

THE YOLA ABATTOIR

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Degree of Master of Science in Architecture

by

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DEDICATION

TO MY PARENTS

CHAPTER ONE

- INTRODUCTION
- PROBLEM
- PURPOSE

Introduction

Although animal flesh is not an essential constituent of the human diet, it provides an important source of easily digestible protein, and meat consumption per capita is now frequently used as a rating of the standard of living.

However, animal flesh as a source of human protein poses a serious danger to mankind with its attendant borne diseases which exert heavy toll on human consumers.

This danger always results from the poor handling of animal flesh, which is a consequence of the absence of facilities and trained personnel to coordinate the slaughter operations.

This problem is more acute in the third world - countries, where the factor of low technical know-how and weak Economics, plus climatic conditions, all combine to make the provision of clean and healthy meat to the general public, a difficult task.

Thus, it is against this background, that various within this country have divided to give the issue of provision of improved food supply to the generality of their respective citizens a priority. In order to achieve this noble objective, governments are embarking upon a policy of creating modern and hygienically acceptable slaughtering and animal processing industries, and also applying the equipments and machinery requirements needed for the continued maintenance of these industries.

Thus, it is in the light of this policy, that the Gongola State Government has decided to build a modern Abattoir in Yola - to provide the towns of Yola and Jimeta and their environs with hygienically acceptable meat for human consumption.

Therefore, the purpose of this thesis is to design an Abattoir in Yola which would fulfil these objectives of the state government.

The Problem

Whereas the handling of slaughterstock from the time they enter the lairages until they leave the abattoir as dressed carcasses or as other edible and inedible by-products could not be said to be an easy operation, it is made all the more difficult in third world countries like Nigeria, by environmental as well as social factors.

These factors include the effects of a tropical environment with its resulting high critical temperatures and humidity which is conducive to the growth of meat-spoiling micro-organisms; the absence of any sanitary standards within which butchers and meat handlers would be required to operate, resulting in unrestricted handling of meat by these people, and finally the absence of facilities within the existing abattoirs as evident by the inadequate water supplies and sewage disposal systems.

Furthermore, this problem is compounded by the total absence of any form of indignation from the consuming public vis-a-vis the appalling low sanitary conditions existing presently in the local Meat Industry. This has resulted in the neglect of the upliftment of conditions within the local meat Industry by past administrations.

Purpose

Therefore, the purpose of this thesis is to design an Abattoir in Yola which would use modern equipments and facilities for slaughtering, transportation and storage of meat and its products and fulfill the main objective of the government - that of providing hygienically acceptable meat to the citizens of the towns of Yola and Jimeta.

To achieve this purpose, this thesis would attempt to employ architectural solutions to meet the following goals:-

- a) That of using the abattoir as a source of revenue for the state and its citizens by:-
 - i) Maximising the daily production of meat and giving allowance for future expansion.
 - ii) Using the Abattoir for the provision of employment for the local populace.
- b) The provision of an efficient communication system through:-
 - i) The smooth flow of raw materials and the evaluation of finished products in the form of dressed carcasses to be achieved by an organised space relationship in the production area.
 - ii) The establishment of adequate and safe communication links between the various facets of the production area.
- c) To humanise the area within the abattoir for the workers by the provision of:-
 - i) Adequate health and welfare facilities.
 - ii) Adequate facilities for their safety within the complex.
 - iii) Adequate atmospheric environment both inside and outside the buildings of the Abattoir complex.

CHAPTER TWO

- REVIEW OF EXISTING SLAUGHTER SYSTEMS IN NIGERIA

REVIEW OF EXISTING SLAUGHTER SYSTEMS IN NIGERIA

A look at the existing slaughter systems provides the easiest way of getting an insight into the development of the Abattoir systems in this country from the early slaughter slabs to the modern in-line dressing systems presently being used in some parts of the country, and also sheds some light on the cultural - aspects of the local cattle Industry viz - the local commercial aspect as regards the cattle Industry as well as the traditional butchering and marketing systems.

A look at the National cattle market shows that is dominated by three interest groups namely:-

- i) The traditional cattle owners, that is the nomadic tribes.
- ii) The cattle merchants who are mostly rich business men acting as middlemen by buying the cattle from the nomadic tribes and selling them to the third groups, namely:-
- iii) The Butchers, who undertake the slaughter of the animal and disposal of the carcass to the consuming public through retain outlets.

The number of animals handled daily by a butcher depends upon his economic status, and as such, the rich butcher normally handles large numbers of cattle daily while the small-time butcher usually handles one or two - animals daily. The small time butcher is able to stay in business by making use of credit facilities normally offered by the rich big-time butcher who favours the link between the cattle merchants and the small-time butcher. Thus, it can be observed that the small

butcher forms the last link in the long chain of cattle dealing and performs the valuable function of facilitating the distribution of meat within large urban populations which more often than not are poorly served with retail outlets.

The small butcher normally undertakes the slaughtering of his animals and for this purpose employs three to four slaughtermen who carry out all the operations involved from the flaying, evisceration to butchering. However, the actual killing process is carried out by a licensed slaughterman - who answers that the killing is performed in accordance to religious - requirements, namely the Muslim law.

The Butcher's slaughtermen normally do not receive payment in form of cash, but by taking some parts of the carcass which they consequently resale to the public.

The slaughtering facilities varies from the use of a convenient tree, slaughter slabs to the modern in-line dressing systems.

In some Rural areas, slaughter still takes place under a convenient tree with the animal hoisted on a branch and all operations being carried out on the carcass on such suspended position. In this case, sanitary conditions are - maintained to some extent by moving on to another tree as the previous site becomes fouled. Presently, this system is rarely used.

However, the development of large Urban centres has given rise to the need for the concentration of slaughtering facilities at permanent sites, with the development of the slaughter slab being its consequence.

The early slaughter slabs consisted of concrete hard standing on which all the slaughter operations were carried out. They were characterised by the absence of any hoisting facility - which meant that all operations were carried out on the ground at one spot. Thus, bleeding, flaying, evisceration and dismemberment were carried out where the animal fell and was killed. Consequently, blood and stomach contents were mixed up with the carcass and in most cases, little or no water was available for cleaning purposes. Attempts to overcome this serious defect were made by designing the - slaughter slabs in such a way that the concrete hardcover on which all the operations took place sloped into an open drainage system which was - intended to carry away the wastes of the slaughter operations.

However, lack of water and the absence of staff responsible for clearing the drainage system of solid wastes rendered this innovation - inoperative, thus, consequently, these drains became blocked in actual practice.

Another important aspect of the slaughter slab was the fact that within a short time, the slab were required to handle more slaughtering than the capacity for which they were designed, with the result that the drainage system became inadequate for a large part of the slaughter. The - system of carrying out a large part of the slaughter operations on the ground became so deeply entrenched within the system such that when at a later date hoisting facilities were included in slab design, they were largely ignored by the slaughtermen.

Continuous efforts at improving the slaughter slab led to the evolution of an advanced type of slaughter slab known generally as the slaughter-house where the basic concept of design was the separation of the killing operation from the rest of the slaughter operations and the enclosure of the slab inside a building. As all the operations were still being carried out by the individual butcher and his staff, the slaughter-house was provided with multiple individual cubicles in which the slaughtering took place and also with hoisting and overhead transport facilities for conveying the carcass into the main hall where, flaying, evisceration, and dismemberment took place.

However, as in the case of the slaughter slab, the slaughter-house was also rendered inoperative because within a short time, the numbers of cattle to be slaughtered were considerably in excess of the design capacity with the result that slaughtering had to revert back to open slab conditions, but this time within an enclosed building which is quite inappropriate to the operations being carried out.

The resultant appalling sanitary conditions within the sites and - coupled with the mixing of blood and stomach contents with the carcass in the slaughter halls; - meant the offering to the public, of dangerously contaminated meat.

At this juncture, it is imperative to examine where despite all attempts at improvements, there is always this tendency of slaughtering facilities to refer back to the slab conditions. The cause might be needed by - Individual butcher to identify all parts of the animals as his property, which requires a multiple in-line system which only the slab-system could accommodate.

The last stage in abattoir evolution is the modern "line dressing" system in which the most recent innovation is the in-line dressing system. In this system, the animal is hoisted to an overhead track after skinning and all other subsequent operations are carried out on the track. Working platforms at adjusted at heights appropriate to the parts of the carcass on which work is being done are used by the operators for more efficient handling of the carcasses. Parts of the carcasses not considered clean are kept in proximity to the carcass only for the time necessary for inspection after which they are removed to the by-products area for subsequent operations. This system may be either manually operated or a mechanised conveyor system may be used. Modern incline systems are characterised by the following:-

- (i) The use of humane stunning methods in the form of either the captive bolt pistol or the electric stunning methods. Slaughter either by ritual methods or any other ways could then be effected.
- (ii) The performing of all subsequent operations with the carcass suspended from an overhead track. Hoisting is effected after stunning.
- (iii) The separation of stomachs, offals and intestines from the carcass after inspection.

The "in-line" dressing system has made it expedient for operatives in slaughtering to specialise in the handling of specific parts of the carcass as it is not possible for one man or a group of men to carry out all operations on an individual.

Specialisation would ensure better handling of the carcass, hence the supply of higher quality meat to the public.

CHAPTER THREE

- SLAUGHTERING TECHNIQUES.
- METHODS OF SLAUGHTERING.
- REQUIREMENTS FOR HUMANE SLAUGHTERING.
- SLAUGHTERING FOR MUSLIM COMMUNITIES.

a) Striking Instrument

This method involves the use of a club or pole-axe as a striking instrument for stunning. The blow must be dealt with precision and force to ensure that the roof of the skull is smashed at the outset, thus causing the animal to lose consciousness immediately.

In cattle, the point of aim is the intersection of the lines drawn from the base of each horn on one side to the inner corner of the eye on the opposite side. At this point, the brain is under the thinnest portion of the skull.

However, in small ruminants i.e. sheep and goats, the brain is more easily reached from the back of the neck.

Since pigs are blessed with a well developed frontal cavity, which makes it difficult to affect the brain by a frontal blow, in this case, the blow should be aimed at a point just above a line drawn between the animals eyes.

When applying this method for the stunning of animals, care should be taken to see that the animal's head is secured, as this reduces the risk of the blow missing the right spot, consequently reducing the risk of unnecessary suffering to the animal.

b) Use of a Pistol (with a bolt or a bullet).

This technique involves the use of a captive bolt which is a pistol discharging free bullets. The discharging bolt penetrates the skull and the brain. However, the use of a pistol discharging

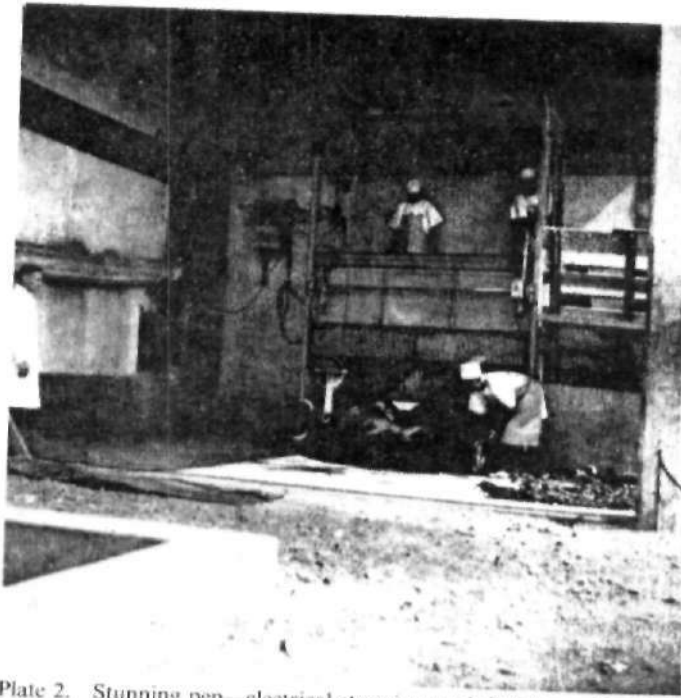


Plate 2. Stunning pen—electrical stunning used. Salisbury, Rhodesia

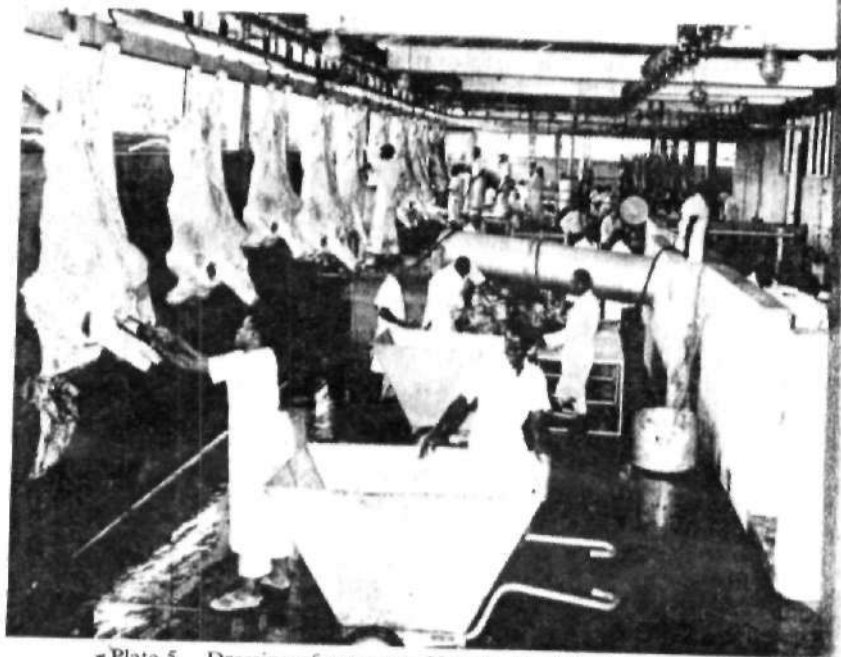


Plate 5. Dressing of carcasses, Uganda Meat Packers, Kampala

- (i) Small animals (Ruminants) - 198 watts.
- (ii) Cattle and Horses - 285 watts.
- (iii) Bulls - 420 watts.

