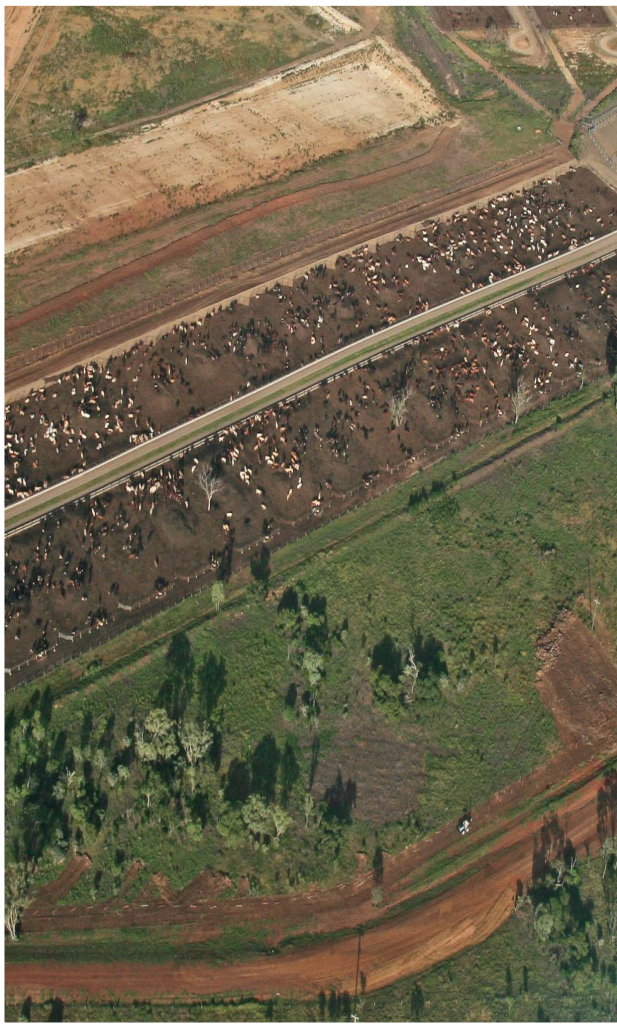

FEEDLOT DESIGN AND CONSTRUCTION

23. Cattle processing facility

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Introduction

All cattle arriving at a feedlot must undergo a process of 'induction' soon after arrival before being allocated to the production or feeding pens. Cattle that have travelled a long distance or that are stressed are first allowed feed and water and overnight rest to allow them to settle. All newly arrived cattle are observed for injury or impending disease, key details are recorded and treatments given, along with identification.

All cattle are then allocated a home production or feeding pen.

Over the feeding period, cattle performance may be measured. Once they reach their marketable weight and condition score, 'finished' cattle are dispatched from the feedlot to an abattoir.

A dedicated facility is needed to handle the cattle during the processes of induction, drafting (or selection) and dispatch. Induction and dispatch may be handled in separate facilities in a large feedlot.

The processing facility and associated equipment are designed to provide a fast and efficient way to handle and treat cattle and to provide safe working conditions for cattle and staff.

A processing facility typically includes

- holding pens
- forcing yards
- raceways
- restraint equipment
- drafting pens

A well planned processing facility allows cattle to flow smoothly while giving handlers convenient access, so that traceability, health and welfare and performance operations will put minimum stress on animals.

Aerial view of a processing facility and holding pens

Design objectives

The processing facility should be designed, constructed and maintained to ensure that it

- accommodates the operations to be performed
- provides access to other handling facilities and production pens
- minimises stress and bruising on cattle
- maximises cattle welfare and worker safety
- addresses appropriate conditions for cattle and workers including temperature, shade, dust, noise, lighting, eliminating shadows, non-slip flooring, amenities, services and storage
- optimises vehicle traffic and cattle flow.

Mandatory requirements

Compliance with

- Australian Animal Standards and Guidelines for Cattle (DAFF, 2013)
- National Guidelines for Beef Cattle Feedlots in Australia (MLA, 2012a)

- National Beef Cattle Feedlot Environmental Code of Practice (MLA, 2012b)
- NFAS standards (AUS-MEAT, 2014).

Design choices

All processing facilities are unique because feedlots can vary in scope and production targets. While an adequate processing facility need not be elaborate or overly expensive, oversimplification could make the facility difficult to operate.

No particular processing facility design can be considered the best. Design will vary with the type and size of cattle, number of animals to be processed, operations to be performed, space restrictions and personal preferences on facility layout.

The design of the facility should allow the operations to be performed, be safe, work well and allow cattle to be processed as efficiently and economically as possible. Cattle flow through a processing facility should be orderly so that sorting, weighing, and treatment will put minimum stress on animals and handlers.

The processing facility will include various associated components including forcing pens, races, cattle crushes, draft pens, weigh box, electronic equipment, catwalks, building and amenities.

Figure 1 provides a conceptual representation of the relationships between the various elements of cattle processing.

