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The original technical manual (1990) originated as a result of a number of problems with the handling of beef cattle. These problems were brought to the attention of the ARC-Institute for Agricultural Engineering.

Before on-site visits were then being made to farms, a questionnaire was sent to 4 422 beef-cattle farmers countrywide. The reason therefor was to obtain an estimate of the general needs of the South African farmer regarding beef cattle handling and to transfer good practical ideas from farmers to farmers studying the manual.

The manual endeavours to offer solutions for practical problems experienced in the field. All the research in this regard was done with the following in mind:

- Cheap and effective facilities which would be easy for the farmer to build.
- Application of labour saving to such an extent that two to three persons can easily handle up to three hundred cattle.
- To consider the aspect of animal behaviour or animal psychology.

In the meantime much development has taken place in the field of beef cattle handling and it was therefor necessary to upgrade the manual. The necessary care has been taken to obtain the latest information worldwide. Questionnaires were compiled and sent to selected beef producers to obtain problems and advantages of current systems. Feedlots and farms were also visited. Information, comments and ideas were obtained from producers who use handling facilities on a daily basis, in order to compile a practical manual that is in step with the latest developments.

We trust that the information contained in this publication will be of great value to you, the beef producer.
CHAPTER 1 - INTRODUCTION

For successful beef producing, certain facilities are necessary. These facilities must simplify the management of the system and limit labour to the minimum. It must be functional and economical and a safe environment for the animals, as well as a safe working environment for the handlers.

Equipment and facilities are expensive to buy or build, but the loss of cattle caused by poorly planned handling facilities and insufficient or cheap equipment, is more expensive. Because needs differ, an ideal handling pen lay-out will not be the same for every farmer. The farmer must first consider the matter thoroughly regarding the type of facilities he needs and what he intends to accomplish. This manual endeavours to reflect technical data on as many facilities as possible, in order to help the farmer to make his decision.
CHAPTER 2 - ANIMAL BEHAVIOUR

Animals have certain behavioural traits which determine their behaviour during handling. These behavioural traits must be taken into account in the planning and design of a handling facility. Poorly planned facilities will waste time, which can have an influence on the productivity of the farmer and the animal.

Unlike humans, bovines can see nearly right around them without turning their heads. This means that they cannot distinguish depth everywhere. Figure 1 shows the field of vision. In the front is an area where it has telescopic vision. This is the area where it should theoretically see depth. Behind it is a blind spot where it cannot see anything. In the remaining area it has single level sight. This is the area where it can theoretically not see depth. In reality cattle can however, to a certain extent, see a degree of depth in this area. If a person should close one eye, depth should theoretically not be observed at all, yet the human brain has learnt over the years to associate depth with the image.

![Figure 1: The scope of sight of cattle](image)

Cattle, just like people, have a personal space. This space is called the flight zone and it is the space around the animal in which it wants to be alone to feel safe and comfortable. The size of the flight zone is the distance that the animal will allow a person to approach it, before it moves away. According to T. Gradin (1998) there are four factors which influence the size of the flight zone, namely:

- The genetics of the animal.
- The number of times it has had contact with people.
- The quality of the contact.
- The actions of the handler.
By taking the flight zone into consideration, cattle can be handled comfortably. The point of balance is approximately at the shoulder of the animal. If a handler stands behind the balance point and is in the flight zone, the animal will move backwards.

Cattle must also be driven into the crush pen this way. Figure 2 shows the position of the handler for the successful handling of the animal. The handler moves to position A. This is in the flight zone and behind the balance point. The animal does not want the handler in its personal space and moves forward, so that the handler is now in position B. The handler now moves to position A again.

Figure 2: Position of handler

Whenever a number of cattle are driven into a crush pen, the handler must move from the front to the back, as seen in Figure 3. This action may seem wrong initially, but if the flight zone and point of balance are taken into consideration, it will make sense. To make the animal move forward, the handler must be behind the animal’s balance point.
There is also a social hierarchy between cattle in a herd. When they are grouped together in a waiting corral, the normal frequency of antagonistic behaviour between them will increase. Cattle with horns can injure other cattle, while the younger animals and calves can also be seriously injured. When different groups of cattle are suddenly crowded into a pen, it will cause unnecessary discord between individual animals because the pecking order has been disturbed. It is therefore important, where possible, to keep established groups apart from other groups during active handling. This is also applicable to young animals and calves.

When cattle are being driven, the behaviour as described above must be kept in mind. Figure 4 shows the handler’s position when cattle have to move along a camp fence.

Figure 3: Movement of handler
Figure 4: Handler’s position when cattle move along a camp fence
CHAPTER 3 - HANDLING FACILITIES

In the planning of handling facilities, the objective of the facility must be taken into account. The handling facility for commercial cattle will possibly differ from that of a facility for a stud-farm and definitely from that of a feedlot.

In a well designed handling facility, animals can be gathered safely, sorted and controlled. Depending on the size and type of facility, there are basically five essential components in a well-designed facility:

- Sorting pens
- Working area
- Loading platform
- Crush passage
- Crush pens

3.1 Sorting pens

Cattle are collected from the field or feeding pens, before being handled. The size of the sorting pens must be as large as the largest group of animals to be handled at a time. Each animal needs approximately 2m² of space in the sorting pen.

The shape of a sorting pen depends on the total lay-out of the facility, whether round or square. For savings on labour, there should preferably be two sorting pens. In the planning of systems, provision must be made for possible future expansion.

In sorting pens used for commercial purposes, one pen should be in the shade and be supplied with water, should sick or injured cattle have to be kept there for recuperation.

In feeding lots however, provision must be made for a separate recuperation camp. In large feeding pens a separate sickbay with a crush pen and special facilities will even be necessary.

3.2 Crush pens

Crush pens are used to drive the cattle from the sorting pens to the loading platform. It is usually provided with moveable gates, used for leading the cattle into the crush, by making the area behind them smaller.

In handling facilities with a rectangular layout, a funnel-type crush is usually used. The crushing pen must be designed in such a way that the one side joins up straight, e.g. continuous with the crush. The other side must join up with the crush at approximately 30°. If both sides join up with the crush at an angle, like a funnel, it causes the cattle to try to turn around and mill around in front of the entrance. One of the handling mistakes occurring generally in funnel-shaped crushing pens, is that the pens are overloaded with cattle. The crushing pen must never be filled more than three-quarters full with cattle.
Cattle will move into the crush more effectively if handlers wait until the crush is half filled before they drive in more cattle. This will create enough space for the cattle to follow a leader into the crush. Figure 5 shows a typical funnel-shaped crush pen.

Figure 5: Funnel-shaped crush pen

Cattle usually walk along a fence and are inclined to stand in corners. A round crushing corral is usually better than a rectangular one, as it helps with the flow of cattle. The construction of such a crush pen is however more difficult. To simplify the construction, a pen can be made 10 or 11 sided instead of round. A partial circle can also be used. A number of exit gates are provided on the sides and lead to the loading platform, crush or sorting pens. The crushing pens are provided with two crush-gates that hinge around a pole in the centre of the pen. One gate is for directing the cattle to the correct exit and the other gate is for moving the cattle. These crush-gates can be 3.0m to 3.5m long. The pole on which the gates are joined, must be securely concreted and sturdy hinges must be affixed. For very heavy gates, a bearing is used on the top end as a hinge. A wheel can also be affixed to the bottom end of the gate, to provide sturdiness to heavy gates. A space of approximately 100mm must be left between the gate and the ground, for unevenness of the ground and to make provision for collection of manure. Layouts of different crush pens are shown in Figures 5, 6, 7 and 8.