The moment the current passes through, the animal is seized with - muscle spasms which stop within 10 - 20 seconds and the head drops towards the floor with the legs executing reflex walking movements.

Electric Stunning in pigs often produced "blood splashing" in the carcass. However, the main factor concerned in reduction of "blood splashing" appears to be the interval between interruption of current flow and "sticking". The recommended interval is five seconds.

Gas (Carbon dioxide)

This method of preslaughter anaesthesia is mostly applied to pigs and has been successfully used in America and Europe and may well be adopted in the tropics in large bacon factories.

In the original "oval tunnel", type, pigs are admitted singly - through a hand-operated gate to a conveyor belt which is divided into three compartments. The conveyor transports each pig through an oval tunnel which contains a mixture of 62% - 70% carbon dioxide in atmospheric air and on exposure to the gas, the pigs become anaesthetized. The pigs as they are removed from the gas chamber on a conveyor belt are shackled mechanically by the leg on to the bleeding rail, where they are stuck and bled. Advantages of this method are:-

- (i) Pigs enter the machine through hand operated gate, and while the gate is open, the conveyor stops moving and the pigs may enter without struggling and discomfort.

- (ii) The pigs are immobilized when shackled and hoisted.
- (iii) They are completely relaxed when "stuck".

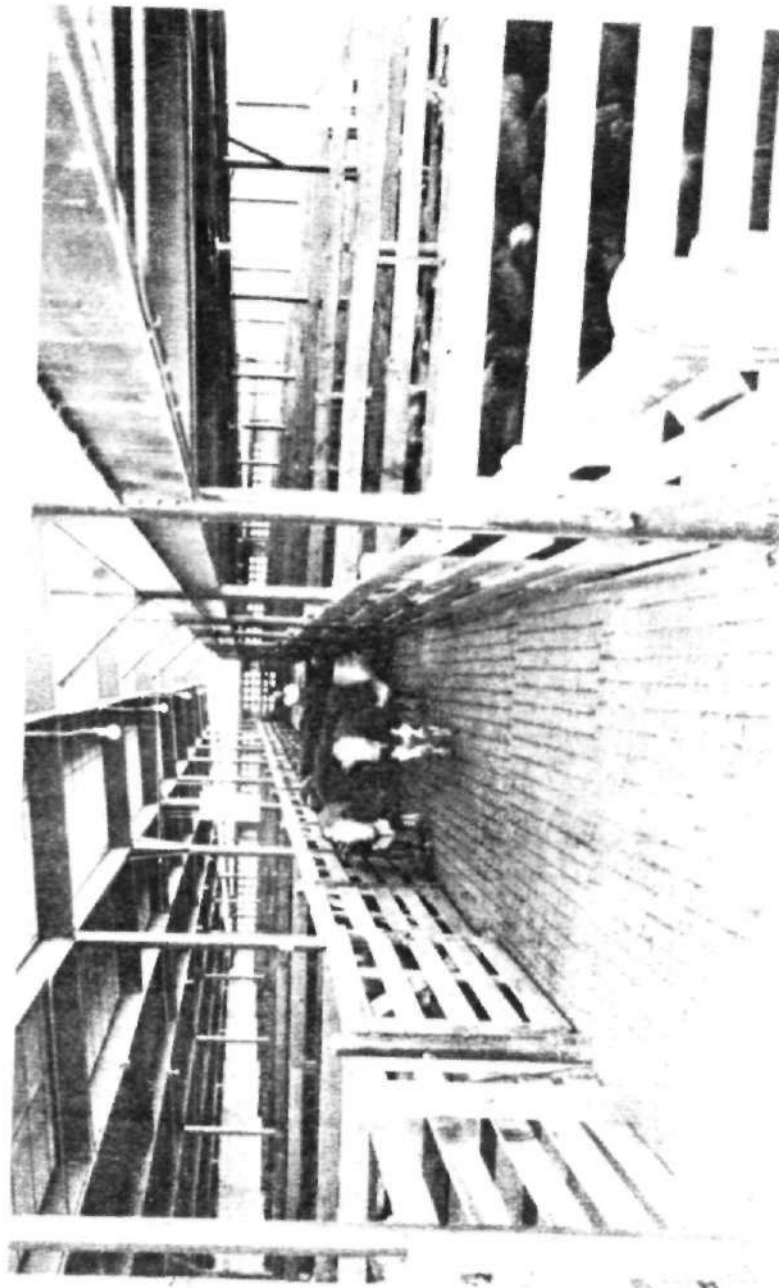
Requirements for Humane Slaughtering

In designing an Abattoir, efforts should be directed towards the provision of facilities which ensure that the animals are slaughtered as humanely as possible. Human slaughtering does not only mean the use of painless techniques for the slaughtering of an animal, but also include the overall attention given to the animal from the time it enters the lairages until it reaches the stunning pens.

These include the total separation of live animals from carcasses or any product following slaughter. The provision of sufficient lairage space with sufficient water supply, shade and ventilation. Access from the lairages to the killing floor should be direct with the entrance to the killing floor narrow to prevent the animals from turning round, and it should be ensured that this part is completely screened from other operations within the Abattoir.

Also, in connection with achieving these requirements, other details should also be considered like the design of offloading ramps, the rounding of all corners, the provision of non-slip surfaces in floors of passages and the avoidance of drains crossing these floors.

In fact, all efforts should be made to ensure that from the moment the animal enters the lairage until it is bled, it does not suffer any heat, fatigue, excitement or beating, nor sees dressed carcass, running



v Figure 12.—Livestock pens.

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blood or other animals being slaughtered. The ideal requirement is for death to come instantaneously while the animal is in a state of unconsciousness after being stunned.

A quiet and relaxed animal bleeds more satisfactorily than an excited one, and hence yields a better carcass with a longer keeping quality and better hide.

SLAUGHTERING FOR MUSLIM COMMUNITIES

The Islamic law lays down two basic laws for the slaughtering of animals for consumption in Muslim communities. These laws are:-

- (i) The involving of the name of Allah during slaughter and subsequently the orientation of the animal towards the holy Ka'aba and
- (ii) The complete flow of blood from the carcass, since under the Islamic law, blood is forbidden as a food for Muslims.

These two laws are binding on all Muslims and as such, only slaughter technique which does not take cognisance of them renders the carcass of the animal unfit for consumption for Muslims.

EQUIPMENTS AND MODIFICATIONS WITHIN ABATTOIRS FOR MUSLIM REQUIREMENTS.

When designing an Abattoir, considerations have to be given to the community's customs and religious aspects - especially with regards to the type of animals that are slaughtered.

Since, an Abattoir is an important social facility that is supposed to cater the needs of the various sections of a community, there is always the problem of how to go about achieving this objective.

For instance, the Islamic religion lays down clear guidelines as to the types of animals that can be killed for food by its adherents and those that are prohibited to them. Among those prohibited, is the pig, which is regarded as unclean, and in no circumstances, may its carcass, offal, blood or manure come into contact with animals or meat slaughtered for Muslim communities. However, the pig is an important diet of the non-Muslims and Abattoirs have to cater for the needs of this section of the community as well.

The easiest solution to this problem might be the building of separate Abattoirs to cater for these divergent needs, but this solution, more often than not, is not economically viable, thus the best alternative might be the creation of a separate lairage and slaughter hall to serve pigs and other - one for cattle, sheep and goats, but all these facilities should be located - within the framework of a single Abattoir complex.

However, even putting the religious consideration apart, most experts have agreed that the separation of the pig slaughter hall should be an essential aspect of any abattoir in view of the fact that the steam and dirt produced as a result of scalding and scraping of pork has a contamination effect on the carcasses of other animals, thus affecting their keeping quality and forming a serious health hazard.

Other factors that should be considered when slaughtering for Muslim communities include:-

- (i) The slaughter of healthy animals, which meant that diseased animals are prohibited.

- (ii) The ensuring of a quick method of slaughter as exemplified in the Muslim method of slaughter whereby the animal is casted so that it lies on its side and the throat cut by a single stroke from a sharp knife which serves transversely the trachea, oesophagus and the large blood vessels.
- (iii) The attainment of complete bleeding of the carcass, hence ensuring the keeping quality of the meat. Since the severing of the blood vessels allows the heart of the animal to continue beating, and hence the animal to continue breathing, complete bleeding of the carcass can be assured by - hoisting the animal after the throat is cut.
- (iv) The conducting and supervision of slaughter by a Muslim as this ensures that the name of God is involved during slaughter and correct orientation achieved, rules which if not fulfilled means that the carcass is prohibited to any Muslim to take as food.

Equipments.

The Islamic religion commends its followers to be kind to animals, and hence should adopt methods for the killing of animals as humanely as possible and with the least pain.

Thus, equipments used in abattoirs for Muslim communities, as long as they fulfill these requirements, are acceptable to all Muslims.

CHAPTER FOUR

- DESIGN FACTORS IN AN ABATTOIR
- PLANNING.
- SITING
- SERVICES TO THE SITE.
- TRAFFIC CIRCULATION.
- SANITARY CONSIDERATIONS.

CHAPTER FOURDESIGN FACTORS IN AN ABATTOIRPLANNING.

The design of an Abattoir is essentially a functional problem requiring the economical use of space for the provision of a smooth flow of operations from the animals off-loading bay to the dressed carcass (finished product) dispatch area and the ensuring of the provision of safe equipments, satisfactory - working condition and the maintainance of the highest sanitary conditions.

It also involves the provision of efficient internal communication networks, and facilities for meat inspection and the quick and easy removal of - diseased carcasses and organs, and also the harmonization of the whole - complex to the countryside and local climatic conditions.

Broadly, an abattoir consists of four zones and any design of an abattoir must reflect these zones in its layout. These are:-

- i) The Pre-slaughter Zone.
 - ii) The Slaughter zone.
 - iii) The By-product processing zone.
 - iv) The Administrative and workers facilities zone.
- i) The Pre-slaughter Zone.

This zone consists of the lairage area, where the animals are accommodated on being brought to the abattoir. It is usually provided with an off-loading ramp for the off-loading of animals brought in either by rail or - vehicles, and their ramps should be large enough to accommodate the arriving vehicles and of adequate height and width to permit easier off-loading.

It is also normally provided with ante-mortem inspection facilities and isolation blocks for diseased or suspected stock, and also with an efficient water supply system.

The surfaces here, are of concrete and non-slippery and this is achieved by the use of concrete mixed with granite chips which gives a good grip.

Thus, in this zone, all efforts are made to ensure that the animals are well-rested from their journey to the abattoir, and are put in a condition that is favourable to the production of meat of good quality.

ii) Slaughter Zone -

Slaughter Hall.

All operations within any abattoir can be classified into two classes. These are the clean and the dirty operations. The slaughter zone normally caters for the clean operations within the slaughter zone which - basically is the provision of clean, healthy and dressed carcasses fit for human consumption.

This normally takes place in the slaughter hall which include the killing areas. Facilities for skinning, lagging, evisceration and dressing of carcasses are provided in this zone. To ensure the quality and healthiness of the meat, a meat Inspector's office together with - accommodation for keeping records, specimens and laboratory equipment should be provided.

Efficient drainage system for the removal of wastes (both liquid and solid) should be provided here to reduce the danger of meat contamination, and also continuous water supply (both hot and cold) should be ensured.

The chilling and storage rooms are normally attached to the slaughter hall.

iii) By-Product Zone.

This zone handles the dirty operations of the slaughter house and these include the treatment of hides and skins from the slaughter hall and the conversion of the inedible parts of the offal into animal feeds and fertilizer.

It also consists of the gutters or Triperies which cater for the cleaning of the viscera and the stomach contents as well as the treatment of the legs and heads of the slaughtered animals.

The condemned meat room and the destructor for its disposal or conversion into fertiliser are also located here as well as the Emergency slaughter room which is located close to the condemned meat room and is in communication with the by-products plant.

Other facilities which include the boiler house for the supply of hot water to the slaughter halls, and the engine rooms also form a part of this zone.

Especially in the tropics, it is essential to have this zone totally separated from the main slaughter halls, for ventilation and meat quality purposes.

iv) Administrative and Workers Facilities Zone.

This zone consists of the Administrative section which ensures the smooth running of the Abattoir complex and the workers facilities area which consists of lavatories, Washing and shower facilities to ensure the maintainance of satisfactory hygiene among the Abattoir workers.

