water works Zaria one or two hole wholes could be provided with the complex or beside a river that is about ½km away from the complex.

Electricity and Electrical Equipment

Electric power will be supplied by the National Electric Power Authority (NEPA).

In addition to the power supplied by NEPA there will be stand-by generator to serve the plant in case of power failure from NEPA. The pewer supply will comprise of sufficient spare power for future plant extension.

Transportation Media (Within the Factory)

Diesel fork-lift, palettes, Jacks are the main transportation media within the factory.

Compressed-Air Supply

A compressor for compressed-air supply at the spraying and drying units and for cleansing purposes should be procurred locally.

Personnel Required

Approximately 175-200 workers will be necessary for the planned capacity.

CHAPTER 5

THE BRIEF - FACTORY REQUIREMENT

The industry will be set up at Zaria in Kaduna Sate (ZARIA - 11° 11'N, 07° 38'E) South-Eastern part of the town (Area already maped out for heavy and toxic industries.

The maintenance and finance of the industry will be catered for by the Federal Government of Nigeria. From the available datas and the No of animals consumed daily the factory will be able to maintain an output of 600hides and 6,000 skins daily. As I had written earlier the project is a solution to the possible integration of the production of leathers like cow, goat, sheep, camel etc. and the inclusion of glue as a by-product during the 1st phase of the scheme. Thus making a comprehensive industry from the skin and hides from consumed animals everyday.

The 2nd phase of the industry will be basically the expansion of the production hall up to 100%

It is very important that the production flow(s) should be smoothly designed, so that there will be no interruption of the flow of material from the delivery of raw materials to the dispatch of finished goods.

The flow of workers should be straight forward and made flexible to allow easy reach to social facilities, administrative wing and auxilliaries from the production hall.

Note

The wastes which are hairs removed from the raw skins and hides are used for agricultural purposes. I proposed that the hair removed will be used as manual in the government agriculture plantation that is around ½km from the factory. Part of the treatment waste water will also be used for irrigation on the plantation, which the other part will be recirculated in the factory.

FACTORY REQUIREMENTS IN TERMS OF PRODUCTION SEQUENCES MACHINERY INVOLVED AND THE ESTIMATED WORKING SPACE

A. Below are the sequence followed by hides and skin leathers.

1. DELIVERY

Vehicles bringing in the raw materials will drive in through the service gate and then off load the raw materials at the delivery platform.

2. STORAGE

The raw-material storage is always located close to the beginning of the production.

3. SOAKING

The purpose of soaking is to revert the dry skin or hides to its natural swollen state and removal of dirt soluable proteins and curring agents.

The soaking can be accelerated by mechanical treatment i.e.;By dry druming and breaking; temperature increase - temperature may be increased to 28°C and thirdly by the use of chemicals like acetic chemicals, formic acid, bisulphate solution and sodium sulphate. The soaking may be continued for several hours (24hrs) until a desired physical condition is achieved.

4. UNHAIRING (LIMING)

The next essential preparatory state is loosening and removing the hair from the grain (outerpart) surface. Many methods are employed but liming method is widely used. In the case where the hair is deliberately left on the skin, this process is skipped and the resultant project is hair on the skin or hide.

(i) Methods of Unhairing are:-

a. Liming - slaked lime powder, chalk, starch can used in the processes. The skins and hides are immersed in the solution of line and water. The result of liming are coplex. In addition to preparing for untanning, liming loosens and dissolves the epidermal layer of cells.

b. Chemicals used in liming - sodium sulphide and sodium sulfhydrate with a concentration of 2-6' $B4^{-}$ are used.

c. Enzymatic Method:-

Hair loosening in affected by addition of enzymes. Auali relimin is necessary. The chemicals used generally are sulphides of sodium and calcium. Other s are HCL, H_2SO_4 formic acid, latic acid etc.

(ii) Chemicals used in Liming Process

a. Pure sulphide lime liquor.

Hair is destroyed (poor opening-up of the skin) For leather with particularly flat closed grain.