Figure 6: Herding pen
It is preferable to make the crush-gates and sides of the crush pen solid, while it is a must for feedlots. The only exit that the cattle then see, is to a certain exit gate. The sides can be made solid with steel sheets or rubber. Steel sheets of one millimetre in thickness are too thin and cause a lot of unnecessary noise, use thicker sheets instead. Peepholes can be made for the handlers to observe the animals.

### 3.3 Crushes

#### 3.3.1 Static crushes

A crush is used to line up cattle in single-file to handle them. The end of the crush is considered the working area. A general problem at crushes is that they are usually made too short and too wide. By following a few directives, much frustration can be avoided. The type of crush which will be used will depend on the specific lay-out of the handling facility.
The length of the crush is determined by the number of cattle that have to stand in the crush at the same time. As a rule of thumb, 1.5m per animal is allowed. Therefore, multiply the number of cattle that have to stand in the crush at one time with 1.5m. A crush must preferably be at least six metres long, with the length of a straight crush generally 12m to 21m long.

A too-short crush will lengthen the work time of large herds of cattle, while a crush that is too long, will cause the cattle to remain crowded together during a long work session. This could cause some cattle to lie down and cause disorder and injury. It happens especially with wild cattle.

It is preferable that the crush is built at an upwards incline towards the front, because cattle will rather tend to move uphill in a narrow passage than downhill. Cattle tend to stop if they are driven downhill in a crush. The slope will also help to allow rainwater to run off and this prevents slush.

Crushes may be curved or straight. The overall lay-out of the handling facility will determine which type to use. The advantage of a curved crush over a straight crush, is that the flow of cattle is generally better in a curved crush. One of the reasons therefor, is that the leading animal cannot see the exit in front of him and only follows the crush. The rest of the cattle only see the animals in front of them and follow easier. The cattle can also not see ahead that they are to be handled. Another advantage of the curved crush, is that the rumps of all the animals are in the same direction. This simplifies gestation examinations. The radius of such a crush is approximately 13m.

Crushes with V-shaped solid sides have the best flow of cattle and an advantage is that calves cannot turn around in these types of crushes. The sides of these crushes are usually solid to prevent cattle from getting injured by the poles as a result of the limited walking space. For cleaning purposes and easy drainage, the solid sides must not reach the ground. The opening must however not be too large, as the cattle can injure their hoofs. An opening of 50 mm should be sufficient. The disadvantage of crushes with solid sides is that the cattle cannot be handled from the side. These crushes are also expensive to erect and a catwalk has to be erected, from which the cattle can be monitored or driven. A catwalk is a raised
platform on which the handlers walk, as shown in Figure 9. A further disadvantage of V-shaped sides, is that when an animal falls or lays down in the crush, it wedges itself in. The animal can then only be lifted with great effort. Box-type crushes with vertical sides are a variation on V-shaped crushes. It has basically the same benefits and disadvantages as the V-shaped crush.

Crushes with vertical, transparent sides are relatively cheap and easy to build. Cattle are handled easier and there is still an effective flow of cattle. Calves however turn around very easily in this crush. In feedlots, crushes are used daily and a more durable crush is therefor justified. The cattle are approximately the same size and the width of the crush can be adapted accordingly. Cattle are basically only handled in the working area and the crush only serves as an inlet channel. A V-shaped crush with solid sides is therefor recommended for feedlots.

Commercial and stud farmers sometimes want to handle the cattle in the crush themselves and for this purpose a crush with vertical sides is preferable. A separate calf entrance can also be built. This simplifies the handling of calves.

Where crushes are used regularly, the ground surface tends to become trampled concave. Such a crush surface makes cattle very uncomfortable and they stand very anxiously. The ground surface should be filled regularly so that it is level. A cement floor with a rough surface is a better alternative for a crush floor. It is easier to be kept clean and does not become trampled. The floor can be made slightly convex, so that the cattle trample the manure out themselves. Be however very careful that the hoofs of the cattle do not slip in under the solid sides and get stuck there.

The width of a crush must be selected very carefully, as cattle turn around much easier if the crush is too wide. There are no fixed rules on the width of a crush, but as a rule the inner dimension should be approximately 750mm. In the case of exceptionally large stud bulls, this dimension can be slightly enlarged. As cattle which are offloaded at feedlots are reasonably young, the width of the feedlot crushes can be adapted, even as narrow as 620mm. Figure 10 shows the measurements of a practical crush. In the length direction, the supporting poles must be spaced approximately 1,5m apart.

![Figure 10: Practical crush specifications](image-url)
The question remains whether calves should be handled together with large cattle. The general tendency these days is to handle calves separately from large animals. The reason is obvious, as calves sustain fewer injuries and handling is fast and easy. Two calf crush constructions are possible. The crush for large cattle must be built as such that it can be adapted to handle calves, or a portion of the main crush must be designed as such that it can easily be made smaller to handle calves. Figure 11 shows the typical construction of such a crush-decreasing unit. The other possibility is to erect a separate crush especially for calves. Figure 10 shows practical measurements for a calf crush. The lower 300mm of the calf crush should be solid, because calves can more easily poke their legs through the sides of the crush and break them. Calves are also not as tame as adult cattle because they are not as used to handling as large cattle are.

![Figure 11: Crush decreasing unit](image)

A great problem being experienced with the handling of calves, is the separation of a cow from her calf without disturbing the flow of cattle. In a V-shaped crush the calf can however be easily separated from the cow, because the V-shaped crush forces the calf to walk ahead of or behind the cow. The calf can then easily be headed off with a gate. Figure 12 shows such a calf drafting race. Figure 13 shows a calf drafting race in a crush with vertical sides.
Another method of separating calves from cows, is to build a portion of the crush with vertical poles spaced approximately 350mm apart, as shown in figure 14. The calf is then driven through the vertical poles to stand outside the main crush in a small pen. The separation process must be undertaken calmly, otherwise the large cattle may injure the calves while they are moving out.
When a cow and her calf are separated, the calf must remain as close as possible to the cow, or she will search for her calf and this causes a delay in the crush. The calf crush must therefore not deviate too sharply away from the main crush.

Where cattle are being driven into a crush, handlers should be standing only one side of the crush, on the opposite side of where the cattle’s heads should be. The reason therefore is that the movement tendency of cattle is away from people. The application of this principle will help to make the cattle stand at an angle in the crush for inoculations and gestation examinations, because each animal will tend to place its head behind the rump of the animal in front of it. Cattle tend to strain backwards in the crush when they are handled intensively. This causes unnecessary injuries and can be easily prevented by placing a one-way gate in the crush. Figures 15 and 16 shows the constructions of such a gate. The height of the gate can be adapted to the average height of the cattle by adjusting the chain. Such a gate can be affixed every three metres in the crush.
3.3.2 Mobile crushes

Mobile crushes are generally used for fieldwork where permanent handling facilities are not close to pens, or where it is not viable. It can also be used to treat sick animals in a camp. Mobile crushes can basically be used anywhere in the field next to a fence. Such a crush will obviously have to be easily assembled and transported. The length of the crush can therefore not be longer than three to four metres. This length should be long enough for two animals. Figure 17 shows a typical assembly of a mobile crush.

![Figure 17: Erection of a mobile crush](image)
Measurements for a mobile crush are basically the same as those for a conventional crush. Where the mobile crush for calves has to be used, it can be assembled as such that the crush forms a curve. By doing this, the effective width of the crush decreases for easier handling of the calves. An inner measurement of 450 to 500mm is effective for calves. Figure 18 shows the adjusted erection of a mobile crush for calves with the decreased inner measurement.