It deals with the overall comfort of the workers within the complex and other facilities which go along way towards achieving this like the - workers cafeteria and kitchen are also located within this zone.

SITING

An Abattoir should be located (so far as practical) in areas free of objectionable odours and away from the residential areas preferably in the Industrial sector of the town. This reduces to minimum the inconveniences caused by odour and noise to members of the residential areas, and also reduces the cost factor of the required land.

In the siting of Abattoir, consideration should be given to the building of Abattoirs in such a way that they serve a wide area as is practically possible. Thus, the tendency to build one abattoir to serve a group of towns or villages should be encouraged.

Abattoirs should be readily accessible both to users and cattle. Adequate dustproof access-ways for automobile trucks, connecting the shipping and - receiving areas of the plant to the public streets or highways, should be made available. If supplies or raw materials are to be received into the plant or finished product is to be shipped from the plant by rail, consideration should be given to arranging for suitable railroad spur tracks.

Also, facilities for the disposal of wastes (both solid and liquid) should be an essential aspect of any abattoir complex. This waste-water disposal plant should form part of the site. For waste disposal purposes, the ideal site - would be on a hill, near a river or a lake, such that it would be possible to discharge the wastes into them after a simple purification process. These sites would also be ideal for the provision of drinking water and also abundant water for use for the day to day running of the abattoir.

Efforts should also be made to ensure that an abattoir is completely separated from any other plant or buildings, whether used for industrial, commercial, residential or other purposes.

No communication by means of doorways, windows, stairways, elevators, or passageways, loading or unloading platforms, or loading courts is permissible.

SITE SERVICES

Water Supply.

There must be ample water supply both for drinking purposes and for the day to day operations of the abattoir. This water must be well-treated preferably chlorinated to ensure the maintenance of the highest healthy-standards.

Within the main slaughter halls and the by-product areas, hot and cold water points must be provided and hot water storage facility must be available to meet peak hour demands. Steam points should also be conveniently located within these areas for the cleansing and sterilisation of equipments used within the slaughter hall and the by-product unit.

Normally, 'on site' water storage tank with a capacity of at least a days normal consumption should be provided. Standards give the daily requirements of water for each as follows:-

Cattle	-	1500	litres	daily
Pigs	-	600	"	"
Sheep	}	- 600	"	"
Goats				

The requirements for the workers facilities and administrative units are:-

Workers Facilities - 100 litres per worker per day.

Administrative Facilities - 50 litres per workers per day.

DRAINAGE

Internal Drainage.

Internal drainage within the slaughter halls should be carefully planned to ensure that waste water especially from the wet areas is adequately drained from these areas. This could be achieved by the taking of the following measures:-

- (i) The use of open channels or valleys provided with metal gratings and the sloping of floors towards these drains. The floors should be of slope $1/50$ or in dry working areas, a slope of $2/100$ is acceptable. However, care should be taken that open channels from unclean areas do not pass through clean areas.
- (ii) In the case where drainage pipes are used instead of channels, these pipes should be of 10cm minimum diameter, and should be constructed of cast Iron or galvanised metal. At least one inlet should be provided for each 40 sqm of floor area.

- (iii) In modern Abattoir where the in-line dressing rails are used, drainage channels or valleys should be provided below the rail. These floor drains or channels should be equipped with deep seal traps and be properly vented to the outside air.
- (iv) Drainage pipes from wash basins or other equipment should not be permitted to discharge directly onto the workroom floor.

External Drainage.

Efforts should be made to ensure that the direction of all effluent pipes or drainage channels is away from the main slaughter hall and the - edible product handling premises and if possible, these drainage lines should follow the natural slope of the land.

External feeder drainage pipes should be of 20cm diameter, while the main drainage pipe that carries effluent to the waste-treatment plant should be of 30cm diameter. Where open channels are used, they should be covered wherever they pass in close proximity to any building.

Plant Waste Disposal.

- (i) An efficient method of disposing of plant wastes is essential. If permitted by local ordinance, plant wastes may be discharged into municipal sewer system, and this is most desirable. If discharge is into a stream, the flow of water must be sufficient at all seasons of the year to carry the sewage well away from the plant. If private septic tank or sewage disposal system is used, it must be sufficiently designed and operated so as not to produce objectionable conditions on or near the official premises.

Sanitary Considerations.

In modern abattoirs using the in-line dressing system, there is a cycle of - operations which starts from the killing pens and then onto a conveyor belt. The succeeding operations may be carried out according to two different systems as shown in schemes A and B.

In scheme A, the carcass moves along a conveyor chain from which branch off the secondary circuits for the by-products while in B, the chain is interrupted at the point where the principal operations are carried out, the circuit subsequently being resumed after the operations.

The scheme 'B' enables the veterinary Inspectors to maintain a more careful supervision of the carcass, since it enables them to cover all phases of the work - and allows the immediate seizure and consignment to the condemned section of any infected carcass or offal. With the continuous chain system in scheme "A", the carcasses are already dressed before inspection, which means that the sanitary Inspectors have less material at their disposal on which to base judgement. Coordination between the Inspectors on the visceral circuit is also rendered extremely difficult since it is always extremely hard to identify the organs from a suspect carcass. Coupled with this, is the loss of time caused by seizure through the interruption of operations. This loss of time is chief disadvantage of the scheme ("A").

Sanitary Inspection is carried out in two stages, the first being the examination of the live animals which takes place when they enter the abattoir yard and is known as the ante-mortem. After this examination,

animals found to be unacceptable are immediately destroyed and rendered. Those regarded as suspects are conducted to the isolation pens where after an adequate period of examination, they may be passed into:-

- (i) The condemned slaughter room for destruction and rendering if they are found to be unfit for human consumption.
- (ii) The quarantive slaughter room; if found to be partially usable
or
- (iii) The normal circuit, if found to be sound healthwise.

The second stage of Inspection is carried out during the operations that follow the actual slaughter and consists of the Inspection of four separate items. In the modern in-line dressing system, this is effected at specified points in the circuit for the principal operations. This Inspection covers chiefly the head, abdominal cavity opening the viscera, the halved and dressed carcasses.

Whichever of the two chain systems is used, carcasses or parts of carcasses that are judged unacceptable must be taken out of the circuit immediately and removed to the appropriate of the sanitary premises for destruction and rendering.

The sanitary premises normally located where it is easily accessible from the main slaughter halls, should be divided into condemned and suspect sections and the plant for the destruction of condemned carcass should always be located in the condemned section but with access to it from the suspect section.

High sanitary standards are also enhanced by the selection of appropriate constructional materials, and in particular, materials to be used for floor and wall coverings. Materials used shall be impervious, easily cleanable, and resistant to wear and corrosion as it is essential that walls and floors of workrooms, cold chamber should be easy to wash, clean and disinfect.

Finally, the hygiene and cleanliness of the abattoir personnel should be considered by the provision of healthy and well ventilated workers facilities premises which include lavatories, showers and changing facilities, and normally in close proximity to the main work areas.

CHAPTER FIVE

- ABATTOIR LAYOUT
- CATTLE AND RUMINANTS SLAUGHTER HALL.
- PIG SLAUGHTER HALL.
- BY-PRODUCTS TREATMENT AND SEPARATION.
- REFRIGERATED STORAGE.
- DISPATCH OF FRESH MEAT.
- GENERAL AMENITIES.

ABATTOIR LAYOUT

LAIRAGE.

A lairage is an enclosed and covered area normally built within the confines of an abattoir and serves as the holding zone for animals brought to the abattoir for slaughter. Its size is normally determined by the maximum number of animals slaughtered daily in the abattoir,

Lairage sizes are based on the space requirements for each breed of animal and the recommended standards are:-

Cattle loose	-	2.32 - 2.8 sq. m
Cattle tied	-	3.25 sq. m
Sheep/Goat/Pig	=	0.56 sq. m.

These areas represent the actual pen space requirements, but for better housing, an additional space allowance of 25 - 30% for passage ways and reception areas must be made.

Lairage Composition.

- i) Reception area.
- ii) Animal pens.
- iii) Isolation pens for suspect animals.
- iv) Fodder and bedding facilities.
- v) Toilet Facilities.
- vi) Passage ways.

i) Reception Area.

As most animals are frightened of steep descents, the reception areas should consist of an off-loading dock constructed about 1.07m above road level so as to accommodate the varying tailboard heights of animal vehicles. Thus, on a flat site, a compromise between lowering the road level or raising the reception floor level should be decided upon. The off-loading dock should be designed to accept wagons in angled formation or straight line and should be wide enough such that the animals are not frightened when off-loaded. The enclosing of unloading points for the keeping of species separate is also an added advantage. However, these off-loading bays should be drained to avoid the fouling of the roadway.

ii) Animal Pens.

Separate pens are normally provided for each species, though cattle and sheep pens can be comfortably interused depending upon the number of respective species available. Cattle and sheep can be comfortably housed in pens of approximately 24.00 sq.m, a size capable of accommodating 8 - 10 heads of cattle and 40 sheep and goats. Pigs could also be held in families of say 10 per pen of size 6 sq. m.

Pens could be divided with either tubular pipes or solid walls. Where steel fencing is used, it should be galvanised after manufacture to protect it from corrosion and in the case of solid wall, it must be impervious to moisture. Pens divisions should not be less than 1.22 m for cattle and 0.90 for pigs and sheep.

Within the pens, water troughs should be provided with suitable overflows located over or adjacent to open floor drains.

The gates to the pens should be constructed with steel pipes which should be hot dipped and galvanised after manufacture and should be latches and hinges that are strong and easy to clean. They could be single acting or double acting but should have efficient locks that are strong but easy to operate.

iii) Isolation Pens.

Isolation pens should be provided for the accommodation of suspect animals, where they are quarantined for observation for a period of two to three days. Normally, after the initial ante-mortem examination, suspect animals are directed to this zone.

The pens should be solidly partitioned to a minimum height of 1.83m and provided with easily lockable gates. The floors must be well drained, and for more efficient inspection purposes, must be provided with artificial light. Water and feeding arrangements should be separate for this area.

iv) Fodder and Bedding Facilities.

These are small rooms within the confines of the lairage area, used for the storage of animal fodder for the feeding of animals brought to the lairages. Normally, they are located in close proximity to the animal lairages.

v) Toilet Facilities

32.

These are provided for use by the animal hands working within the lairages and the drivers of the vehicles bringing animals to the abattoir and all other people involved in animal handling in this zone.

vi) Passage Ways.

Passage ways must be of sufficient width for the driving of animals, and widths of 2.0m are appropriate for animal handling and also for cleaning purposes. A tractor with a sloop or a hand barrow can be used for purposes of cleaning. Passage ways should also be paved with concrete preferably non-slip for better grip by animals.

vii) Drainage

Pen floors must be laid to a fall of 50mm in 3m and all drainage lines should be sited outside the animal pens in the passage ways. Floors should be of tamped concrete for economic purposes.

viii) Ventilation and Lighting.

Natural ventilation could be achieved by the use of screen walls or vertical concrete panels which ensures efficient ventilation and at the time protects the animal pens from adverse weather conditions such as rain. Where natural ventilation is not possible, mechanical means such as the use of extractors or the fan and duct system should be considered.

For efficient examination and observation, sufficient lighting is required. Thus, where the natural lighting is not sufficient, well distributed artificial lighting could be used.

SLAUGHTER DEPARTMENT

This consists of three separate lines namely:-

- a) The cattle line.
- b) The sheep and Goats line.
- c) The Pig's line.

CATTLE SLAUGHTER HALL

Cattle Race.

The link along which the cattle moves from the lairage to the cattle stunning pen is known as the "Cattle Race". It is normally 0.90m wide and slopes upwards from the lairage as the floor of the stunning pen is normally 0.50m higher than that of the slaughter hall. The floor of this passage should be rough tamped and the length should not be more than 5.0m.

For the driver's safety and maximum control of the cattle, a drover's passages with floor level 0.30m above of the cattle race, is normally constructed alongside the cattle race. The two passages are separated by a wall 1.22m high and this offers the drovers maximum protection from the animals. As much as possible, 'cattle race' should be along a straight line for efficient droving.

Stunning Pen.

The simplest type of stunning pen uses specially shaped concrete floor in conjunction with a revolving discharge door for the discharging of animals into the slaughter hall floor after stunning. This type of stunning pen is simple and easy to operate and can handle up to 60 animals per hour.

Dry-Landing Area.