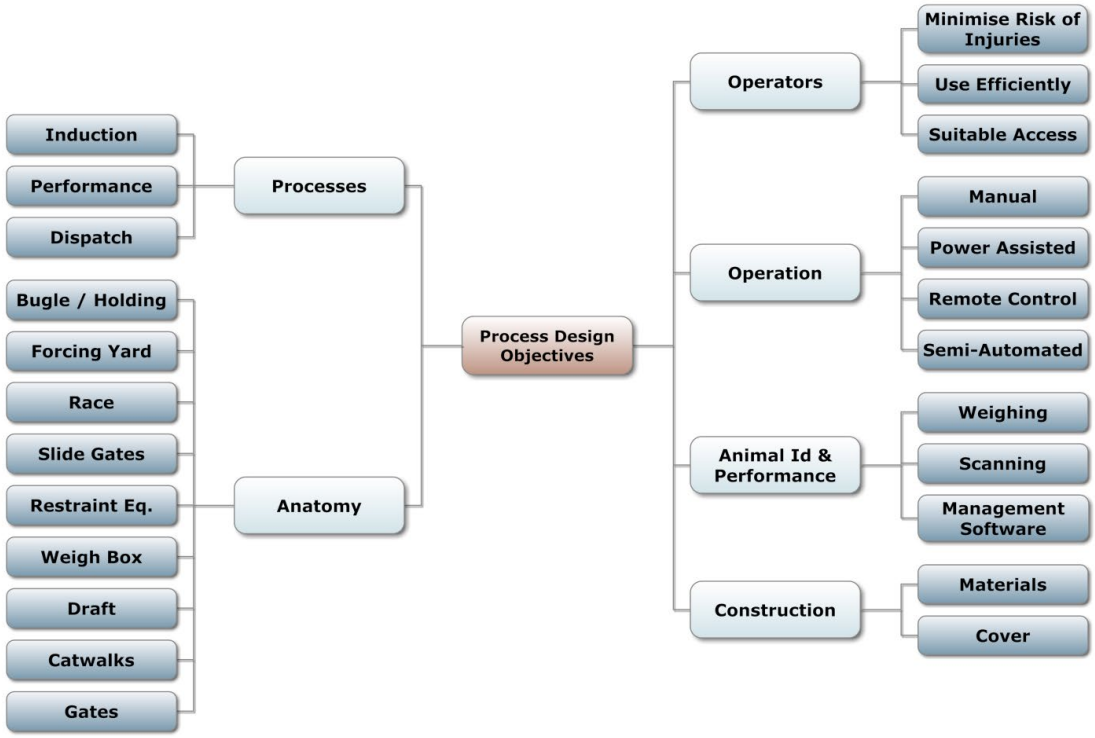
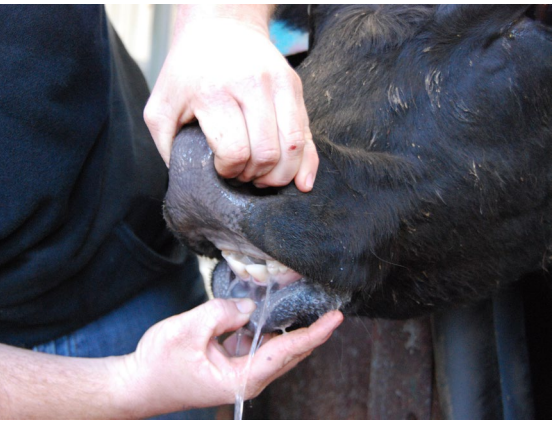


Figure 1. Conceptual representation of cattle processing design factors

A processing facility must be designed to

- accommodate the operations to be performed (e.g. induct cattle, weigh and/or draft cattle into groups, NLIS recording)
- handle the type and number of cattle to be processed
- give access to other handling facilities and production pens
- prevent injuries to cattle
- minimise stress on cattle
- prevent injuries to handlers
- consider size and shape of the components
- consider traffic and cattle flow to avoid cross overs
- ensure cattle flow smoothly by avoiding tight turns
- improve labour efficiency
- provide storage facilities for veterinary chemicals, ear tags
- provide amenities for people – first aid kit, personal protection equipment as required
- specify material type of construction (wood, steel)
- accommodate all-weather processing of livestock
- provide a cattle washing facility if required (*see Section 41 – Cattle wash facilities*).



Induction – age classification by dentition

Processes

Processing activities are generally combined to reduce cattle handling and improve labour efficiency. There are typically three stages of handling during the feeding period — induction, performance and dispatch.

Induction

The induction area of the feedlot must be designed to handle cattle in a safe and efficient manner. As some of the processes can alarm the cattle, low stress stock handling techniques and facilities will enable cattle to be managed in a more relaxed environment.

The processes of induction may include

- inserting and recording individual feedlot identifier ear tag
- NLIS scan of property of origin EID tag – refit if missing
- tail docking
- dehorning or tipping
- recording visual details
- weighing
- mouth dentition for age classification
- vaccinating, drenching and/or injections
- implanting with an HGP
- pregnancy testing
- health check
- classifying/segregating / drafting by sex, weight, age, type, cattle class, market specification or health observation

Induction – implanting an HGP

Performance

- scanning and weighing
- classifying/segregating/drafting based on performance to date
- health treatment
- re-implant of HGP
- health check

The performance process may be conducted multiple times or not at all.

Dispatch

- classifying/segregating /drafting by weight, market specification, market destination, or vendor
- washing muddy cattle
- scanning for loading out – individual cattle, withholding period (WHP) checks, export slaughter interval (ESI) checks, hormone growth promotant (HGP) checks, days on feed (NFAS) checks.

Features

The components of a processing facility are shown in Figure 2. Most systems implement similar equipment, but the main variations relate to the forcing yard and type of restraining crush. Other variations of the handling system may depend on which side of the animal in the crush faces the handler – near-side or off-side.