![Figure 18: Adjusted crush erection for calves](image)

Figure 19 shows the construction of a typical mobile crush. The crush consists of separate units which are driven into the ground with spikes.
3.4 The working area

The working area is at the end of the crush. This is the area where the animals are handled and can contain the following items:

- Neck clamp.
- Body clamp.
- Scale.

The working area must preferably be provided with a roof and concrete floor. The floor must be made coarse to prevent animals from slipping. Floors with an imprinted diamond pattern give very good results. After casting the floor, a straightedge is used to imprint the diamond pattern of approximately 200mm wide and 20mm deep into the concrete. This diamond pattern is also easy to clean. If an earth floor is used, it must be such that it can drain easily and not be trampled into slush. In order to ensure this, the floor must be thoroughly compacted. Figure 20 shows a typical working area.
The work area components as mentioned, must be arranged in such a way that the openings and gates are combined, to make access to the cattle possible. A gate that swings open from the side in the direction of the crush in order to block off the crush for other animals, but gives access to the rump of the animal, is convenient. A comfortable work area must be provided in front of the animal.

It is convenient to control all the equipment in feedlots hydraulically. It simplifies the process and saves a lot of time. The hydraulics must however be designed in such a way that the animals are not injured. Pressure control valves must be used to prevent injuries. Figure 21 shows a hydraulically controlled unit.
3.4.1 Neck clamp

A neck clamp is one of the most essential items in the working area and is used to hold the animal in position if work is done on it. Quite a few neck clamps are available on the market, with different opening mechanisms and different neck openings. Guard against delicate neck clamps made from poor materials. The shape of the neck clamp plays a major role in decreasing the vertical movement of the head. The locking mechanism of the neck clamp must also have a fine setting. It is advisable to obtain the opinion of other farmers or owners about a certain product on a certain breed, before a neck clamp is purchased. Figure 22 shows a typical neck clamp.

![Figure 22: Typical neck clamp](image)

3.4.2 Body clamp

A body clamp is used for holding the animal in firm position when working on it. The sides of the clamp swing inwards to clamp the body of the animal firmly. Some body clamps are provided with removable side plates for easier access to the animal. Figure 23 shows a typical body clamp.
3.4.3 Scales

The current emphasis on standardisation and increasing economic pressure contributes to the situation where a great number of livestock have to be measured several times during their lives.

Great demands are placed on scale operators and psychological and physical exhaustion gives rise to inaccurate results, rough handling of the animals and mistakes on information observed. Special attention must therefore be given to the choice and placing of a scale to ensure easy and effective handling of animals.

There are basically four categories in which scales can be placed, namely:

- Spring balance scale.
- Hydraulic scale.
- Oil bath scale.
- Electronic scale.

3.4.3.1 Position of the scale in the handling complex

Depending on the specific set-up, a scale can be placed in the working area. This is the cheapest option, as an additional passage is not required for weighing. Ensure that the scale has a locking mechanism, to prevent the scale from being subjected to unnecessary shock loads when cattle move over it for other purposes. It is however strongly recommended that the scale is removable, meaning it should be able to be moved out of the crush when animals are not being weighed. This will lengthen the life of the scale. Wheels or a sliding rail can be used for removal of the scale. If the calf crush is next to the main crush, one scale can be used for both by moving the scale to and fro.
In a feedlot set-up, cattle are usually weighed and processed after arrival. This is a consecutive action and the mass of each individual animal is determined. When cattle are treated in a crush, it is mainly for weighing and the scale can be permanently installed. The scale can also be placed in a separate weighing crush. Some feedlots prefer large scales on which more than one animal can be weighed at once. Figure 24 shows a typical mass scale.

![Typical mass scale](image)

**Figure 24: Typical mass scale**

There are a few general suggestions for the placing of a scale, namely:

- Ensure that sufficient shade is provided for the scale operator.
- Ensure that the scale is placed on a hard, level (preferably a concrete slab) surface. This will prevent inaccurate readings.
- Place the scale in such a way that animals that have been weighed can be allocated to the loading platform or to the holding pen.

### 3.4.3.2 Access gates

Access to the scale can be controlled in different ways:

- Access gate that swings outwards:
  
  The disadvantage of this gate is that it is opened into the face of the approaching animal. To prevent this, animals can be held back in the crush with the aid of a crossbeam. If the animals are used to this type of access gate, they will leave sufficient space for the gate to open.

- Trapdoor:
  
  This type of gate does not take up much space, but the operation of the gate can be an exhausting exercise because it has to be lifted with a rope. A counter mass can however be affixed to the gate.
Pipe:

Instead of using an access gate, a pipe can be affixed in the crate at a point which can be adapted to the size of the animal. This pipe is held in position with hooks in the side beams.

The choice of control at the entrance depends largely on the conditions on the farm.

3.4.3.3 Body clamps and crates

Some crates are provided with swinging body clamps that serve two purposes:

- To adapt the width of the crate when calves or smaller animals are handled.
- To keep an anxious, unwilling animal tightly against the side of the crate so that the mass can be easily read.

These body clamps work satisfactorily if the locking mechanism is designed as such that accidental unlocking is prevented. The body clamp must also stretch over the entire length of the crate to prevent calves from landing up on the wrong side of the clamp.

3.4.3.4 Exit gates

There are mainly two types, namely:

- Open-beam type exit gate

  It enables the animal to see through the beams and reassures it that it will not enter an enclosed space. The gate swings open to the outside.

- Gate with neck clamp

  This type of gate, combined with a neck clamp to a scale, can also be used for veterinary purposes. The neck clamp must be provided with a safe clamp and an easy releasing mechanism. It is essential that the mass measuring mechanism of the scale should be disconnected when the steel crate is used for dosing, branding or dehorning.

3.4.3.5 Crate floors

Most scale crates have hard wooden floors. Cross bars on the floors prevent animals from slipping and getting injured. The bars must be kept firmly in position at all times.

Some scales have floors made from thick steel. These are durable and are also fitted with cross bars. The farmer must examine the bars beforehand for sharp edges. Anxious animals that stamp about on the steel floors often create a noise. A thin layer of sawdust can be strewn on the floor to prevent this. Slippery floors must be prevented at all times.
If manure or urine collects on the scale, it must be continuously removed during the weighing action. It can be swept away, flushed away or covered with sand. Ensure that the scale is “zero’d” before each mass reading.

High, solid sides (approximately 450mm high) on a scale, will prevent animals from stepping sideways and hurting themselves. The weighing of calves is also made easier.

3.4.3.6 Installation of a scale

It is essential that the scale is calibrated at regular intervals. Scales must then be tested with masses of the same size as the average animal to be handled. Bags of cement, fertiliser or grain can be used for this purpose, if their masses have been determined on an accurate platform scale.

Re-calibration can be done as follows:

- Set the system on nil.
- Place the mass on the platform and get the correct reading.
- Remove all dirt from the platform and do necessary adjustments.