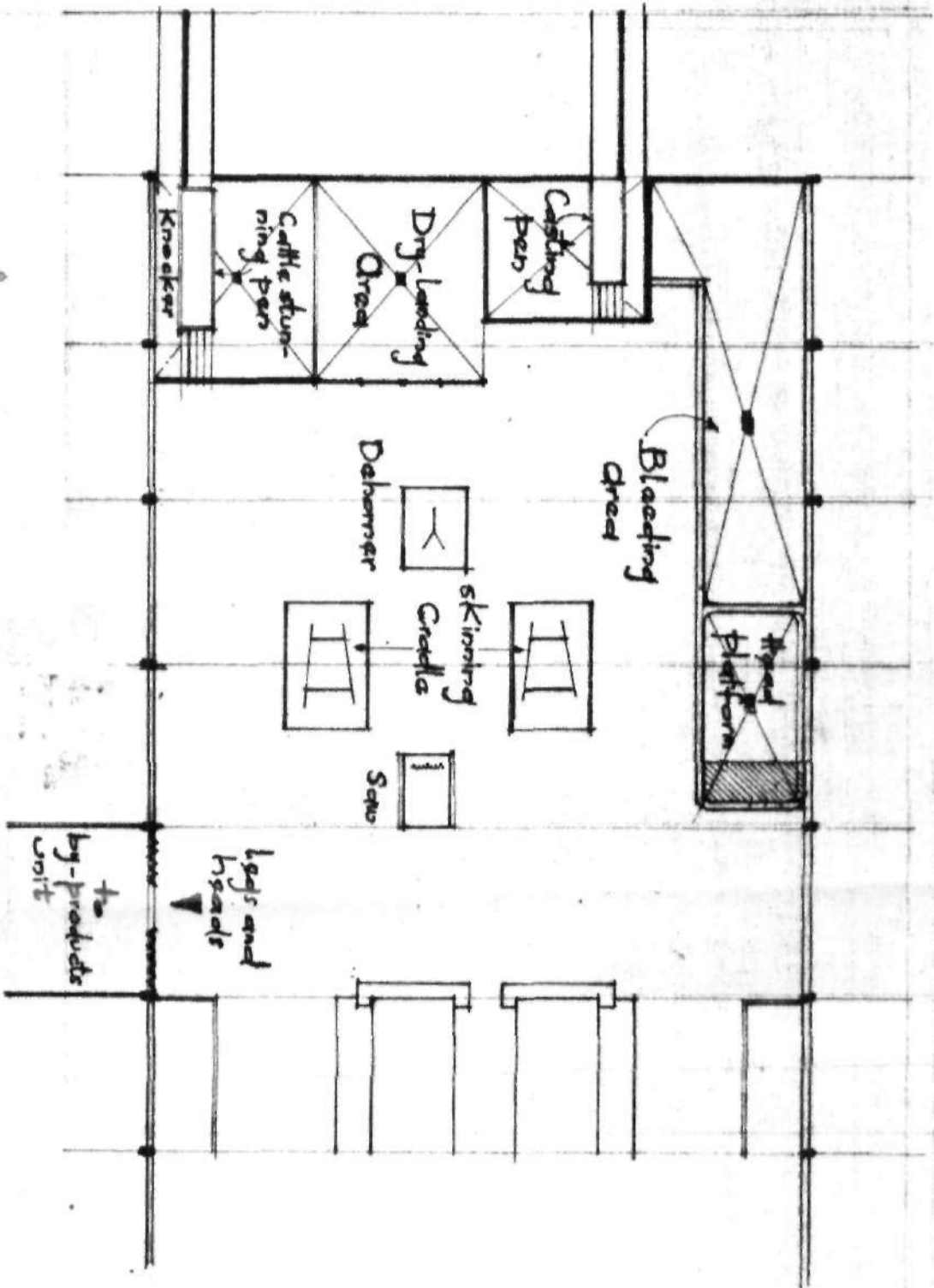
The dry-landing area at least 3.50m wide should be provided in front of the stunning pen to receive stunned animals ejected from the stunning pen. This area must be enclosed by a fence about 1.20m high to prevent the escape of improperly stunned animals and be provided with an opening for employee's entrance and exit. The fence shall be constructed of rust-resisting metal pipes and may be installed as upright pipes.

A 5.00m x 3.50m provides the minimum area for safe working conditions and if an electric hoist for the moving of animal carcass from this area is installed, efficiency could be greatly increased.

The floor of the dry-landing area is subject to impacts loads from carcasses and shadeless, so the finish should not only withstand these impacts but also be resistant and have good non-slip qualities. To avoid increased hide contamination, it should also be kept as clean and dry as possible and be adequately drained.

Bleeding Area.

A curbed-in bleeding area of adequate size must be provided and be located so that blood will not be splashed on stunned animals lying on the dry-landing area or on carcasses being skinned on siding beds. Bleeding troughs could be cast in concrete or built in masonry with impervious surfaces and coved junctions. Lengths of the bleeding troughs vary, but sizes are calculated on the basis of a bleeding time of 8 minutes per beast and a minimum length of 2.5m. This gives the following standards for trough lengths:-



Layout
 Diagram of typical Beast — Stumping
 and Bleeding Area for Cattle and Sheep.

up to 15 heads per hour - 2.50m with 2 beasts bleeding + one in sticking position.

15 to 20 heads per hour - 3.05 with 3 beasts bleeding + one in sticking position.

20 to 30 heads per hour - 3.70m with 4 beasts bleeding + one in sticking position.

30 to 40 heads per hour - 5.0m with 6 beasts bleeding + one in sticking position.

A bleeding rail 0.90m from the face of the wall and with its top at least 5.0m above the floor level or the metal grating over the bleeding area and dressing rails at least 3.00m above the floor level are required.

Facilities For Handling Legs and Heads.

Suitable facilities and adequate floor space should be provided for de-honing, flushing, washing and inspecting of heads. If rails are used for head - inspection, the heads must be spaced 0.60m on centres and a distance of about 1.2m be provided between the bottom of the head hooks and the inspectors foot platform. These operation (head removal) are normally carried out while the beast is suspended from the bleeding rail.

The legs should be severed at this juncture and dispatched to the guttery for cleaning.

Hide Removal.

Hides should be removed and passed out of the slaughter hall in such a way that contact is avoided between it and other edible carcasses. Removal

could be effected either by the use of manual means i.e. manual flaying or by mechanical means which involves the use of Hide stropper or a Hide puller.

A Hide stripper is a machine equipped with devices which, when attached to the fore or hind legs skin, pull the hide vertically up or down and - away from the carcass, whereas a hide puller is equipped with powered arms which grip the hide at each flank and exert a great pull from flank to back, the final removal being a manual operation.

Cattle Dressing Layouts.

Cattle dressing layouts are of three principal general types:-

- a) Double Rail Hand-off.
- b) Single Rail Hang-off
- c) "On-th-rail" dressing.

Of these three, the single-rail system had been preferred for reasons of efficiency, though in recent years, there is a growing acceptance of the double-rail-system as well. In the most modern abattoirs, the "on-the-rail" dressing system appears to be more utilised, as it gives significant improvements in efficiency of operations, inspection and sanitary maintenance.

a) Double Rail Dressing System.

In this system, the carcass, after cradle operations, is hoisted and suspended from two rails approximately 1.07m apart to be splayed for viscera removal and splitting. Distance between the dropping and hoisting points should be sufficient to prevent cross-contamination between carcasses.

Evisceration

This consists of two major operations, the first being the removal of the stomach and Intestines onto an Inspection table and the second involving the handing of the trachea, Oesophagus, heart, spleen, liver and the thick part of the diaphragm onto a rail or on a carrier for inspection.

Within, the slaughter hall, a main Inspection zone should be specified to enable the correlating of the sets of viscera to their respective carcasses during inspection. Carcasses are normally split at the sides for inspection and in most modern slaughter halls, a splitting saw is positioned alongside the Evisceration point.

Slaughter men working within this area are provided with a workers platform about 0.90m high and equipped with a knife sterilizer and hand wash facilities. At this point, carcasses may face either towards the by-products unit or away depending upon whether a rail turntable is used.

FINAL DRESSING.

Carcass Splitting.

A mechanical saw equipped with sterilizing facilities for the saw blades to be used between each carcass is normally installed. A shield is normally placed at the front of the carcass to protect the other carcass and offal from contamination by bone dust.

Inspection.

The design of this area must permit the identification of the carcass viscera and head of respective animals, and should also provide smooth

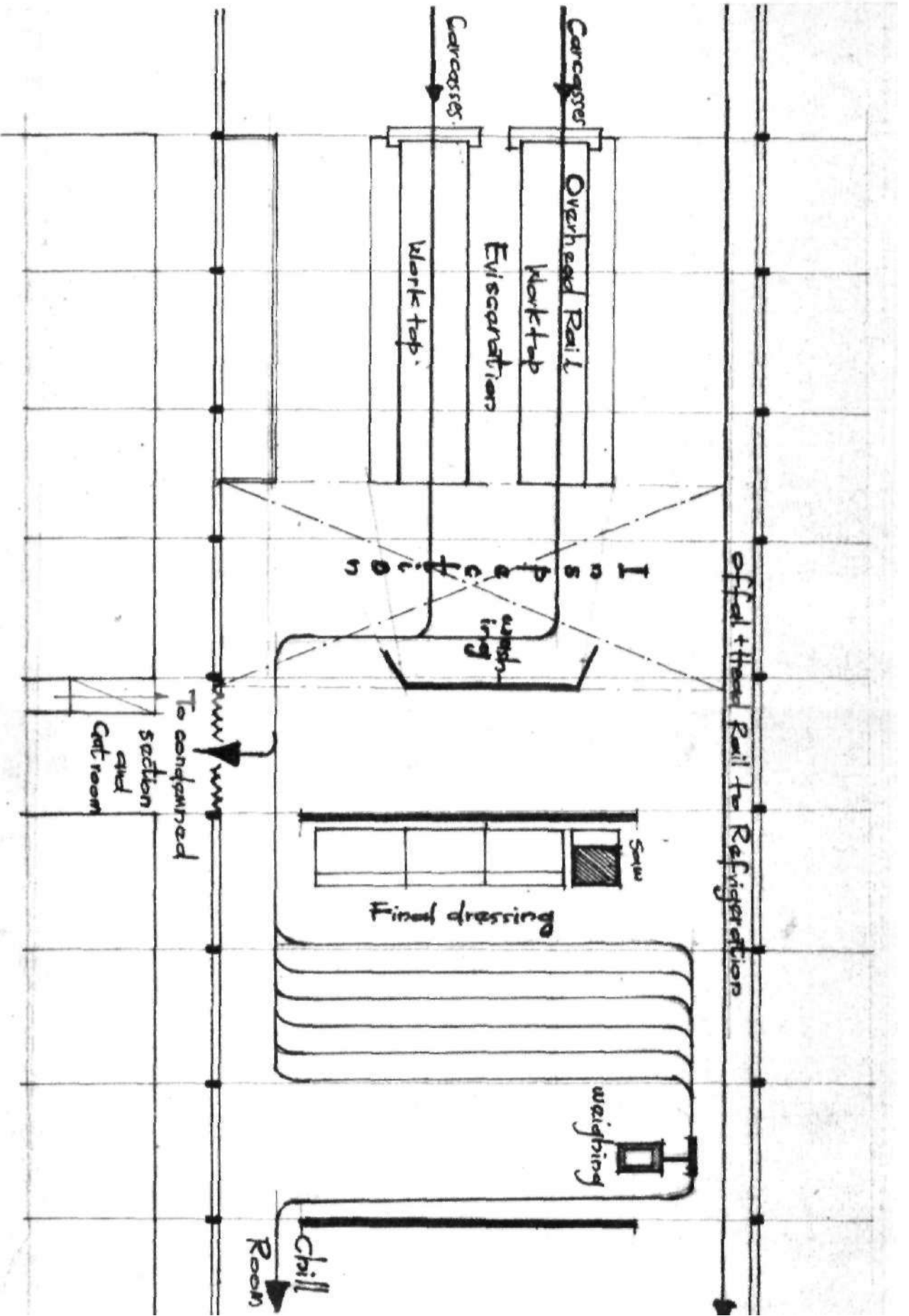


Diagram showing typical layout of the Evisceration and final dressing sections.

movement flow for the meat Inspectors by the thoughtful installation of rails and work tables in such a way as not to be of any hinderance. Hand wash facilities and knife sterilizing units must be provided for the Inspectors.

Efficient lighting must be achieved, thus artificial lighting could be used to supplement Natural lighting if it is considered not sufficient.

Carcass Washing.

This area should be partitioned from the other zones to prevent over-plash onto other carcass and offal, and washing is best achieved by the use of a hand held spray gun. The floor in this area should be laid to the necessary fall and be individually drained to reduce the risk of contamination.

Carcass Weighing

A runway buffer rail system formed in a loop around a scale gives an efficient weighing system for the dressed carcass.

SHEEP AND GOAT SLAUGHTER HALL

All the operations involved here are the same as the operations described above in the cattle slaughter hall. The only difference is the heights of the various rails which in this case are lower than in the cattle slaughter hall. The bleeding rail here is about 3.0m above the floor level and the dressing lines are at about 2.50m above floor level.

THE PIG SLAUGHTER HALL.

Stunning Pen.

This area must have no direct access to the carcass dressing and adequate space must be provided for safe working conditions. Minimum working space could be about $10m^2$, but this could be increased depending upon through put.

The floor should be of tamped granolithic concrete laid to falls of 50mm in 3m to a drain within the pen with walls of impervious material to ensure regular easy cleaning.

Bleeding Area.