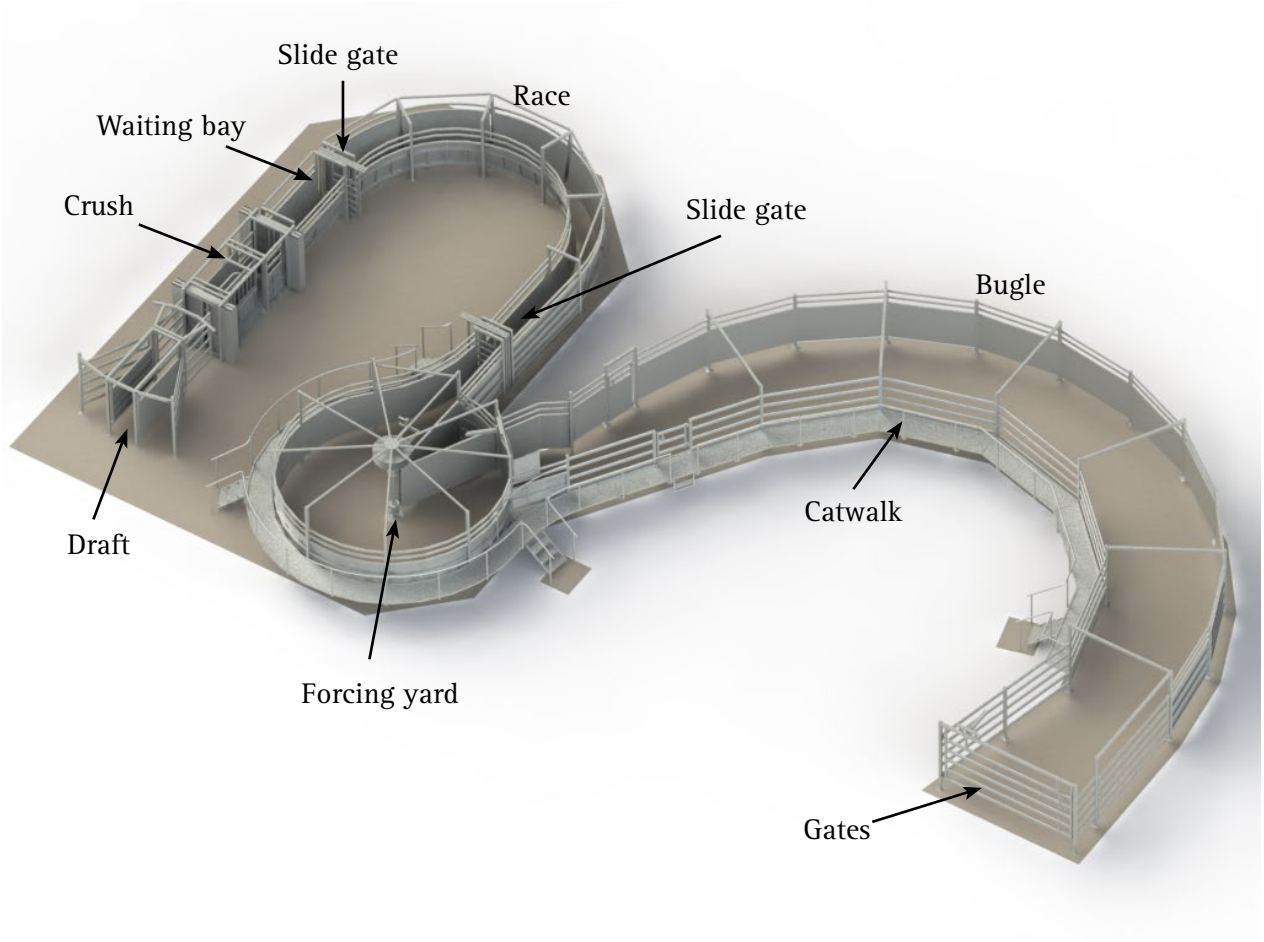


Figure 2. Components of processing facility

Complete handling centre with roof cover over crush area.

Bugle or holding pen

The bugle or holding pens hold cattle for a relatively short time before processing. Pens are usually joined in series, possibly with larger capacity additional pens off to the side. The holding pen size is typically for a single deck of cattle, which is generally an easier quantity to process at a time. This capacity will need to be able to fill the forcing pen and race, or just the race for feeding into the crush. The holding pens have direct access to the forcing pen (i.e. forcing pen/crush).

Well designed holding pens will help minimise bruises and stress. Long, narrow pens are recommended where livestock are held for a relatively short period of time as this gives efficient animal movement. With pens in series, handlers can control the animal's movements from outside the pens, usually from a catwalk alongside the fence. Narrow pens should have a maximum width of about 3 m.

The path or flow of the long narrow pens is commonly curved, hence the naming bugle (after the musical instrument). The pens are usually sheeted from the catwalk to separate cattle from handlers and on the outer fence line to prevent external distractions or baulking.

Forcing yard

Forcing pens (bugle) with slide gates and catwalk with safety handrail.

A forcing yard is typically installed at a facility that processes a large number of cattle. A properly designed forcing pen decreases the labour required to work cattle and offers handlers a safe working environment.

The forcing yard is used to channel cattle into a race. Forcing pens can have a range of configurations; they can be either straight sided or circular.

Funnel-shaped forcing yards are less expensive and easier to construct than circular forcing pens, and this design may be appropriate for small feedlots. This design incorporates one straight side and the other side entering the race at an angle of approximately 30 degrees.

A straight-sided forcing yard is easier to build into an existing set of pens, but a circular forcing pen (Figure 3) should be considered if the facilities are being extensively rebuilt or new facilities are being constructed.

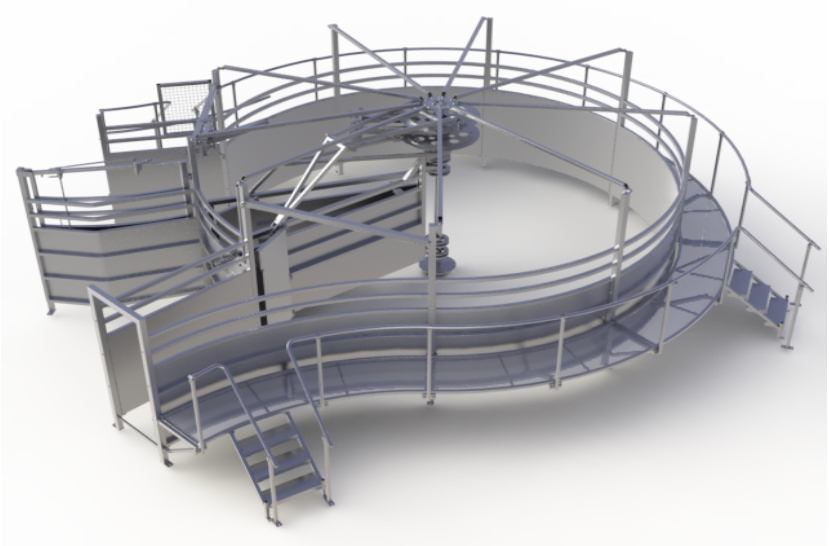


Figure 3. 3-D schematic of a circular forcing pen

Typically, forcing yards are a small circular yard. A cattle 'talker' or 'flapper' is used to reach all animals from outside the forcing pen, or a centre swing gate is used to reduce the size of the excess yard space. The forcing yard can be a full circular or semi-circular shape – anywhere from 180° to 270°. The size of the forcing yard is important as too large a forcing area makes it difficult to effectively coax cattle from the catwalk. The circular shape helps encourage continuous flow by taking advantage of the natural behaviour tendency of cattle to return to whence they came and circle around the handler. However, this circling can raise the arousal level of the cattle making them more difficult and dangerous to handle (*Section 21 - Livestock handling*).