3.4.3.7 Maintenance

The general requirements must be adhered to, in order to ensure maximum performance from a scale for as long as possible:

- The scale must be kept clean to prevent a build-up of dirt and manure, as this can influence the performance of the parts.
- The authenticity of the readings must be examined regularly for re-calibration.
- Use the correct type of oil in the dashpot.
- The spring balance and reading column must be removed after weighing.
- The spring balance must be mounted carefully in order that the parts can move freely.
- The wooden floor and scantlings must be examined regularly to ensure that there are no breaks or cracks.
- In the case of an oil bath scale, the oil level in the container must be examined regularly.
- The periodic examination of bearings and the effectiveness of hydraulic pressure cells (where applicable).
- Ensure that a lightning deflector is coupled to the scale.
- Make provision for wheels on the scale to make it portable (if applicable).
- Newborn calves can be weighed with a simple, cheap suspended scale, as shown in figure 25.
3.5 Loading platforms

A loading platform must be designed as such that the cattle can be loaded fast so that the first animal does not get a chance to walk back. The height of the loading platform is determined by the height of the back of the truck or transportation vehicle. As general directive, a height of 1,1 to 1,2 m for trucks are accepted.

A loading platform which is built at a steep angle causes injuries, therefore, the gradient must not exceed 16°. This is equal to a one meter increase over 3,5 m horizontal distance or 1,1m increase over 3,85m. Loading platform floors can become very slippery and must therefore be made very coarse. A diamond pattern is recommended. The width of the loading platform is the same as that of a crush, e.g. approximately 750mm. For the collection of cattle, a wider loading platform can be used. Figure 26 shows the construction of a loading platform. Figure 27 shows the offloading platform.
Cattle are normally afraid of heights and a loading platform with a solid floor and solid sides gives the best results. Loading platforms must however be provided with swing gates which can swing open into the truck. This will prevent cattle from jumping off between the truck and the loading platform. Telescopic sides which can be extracted into the truck are also suitable, but if they are bent by the cattle, they can impair the operation.

It is preferable that the top of the loading platform should be horizontal for approximately 1,5m. A curved loading platform with an inner radius of 4,5m gives better flow results than a straight loading platform. The loading platform must also have a catwalk on the sides on which the handlers can move to help with the loading process.

3.6 Additional equipment

3.6.1 Tilting table

This apparatus basically consists of three parts, namely the neck clamp, tilting crate and tilting mechanism. The neck clamp opens the entire width of the crate and has a head piece on which the animal’s head rests after it has been tilted. The tilting crate has two straps that pull the animal tight and gates that swing open. The floor plate also swings open to make the animal more accessible. The tilting mechanism consists of a differential of a motorcar, fitted with pulleys and a crank handle. One person can therefor tilt the animal. The only disadvantage of tilting an animal, is that as soon as the animal has regained its balance, it starts panicking. Gestating cows can injure themselves and even abort.

3.6.2 Hoof lifting crate

The apparatus basically consists of three parts, namely, a neck clamp, crate and hoof lifting mechanism. The neck clamp is designed as such that it can open the entire width of the crate from the bottom to the top. The crate consists of a framework of steel pipes and angle iron with a broad band made of hessian sacking that supports the animal while being handled. The hoof lifting mechanism lifts the animal’s hoof to the back so that the hoof may be clipped. Uses of the hoof lifter are as follows:
• Castrating of calves
• Dehorning and dosing
• Branding or freeze branding
• Application of ear tag
• Ovum (egg) flushing and embryo transplanting
• Heart-water blood administering

Benefits of the hoof lifting crate:

• The animal remains standing upright. This means that gestating cows can be handled safely.
• The apparatus is adaptable.
• The apparatus can be easily moved and transported.

3.6.3 Dipping facilities

Many cattle diseases are transmitted by ticks and in cases of a serious infection, it can cause anaemia. The most effective method of controlling ticks, is to dip the animals regularly. In South Africa the following dipping methods and facilities, or combinations thereof, are used:

• Spray dip.
• Immersion dipping.
• Pour-on remedies.
• Hand spray or tractor spray.
• Hoof dip.
• Draining pens.

The basic requirements to which any dip must comply, are the following:

• Large enough capacity.
• Must not waste dipping fluids.
• Must wet the animal thoroughly.
• Must not have a slippery surface.
• The cattle must not be able to turn in the dip.

3.6.3.1 Spray dip

A spray dip is a dip where cattle move through a passageway equipped with sprayers that apply the dip. Sprayers are affixed as such that they wet the animal thoroughly. The dip then runs off and is collected in a pit, from where it is pumped through the sprayers again. Wetting by spray dip is generally not as good as that of the immersion dip. According to Nieuwoudt (1996), correct installation and good management are however the determining factors of a spray dip. An effective spray dip contains a number of benefits, such as:

• A fresh mixture of dip is used for each dipping session which means that the dip concentrate is always correct at the beginning of the dipping process.
• It is possible to adapt the dip mixture immediately as soon as ticks begin to build up a resistance to a certain type of dipping fluid.
A further advantage is that contamination in a spray dip is relatively low. As a result, the storing of proteins and the possible build-up of bacteria is not possible. Some farmers maintain that the anxiety factor of cattle in a spray dip is much less than in an immersion dip. This fact is important for feedlots and dairy complexes where anxiety definitely has an influence on the meat production and the milk production of lactating cows.

The disadvantages of the spray dip is that conventional sprayers become blocked easily, if the dipping fluid is not kept clean. Some parts of the body under the animal and the tail and ears are not wetted thoroughly. A possible solution is to hang a wet bag or canvas at the entrance of the spray dip so that the cattle do not simply walk through, but move through carefully. In this way a better and more even wetting is ensured. White painted inner walls brighten the interior of the spray dip and lessens the anxiety factor in the animals.

Animals must drink water before they are dipped to prevent the dipping fluid from dripping into the water troughs after the dipping process. This contaminates the water that other animals have to drink from. Regular maintenance on the spray dip system is necessary. Animals that are nor used to the spray dip, must first be taken through the dip two or three times without being wetted. Transparent roof sheets brighten up the “tunnel”, improves the flow of cattle and prevent the unnecessary loss of dipping fluid.

The construction of a spray dip can be seen in Appendix A.

### 3.6.3.2 Immersion dip

With this method, cattle are completely immersed in a dip tank. The general wetting with this system is very good as a result of turbulence against the animal’s skin, which achieves a good penetration between the animal’s hair. As in the case of a spray dip, design and management plays an important role in the level of effectiveness of an immersion dip. The immersion dip has however a few disadvantages:

- The dip tank can crack and seepage of dipping fluid can occur.
- The anxiety factor in cattle is reasonably high.
- Gestating cows can abort if the entrance is not designed correctly.
- Because of the use of a large volume of dipping fluid, it is unpractical, as well as uneconomical to make a new mixture every time dipping has to be done. Good control over the concentration of the dipping fluid is therefor very important.

The construction of an immersion dip is shown in Appendix B.

### 3.6.3.3 Manual spraying

Cattle are sprayed with dipping fluid in a crush. This process is done manually and gives a good level of tick control. It takes a lot of time, however and is unpractical in large herds. Installation costs are relatively low and running costs are limited effectively.

### 3.6.3.4 Dipping fluids (systemic)

The tendency to use systemic remedies is becoming more popular. The fluid is applied to the animal’s skin in a limited quantity, from the head to the tail, along the spine. The oiliness of the skin and hair spreads the fluid over the rest of the body. Applicator fluids are quick and easy to apply and no special facilities are necessary and no wastage of fluid takes place.
This process has been mechanised over the years. A unit that applies the fluid is positioned in the crush. Applications are electronically controlled so that the dose is adapted to the mass of the animal. This is a timesaving method and is very popular in the feedlot industry. Good quality dipping fluid must however be used to prevent parasites from becoming immune to the remedies. These remedies are relatively expensive, but good results are obtained.