Chemicals are: Sodium Sulphide and Sodium Sulfhydrate.

Concentration: 2-6° Be^-

b. Pure white lime:

Hair loosening (strong opening-up of the skin) mainly used for reliming and seldon for long liming of soft leathers.

Chemicals are: Slaked lime in powder

Concentration: 4-6g per 1 litre of lime liquor.

c. Combined sulphide and lime: The most comonly used type of line liquor.

d. Oxidative liming.

(iii) Enzymatic Method:

a. Cold and warm sweating: putrefaction that is curing process brings about deliberately. Hair looseing is affected by formation of enzymes and ammonia. Seldon used method.

b. Enzymatic liming:

Hair loosening is affected by addition of specific enzymes. Aluali prepump or reliming is necessary.

Genral Chemicals Used are:

1. Calcium hydroxide
2. Sodium sulphide
3. Sodium sulfthydrate

other are; hydrodoric acid, sulphuric acid, formic acid, lactic acid, Boric acid etc.

5. FLESHING

The next stage is fleshing. By fleshing it means removing the flesh that has been cut with the skin during the flaying process. The flesh and the fat is removed by machine. The semi-solid waste is used in the production of glue as a by-product.

6. DELIMING

Water is used to wash the hides and skin that delimed by use of sulphide and then wash with water again.

7. BAITING

The purpose of baiting is to further loosen and peptize the fibre texture of the skin and eliminate the alkali swelling by the action of specific enzymes. Enzymes in baiting agents: Enzymes are biological catalysts which accelerate the reactions without themselves being modified. Enzymes which act specifically on proteins are proteases like: (1) Pancreas proteases

(2) Mould fungus proteases

(3) Bacteria proteases

Some enzymes develop their optimum effect in slightly alkaline media and temperature i.e. 30-37°C but above can cause damage to skin.

PICKLING

This process consists of bringing the stock to a condition of equilibrium in a bath of sulfuric acid (H_2SO_4). The purpose of pickling is to acidity the pelts to a certain PH before chrome tannage.
Thus the astringency of the chrome tanning agents is reduced. Pickling contributes to the softness in the leather.

Pickling Methods:-

(1) Salt-containing pickle system.
Common salt (sodium Chloride) with concentration of $6^{\circ}Be^{-}$

(2) Salt - Containing poor pickle system.

(3) Short - pickling methods.

TANNING

After these preliminary preparation, hides and skins are ready for the chemical conversion to leather, known as tanning. Tanning, like soaking is a gradual process from week tanning agents to a more aneentrated solution so that the skin may be properly tanned. Hides and skins are rendered non-putrefiable or they can not decompose again. The oldest system of tanning relied on the action of vegetable material containing tannin, but modern technology developed a large number of chemical agents and processes to produce leather.

Tanning with chrome compounds came to be the most important method in volume of production, although vegetable tanning remain basic for certain kind of leather. In chrome tanning - it consits of neutralizing the acid of chromium sulfate by adding sodium carbonate.

Vegetable tanning:- In this process extracts of infusions derived from tanning beaving plants, backs or growths are allowed to act on hides and skins. The tanner originally processed skins extensively with oak back. Other types of tannage are mineral tannage - i.e. tanning with mineral salts primarily sodium or potassium bichromate *STFN (i)

SAMMYING - This is the removal of the water in the skins and hide by the use of sammying machine.

SPLITTING

Splitting machine is used to achieve the rough thickness needed. The waste from the split can be utilized for building board.

SHAVING

This is to achieve the particular leather.

RETANNING

The process is like the tanning process. The purpose of this stage is to render the skin or hide more putrefrable. The skins or hides are soaked in the solution of water and chrome or in the solution of water and "BAGARUWA" to give vegetable retannage. Duration of retannage: 4-5hrs.

SAMMTING/SETTING OUT

The water embeded in the is removed and the sur ace of the skin is smoothened.