Circular forcing yard and cattle flow.

The sides of the forcing yards are generally sheeted to prevent cattle from seeing workers or other cattle out of the pen, and baulking.

The forcing yard must be designed so that cattle can be easily moved into it from the holding pen and then be easily guided into the race.

Sight between the forcing yard and the race is important. The cattle in the forcing yard should be able to see at least one body length up the race. If they cannot see into the race or are distracted, cattle will hesitate or refuse to enter without persuasion, adding pressure and stress.

A centre-swing gate is used to remove excess space, preventing cattle circling in the forcing yard. This also encourages the cattle to think that the exit of the forcing area is a way of escape. The centre-swing gate should be sheeted to prevent cattle from seeing people or other cattle and baulking.

Centre-swing gates can be **pneumatically** or **manually** driven. The gate can be designed to latch at various positions as it closes, or backstops can be used. Backstops allow handlers to move the gate and not have to worry about locking it. An automatic, self-locking latch or backstops on the centre-swing gate can speed up movement of cattle through the forcing yard. These systems also increase safety by preventing cattle driving the gate in reverse and injuring the handlers.

Hydraulically-controlled gate

Continuous operation, whereby the centre gate does not need to be reversed before refilling the forcing pen, may be achieved with a fully circular forcing yard fitted with double pneumatically driven centre-swing gates. In this design, when one centre-swing gate has completed a full rotation, the other is activated and rotates behind the next group of cattle.

Cattle that have already been processed with a circular forcing yard at least once are generally used to its operation and will flow through– often without needing to use the centre-swing gate.

Major design problems with forcing yards are inadequate swing gates or no swing gates, and a failure of the forcing yard design to channel cattle into the race. Poor drainage and mud accumulation can cause poor footing in the forcing pen, with cattle baulking and being more difficult to work. The forcing pen surface should be compacted, well-drained and well maintained. A concrete slab with non-slip surface will maintain good footing in the forcing pen but soft flooring may also be used. See *Section 22 – Receival and dispatch facilities.*

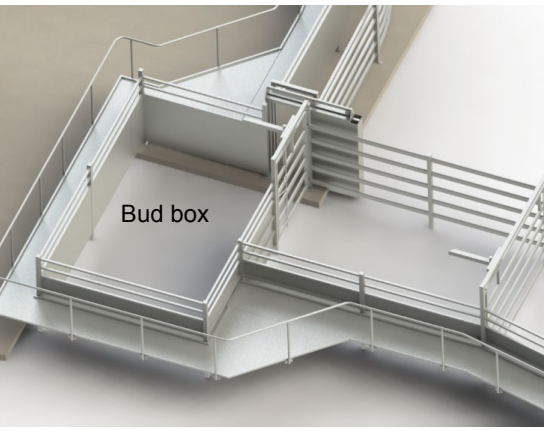
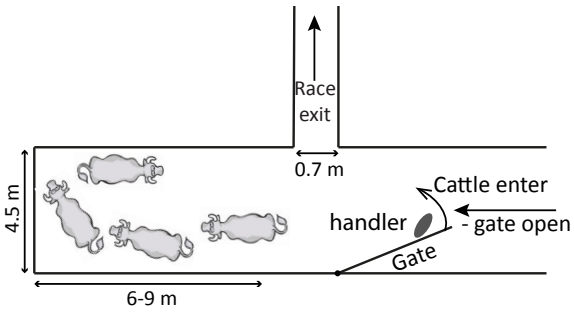
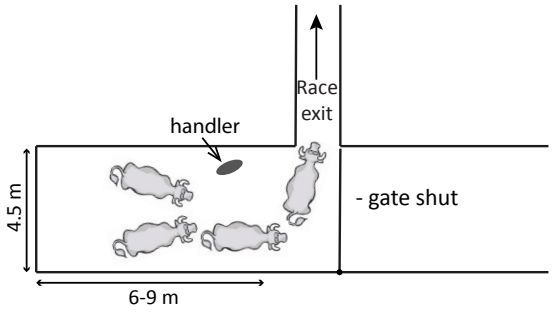


Figure 4. 3–D graphic of Bud Box



1 – cattle enter



2 – cattle exit

Figure 5. Basic Bud Box design and operation

Bud Box

The decision to incorporate a Bud Box or a crowd pen in the facility is a matter of personal preference.

A Bud Box is simply a small rectangular pen that replaces the traditional half-round crowd pen to move cattle from the holding pens to a race (Figure 4). It is named after Bud Williams, an American pioneer of low stress livestock handling.

Bud Boxes rely on the natural behaviour of cattle in that they want to go back the way they came. When cattle enter a Bud Box and reach the dead end, they naturally turn back. At this stage, a gate is swung across the entrance side of the pen, and cattle are directed to the adjacent race exit by the handler in the box (Figure 5).

The box is a flow-through part; cattle are brought in and then let flow back out immediately. Cattle should never be held in the Bud Box.

An advantage with the Bud Box is that it is built as a rectangle with 90° corners making construction simpler than curved yards. The entrance to the single file race should not be V-shaped; a square opening allows cattle to enter in single file without getting blocked and then retreating.

Dimensions of the box (length and depth) are determined by the size of the group handled and then by the capacity of the race. The box needs to be deep enough to allow cattle to flow forward while the handler closes the swing gate and gets into position before the cattle move towards the race. The race should be long enough to hold an adequate number of cattle for processing or loading, and be straight for at least two body lengths to encourage entry.