3.6.3.5 Hoof bath

A hoof bath serves a very good purpose, especially if it is used to wash mud and manure from the animals’ hoofs before allowing them into the dip. It is easier to clean the hoof bath than the sieve and sprayers of a spray dip, or cleaning an immersion dip. A construction plan for a hoof bath is shown in Appendix C.

The floor of the hoof bath must be corrugated like corrugated zinc. It opens the hooves slightly, so that all the mud and manure trapped in the hooves is rinsed out. The drainage pipe must be installed in such a way that the hoof bath can be cleaned easily.

3.6.3.6 Dripping pen

Dripping pens are usually combined with the dip facility. The main purpose of these types of pens is to get some of the dipping fluid back into the tank after the dipping process. Two pens are recommended to ensure continuous flow of dipped cattle. While pen 1 is being filled with cattle, cattle are dripping in pen No. 2. Approximately 2m² standing space per animal must be allowed. The floor must be of concrete, with an incline for the dipping fluid to run back into the dip tank.

3.6.3.7 Other methods

Other methods can be used, especially to get rid of heart-water bearing ticks, namely:

- Implanting medicine behind the animal’s ear.
- Intravenous injection of antibiotics and vaccine.
3.6.4 Lifting apparatus for lame cattle

Many animals become lame and can then not rise. It is usually caused by disease or a poor nutritional condition or the nerves in the pelvis which were bruised after difficult calving. If the animal should remain lying down, the blood circulation is cut off as a result of pressure which in turn will cause muscle degeneration. The end result will be that, even if the original disease is cured, the animal will still not be able to rise to its feet as a result of the muscle degeneration. The other problem is that the urine and solid excretions must be done as normally as possible, namely in the standing position. It is therefore necessary to use the lifting apparatus to keep the animal in the standing position until the disease is cured. It is however very important that most of the weight must be carried by the chest portion of the animal and not the abdominal part. Figure 28 shows the construction of the lifting apparatus.

Figure 28: Lifting apparatus
3.6.5 Artificial insemination

When artificial insemination (AI) has to be done in a handling complex, a separate crush with the AI-facility should be used therefor. The AI-facility can also be installed in the hospital camp. The reason therefor is that animals associate the normal crush with instruments such as neck clamps and tilting tables which can sometimes cause pain. This association causes the cow to be more anxious and this results in a lower acceptance rate. Figure 29 shows a typical AI-facility. Easy access to the animal by the handler is essential.

![Image of AI-facility]

**Figure 29: AI-facility**

Cows are much more at ease in a dark AI-facility. The sides, tops and front is made of non-transparent material, so that the compartment has a dark atmosphere inside, which has a calming effect on the cow. A chain can be hooked in behind her to keep her inside. After insemination she moves through a gate at the front or the side.

3.6.6 Hay racks

Hay racks must only be used for providing the animals with hay and must be designed as such that it limits wastage to the minimum. It must preferably be portable.

Cattle graze with lowered heads and the hay racks must be placed in such a position that they can graze in the same natural position. If animals take hay from high racks with the head and neck stretched upwards, they tend to waste by pulling the hay down.

The animal should poke its head through partitions to get to the hay. To a certain extent, this prevents competition of the intake of feed by lateral thrusting movements of the head. Figure 30 shows typical high hay racks.
3.7 Handling pens

The various components can be combined to provide in the relevant requirements, after thorough consideration. The figures on the following three pages show typical layouts of handling pens. These lay-outs must not be followed stringently, because it might not serve the relevant requirements exactly.

3.8 Field pens

In the commercial industry it is sometimes handy to have a number of handling pens in the field. The handling pens make it easier to handle the cattle because they can be handled in the field and do not have to walk great distances to get to handling pens.

These pens are simple and are combined with the watering points of the camps. Cattle usually gather near watering points and will then be at the pen to be handled.

The pens usually consist of a crush with a neck clamp, sorting pens and a water trough.

The pens must be placed in such a way that they can serve a number of camps. A four-camp or six-camp system can therefor be provided with a single field pen with a watering point.

If there are only loose camps, the lay-out of the pen can be such that it has two watering points to serve two separate groups of cattle at a single pen.
1. The crush can be positioned as shown or inside the crush if it is equipped with a distracting mechanism.

2. When the crush is piped as in the plan the animals must first be lanced through the weighting section and then sorted by drawing them through the crush and sorting them at either A or B.

3. Crush 1 is equipped with two gates for drawing the cattle.

4. This plan is specifically for farmers who prefer straight crushes or who have a steady portion of straight crush. This plan can be used to improve and adapt such a crush.

5. All gates and the winding road to the gate are indicated with a 60°. Note the position of the 60°-through aperture (200–250 mm) that make labourer's movement around and through the pen easier.

ARC-Institute for Agricultural Engineering
Handling pens and sorting pens for 200 cattle
CHAPTER 4 - STOCK WATERING SYSTEMS

Each stock watering system usually consists of:

- The water source - this is either a borehole, fountain or a permanent stream.
- Inlet pipe to the main storage location.
- The distribution network to the water troughs - this can include interruptions, pressure releases and buffer reservoirs.

4.1 Water requirements of cattle

A number of factors influence the amount of water that cattle need daily. The time of the year and the nature of the grazing plays a role. It varies from region to region and the figures are not rigid. Table 1 shows the water requirements of cattle under normal circumstances.

<table>
<thead>
<tr>
<th>Type of cattle</th>
<th>Water requirements per head per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small stock</td>
<td>5 litre</td>
</tr>
<tr>
<td>Large stock</td>
<td>50 litre</td>
</tr>
<tr>
<td>Lactating milking cow</td>
<td>90 litre</td>
</tr>
<tr>
<td>Ostrich</td>
<td>10 litre</td>
</tr>
</tbody>
</table>

4.2 Total number of cattle dependant on a drinking trough

If more than one water point per camp is provided, the water requirement can be distributed over all the water points. Table 2 can be used as a directive for the distribution. It shows the percentage cattle of the total number of cattle per camp dependant on each water point.

<table>
<thead>
<tr>
<th>Number of water points</th>
<th>Percentage of stock loading for which provision must be made at each water point</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>100%</td>
</tr>
<tr>
<td>Two</td>
<td>66%</td>
</tr>
<tr>
<td>Three</td>
<td>50%</td>
</tr>
<tr>
<td>Four</td>
<td>33%</td>
</tr>
<tr>
<td>Five</td>
<td>25%</td>
</tr>
</tbody>
</table>
4.3 Watering times for cattle

The amount of water needed at a drinking trough daily, is determined by the type and number of cattle that drink there. The daily drinking time is determined by the grazing habits of the animals, which is determined by the camp sizes. In large camps, cattle tend to graze in herds and then go and drink as a herd. Drinking takes place in a relatively short time. The provision network must then be such that it can provide the full water needs in a short time. For design purposes a time of four hours, or 5 litres per animal per hour is recommended.

In smaller camps, the tendency to herd forming is less. The animals are usually near the drinking troughs and sufficient water must be provided per day. Ten hours of drinking time per day is recommended for design purposes.
CHAPTER 5 - COMMERCIAL CATTLE FARMING - PLANNING AND DESIGN

The farmer finds himself more than ever in a competitive market – a market where Rands and cents influence each decision. It is therefore extremely important that the farmer must consider the financial implications of every decision made, before he makes a final commitment. As it is very expensive to construct proper camps and pens, the facilities must be sufficient to house the expensive animals. There are very important aspects regarding the design and construction of these facilities that the farmer must consider. The facilities must be designed as such that the animals are comfortable and unnecessary handling of animals is avoided. Unnecessary handling of cattle has a detrimental cost implication, because the production and quality of the cattle decrease while labour costs increase.