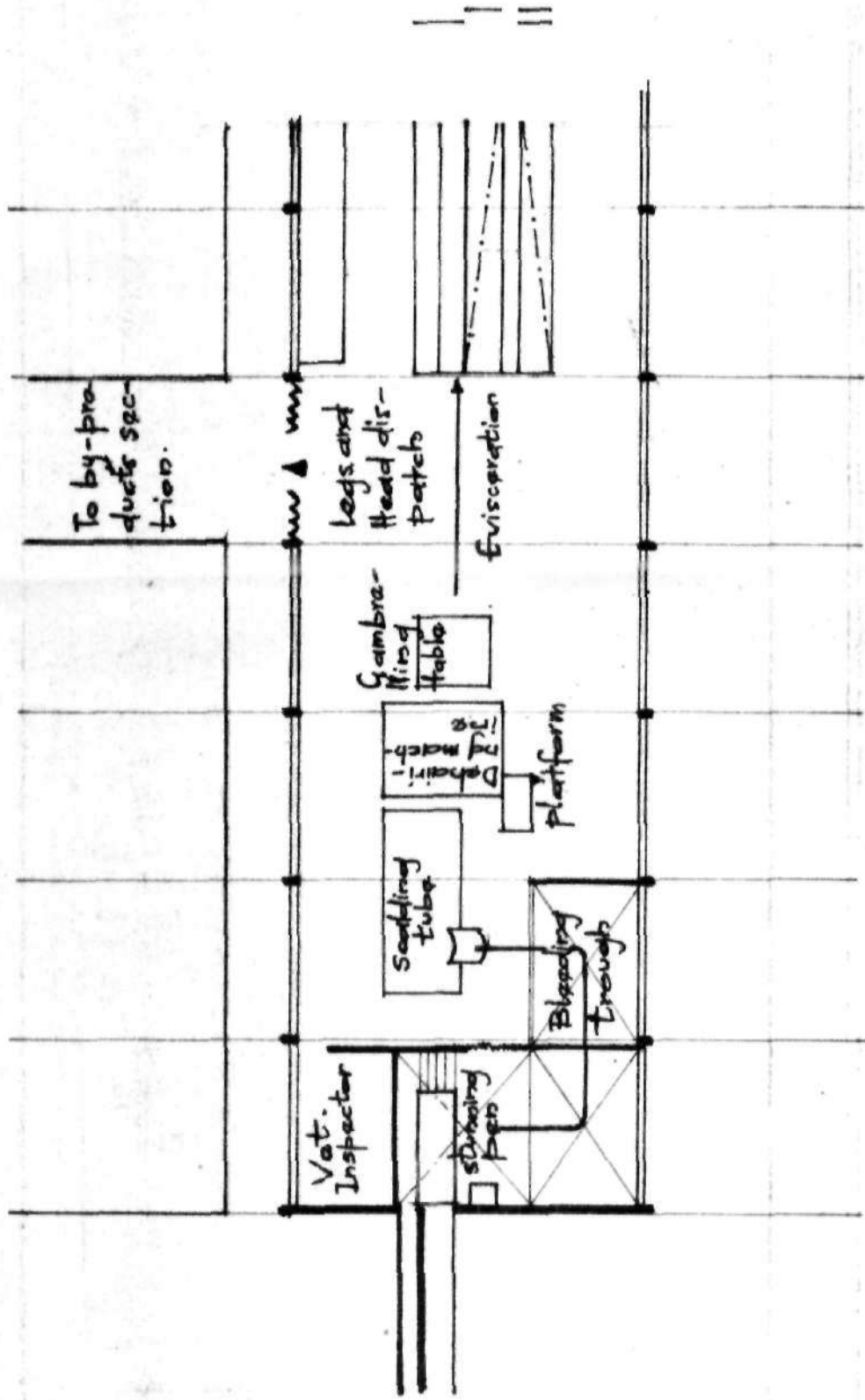
This area must be designed in such a way as to prevent the flow of blood into other areas and be fitted with a double drain as in the cattle section. Width of trough could be between 1.50m to 2.0m and a length of 3.0m is suitable for steady through puts.

The bleeding rail should be placed at a distance of 0.60m from the wall surface and at a height of 3.00m from the floor level.

The bleeding trough can be constructed in non-corroding metal or concrete. When constructed of concrete, the surface must be smooth and impervious and all joints with walls and floor must be coved.

Scalding and Dehairing Processes.

Pigs carcasses are brought directly from the bleeding area to this section and efforts should be made to see that the carcasses do not pass through the other dressing areas.



Diagrammatic layout of a typical

pig stunning and bleeding area.

The operation in this case involves the immersion of pigs carcass into hot water in the scalding tank for efficient scraping of the skin and the use of dehairing machine for purposes of hair removal from the skin,

The floor around the scalding tank and the dehairing machine should be laid to falls of 50mm in 3.0m and at least a drain should be located nearby to carry away liquid wastes.

A knife sterilizer and hand wash facilities must be provided at the end of the dehairing line for use by operatives performing the finishing scraping procedure.

Evisceration.

The main equipments used here consists of a worktable for the handling of stomachs and intestines while the red offal is suspended for a fixed hood or rail. Efforts should be made to identify all parts of the viscera with the original carcass until the conclusion of the Inspection process.

The synchronisation of the operations on the dressing lines and viscera line facilitates smoother slaughtering rates. For stomachs and intestines, a conveyor belt fitted with steel trays is more appropriate as it is more easily cleaned and allows horizontal movement in all directions, simplifies the correct disposal of viscera, after Inspection and permits flexibility in the siting of by-products rooms.

A knife sterilizer and hand washing facilities must be provided at the point of Evisceration.

Splitting.

Pigs carcass may be split by cleaver or mechanical saw and a sterilizer of sufficient size to permit the complete cleaver and the immersion of the saw blade must be provided together with hand wash facilities.

Inspection-Carcass Weighing - Weighing

These operations are similar to in requirements to the ones set out in the cattle section.

BY-PRODUCTS SEPARATION UNIT

This area should be sited away from the main slaughter lines with openings restricted to those necessary for the movement of by-products materials into and out of the area.

All by-products materials both edible and inedible should be dispatched in covered and if possible lockable containers for the maintenance of good hygiene standards. These materials should be dispatched daily for treatment.

Blood Disposal

Blood has many uses either as a source of protein when used as edible product or for other purposes as fertilizer or pet food. Where possible, blood should be collected hygienically and should not be discharged directly into the drainage system as it causes problems resulting in high effluent treatment charges.

Edible Blood.

This should be collected in such a manner as to eliminate the danger of contamination and must remain identified with the carcass until the conclusion

of its inspection. Storage facilities must be clearly identified, non-corroding containers with close fitting lids which must not be used for any other purpose.

Inedible Blood

Blood used for feeding stuff and fertilizers should be collected by connecting the blood through drain direct to a vessel and a pneumatic system will transfer the blood to a tank transporter or a storage tank.

Hide and Skin Room.

This room is used for the treatment, cooling and stacking of hides and skins and could also be used for the holding of cattle feet, horns, pigs hair and sheep feed pending dispatch.

The floor of this room must be laid to falls of 50mm in 3m to a drain within the room and all floor to wall junctions must be coved and wall angles rounded.

The Guttery

This is an area in which the separation and rough-cleaning of intestines take place.

This room must be laid out and equiped in such a manner that work on the raw material takes place at table height. The work tables should be arranged so that stomachs and intestines can be separated for cleaning in different areas of the room. It should have an impervious surface and be constructed of a corrosion resistant metal, the best being of stainless steel. The worktop should be sloped to a drainage outlet for efficient wastes (liquid) removal.

Stomach and Stomach Fats.

Stomach fats for human consumption should be stored in a separate fat room and any washing must be by means of running water in the form of cold spray.

Stomachs must be emptied on work table and waste contents must be discharged through a pipe to the drainage system or preferably a discharge vessel. After emptying, the stomachs must be washed under running water.

Intestines.

These are rough cleaned on the work table with the manure discharging directly to the drainage system and subsequent storage must be in containers with close fitting lids.

Inedible Materials.

All the inedible products must be placed in containers fitted with lockable lids. Sterilizers and hand wash facilities must be provided within the gut room for the maintenance of high hygiene standards.

Detained Meat Room.

Suspect carcasses after inspection should be immediately removed from the slaughter hall to the detained meat room for further examination and observation and this room should be connected with direct linkages to the main slaughter halls and the condemned meat section. There should be sufficient space available for carcass inspection and an impervious work surface should be provided for detailed examination of meat portion and offal. Facilities for sterilizing and hand wash basins as well as disinfecting facilities should also be provided in this case.

For the maintenance of high health standards, the floor must be laid to falls of 50mm in 3.0m and these falls must be directed to a drain within the room which connects directly to the main drainage system of the whole complex.

Condemned Meat Room.

This room is used for the holding of condemned meat or offal pending its dispatch or conversion into fertiliser in the by-product plant if the facility is available. It is normally cut up and stored in lockable containers which must be of material resistant to corrosion.

The floor area must be laid to falls of 50mm in 3.0m and should be directed to a drain within the room which connects directly to the main drainage system.

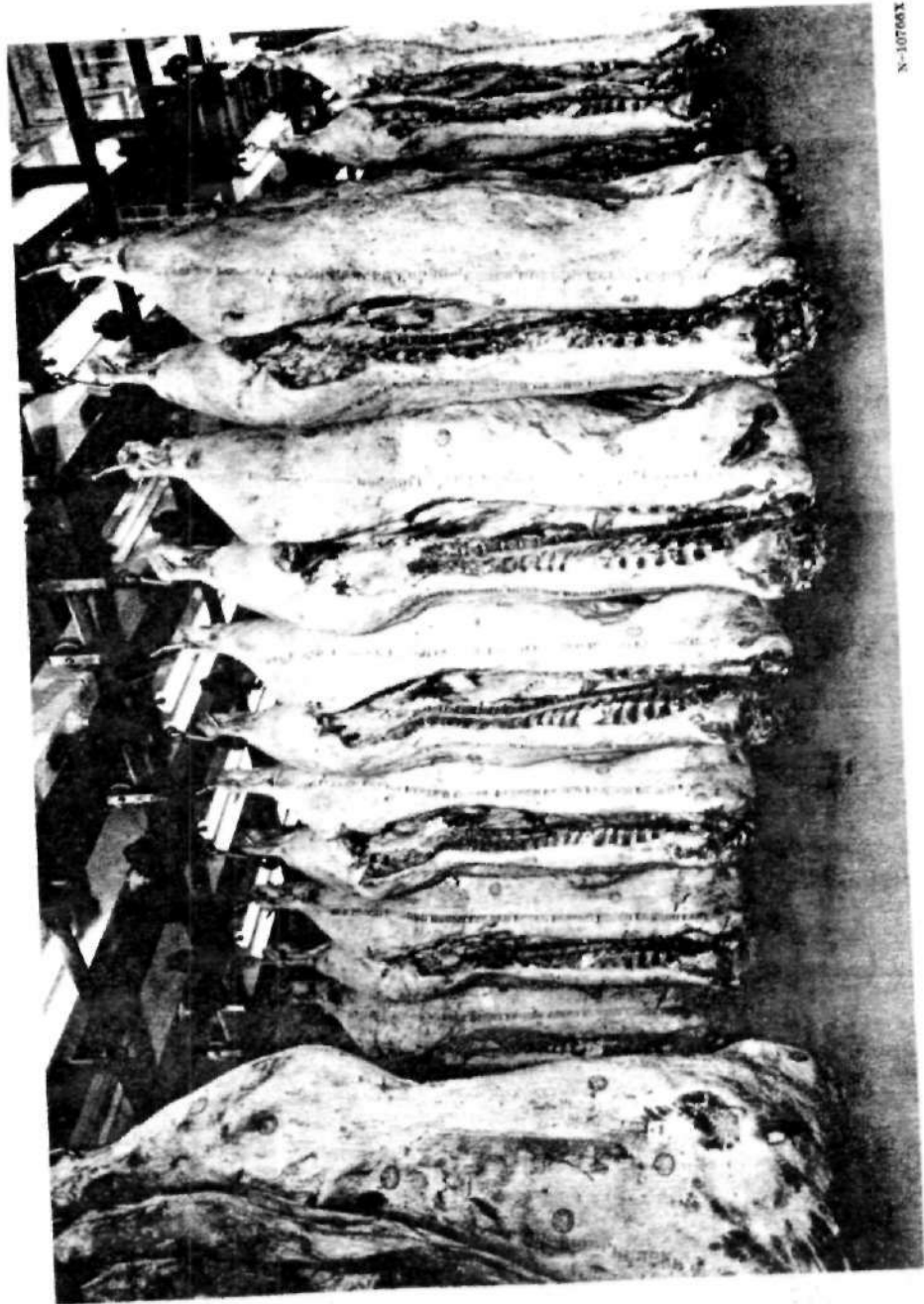
REFRIGERATED STORAGE

This area forms the zone of final operations within the slaughter hall and acts the linkage between the slaughter hall and the dispatch area. It consists of chill rooms for the storage of carcasses and offal and facilities for sub-zero storage.

After inspection, carcasses are brought to this zone by the use of overhead rail of the main slaughter line to be chilled to and held at a temperature not higher than 7°C, and offal are held at a temperature of 3°C.

Chill Rooms.

It is recommended that chill rooms should be equipped with two sets of rails, one being high level rails for the hanging of beef carcasses and low level rails for pork and lamb carcasses. Periods when chill rooms are open must be restricted as much as possible, in order to reduce the possibility of meat spoilage through bacterial infection.