DRYING

Humidity and temperature control are imperative in the drying process in order to maintain proper hydroscopic balance to avoid deformation of surface and fibres by nonuniform evaporation of moisture and to condition the leather for subsequent stages of manufacture. There are tow types of drying i.e. the vaccum dryer which is mainly for the hides alone and the tunnel dryer is for both the skin and hide.



PADDING SECTION (COLOUR APPLICATIONS)

Tunnel drying, in which hides and skins move coninuously through an enclosed tunnel under controlled heat and humidity.

CONDITIONING:- In the conditioning room water could be sprayed on leathers that are too dry to attain the require humidity needed.

STAKING:- This is mechanical action to soften the leather.

BUFFING:- Also mechanical action to smoothened the grain or upper surface of the leather.

DEDUSTING:- Dedusting machine to remove the dust on the leather, so as to allow smooth coloring of the leather.

PADDING SPRAYING/DRYING

This is the dyeing of leather by colour application. Colour is impacted to leather either by dyeing or by applying pigment to the surface. Spraying dyeing is the most important method for dyeing and colouring various kinds of leather. In the spray method the dyes are applied to the leather in an atomized state with pressure spray guns.

IRONING/PLATING

This is the glazing of the leather to make the grain side to be more restance to water.

EMBOSSING:- This is the embossing on the leather the patterns wanted. This stage is normally left out unless special specification demands for it.

MEASUREMENT:- The finished leathers are sold in areas, so the final measurement is in area, which is done by a measuring machine.

PACK/STORAGE:- The finished goods are packed grain to grain or outerpart to outer part this is to avoid abrasim on the finished leather.

DISPATCH:- The dispatch vehicle will come in through the main entrance or gate to the dispatch platform to receive the finished goods. The loading bay is covered. After receiving the goods the vehicles follow the main entrance out to the Nigerian markets or Overseas markets.

NOTE: The semi-finished products of leather (know as wet/blue) is immediately after the tanning process. The semi-processed leathers include pickled, chrome-tanned, vegetable tanned. The production and export of semi-processed leather offer certain economic grains to a developing country.

(B) PRODUCTION HALL

SEQUENCE OF OPERATIONS	TOTAL AREA
1. DELIVERY/SORTING OUT	
2. STORAGE	
3. SOAKING	
Working space=	
Circulation =	

4. LIMING (UNHAIRING)

   Working space

   Circulation

5. FLESHING

   Working space

   Circulation

6. TANNING (deliming, bating pickling & tanning)

   working space Circulation

7. SAMMYING

   Working space

   Circulation

8. SPLITTING

   Working space =

   Circulation =

9. SHAVING

   Working space =

   Circulation =

10. RETANNING

    Working space =

    Circulation =

11. SAMMYING/SETTING OUT

    Working space =

    Circulation =

SEQUENCE OF OPERATION	TOTAL AREA
12. DRYING Working space = Circulation =	
13. CONDITIONING Working space = Circulation =	
14. STAKING Working space = Circulation =	
15. BUFFING Working space = Circulation =	
16. DESUSTING Working space = Circulation =	
17. PADDING Working space = Circulation =	
18. SPRAYING Working Space = Circulation =	
19. IRONING PLATTING Working space = Circulation =	

SEQUENCE OF OPERATION	TOTAL AREA
20. EMBOSSING	
Working space =	
Circulation =	
21. MEASUREMENT	
Working space =	
Circulation =	
22. PACKING	
Working space =	
Circulation =	
23 STORAGE	
Working space =	
Circulation =	
24. LOADING BAY/DISPATCH	
Working space =	
Circulation =	

MAINTENANCE SECTION (AUXILLARY)

The auxillary section is an integral part of the whole complex. General machine repairs, other machinery instalment packing materials storage of fuel for the heater house, laboratory etc. is the sole responsibility of this section. This section is equiped with the necessary auxillary tools and trained machine technicians. Close to the auxillary facilities is the glue production hall. Glue as earlier stated is a by-product of leather industry or tannery, which is included in the 1st phase of my design.