In the planning of an efficient cattle feedlot, a number of requirements must be considered. These planning requirements can include one or all of the following:

- Feasibility study.
- Choice of a suitable site.
- Planning of the entire Lay-out.
- Planning and design of individual facilities.

5.1 Feasibility study

This is one of the aspects which is easily neglected, because the end product always looks profitable. A complete market survey must be done, in which the potential demand for and availability of the product must be analysed together with the current market prices. Questions to consider are whether there is a demand for more meat, how great the demand is and whether it will be profitable to try and meet the need.

It is also necessary to investigate the most beneficial locality for such an enterprise. The locality is influenced, among others, by the following factors:

- The availability of raw materials in the vicinity. This includes the supply of cattle from the immediate area. If raw materials are unavailable, it can lead to high transport costs, which will make the enterprise less profitable. This also applies to feeds, silage, maize and other feed components. Electricity and a water source must also be available.
- The distance and cost of transport to the most important markets, whether by rail or by road.
- The suitability of the climate. Under certain climatic conditions, cattle are inclined to poor production and these areas must be avoided.

5.2 Choice of a site

When selecting a site, the following must be considered:

- Is the site already available or is there a choice of other sites.
- What is the quality of the existing infrastructure? Are there roads, electricity supply and water?
- The topography of the terrain - earthmoving and drainage must be taken into account.
- The soil characteristics.
- Pollution problems.

With the choice of a site for a feedlot, it is important that the slope, the type of soil and prevailing winds must also be considered. Future extensions must be kept in mind, in order that the initial lay-out can be enlarged with the minimum effort.

A northern slope is recommended, as it dries out sooner. An incline of between 1% and 6% will aid drainage and will prevent an excess of solid manure water from running off during floods. The type of soil, whether it be sandy or clay, will however give a good indication of what the incline should be. Marshy soils must be avoided as much as possible, because of poor drainage. Seen from a drainage viewpoint, gravel is recommended for a feedlot.

Concerning the prevailing winds, the direction is important and the feedlot must be placed in relation to the other buildings (see figure 31). It is just as important that sufficient space for waste water dams is provided at the lower point of the pen lay-out and dams must be placed at a safe distance from rivers (minimum 100m) and streams and boreholes. To prevent contamination of streams, ensure that waste dams do not overflow except if there is a grass-covered safety strip of at least 100m wide. A better solution to possible problems, is to use water from the manure dam for irrigation purposes or other alternatives.

Figure 31: Prevailing winds
5.3 Planning of the entire lay-out

A typical feedlot lay-out consists of a feedlot, handling facilities, office complex, hospital, feeding facilities, workshop complex, water supply, roads, drainage canals, manure and run-off storage dams and windbreaks.

The placing of these facilities is important and must be handled as such that the lay-out according to the characteristics of the site, is compact, tidy, orderly and labour-saving. Such a lay-out will promote productivity and managerial ease.

Depending on the distinct set-up, there will still be certain buildings on the site. If possible, these buildings must be integrated with the new buildings to save costs.

To determine distances between buildings, aspects such as ventilation, fire hazards and the spreading of disease must be kept in mind.

With the planning of the lay-out, it is important that the office must be the centre of the lay-out. It is just as important that the access road ends up in the office. This will make proper control over access to the site possible. The access road must be as short and straight as possible and must be able to carry two-way traffic.

The handling pens, feed depot and workshop is arranged in a logical manner around the office, so that all traffic, especially between the silage trenches, feed depot and pens, will flow smoothly.

To regulate truck traffic, the processing plant and silage trenches must be placed as close as possible to the access roads. It is also better to place them on the topside of the pens, so that heavy loads of feed can be transported downhill. Separate passages must be constructed, along which the cattle can be driven, to prevent them from unnecessarily moving between trucks. If so desired, a weighing bridge can be installed at the access gate, so that the animals and feed can be weighed while moving in and out.

To ensure a circle flow of activities between the feedlot pens and handling pens, it is important that the single-line pens connect to the handling pens. The hospital pen and facilities for post mortem examinations must connect to the feedlots.

The water reservoir is usually at the highest point of the site to make use of gravity for the water flow to the troughs in the feedlots.

Flood water must be considered carefully during the planning of the site lay-out. Drainage problems in feedlots mainly occur as a result of insufficient inclines and poorly planned run-off control. Rain water must be kept clean and must be transported in diversion courses. Water harvested from roofs and any other run-off water on the site around and above the pens, must be drained separately from the pen run-off.

Sufficient space for possible future extensions must be allowed. Figure 32 shows a typical lay-out of the entire feedlot.
5.4 Planning and design of individual facilities

Each individual component of a feedlot facility must be well thought-out and designed. The most important components are discussed in the following paragraphs.

5.4.1 Feeding pens

Although interior feeding pen systems hold definite benefits, the lower cost associated with a pen system is usually the conclusive factor and therefore very little interest is shown in other types of housing in South Africa. The cattle are kept in limited areas where they receive thoroughly formulated rations and can be rounded off as fast as possible for slaughter.
In some foreign countries, the double line trough lay-out is more prominent because it is a compact and cheaper system. This system however causes drainage problems and in South Africa a single line feedlot lay-out is used generally. Figure 33 shows such a typical single line trough lay-out.

![Figure 33: Single line trough lay-out](image)

5.4.2 Site incline

A moderate incline of between 1% and 6% should keep trough areas dry and will be acceptable to the animals. Such an incline will also drain well, without allowing an excess of solid manure to run off during a flood. A single line trough is therefor placed parallel to the contours so that the pens can drain vertical against contours and in one direction only, away from the troughs.

5.4.3 Pen sizes

The sizes of the pens are determined by the number of cattle in a group and the surface of trough space allowed per animal. The accepted practice is to place about 100 to 200 cattle per pen. Depending on the average rainfall in the area, about 8 to 15m² pen space is allowed per animal.
Pens must however be large enough so that a front-end loader can move comfortably and a truck can turn when the pen is being cleaned. A minimum width of 20m is therefore recommended. A disadvantage of a smaller pen is that the material cost per square metre is higher. If more than 5 000 cattle are fed, larger pens can be considered, up to 500 cattle per pen. Although larger pens save on material costs, it makes handling of cattle more difficult.

### 5.4.4 Feeding troughs

A minimum trough length of 150mm is needed per animal if young animals are fed at will. Older animals need a longer trough length. The recommended trough length in adaption pens is 300mm and these are also shallower. Figure 34 shows a typical feeding trough lay-out.

![Figure 34: Feeding trough lay-out](image)

A feeding trough inner width of 600mm is ideal for the maximum basin measurement, as it also allows young animals to eat everywhere. The bottom must preferably be rounded so that animals can easily eat it clean and it will also prevent feed from remaining in corners and rotting. If the feed is divided into two or three feedings per day and control is exercised over the quantities supplied, troughs will be eaten clean each time. The bottom of the trough must preferably be 150mm above the standing level of the animal with the feeding sidewall 400mm from the standing level, while the roadside wall must be 600mm high from the animal’s standing level. This is high enough for prevention of feed wastage and low enough to ensure mechanical feed supply. The sloped sides help to always bring the feed as close as possible to the animals.