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Figure 17.—Cattle carcass cooler.

DISPATCH OF FRESH MEAT

This area must be sited within the clean zone of the factory and access to it should be restricted to meat vehicles only. It should be provided with a loading bay raised at 1.20m above the road level to facilitate smoother loading of the meat vehicles and this dock must be covered and the roof should extend at 2.0 - 2.5m forward to cover the rear ends of the vehicles. The floor of the dock should be of rough finish and be well drained to prevent contamination of meat by spray and water splash.

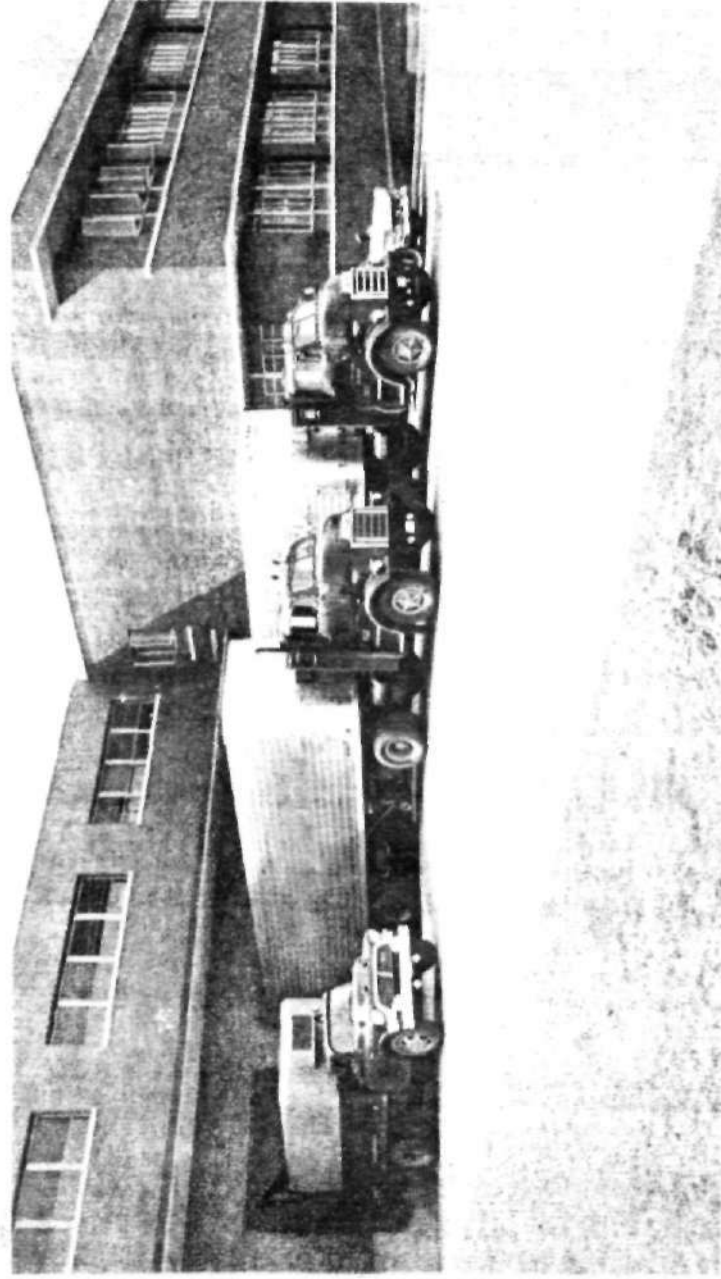
GENERAL AMENITIES.Dressing Rooms and Equipment.

Well located dressing rooms, properly separated from toilet rooms, are required for employees of each sex, unless only one sex is employed at the plant. Wash hand basins must be located near the water closets and must be of hot and cold water systems. Showers also provided with hot and cold taps are required and each shower should support 25 persons.

Floors and walls should be provided with impervious surfaces which should be easily cleaned.

Lockers.

Each employee must be provided with a metal locker and to permit ready cleaning beneath the lockers, they must be placed above the floor on legs or other supports. The lockers shall have sloping tops. To facilitate orderliness and cleaning of the dressing room, employee seats should be in the form of plastic or wooden planks mounted in front of and below the doors of the locker on an extension of the framework supporting the lockers. The side width between the lockers shall be about 2.00m minimum.



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Figure 11.—Paved vehicular area.

Shower-Bath Facilities.

Suitable shower bath facilities shall be provided in locker rooms at establishments where slaughtering operations are conducted. Such facilities are also desirable in processing plants. The shower bath should have a 20cm high curb of impervious material unless it is entered through an individual dressing room that has the floor sloped to drain into the shower.

Toilet Rooms and Facilities.

They must be separated from adjoining dressing rooms by tight, full-height wall or partitions. Toilet rooms may be entered directly from a work-room, but entrance through an intervening dressing room or ventilated room vestibule is permissible.

Elongated water closets with open split seats shall be provided in sufficient number for the employees using them (at least one unit for 25 men or 20 women). It is desirable to provide urinals in toilet rooms for men.

Hand Washing Facilities.

A sufficient number of modern type hand-washing basins (lavatories) are required in welfare rooms. Also, large dressing rooms should also have hand washing facilities in addition to those located in the toilet rooms.

Employee's Canteen.

Adequate feeding facilities namely a canteen shall be provided for employees to rest and eat during meal breaks. Facilities for the boiling of water, washing up and crockery storage should be made available. The internal finishing and all furniture should be easy to clean and be kept clean for the maintenance of high hygienic standards within this area.

Other facilities should include the provision of offices for the accommodation of the Veterinary Inspector and his staff, normally sited near the Inspection area if possible. These rooms should be furnished and fitted with lockable doors and provided with hand wash and shower facilities as well as laboratory facilities.

It is also highly desirable to have a separate welfare facilities for employees in the by-products section of the abattoir.

CHAPTER SIX

- ABATTOIR STANDARDS AND CONSTRUCTIONAL REQUIREMENTS.
- LAIRAGE
- SLAUGHTER HALL
- REFRIGERATED STORAGE SPACE.
- BY-PRODUCTS UNIT.

ABATTOIR STANDARDS AND CONSTRUCTIONAL REQUIREMENTS.LAIRAGEAccess:-

This area should be readily accessible to vehicles so that the unloading of stock can be effected directly from cattle lorries into the lairages. There should be good access from the grazing grounds so that stock can be driven easily into the lairage area.

Gates:-

Efforts should be directed towards the standardizing of all doors and gates and a width of 2.0m is appropriate. Animal pens gate should be double swinging as this ensures effective control of stock. The "cattle race" leading to slaughter hall should be 0.80 to 0.90m wide.

Pens divisions are best constructed of tubular steel and gates should be of the same material as this ensures better ventilation, takes less space and is more hygienic.

For better accommodation, separate lairages is necessary for pigs. Thus, a separate lairage coupled with separate slaughter hall for the pigs gives the best solution.

Tying:-

Within the cattle lairage, facilities should be provided for the tying of restive cattle and a provision of 25% of the lairage space should be made available for this requirement. The tubular steel yoke is appropriate for this purpose.

Lairage Size.

This will depend upon the daily throughput of the slaughter hall. However, sufficient covered lairage space enough to accommodate a days slaughter is considered a necessity and the provision of sufficient grazing area to accommodate up to two days leill is desirable if possible.

Space requirements are given as 2.82 sq m for a head of cattle and 0.6m² for pigs. Thus pens of 25.0m² size can accommodate 8 - 10 cattle and 40 sheep.

Walls.

Walls should be constructed with impervious surfaces to facilitate easy cleaning and should be of maximum 1.2m in height.

Floors.

Floors should be non-slip and finished with impervious material such as granolithic screed laid over mass concrete. It should be laid to a fall of 25mm in 3m to drain into a central channel outside the pen.

Drainage.

Floor drainage should be by channel or drainage pipes running outside the lairage area but being connected by feeder drains from the animal pens.

Roof.

Roof structure should be of light steel lattice trusses carrying light asbestor as roofing elements.

Ventilation.

In cattle and sheep lairages ventilation can be permanent. A screen wall is suitable for the housing of these animals while awaiting slaughter. However, in pigs lairages controlled ventilation is necessary as pigs require warmer conditions.

Lighting.

Efficient lighting using both natural and artificial means is desirable to provide better conditions for stock examination and observation.

Fodder and Bedding Facilities.

These facilities should be provided for the storage animal fodder and if possible located close to the lairage area.

Isolation Pens.

This should be provided for the Isolation of suspect animals for two to three days for observation. Preferably, it should be equipped with a small slaughter hall and isolated from the main slaughter hall. Pens could be of size 3.5 x 3.5m and the slaughter hall could also be of the same size.

However, if this is not possible, Isolation pens could be located within the main lairage area but should be separated from the other pens with a high wall to reduce the risk of contamination.

SLAUGHTER HALL

Construction.

The slaughter halls should have as the main loadbearing elements concrete columns designed to carry the load of the roof and that of the

mechanical handling equipment within the slaughter hall. Horizontal concrete elements run between the columns to give a better flexibility in the fixing of openings in the walls which is a curtain wall which can be filled as required.

Height

The height from the floor to the beef carcass rails should be 4.0m from the floor level and that of the bleeding rails about 5.0m from the floor level.

Walls.

Walls should be constructed of sound materials and the finishing should be of durable smooth impervious surface to facilitate easier cleaning and maintenance of high hygienic standards. Slaughter hall's wall should be rendered to the full height and should be coved at the junction with the floor.

Floors.

Floor surfaces should be hard, impervious and non-slip and this is achieved by the use of ridge sandstone slabs, bricks and grooved tiles as the floor materials. A 5cm granolithic screed tested with carborundum laid over 10cm mass concrete on a 15cm clean hardcore gives a finish.

Drainage.

Drainage within the slaughter hall consists of the removal of both solid and liquid wastes. For the removal of blood, it is normally removed by draining into specially formed storage tank or it is effected by draining through blood drains in the bleeding trough to barrels placed under it, the

blood being subsequently removed from the slaughter hall. Blood basins are normally provided with long-neck deep seal traps properly vented to a point above the roof.

The floor of the slaughter hall should be laid to fall towards the bleeding channel which itself should run from the slaughter hall floor to the bleeding channel. The bleeding channel outlet should be carried through the wall to discharge over the grating of a 30cm diameter deep trapped gully fitted with a strainer basket which should be cleaned frequently to ensure that the whole system works satisfactorily.

Doors and Openings.

The width of doors and openings should be standardised at 1.2m though the main circulation doors of the slaughter hall should be of 5.0m standards. These doors should be the roller-door types.

Linkages (covered) of 5.0m width should connect the slaughter halls to the by-products area which houses both the Hides and Skins room as well as the Gut room. These linkages facilitate the smooth flow of by-products from the slaughter halls to the by-products processing units.

Windows.

These should be high level and should be located on the north-south facing walls. This reduces the effect of the sun's rays while at the same time facilitating efficient natural ventilation and lighting.

Windows should be of galvanised metal frame construction. They should be of the top-hung type and openable and this has the advantage that the openable portion may be protected against insect entry especially flies, by the use of copper gauze for protection purposes.

Roof

Folded plates are used as roofing elements. This makes it possible to cover the span of the slaughter halls without the use of intermediate columns resulting in the availability of unimpeded space within the slaughter hall, a factor which is very important to the smooth flow of slaughter operations.

Ventilation.

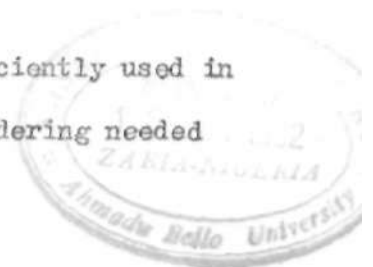
The orientation of the slaughter blocks along the North-South axis and the locating of opening along the walls lying along this axis facilitates efficient natural ventilations.

Lighting.

Natural lighting can be provided by the efficient use of openings located on the walls lying on the north-south axis. As the walls are curtain walls, flexibility in openings until desired level of natural lightning is obtained is easily possible.

Artificial lightning of good quality is required at all places where, or at times when, adequate natural lighting is not available or sufficient. The overall intensity of artificial illumination in workrooms should not be less than 20 foot candles. At places where inspections are made, the illumination shall not be less than 50 foot candles.

Lamps such as the warm white de-luxe lamps are efficiently used in slaughter halls and cooling rooms giving good colour rendering needed for meat inspection.



Water Supply.

The slaughter hall must be provided with ample, potable water and it should be distributed throughout the plant under adequate pressure and in quantities sufficient for operating needs. Thus service pipes from the mains should be designed so that it is possible to use all the draw off points at the same time.

Both hot and cold water must be provided, the hot water from a central heating plant of sufficient capacity or from other suitable facilities. Thus, multiple supply points both hot and cold should be situated in the slaughter hall as close to the sight of operations as possible.

REFRIGERATED STORAGE.Chilling Hall

The construction of the chilling hall should be the same as the slaughter hall as already described.

Height.

Beef rails should be 4.0m high from the floor level of the chilling hall.

Walls

The walls should be the same as for the slaughter hall.

Floors.

The floor of the chilling room should be the same as that of the slaughter hall.