Table 1. Dimensions for a Bud Box

Bud box dimensions		
Handler	Width (m)	Depth* (m)
Always on foot	3.7	Minimum 6
Afoot and horseback	4.3	6-9
Always horseback	4.9	Maximum 9

*Depends on size of groups handled

The end of the Bud Box should not be enclosed so that cattle see light again and enter the box without baulking. Solid or opaque panels should be limited to the Bud Box's entry gate and the side closest to the race.

A disadvantage of the Bud Box system is that the handler has to be inside the box with the cattle to close the swing gate and then to be in a position that encourages the cattle to move naturally to the race exit. The handler may be mounted on horseback but if on foot, has no easy escape route should an aggressive animal approach. This becomes a Workplace Health and Safety issue.

Race

A race is a narrow lane to single file cattle for further processing, batch treatment or visual inspection. When used as a feeding or indexing unit it can be used in conjunction with crushes, weigh

boxes, scanners, loading ramps or drafts. A race is usually located before a crush or draft and best filled by using a circular forcing pen.

Cattle are forced into **single file** to direct them towards the crush or weigh box, and to overcome their natural instinct to return to where they came from. The aim is to maintain a **constant and continuous flow** without involving many workers in the process.

Races are typically curved, but can be straight. A curved race gives the cattle the impression that they are returning to where they came from (Figure 6), and gives a more steady flow, whereas long straight races tend to speed the cattle up.

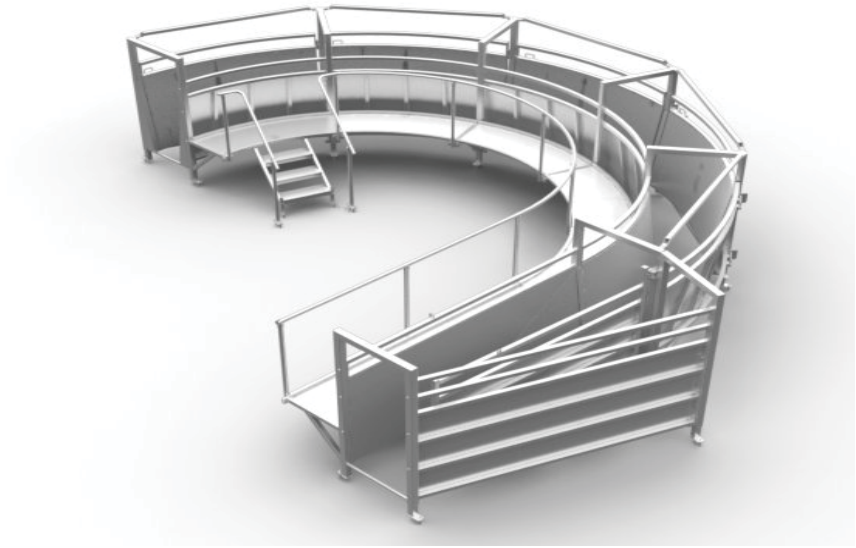


Figure 6. 3-D graphic of a curved race

Straight race sections with split slide gate. The section before the crush is a waiting bay.

However, the race needs to be straight for at least two animal lengths at the start, as an immediate curve would look like a dead-end to the lead animal. Once in the race, cattle are content to follow the curve if followed or pushed by others.

Another advantage of a curved race is that the person operating the race can walk directly across from the forcing pen to the restraint equipment without inhibiting cattle flow; this is helpful if the same person is working both the race and restraint equipment.

To obtain and maintain a single profile of cattle the race needs to be narrow, but the optimal width will depend on the size or age of the animals. Too wide a race allows small cattle to turn around or all cattle to put their heads down beside the animal in front; too narrow a race will constrain large cattle and restrict their flow. The width and height will depend upon the breed and class of cattle being handled – widths can be between 660 mm and 760 mm of clear space. The most suitable race width will balance cost against the degree of prevention of animals turning around.

The race length will reflect the number of cattle being handled – about 1.6–2.4 m per adult beast is adequate.

Races may be parallel-sided, V-shaped or with adjustable width. A V race accommodates a diverse range of cattle sizes and weights

Curved V-race with full sheeting on the outer wall and half sheeting on the inner wall.

Parallel curved race with no inner sheeting.

Curved V-race with full inner and outer sheeting and a catwalk with safety handrail.

by restricting leg room but allowing adequate room for their upper bodies. Curved V races must have conical inner and outer panels; curved parallel-sided races need rolled radius panels to provide a constant width all the way round; a truncated race varies in width. An adjustable race has one side adjustable from a remote location to accommodate various cattle sizes and weights.

Sheeting the walls of the race to block out distractions focuses the attention of the cattle on the preferred way out. The outer panel of the race is normally fully sheeted to aid good livestock flow by overcoming external visual distractions that will baulk and frighten them. Sheeting of the inner panel is largely determined by the type of operations to be performed.

A **fully-sheeted inner race** favours tasks where back applications are performed as it can have a catwalk along which cattle cannot see the handler.

A **half-sheeted race** does not have a catwalk but allows cattle to see the handler to control flow by standing at their sides. Half-sheeting also allows side access to livestock while reducing the risk of being kicked through the lower rails. A **non-sheeted race** is best where lower portions of the animals (the underside, legs or hooves) are to be inspected.

Break-out gates in the outer panels of the race help quick removal of an animal that goes down, and allow cleaning inside the race. Break-out gates should be fitted with latches that make them quick and easy to open and close while providing secure rattle-free operation.

There are variations and options on the single-race design including a waiting bay for crushes, weigh boxes, anti-backing gates, dual race, split race and load out gate configurations.

A dual-race configuration typically has two fixed-width races side by side and sharing a common non-sheeted panel. This race is used to feed a single process (such as a crush) but helps improve cattle flow as one race can be loaded whilst the other is being emptied. A split race is two races with a splitter gate that can feed two processes; it is used in large operations that require double the throughput or where separation is required for two specific processes.