A problem found at feeding troughs is that cattle climb into or fall into troughs. This can however be prevented in different ways. Figures 35 and 36 show a typical solution.
The upper cable is fixed, while the lower cable can move in a steel frame. When cattle feed, they press the cable forward in the frame and the cable usually remains in position. When an animal, especially young cattle, falls into a trough, it is easy to take it out, by simply pushing the cable back and upwards. Another possibility is to use a pipe instead of a cable. The pipe is welded in the foremost position of the cable and the frame is replaced by a single horizontal pipe, as shown in Figure 36.

Figure 35: Feeding trough with movable steel cable

Figure 36: Feeding trough with single horizontal pipe
Troughs may be built from brick and plastered, or can be cast by concrete. A concrete slab must preferably be cast on both sides of the trough. The concrete slab in front of the trough prevents trampling and keeps the animals dry so that they can feed in comfort. The slab must be coarse to prevent animals from slipping. The slab is scrubbed clean weekly and must be as wide as the scraper blade, approximately 3 m. The slab on the side of the feeding path only needs to be about one metre wide. This is to prevent the feed wagon from treading out the path and to create a level surface for the feed wagon for even feed action. It is wise to lay the slab as one strip and building the trough on it. The thickness of the concrete slab varies from 75 to 100mm and must have a slight drop away from the trough.

The feeding trough must have a drop in the longitudinal slope with a drainage opening for rain water or washing water to run off.

It is advisable to put up gates at the concrete slab between the different pens, as it will simplify mechanical manure removal. It is also convenient, where a grader is used, to scrape away the manure directly next to the trough. In order to limit the cost of maintenance, heavy duty gates should be used.

There is disagreement on the construction of a roof over the feeding trough. It is expensive to construct, but it protects the feed against rainy weather and provides shade for the cattle. Cattle like to lie in the shade and this sometimes prevents the less dominant cattle from feeding. If heat is really a problem, shade structures can be erected elsewhere in the pen, as shown in Figure 37. Figure 38 shows a typical solution for a roof over a trough. If the roof is erected, the roof supports must be placed in such a way that they will not hamper the mechanical off-loading of feed or manure scraping on the concrete slab.

Figure 37: Shade provided separately
5.4.5 Water troughs

Water troughs are placed approximately two-thirds of the camp length from the feeding troughs and on the border between two pens, so that both pens can be served by one trough. Water troughs must be cleaned regularly. For this purpose, a 50mm tap can be provided at the lowest end for drainage as shown in Figure 39. The water for washing the trough causes muddy conditions in the pens. Provide the pen with a concrete trench to drain the water from the pen, or use PVC pipe or quick couple pipe when troughs are being drained.

Figure 38: Roof over feeding trough

Figure 39: Water trough with drainage
Provide a concrete slab (75 to 100mm thick) around the trough, extending two metres on the long side and 0.5m on the short side. The purpose of the concrete slab is to prevent trampling around the troughs.

The ball valve must be well protected against possible damage by the cattle. Figure 40 shows a typical plan of a water trough.

![Figure 40: Water trough](image)

### 5.4.6 Fences

Feedlot fences differ from the usual camp fences. In feedlots there is a higher concentration of cattle and the fences must therefore be sturdier.

Fences in these pens are 1.5m high and consist of five cross wires. Barbed wire injures the cattle and ordinary wire is not strong enough. Steel cables instead of cross wires are recommended.

Another possibility is to make a cable from galvanised wire and steel wire. One 4mm galvanised wire is used with two 2.24mm high tensile steel wires. The length of the wire is slightly longer than the distance it has to span. The loose ends of the wire are tied to the power take-off shaft of a tractor by pulling the ends through the hole on the power take-off shaft. The other ends are tied in position to a corner post. The wires are tightened slightly. Ensure that the tractor’s brakes are disengaged and that the gears are in neutral. At idling speed, get the power take-off shaft in operation for 2 to 3 seconds, to wind up the cable slightly. This cable can now be spanned tight and used as fencing cable. Wood or steel can be used for the standard poles and droppers. Standard poles must be placed three metres apart in the earth and one dropper can be placed between them. If wood is used for standard poles, the diameter must be 100/125mm, while 32/50mm droppers can be used. If steel is used for standard poles, pipes with a 100mm diameter, 100mm IPI-I-beams, or railway sleepers can be used, depending on the cost. If sturdier poles are used, such as metal train rails, the standards can be placed 4.6m apart, with two rails between them. All poles must be planted firmly into concrete. Figure 41 shows the construction of a typical fence.
The top cross wire in the fence can also be replaced with a pipe to ensure sturdiness of the fence, as shown in Figure 42.

If round pipe standards are used, the bottom part must not be concreted in under the ground, else the pipe will not drain and will rust. Poles must be sealed at the top to prevent rainwater from collecting and causing erosion. The concrete anchor blocks are built slightly higher than the soil surface and tapered away from the pole. This is to protect the poles from erosion because of the high urine concentration and water collection around the pole. At gates and at the end of the fence, the standards must always be anchored. Fences must be maintained regularly to ensure long life. If wooden poles are used, they must at least be treated with bitumen or a similar substance to make them more durable. Steel poles must be treated with an anti-corrosive substance, if it has not been done by the manufacturers. Treat the poles before planting, it will be easier and will ensure that it is done thoroughly.
5.4.7 Gates

If the cattle walkway is used as an access to the pens at the lower side of the pens, the walkway must be wide enough to allow cleaning machinery to turn easily into the pens. Alternatively the gates must be adapted, as in Figure 43, or larger gates must be used. It is however advisable to rather use the gates at the feeding trough.

![Figure 43: Fence adaptation for entrance to pens](image)

Standard 3.5m wide gates are not strong enough to inhibit cattle effectively and must be strengthened, or heavy duty gates must be used. The locking mechanism of the gate must be such that it can be easily opened and closed, but not by the cattle.

5.4.8 Preparation of pens

Before building work can begin, the site must be cleaned and graded according to slope. It is worth doing a complete survey and grading the inclines correctly from the onset. Roof run-off water or any other water from the site around and above the pens must be drained separately from the pen run-off. Make special drainage canals so that the water does not run through the pens. Prevent the water from running from one pen to another. Figure 44 shows a practical solution for drainage of pens.

![Figure 44: Drainage of pens](image)
Pen surfaces must be finished neatly, so that rain water cannot dam up. The pen surface must preferably be compacted by means of a roller. In high rainfall areas hills are often constructed in pens. The hills provide a drier place to lie down. The hills must however be constructed in the centre and not at the sides of the pens. This will slow down wear and tear on fences because the poles will not be standing in the mud. Pen maintenance must be done regularly during production. By constructing a sufficient number of pens, pens will be able to rest for a week or two.

5.4.9 Roads

Roads in and around the feedlot must be of high quality. They are indeed the backbone of the enterprise. These roads carry very heavy traffic, cattle, feed wagons and cleaning wagons move over them daily. If the roads are in a poor condition, it will slow down the whole growing process.

If the set-up justifies it, gravel roads, thoroughly compacted by rollers, can be built. An investment in a road is an investment in success.

5.4.10 Handling facilities and office complex

This complex is the heart of the unit. Cattle are received, processed and handled here. Cattle which are ready for marketing are dispatched from here. The design of these handling facilities must simplify the execution of important tasks in the unit. The lay-out of the handling facilities are discussed in Chapter 3.

5.4.11 Office

At large feedlot operations, the offices will usually be separate from the feedlot and handling facilities. At smaller units it would be sensible to have a small office at the processing plant. The office complex consists of an office, storeroom and dressing room. Equipment and medicines are kept in the storeroom. Some medicines have to be cooled, therefore a refrigerator is a necessity. A wash basin with hot water must preferably be installed.