Seperated from the factory also is the stanby-generator with provision for fuel storage at close proximity for generators. Also there is waste water treatment plant behind the factory. This is for the entire factory sanitation. The thruck conveys the hair removed to a nearby plantation about ½km away from the seat of the industry.

AUXILLARY SECTION

OPERATIONS	TOTAL AREA
1. PACKING MATERIAL STORAGE	120 m^2
2. PAINT STORAGE	72 m^2
3. BOILER HOUSE AND STORAGE	72 m^2
4. LABORATORY	60 m^2
5. CHEMICAL STORAGE	
6. WET BLUE (SEMI-FINISHED) STORAGE	120 m^2
7. WORKSHOP/STORAGE	120 m^2
8. GLUE PRODUCTION HALL STORAGE	420

STAFF STRENGTH

The industry is to have sufficient staff to manage it efficiently. The whole complex is to be headed by a general manager. The general manager will act as the line between the Federal Government of Nigeria and the entire factory personnel.

10.	SHOW ROOM (Ephibition or Sample Room)	1	$16m^2$
11.	STATIONARY STORE	1	$1\ m^2$
12.	TOILETS FOR STAFF & CUSTOMERS	2	$32m^2$
13.	DUPLICATING MACHINE ROOM	1	$16m^2$

WORKER'S SOCIAL FACILITIES

CHANGING	NO.	AREA
CHANGING ROOM	1	
SHOWERS		
TOILETS		
URINAL		
WASH HAND BASIN		
WASHING/DRYING AREA		$504m^2$

CAFETERIA/COMMON ROOM

	NO.	AREA
DINNING AREA	1	$240m^2$
COMMON ROOM/STORAGE	1	$172m^2$
KITCHEN	1	
STORAGE	1	
SERVICE	1	
CHANGING ROOM FOR KITCHEN WORKERS.	1	

Workers facilities should be geared to the man power requirements of every industry.

If these conditions could be improved, the future for leather producing (and other industrial products) developing countries seems promising.

CHAPTER 6

DESIGN CONCEPT AND APPRAISAL

It has been proved by experience that good architecture i.e. the blending of good planning, efficient construction and pleasant appearance, when applied to industries buildings, does produce happier and heal their workers, greater production and higher standard of workmanship.

Industrial designs in Nigeria are receiving great attention from the architect, because the old designers tend to separate the workers from the emplyers/administrative workers. One also found out that there is no satisfactory relationship between various building elements involved. Designers must provide for the workers a high standard of creative comfort (i.e. workers facilities), which will eventually has a feed back of happy workers with greater output.

This is the smaller and detended portion of the problem giving me great concern which I set to solve in my thesis. I have tried as much as possible to design an industry where all workers will fill fine and be happy with the job.

Production flow is another major consideration that affects the design. The industry was designed to accomplish a smooth/uniterrupted flow process. In the production area I have I have provided adequate space for the workers, with the auxilliary facilities close to the production hall and easy accessibility to the section where the services are needed.

The zoning of the different units of the complex were carefully set out to achieve the best inter-relationship connections.

FUNCTIONAL DIAGRAM

Though the design is for the present conditions and demand it also caters for future expansion. The following paragraphs will carefully describe the design and explain some special measures taken.

The administrative (or office) block is seen first when the site is approached from the town. It is at the entrance of the site so that any visitor coming to transact any business would go straight without aid to the administrative section, first to the receptionist where he would be

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directed to the appropriate person. There is a suitably located car park for both visitors and office workers infront of the administrative block.

The factory workers have their own entrance different from the administrative staff/visitors and customers. This is not to say am creating inferriority complex among the workers but to avoid conjection at the gate and for smooth business transactions by the customers. The common facilities like this Cefeteria, common room, clinic are all located between the production and administrative block.