Slide gates

Slide gates are sideways sliding gates installed in races (Figure 7). They are used to prevent cattle backing (as a manual backstop) or to help separate animals when indexing into a crush or draft.

Slide gates may be manually operated or power-assisted (usually pneumatic), and either solid (single gate) or split slide (two gates). For power-assisted gates, guarding is required for personnel safety. The gate itself may or may not be sheeted.

Slide gates can be placed between the forcing pen and race, race and weigh box, crush and draft. A solid slide gate is typically used between the forcing pen and race as a backstop to keep animals in the race. With a catwalk, a solid gate is used that slides away from the handler, whereas the guard on a split slide would interfere with the catwalk. A split slide is commonly used between the race and weigh box as this allows quick separation of the animals – catwalks

around this slide gate are widened to accommodate the guarding. Slide gates for a draft are used to prevent animals returning back up a draft when not in use for a time (e.g. during a workers' break). These are typically a manual gate.

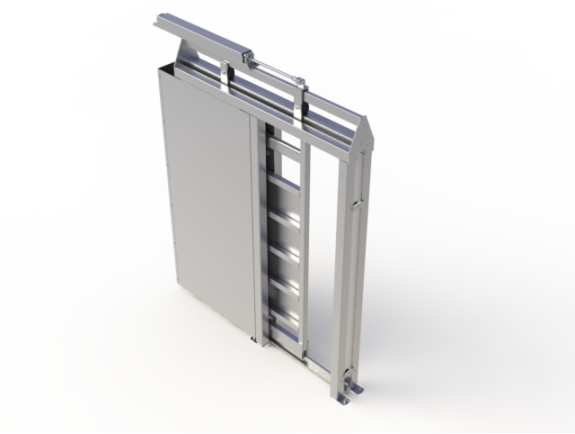


Figure 7. 3-D graphic of a slide gate

Cattle restraint equipment

All cattle have to be restrained in a cattle crush for safe examination or treatment at some time during processing.

All feedlots should have a purpose-built crush which allows all-round access. Important features include quietness, strength, safety for animal and handler and positive operation from behind the animal. *Section 25 - Cattle crushes* provides further discussion.

Weigh box

A dedicated single-animal weigh box may be integrated into a processing facility to speed up processing or for accurate weighing of individual animals. A bulk cattle weighbridge may also be used for large groups of animals. See *Section 27 – Truck weighbridges*.

Weigh boxes are walk-through design, typically 2.8 m long and 660–760 mm wide inside, and can be setup for automatic operation (with gates and identity scanning). They are usually located immediately before the cattle crush.

Cattle crush for restraining animals in the race.

Drafts

Cattle will have to be sorted into groups as an integral part of feedlot management.

The number of animals to be drafted usually determines the type and configuration of the drafting system. A drafting system may be operated manually, be power-activated using remote control or fully automatic (Figure 8). The number of drafting pathways will depend on local requirements.

Figure 8. 3-D graphic of a 3-way draft

Suspended weigh box and NLIS race reader.

The drafting system is best located in the processing area, a short distance away from the crush and connected directly to the various holding/drafting yards.

For smaller-sized feedlots, the drafting system may comprise a circular pound centrally located. The circular pound would have a number of sides with associated gates to holding pens. This allows for one person drafting and the transfer of cattle anywhere through the facility.

Automated systems that are affordable and can work accurately and consistently will reduce stress on handler and cattle by improving the flow of activities. Consistent cattle flow is critical to the success of automated drafting.

Automated drafting systems consist of a short race, sorting gate, drafting pens and an identification system and controller. The gate can be actuated by electric motor, pneumatically (pressure or vacuum) or hydraulically (water or oil) and can be operated by a system controller or by remote control. The drafting system allows the controller to communicate with the drafting unit; automated systems are equipped with a manual override in the event of a malfunction.

Pneumatic 3-way fan draft

Automated drafting may require electronic identification of the cattle (e.g. NLIS). The NLIS technology should be fully integrated and compatible with the NLIS requirements of the processing system.

Some systems require each animal to be stopped for accurate identification whereas others allow a constant walk-through with animals being identified as they pass by a remote sensor. The system will affect cattle flow from the processing area.

Race design, animal travel paths and holding pen location all require careful consideration if the automated drafting system is to be a success. The lead-up race should be a minimum of two animals in length (4000–4800 mm) and a constant single animal width (760–820 mm).

Variations to cattle travel paths should be minimised, with the drafting path being the same as the exit path. Holding pens that are parallel with the exit race will also assist cattle flow.

Many systems allow the drafting criteria to be tailored for the feedlot, thereby allowing individuals, groups of animals or any animal meeting a particular criterion to be drafted. This feature can remove or reduce the need to program the drafting requirements just prior to each activity.

Several gate designs are used in automated drafting systems (Figure 6). They include single gates, where one gate is moved to switch the animal path from exit to holding pen, and twin gates, where two gates are moved in counter directions to switch the animal path.

Animal path variation can be minimised by good gate design. The `straight ahead' or `out the side' choice has more options than a system using a left or right choice.

The drafting gate must activate fast enough to draft the desired animals without catching those not required. Cattle must not be able to force the gate and get jammed. The drafting system must be constructed to withstand the rigours of cattle handling.

Cattle like to follow one another by sight and the drafting gates should ensure good forward visibility to encourage cattle flow. Poor visibility and noisy operating actions can interrupt flow.

Catwalks

Catwalks provide a continuous and unbroken path between the forcing yard, race and cattle crush, especially in large operations. They put a handler at the right level to coax any unfamiliar animals into the right direction in the forcing pen, and can be used for applying backline treatments.

A catwalk along the race saves handlers from having to continually get up and down from the forcing pen catwalk and for crush handlers who are also required to control the race.

A catwalk typically has step access at the entry and exit ends. Interim steps allow a handler to get onto the catwalk without baulking the first few cattle that are ready to enter the race.