The surface should be constructed of (a) vitrified bricks of good quality, bonded with acid resistant waterproof mortar, and laid on waterproof concrete base or (b) dense, acid resistant water proof concrete. To prevent accidents, excessively smooth floors should be avoided. Good results are obtained by using brick or concrete floors with embedded abrasive particles in the surface. Concrete floors should have a wood float (rough) finish. Concrete or mortar floors that incorporate an approved latex or synthetic resin base have better than ordinary resistance to meat fats and acids.

Drainage.

The floor should slope at 25mm in 3m to an open drainage channel at least 15cm wide discharging into the main drain running outside the building.

Doors and Openings.

The width of doors and openings should be standardised as this gives ample working space. Width of 2.0m is appropriate. Doors should be of the metal sliding type wherever possible.

Windows

Windows should be as described for the slaughter hall.

Roof.

Roof should be as described for the slaughter hall.

Lighting.

This also should be as described for the slaughter hall.

Drainage.

Drainage should meet the same requirements as those laid down for the slaughter hall.

Doors.

These should be 2.0m wide with metal sliding doors fitted to the inlets and outlet openings. Secure locks should be fitted to these doors.

In the case of the roof, lighting, ventilation and water supply, requirements should be the same as those laid down for the slaughter hall.

DETECTION ROOM.

This is an area set aside for the examination of suspected carcass and must be of sufficient size to accommodate an unexpectedly large number of carcasses. It must be located near the main inspection area to facilitate the easy removal of the suspected carcasses from the main slaughter line.

This room is also accessible to the condemned meat room for the easy removal of carcasses confirmed unhealthy to the condemned zone.

Walls, Floors, Ceilings.

The requirements should be as those laid down for the chilling room in the event that a separate room is built to accommodate this function. On the other hand, an area within the slaughter hall could be used for this function.

Ventilation and Lighting

These will also meet the same requirements as those for the chilling rooms if a separate room is used for this function.

If an area within the slaughter hall is used, then this problem does not arise since it has already been solved in the slaughter hall.

OFFAL ROOMS.

Size:

These rooms are used for the cleaning of offal and is connected directly to the slaughter hall by covered linkages and offals are brought to this room in steel containers by stainless steel trucks reserved for that function alone.

General space has been allocated for his function in view of the fact that it handles large amount of offal, since within the tropics, the animal offal forms part of the edible products and is an important source of food. Separate rooms have been provided for the handling of offals from cattle, sheep, Goats and those from pigs respectively.

The Hide and Skin Store.

This should be large enough to accommodate a daily maximum slaughter. Cattle hides are best stored on a raised platform about 15cm high while the sheep and goat skins may be hung on rails or simply spread out on the floor. Sheep skins should be well serated so that the animal heat is quickly dissipated.

Walls, Floors and Drainage.

These should all meet the requirements laid down for the slaughter hall.

Doors.

Doors should be of the metal sliding type with widths of 2.0m.

Lighting

Natural lighting should be sufficient throughout these rooms and working conditions within the gutrooms are improved by the placing of gut tables alongside windows.

Where natural lighting is not sufficient, artificial lighting in the order of 50 f.c. should be supplied over the tables while about 20 f.c. are supplied throughout the rooms.

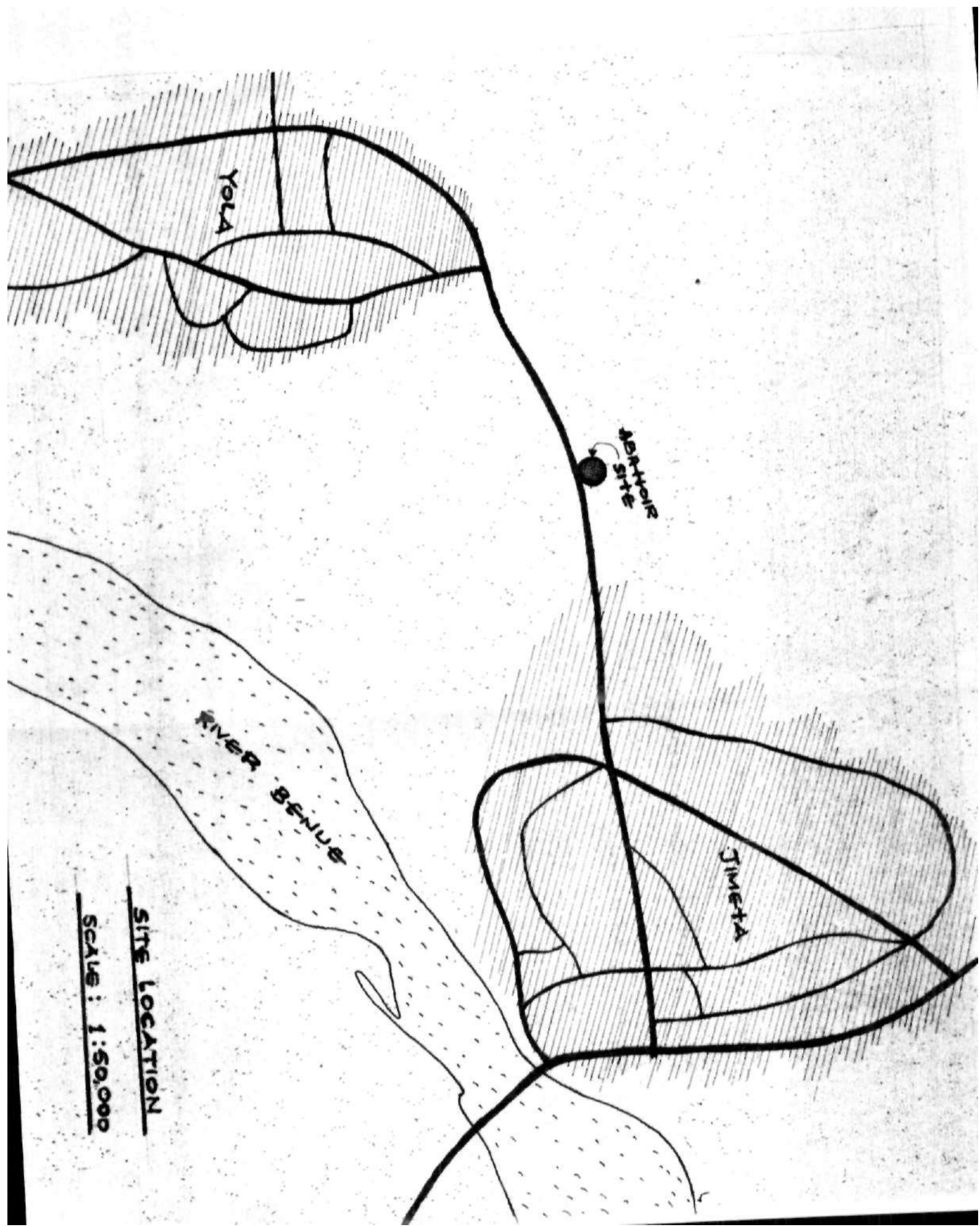
Water Supply.

There should be simple supply of cold water to the gut room and supply points should be easily accessible to the gut table. Hydrant points and steam jets should be provided here in order to maintain a high standard of cleanliness within this zone.

For the improvement of the workers hygiene, a wash basin with hot and cold water taps should be provided in the gut room for the workers personal use.

CHAPTER SEVEN

- SITE ANALYSIS.
- SITE
- CLIMATIC FACTORS
- SITE SERVICES
- AVAILABILITY OF RAW MATERIALS (ANIMALS)
- AVAILABILITY OF LABOUR
- AVAILABILITY OF LAND
- POPULATION TO BE SERVED.



Yola

SITE

RIVER BENUE

Jimeta

SITE LOCATION

SCALE : 1:50,000

SITE ANALYSISSITE:

The Abattoir shall be sited in Yola, the actual site lying along the Yola - Jineta road at a distance of about 3.00 km from Yola. In the Greater Yola master plan prepared by max-lock, this area is designated as part of the Agricultural area of the metropolis. Thus, the location of the site is ideal as its distance from both towns of Yola and Jineta, means that the problem of odour or any other inconveniences associated with abattoir as it affect residential areas does not arise.

TOPOGRAPHY.

Site is located on a almost flat piece of land which slopes very gently to the nearby Chochi stream.

CLIMATIC FACTORS.

The town of Yola lies on the banks of the Benue river and the climate is of the tropical type with two distinct seasons. The hot dry season which normally commences from November to April and the Rainy season which is from May to October.

High temperatures in the regions of 95°F are experience during the dry season especially in the months of March and April while in the months of July and August, during the rainy season, the temperatures are moderate.

Average yearly rainfall ranges between 85 - 100 cm.

Vegetation.

Vegetation is of the Guinea Savannah type consisting of savannah grass interspersed with scattered trees and shrubs.

SITE SERVICES.(i) Water Supply.

The Yola metropolis is supplied with water from the Benue river, The Newly built municipal water works has the capacity of supplying water both for consumption and Industrial uses to the metropolis within the foreseeable future.

(ii) Power Supply.

Power supply shall be from the municipal supply system which is supplied by the National Electric Power Authority. However, if required, a small power plant could be built alongside the abattoir.

(iii) Waste Disposal.

The local Administrative Health Department provides an efficient waste disposal system and wastes from the abattoir could be fed to the municipal drainage system.

(iv) Accessibility

Site is easily accessible due to its proximity to the Yola - Jimeta connecting road and would be served with good hard roads to facilitate the easy evacuation of meat and meat products. Facilities could be easily extended to the site with considerable costs.

AVAILABILITY OF RAW MATERIALS (ANIMALS)

The Yola area carries over 150,000 heads of cattle though majority of these herds are subject to migrations along the Benue valley in search of better grazing lands during the dry season.

AVAILABILITY OF LAND.

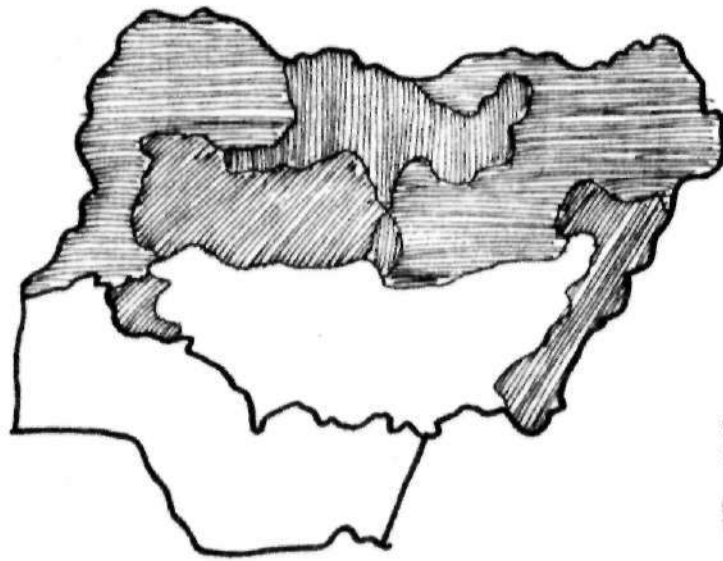
Land in this area is relatively cheap and abattoir site is located in area where unlimited space abounds for expansion purposes. Meanwhile, these areas shall be used as grazing grounds for animals brought to the abattoir.

POPULATION TO BE SERVED.




The Abattoir would serve the towns of Yola and Jimeta and the surrounding villages within the radius of these towns. Population wise, it would be about 70,000 people.

AVAILABILITY OF LABOUR.

Labour is cheap and readily available. The absence of any industry within this area results in high unemployment rates. Thus, establishment of Industries such as this one would go along way towards alleviating this problem.