The office must be placed in such a position that a good view of the entire complex is possible. The weighing instruments and, if necessary, a computer is placed in the office.

5.4.12 Flow of cattle

Cattle are driven along the road or transported by truck and must always remain in separate groups, until identified by number. After receiving the cattle they must all be driven through a spray-dip or immersion dip, but cattle who are received late, remain in the overnight pens until the following day. After the dipping process the cattle move through the crush, scale and body clamp, where they are weighed and vaccinated. De-worming medication is then given, the animals are de-horned and provided with ear tags or other identification. The animals are then ready to be transferred to the adaptation pens where individual groups can mingle.

Adaptation pens are merely a few ordinary feeding pens, nearest to the handling pens, to where new arrivals have free access to silage, hay and balanced feed. The animals can be placed separately or intermingled in the pen for the adaption and orientation period. Cattle
that previously received silage or other balanced feeds react sooner and are sooner ready to be transferred to the finishing pens. After finishing the cattle are ready to be dispatched.

The progress of the cattle in the feedlots must be monitored regularly. This is usually done by means of an inspection, but some farmers prefer weighing the cattle. Cattle may be weighed one by one, depending on the available equipment. The individual animal’s progress, or the progress of the cattle in the pen can be measured. A large mass scale, that can determine the weight of a group of cattle, is very handy.

Two dispatch systems for cattle are generally used. The one system consists of the identification and separation of market-ready animals, while the total number of cattle in a pen can be dispatched as a second system. In cases where individual animals in the different pens are identified, separated, weighed and loaded, the social order is disrupted. If only about 60 cattle from a pen of 600 cattle must be loaded, it is important that the entire group must move through the handling channel. The market-ready animals are then separated, while the remainder goes back to the pen. This frequent handling of cattle causes them to take longer to become market-ready.

When animals are divided into groups according to weight upon arrival, the social order is never interrupted. When 60% of the cattle are market-ready, the entire group is marketed. The benefit is that animals are market-ready sooner, but there are some losses as a result of animals that are marketed but are not market-ready.

5.4.13 Feeding facilities

Any feedlot needs a fodder plant. The size of the plant will be determined by the number of animals to be fed. The daily diet of cattle consists of energy-rich protein and roughage feed components. These components have to kept in storage. Some components may be stored in silos, while it is sometimes easier to store others in barns with dividing walls. Figure 45 shows a typical fodder store with divisions.

![Figure 45: Fodder store with divisions](image)

The feed components are stored in the divisions until needed. From here all ingredients are placed in feed wagons, according to finely calculated formulas, mixed and placed in troughs. The feed wagons must preferably have mass meters for easy measuring. Figure 46 shows a typical feed wagon.
Overloading of troughs can cause weakening of the feed, that can cause fatalities.. A feed processing plant must be as close as possible to the access roads and placed on the highest point of the pens. This will make it possible to drive downhill to the troughs with heavy loads of feed.

### 5.4.14 Silage trenches

Some feedlots use silage as roughage. Silage trenches must therefore be constructed.

### 5.4.15 Workshop complex

If complete mechanisation planning is applied, large amounts of money are invested in equipment and machinery. A well-equipped workshop is therefore necessary for maintenance services.

### 5.4.16 Water supply

It is accepted that young animals drink approximately 40 litres of water per day and that reservoirs can store drinking water sufficient for three days, known design approaches for the distribution network can be followed.

Plastic supply pipes that run through pens, must be buried at least 600mm deep to prevent the cattle from breaking them. Cattle drink about 70% of their daily water requirements between 12:00 and 14:00. The animals need 70% of their water requirements for the day in the afternoon. The supply pipes must therefore be large enough to supply the animals with water at the critical times. The pipe network must preferably run outside the pens. This will simplify repair work and will prevent a mess in the pen when pipes are leaking.
CHAPTER 6 - MANURE HANDLING PRACTICES FOR BEEF CATTLE

6.1 General

Beef cattle produce about 63kg of wet manure per day (85% moisture on wet bases, including urine) per 1000kg live mass. Natural processes of evaporation and biological breakdown processes decreases this mass to about one ton solid manure (at 40% moisture) per animal that remains in the feedlot for 150 days.

Quantities to be removed, vary from 60% of this average figure, depending on the ration, number of cattle per square metre, feedlot surface, cleaning procedure and many other factors.

The tempo of manure removal from a feedlot is determined partly by climatic conditions, comfort of the animals, available labour, as well as water and air pollution. As a rule, manure is usually removed when cattle are withdrawn from a specific holding pen.

Seen from an environmental viewpoint, a continuous aerobic breakdown of manure in a feedlot is preferred. By keeping the moisture quality of the manure at 25% to 50%, dust-control and aerobic breakdown of the manure will be encouraged and odour problems will be limited. This will mean that the manure will have to be wetted. To prevent odours during the cleaning action, only the top layer of manure must be removed if possible, so that an aerobic layer of manure is still present.

Equipment used for manure removal vary with regard to the size of the feedlot, the distance to transport the manure and the actual time that the equipment is to be used. A front or rear-mounted grader blade, combined with a tractor, can be used for piling the manure into a heap. A blade mounted to the rear of a tractor will simplify the scraping around poles and fences.

A grader is used to load the manure onto the manure wagon or trailer for distribution. If the enterprise is large enough, the use of an industrial tractor can be considered, as this type of tractor is designed for easy forward and reverse movements, which makes the scraping and loading easier. This tractor can then be used for other purposes on the farm as well.

Piling up of manure into heaps of 1.5 m high in pens, is seen as an interim step of manure collection, promotes drainage of the surrounds and provides a dry resting area for cattle during long wet periods. Further drying and breakdown also occur during manure storage. This manner of piling of manure will cause odour problems if not removed within 4 to 5 days. This is however acceptable, as the odour problems do not last long.
6.2 Run-off control

Run-off at feedlots must be restrained by means of weirs and no contamination of public water is allowed. It is generally accepted that, if less than 12mm of rain has fallen on a feedlot area, the area contains 12mm of moisture, except when rain has fallen during the preceding 72 hours. The earth beneath the manure layer is compacted by trampling, which allows very little water to penetrate the layer of manure.

The quantity of solids carried away by run-off, comprises less than 10% of the manure produced by the cattle. The total solids carried away annually from an open beef cattle feedlot and that lands up in manure storage dams, can be calculated by accepting a total solid concentration of 1.5%.

6.3 Fly control at a feedlot

The basic requirement for fly control is to get rid of the cause of the flies. This can be done as follows:

- Design the feedlot in such a way that thorough drainage takes place, especially beneath fences or near water troughs where animals do not walk often. An increase in flies will not occur where animals often walk.

- Remove manure five days after the animals have been vacated to control the larva’s phase.

- Chemical control must be performed strictly according to prescription. Bait and spraying of poisons will control the mature flies.

6.4 Operation costs

The profit margin of a feedlot undertaking is described these days as sensitive and risky. The level of management must be extremely high and the application of the management must be thorough.

It is understandable why good management is of cardinal importance, because irrespective of the capital costs of the farming enterprise (land, housing, pens, water supply and manure handling), figures have shown that losses regarding operational costs can undeniably be attributed to low turnover relations, poor control over mechanical processes, mortality figures, poor market strategies, as well as poor feed management.

It is therefore recommended that the most economical infrastructure is created, that will still be cost effective.
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