Handrails meeting WH&S requirements must be fitted if the catwalks are above the minimum distance of 300 mm. More details are specified in Platforms as per the Australian Standard AS1657.

Catwalks should have a minimum width of 600 mm, but be wider in areas where two workers commonly have to pass each other.

An alternative to a catwalk is to have a section of raised concrete that acts as a platform from the forcing yard across to the cattle crush. This provides easy and safe access for one or more operators to all activities in the processing area.

Catwalk on bugle yard

Gates

Gates allow livestock, people and/or machinery to enter and exit any component of the processing facility.

A gate acts like a panel when closed and can be swung, slid or lifted to allow access. Typically, one end of a gate has hinges while the other has some type of latching mechanism to restrain it in either the open or closed position. Poorly hung or designed gates and latches can make cattle work more difficult and increase the risk of injury to the handler and animals.

Gates are normally located in the corners of pens for ease of livestock flow. They vary in length and width depending on the application and desired outcome. A narrow gate of 500 mm gives personnel access and safety, but wider gates are needed for cattle and even wider for machinery access. Access for machinery may be made by way of two gates used together to create a double gate (gate latches to gate) or by using a removable centre post.

Gates are usually made of similar materials and construction as in the surrounding fence panels (e.g. oval steel, round pipe, RHS), and constructed to withstand impact by livestock.

Gates should swing freely and the top hinge gudgeon should be reversed or pinned to prevent gates being lifted off.

Solid slide gate

Operation

Depending on the throughput and number of people involved, the processing area can be operated manually, power-assisted, remote-controlled or semi-automated.

Power-assisted hydraulic gate

Manual

Manual operation has the lowest setup cost and does not need power to operate, but a handler has to walk to each piece of equipment to operate it.

Power-assisted

Power assistance can be pneumatic or hydraulic. Pneumatic systems are cheaper but may need a secondary brake or catch to hold the equipment in its final location. Air power may also need an exhaust system on each piece of equipment to reduce noise. In a remote yard, a pneumatic system using an engine-powered air compressor can be located away from the yards so noise does not interfere with the operations. Air is clean, safe and does not necessarily require experienced personnel or specialised equipment to maintain it. Hydraulics generally offer more power, are slower, quieter, but may require 3-phase power and are generally more expensive. Hydraulics will require specialised equipment and personnel for maintenance, present risks with hot, high-pressured oil and, if they leak, can be messy.

The crush is usually the first item where power assistance is added. Other pieces of equipment that can be power assisted include

- crush – head bail, squeeze
- slide gates
- draft gates
- forcing pen and entry gate
- lane gates
- adjustable width race

Power-assisted pneumatic gate

The installation of power assistance will depend on frequency of use, the physical effort needed to operate and ease of access.

Remote controlled

In a remote-controlled operation, power-assisted equipment can be controlled from a hand-held remote from any location in the processing area. This is useful around the race and forcing yard areas where the handler uses his position to control the movements of the cattle (refer to *Section 21*) and the remote for the gates.

The hand-held remote communicates with a control box which instructs the powered equipment using solenoids. In remote locations, a control box can be powered using a 12V battery.

Semi-automated

Semi-automation is used in systems that require simple repetitious tasks like weighing and/or drafting. It reduces the labour requirement in this area and optimises operational speed.

The system is used where an animal's weight is recorded, a draft decision is made, a draft gate opened to the appropriate pen, and the head bail on the crush is opened to release the animal to this pen. Once the weigh indicator of the crush zeros, the head bail is closed and the rear bail opens for the next animal. The rear bail is then closed by a handler to ensure only one animal enters the crush at a time. With the rear bail closed, the system repeats its cycle.

A computer is connected to the control box, load cells and scanner which records weights and makes draft decisions. Decisions can be made on weights or animal ID.

Pneumatically-swung gates used in stacking pens.

Handler safety

Worker safety must be accommodated as handlers working with animals are exposed to a range of injury hazards. A handler must be able to move safely from one part of a facility to another and be able to easily move to safety if a dangerous situation arises.

Minimising risks of injuries

The level of injury to a handler may range from death, serious injury requiring hospitalisation and down time, to 'nuisance' injury that stops work for a short time or makes work slower and less productive.

Some of the best practices are to separate animals and workers, while allowing workers to control cattle and perform required treatments. In the pens, the use of horses helps create this separation.

Documenting processing procedures helps handlers remain aware of their actions, safety and the importance of the need for this separation.

Efficiency

As the number of available skilled livestock handlers declines, feedlots have to operate with fewer people, and this must be considered in design.

Efficiency can be increased by reducing walking distances and using power assistance and automation. Most layouts incorporate curved races to hold animals, and locate major components such as crush and forcing pen closer together.

Power-assistance helps reduce handler fatigue when processing large numbers of animals. Automation can help make the decisions that someone would have to make crush side, and also supports specific applications such as drafting by weight, drafting by ID and live weight recording.

Documenting processing procedures also helps improve efficiency as it can define the role of each handler and how each piece of equipment is best operated. Procedures can be easily updated if a more efficient method is found, and they are useful in training new handlers.

Controls for operation of gates from hand-held remote.

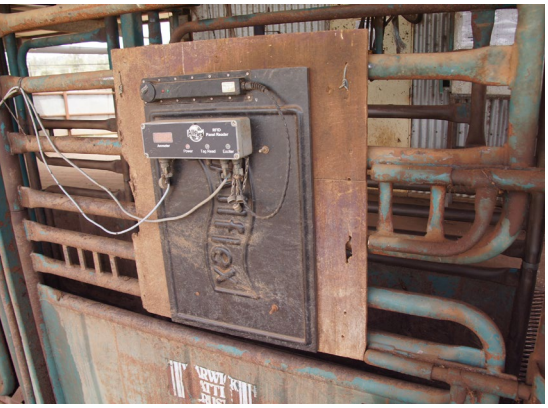
Suitable access

Access for handlers helps reduce walking distances and improves efficiencies.