Cattle per sq. mile

-  over 25
-  10 - 25
-  5 - 10

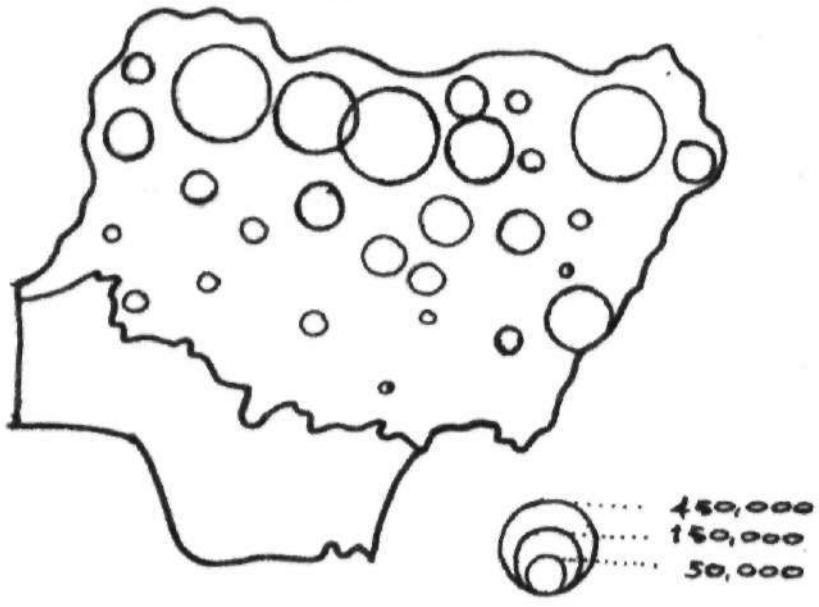
CATTLE DENSITY



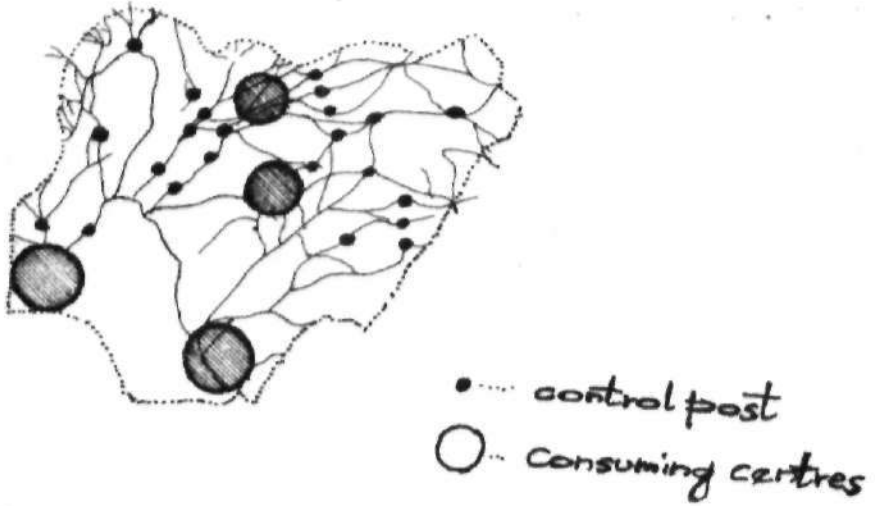
Cattle per 1000 of population

-  over 2500
-  250 - 500
-  100 - 250

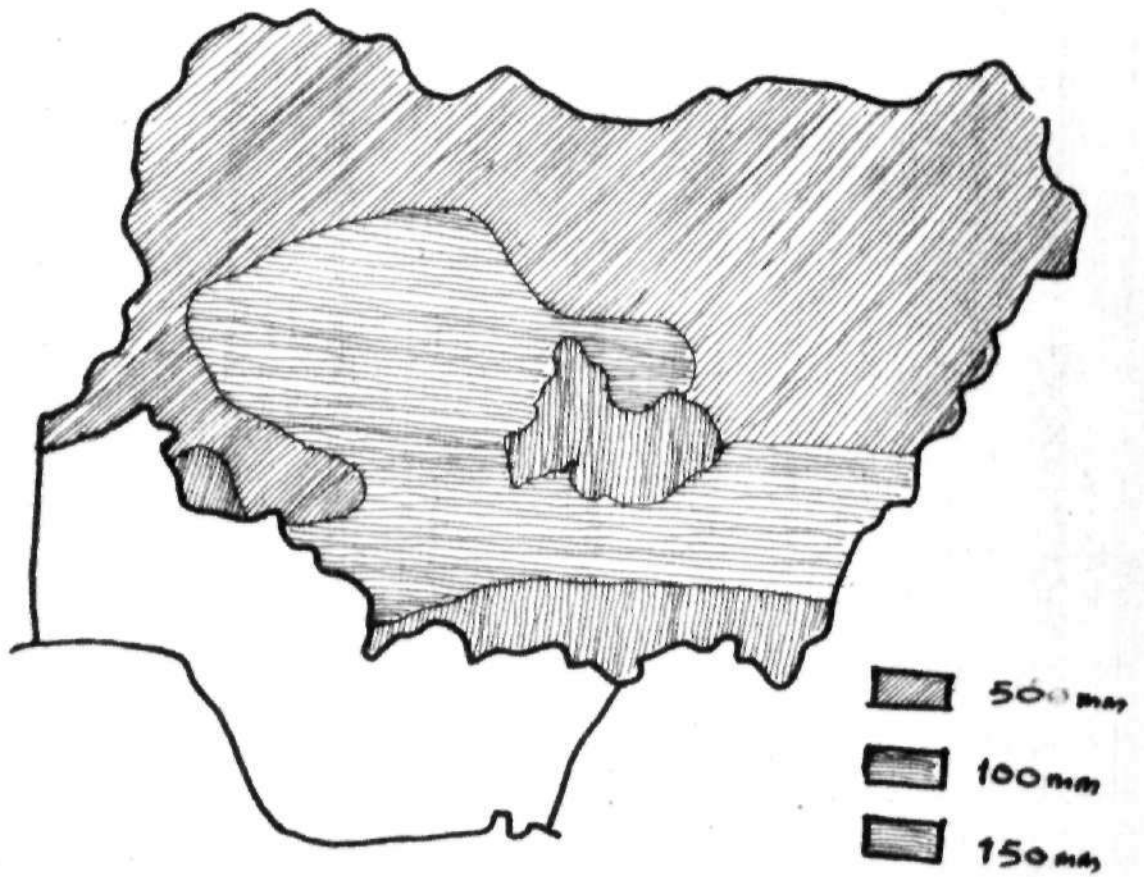
THE RATIO OF CATTLE TO POPULATION



CATTLE POPULATION



CATTLE TRADE ROUTES



ANNUAL RAINFALL

CHAPTER EIGHT

- THE DESIGN BRIEF
- GENERAL COMPOSITION AND REQUIREMENTS.
- GENERAL SCHEDULE OF ACCOMMODATION.

CHAPTER EIGHT

THE DESIGN BRIEFGeneral Composition and Requirements.

The Abattoir would consist of the following:-

- (i) A lairage area for the housing of cattle, sheep, goats and pigs before slaughtering.
- (ii) The main Abattoir complex consisting of the slaughtering halls, cold storage areas and the By-product processing unit.
- (iii) The Administrative and Employee's Facilities units.
- (iv) Maintenance.

Capacity.

The Abattoir is designed to handle 300 slaughterings daily. These include 100 head of cattle, 70 sheep, 50 goats and 60 pigs. This number could be increased by increasing the number of daily shifts.

General Schedule of Accommodation.Lairage.

	<u>Minimum Areas</u>
Lairage space, sheep, goat or pig	- 0.56m ²
Lairage space, cattle	- 2.82m ²
Daily slaughtering (70 sheep and 50 goats)	- 67.2m ²
Daily slaughtering (60 pigs)	- 33.6m ²
Daily slaughtering (100 heads of cattle)	- 282m ²
Width of cattle race	- 0.80 - 0.90m .
Width of drover's passage	- 0.45 - 0.50m.

<u>Cattle Slaughter hall</u>		<u>Areas</u>
Stunning pen	-	15.00m ²
Bleeding area	-	25m ²
Slaughter hall	-	1200m ² (common with sheep/ goat hall)
Cold Stores (Chilling room)	-	250m ²
Dry-landing area	-	25.0m ²
		<u>Height</u>
Bleeding Rail	-	5.00m
Dressing Rails	-	4.0m
<u>Sheep/Goat Slaughter Hall</u>		<u>Areas</u>
Casting Pen	-	15.0m ²
Bleeding Area	-	20.0m ²
Dry-landing Area	-	25.0m ² (Common with the cattle)
Slaughter-hall	-	450.0m ²
Cold Stores (Chilling rooms.)	-	150m ²
<u>Pig Slaughter Hall</u>		<u>Areas</u>
Stunning pen	-	15.0m ²
Bleeding area	-	20.0m ²
Slaughter hall	-	600m ²
Cold stores (Chilling rooms.)	-	200.0m ²
<u>The By-Product Unit</u>		<u>Areas</u>
Skin, Head, and Leg Room	-	100.0m ²
Gut room (Cattle, Sheep, Goat)	-	100.0m ²
Gut room (Pig)	-	56.0m ²
Condormed Meat Room	-	80.0m ²

Administration Section

67.

Section	No. of Users.	Floor Area (m ²)
Entrance lobby plus receptionist	-	30.00
Director	1	30.00
Assistant Director	1	20.00
Secretary	1	15.00
General Office	4	50.00
Accountant	1	20.00
Sales Manager	1	20.00
Conference room/COMMON room		45.00

Workers Facilities Area.

Section	Floor Area (m ²)
Entrance lobby	30.00
Clinic	50.00
Canteen	100.00
Kitchen	60.00
Store	20.00
Changing room	65.00
Shower's room	50.00
Toilet facilities	40.00
Exit lobby (to work areas)	20.00

Abattoir Labour Force

<u>Personnel</u>		<u>Number</u>
Lairage Area	-	20
Slaughter Halls	-	30
Storage Areas (cold)	-	20
By-product Processing Units	-	20
Administration	-	30
Kitchen and Canteen	-	10
Veterinary Section	-	5
Clinic	-	5
Cleaners	-	5
		<hr/>
	TOTAL:	145
		<hr/> <hr/>

CHAPTER NINE

THE DESIGN, CONCLUSIONS AND RECOMMENDATIONS.

THE DESIGN(i) Orientation

The building are oriented along the North-South axis with openings located along the walls lying along this axis, thus avoiding the effects of direct sun rays.

(ii) Ventilation

Buildings are adequately ventilated by the prevailing winds. Also the separation of the building blocks by the use of the court-yard system is an attempt to adapt the buildings to tropical conditions to facilitate more efficient ventilation and the removal of offensive odour from the slaughter hall.

(iii) Circulation.

The circulation conforms to the basic requirement of the abattoir - that of the provision of dressed, healthy fresh or chilled carcass. Live animals enter on one side of the abattoir and leaves as dressed carcass on the other side.

The animals are brought to the abattoir either by vehicles or being driven on hoof and are received on the off-loading dogle attached to the lairage area. Lairage spaces are separated to accommodate the different species. From this area, animals are driven into the slaughter halls to be slaughtered and prepared as dressed carcass which is stored in the chilling rooms before being dispatched to the neat market.

Attempt has also been made to ensure that the workers do not cross the production lines by the provision of roofed underground passage to link the workers facilities area to the work areas and also the creation of efficient circulation between the slaughter halls and the by-products unit by the use of roofed linkways. This results in an efficient and problem free circulation within the whole complex.

iv) Facilities.

To ensure maximum employee's output, facilities for their welfare have been provided. This creates more human conditions within the complex. These facilities include the clinic, canteen, changing rooms, toilets and showering facilities which are all conveniently located close to the work areas.

v) Zoning

Attempt has been made to achieve three clear distinct zones namely:-

- i) The unclean zone comprising the lairage area.
- ii) The semi-clean zone comprising the slaughter halls and the by-product processing units and
- iii) the clean zone which comprises of the cold storage areas and the fresh meat dispatch area.

Thus, as a result of this, it has been possible to divide the slaughtering operations into "clean" and "dirty" operations within the context of the designated zones. Animals enter through the unclean zone that is the lairage and emerge as clean and dressed carcass through the chilling room located in the clean zone at the other end. All unclean parts of the slaughter stock are directed to the by-products processing unit located at the sides.

CONCLUSIONS.

The following conclusions have been arrived at after a study on present slaughtering conditions especially in the Northern States.

(i) Uncontrolled Slaughter.

The lack of enforcing of the law restricting the slaughter of animals to abattoirs has encouraged this practice. Thus animals are slaughtered indiscriminately any where both in our urban and rural areas, resulting in the passing to the public of highly contaminated meat with low keeping qualities - a source of serious health danger to the public.

The absence of any official veterinary Inspector means that animals not fit for human consumption are slaughtered by unscrupulous butchers and the carcass passed to the public.

(ii) Misuse of Modern Facilities.

Where modern abattoirs have been provided, the problem of misuse of instruments abounds. This arises either out of ignorance and illiteracy or the refusal to adopt to any modern innovations by our butchers. A look at our modern abattoirs reveals glaring instances of misuse which can be observed:-

- (i) The attempts to revert back to slaughtering and bleeding on the floor instead of using the bleeding and dressing rails provided. This means that carcasses for human consumption are contaminated by blood and excreta.
- (ii) The failure to observe the simple rules of hygiene required as exemplified in the failure to separate the unclean portions of

the animals from the clean portion resulting in the mixing of the intestinal contents with the carcasses, thereby contaminating the carcass.

- (iii) The failure to use the flaying beds normally provided and instead carrying the flaying operations on the floor under slab conditions.

Similar misuse of facilities are rampant in all our modern Abattoirs.

RECOMMENDATIONS.

PUBLIC ENLIGHTENMENT

The enlightening of the public on the dangers of uncontrolled slaughter, the health risks involved. Butchers, as an important group in the slaughter Industry, should be educated on the benefits of organised and controlled slaughter as is obtained in the abattoirs, instead of regarding them as a threat to their independence.

Within the abattoirs, butchers should be educated on the use and handling of the machines installed in the new slaughter halls.

PROVISION OF ADEQUATE ABATTOIR

The building of an abattoir in at least every local government area or the provision of abattoirs to serve groups of villages in the rural areas. This could greatly centralize slaughtering hence the provision of meat of good keeping quality to the public.

The Introduction of any new innovation is always regarded with suspicion in any society. Thus, in the development of new abattoirs, care should be taken to see that the local religions and customs are not in any

way breached. Improvements do not necessarily have to be rapid, but could be gradually introduced in stages into the obsolete system. This method even allows time for the use of fact and persuasion and the creation of a conviction in the minds of the people that these changes are beneficial to them.