CONCEPT DERIVATION

Factors Involved

1. The zoning system allows for interaction between the factory workers and the administrative workers. The general zoning is the quite (administrative) the neutral (social facilities) and the noisy zone which is the production hall/auxilliary facilities.
2. There are two gates to the whole site of the complex. The first gate from town is the workers gate/customers and the second is specifically meant for the goods (raw materials) I have named the gates the clean and dirty gates respectively. There is a possibility of vehicle access from the administrative block to the factory in case any customer wants to supervise his goods during the loading process. Please see the functional daigram.

3. Provision of auxilliary facilities very close to the production hall and with its own off loading bay. The anxilliary facility is spead along the production hall so as to bring necessary services close to the sections where necessary.
4. The production hall is on one level because the nature of the industry does not involve vertical working spaces. The nature of the production shows that horizontal working space is the one acceptable. Also the land is not a barrier or problem as far as expansion or extension is concerned.
5. The changing room/the washing facilities is close to the production hall because of the nature of the industry. While coming for break some of the workers need to wash their body or change before getting to the social facilities area. The common room is between the clock inn and changing so that worker can relax at the common room in case it is not time for work. Opposite or adjacent to common room is the cafeterial where workers could eat and then go into the common-room for relaxatiion. The clinic is between the workers and the senior staff.

STRUCTURAL CONCEPT:

Factors Involved: (Production hall)

1. Spartial demand of the production process.

2. The requirement for a forklift moving through the length of the production hall and other handling equipments like horse back, jacks and pallets used.
3. The use of reinforced concrete folded plates is being dictated because of the nature of the factory. Folded plates will allow coverage of wide span of production area without any intermediate support to abstruct the smooth flow of operation or process. Folded plates also allows the use of natural roof lighting with nice inviting and becoming view when the folds are well exposed. Concrete is used for the roof because of some chenicals or acids/fumes for the store which can cause corrosin on metal. If other types of materials are used the maintainance cost may be too high.

CONCEPT DERIVATION

My concept derivation are chanelled towards

1. Material
2. Personal movement
3. Production process
4. Services

Production:

The production hall is terminated at the two extreme ends by the delivery/storage and storage/dispatch respectively. The auxilliary building is located beside the

production hall to bring the services or supporting equipments close to where there useses are necessary.

DIAGRAM OF THE PRODUCTION HALL/AUCILLIARY FACILITIES

PERSONEL MOVEMENT

The manufacturing personel enter through separate entrance from that of administrative workers/customers. Close to the clock inn is the common-room before getting to the changing room/wash room from where they will enter the production hall.

PRODUCTION PROCESS DAIGRAM

PRODUCTION PROCESSES

As outlined above the concept is influenced by the nature of the leather handing, the sequence are in sections and use of forklife, jacks and horse back with wheels are essential to transfer the leather from one section to the next during processing. The nature of processes is such that there is minimum wastage of material, and result in high quality products. As the concept is maximum utilisation of horizontal space, it is clearly seen on the design that interior colums are eliminated. There is wide horizontal spaces, through the production hall.

INTEGRATED SERVICES.

The character of leather processing industries is that of toxic; air and water poluting. The essential facilities provided air (a) Waste water treatment plant

(b) Maintenance services of the machineries

(c) Adequate electricity due to the nature of the machinery involved

(d) Boiler house For heating the water, because water of different temperature are used at different section of the factory.

(e) Laboratory: to test the quality of the products.

(f) Storages.

(g) Over head water tank for water storage. Note that part of the treated water is recirculated after treatment. To maximise the available water.

(h) Standby generator as National Electric Power Authority of Nigeria is very very unreliable.

(i) Other services are within the common facilities area to serve both the staff and workers. Common-room, clinic, etc. are provided within the complex.

(j) Bus stop - close to the main entrance of the industry.

FINISHES OF THE FACTORY

The climatic factor of Kaduna has made it possible to use good finishes for both the interior and exterior wihtout much harzard.

UNIT	MATERIALS FOT THE FLOOR
Production area	Cement screed covered with non-slip tiles or terrazo.
Social Facilities	Cement s reed and terazo
Administrative block	Cement screed.