A plan with projected walking and driving paths helps identify the best locations for access gates. Paths to be identified in process documentation include those from vehicles to amenities, access during processing procedures, processing area to pens and for cleaning and maintenance. Where lanes or areas may sometimes be used for cattle, over-passes that do not affect animal flow could be considered.

Appropriate signs and warnings are required at access points where visitors or external personnel have access to the site.

NLIS and visual management identification tags



Automatic NLIS tag reader on cattle crush

Animal identification and performance

The National Livestock Identification System (NLIS) and advances in the automation of cattle handling activities foster development of associated electronic equipment and system controllers. These can identify specific cattle and measure their performance based on weight gain.

An equipment control unit (with power-assisted items), weighing unit, scanning unit and computer with herd management software can be installed. In small operations, these may be separate units requiring some manual operation and data transfer – taking time and the risk of human error – although they can be connected to communicate with each other to record data and calculate decisions.

NFAS requires all animals to be fitted with both a NLIS tag and a visual management identification tag.

Weighing

Weighing of animals should be incorporated into the facility design. Electronic equipment for accurate weighing will need to have dedicated processes and may also be integrated with the cattle management system. An automated drafting system integrated with the cattle management system allows cattle to be drafted automatically on criteria such as weight and market specification.

A weighing unit usually consists of load cells and a controller. This controller converts a signal from the load cells into a weight, and handles the calibration of the load cells (calculates tare weight) to display an animal's live weight. More advanced controllers can also make weight and drafting decisions which can communicate directly with the equipment control unit to operate drafting gates.

Scanning

The technology required for scanning and recording NLIS devices has to be integrated into the processing facility design. The choice of a simple system or an advanced system that uses the technology as a management tool will depend largely on the size of the feedlot.

Scanning manually uses a hand-held scanner that will display the NLIS ID of each animal. For automatic systems, a scanning unit can be fitted to the non-working side of the crush of weigh box.

Herd management software

In a processing area, all units connect to a central computer running software for the collection of data and for decision making. Data from this computer can be transferred either manually (disk or USB) or over a network/wireless connection to the main office.

Construction

Materials

Any combination of materials can be used in the construction of the processing facility, with the choice depending on local availability of materials and budget constraints. The key design criteria will be to balance strength, durability and construction cost.

Corrosion is a major consideration if wash-down water has high salt content. Construction material types and surface metal finishes can help inhibit or reduce the rate of corrosion.

Mesh and cable fence panels should not be used in the race and forcing pen areas.

Materials used in the construction of the yards, flooring of the processing facility and infrastructure are similar to that of receival and dispatch facilities. Design considerations for materials are outlined in *Section 22 - Receival and dispatch facilities*.

Protection from the environment

All or a part of the processing facility may need protection from the weather. More information on this topic is covered in *Section 24 – Buildings*. Flooring, drainage and other amenities are also described.

Quick tips

- All processing facilities are unique. An adequate processing facility need not be elaborate or overly expensive, but oversimplification may make it more difficult to use.
- An excellent design on one feedlot may not work as well on the next – spend ample time planning before building. If possible, visit other feedlots to see what works well and what does not.
- A properly designed forcing pen decreases the labour required to work cattle and offers handlers a safe working environment.
- Holding pens are used to hold cattle for a relatively short period of time before processing. Long, narrow pens provide more efficient animal movement than squarer pens.
- A curved race takes advantage of an animal's natural instinct and gives the cattle the impression that they are returning to where they came from.
- The technology required for recording NLIS devices should be integrated into the processing facility design.
- The accurate drafting of cattle into groups is an integral part of the feedlot cattle management system.
- Noisy operating actions and poor directional visibility can interrupt cattle flow.
- Catwalks provide a continuous and unbroken path between the forcing pen, race, and cattle crush, especially in large operations, and place the handler at the right level to coax any unfamiliar animals in the right direction.
- Poorly hung/designed gates and latches can make cattle work more difficult and increase the risk of injury to the handler and animals.
- Operating the processing facility with minimal labour is a key design consideration.
- NLIS and advances in automation of activities require various associated electronic equipment and system controllers.
- An automated drafting system integrated with the cattle management system allows cattle to be drafted automatically on pre-set criteria.
- Mesh and cable fences should not be used in the race and forcing yard areas.
- All or a part of the processing facility could benefit with protection from the weather.

Further reading

Grandin, T. and Deesing, M, 2008, Humane Livestock Handling, Thomson-Shore

Blackshaw, J. (1986), Notes on some topics in applied animal behaviour, University of Queensland, St. Lucia. <www.animalbehaviour.net>

Herve, J. Szentleki, A. and Tozser, J. (2007), Cattle's behaviour – Perceptions, relationships, studies and measurements of temperament, Animal Welfare Ethology and Housing Systems, Volume 3, Issue 1, Godollo.

Smith, B. (1998), Moving 'em: A guide to low stress animal handling, Graziers Hui, Hawaii.

Grandin, T, 2008, Livestock Behaviour, Design of Facilities and Humane Slaughter (*www.grandin.com*)

Bud Williams Stockmanship School (*www.stockmanship.com*)

agrilifecdn.tamu.edu/beefinfo/files/2014/01/Designing-a-Bud-Box.pdf

Daniels bud box demonstration www.youtube.com/watch?v=o58f4_uNbxo

Animal Health Australia (AHA) (2012). Australian Animal Welfare Standards and Guidelines - Land Transport of Livestock. AHA, Canberra.

AUS-MEAT, 2014, NFAS Rules & Standards (April 2014), AUS-MEAT Limited, Brisbane, Qld.

DAFF, 2013, Australian Animal Standards and Guidelines for Cattle, Department of Agriculture, Forestry and Fisheries, Australian Government, Canberra, ACT.

MLA, 2012a, National Guidelines for Beef Cattle Feedlots in Australia. Meat & Livestock Australia, Sydney, NSW.

MLA, 2012b National Beef Cattle Feedlot Environmental Code of Practice. Meat & Livestock Australia, Sydney, NSW.