For the walls of the complex cement blocks are recommened except on special cases where bricks are used as screen walls.

The roofing material for the production hall is reinforce concrete folded plate. Concrete is used because of the nature of the industry that emits gasses that can cause corrosion on metals or steel. Folded plate is used becuase it can span long distance without intermediate supports, thus maintaining my concept of utilizating the horizontal space to the maximum.

DESING CONSIDERATION:

It is to be noted that the management of the industry shoulders the whole responsibility of caring for the workers. The policy is to have a self-sufficient or reliance industry in one i.e providing almost every thing necessary for smooth and high quality uptput of products.

In the administrative block, it is always better to provide showroom by the main entrance or waiting area for display of the products.

It must be noted that it is of fundamental importance to provide the social facilities, which caters for both the staff and workers. Within the social facilities there is the common room for relaxation, cefetaria, (cafeteria workers must have seperate changing room from that of the factory workers).

The very important point of attention in the design of the production building to allow future expansion during the second phase. The production structure apart from reflecting its industrial character, its easthetic values from an outsider is commendable. The expansion flexibility is fully stressed.

CHAPTER 7

LEATHER INDUSTRY (TANNERIES)

The leather industry in developing countries may be divided into 2 main units, which are in general, non-mechanized and therefore not capable of producing high-quality leathers to uniform standdards, and new large, fully mechanized units. The traditional, rural tanning method is the one termed village method in Nigeria.

In my discussions I will use village method when referring to the traditional/rural methods.

In the following paragraphs I have outlined the advantages and the disadvantage of each method.

VILLAGE METHOD OF PRODUCTION

In most developing countries the leather industry is craft-based, dispersed traditional and inbedded with prejuidices and stigma. The production levels are low and there is the constant possibility of liquidation. The poor living and working conditions of the workers must be improved through education and by bringing science and technology to their doorsteps. This can best be achieved by setting up common facility centres with modern machines, technology and supervision. The economic plight of the small units can be alleviated by their undertaking contract work and working as feeder units to large scale industry. These will help to reduce the stigmas in village tanning method.
The village method in Nigeria is mainly vegetable tanning system.



~~UNHYGIENIC.~~

WASTES ARE PILED UP WITHIN THE RESIDENTIAL AREA.

BETTER WASTE DISPOSAL SYSTEM SHOULD BE EMPLOYED.



VILLAGE PRODUCTION METHODS – NEEDS BETTER MACHINERY

(ABOVE PICTURE SHOWS THE FLESHING STAGE)

Despite the fact that the village method takes longer time than mechanised method it has greatly helped to reduce the shortage of leather in Nigeria. The quality of the products can also be improved if modern science and technology are also employed. Problem of village methods are:

(a) One finds that they waste a lot of material,

(b) It takes longer time to finished the processing

(c) The quality is lower than that of mechanised production.

(d) No skilled workers.

(e) Very inefficient

(f) The number of leather produced daily is very small compared with mechanised method.

(g) Can not attempt to enter the export market.

MECHANISED METHOD

The mechanised method of production makes cheaper and more uniform production possible. The mechanical method has greatly reduced the shortage of leather and leather products throughout the world. Infact the mechanised method is already killing the existence of village method. Sooner or later the village method may no more be in existence.

Advantages of Mechanised Method are:

(a) It has efficiently skilled labour or workers who can handle the material and machine properly.

(b) The daily output is very high. For big industries it can reach 6,000 tanned skins and 600 tanned hides daily.

(c) The wast water and solids are well treated.

(d) Has greatly helped in solving unemployment problem in many countries. A tannery can employ over 700 worker daily.

(e) There is proper division of labour.

(f) There is smooth flow of production, from the starting material to the finished products.

(g) The quality of the products is far higher than in the village method of production.

From the above advantages and disadvantage the proposed leather processing industry to be located in Zaria will be mechanised and a little bit self relient. The production will be about 4,000 skins and 500 hides daily.

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