

FEEDLOT DESIGN AND CONSTRUCTION

25. Cattle crushes

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Introduction

Cattle have to be constrained during routine operations, such as recording, vaccinating, ear tagging, weighing and animal health tasks (and possibly veterinary procedures). A cattle crush holds the animal immobilised to minimise the risk of injury to both the animal and the handler.

An effective livestock handling system requires a suitable choice from a wide range of commercially available cattle crushes.

The operations to be performed will determine what features the crush will need, including veterinary sections, baulk gates, a squeeze mechanism or split side gates. Crushes to be used in the processing facility usually have more functions than those needed for hospital facilities.

Functionality and ease of use by handlers should be prime considerations. Operator safety may be improved if the squeeze section of the crush is operated hydraulically or pneumatically rather than manually. All crushes should be made according to good manufacturing standards using quality materials.

Cattle crushes can be equipped with ancillary equipment, such as chin bars and automated drafting systems. Electronic scales and a National Livestock Identification System (NLIS) identification reader are now standard in most feedlot cattle crushes.

Design objectives

The cattle crush should be designed, constructed and maintained to ensure that

- An animal is adequately restrained.
- The risk of injury to animal and handler is minimised while operations are performed.
- The equipment has the proven ability to effectively restrain the type of cattle being handled.
- The design allows for a safe and easy release should an animal fall during the operation.
- Access is provided on both sides of the animal.
- The floor surface is non-slip.
- Gates and head bail operate effectively to capture and secure stock and do not release when kicked or struck.
- It has easy, quick and quiet operation.
- It has solid and secure anchorage points.
- It is versatile and suitable for all jobs to be performed - this will determine where access to the animal is necessary (e.g. head, sides and rear).
- It is safe to use for handler and cattle with no sharp edges, protruding catches, bolts or wire.
- It is durable.
- It provides value for money.
- It is serviceable and easily maintained with greasing points.
- It is not cluttered with features irrelevant to the intended use.

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

Typically the cattle crush is the most important part of a processing facility and everything else is planned around it. It may be part of a race, a separate facility at the end of a race, free standing under a roof or located in a suitable building.

The processes to be performed, handling requirements and personal preference will define the configuration and control of the various elements of the crush.

The features to be assessed when selecting a crush include

- Location
- Functionality
- Design
- Construction
- Controls
- Electronics
- Operator safety
- Maintenance
- Noise.

Figure 1 provides a conceptual representation of the relationships and structure between the various elements of a crush.

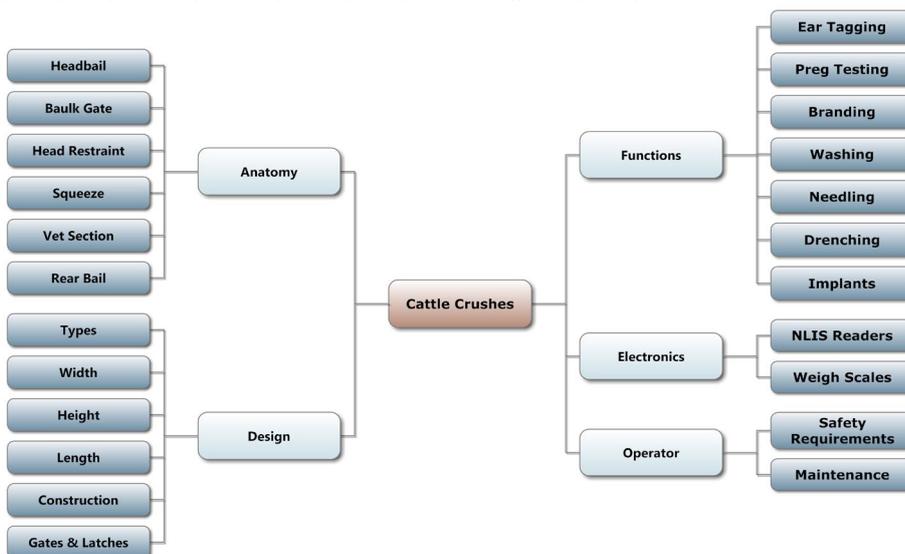


Figure 1. Conceptual representation of crush design factors.



Hydraulically-operated crush with multiple features.



Manually-operated crush.

Location

The following criteria need to be considered when setting up the crush

- Side of operation – nearside or offside – as most people work with cattle from the left side, or the nearside, of the animal.
- Where roof is constructed over a crush, overhead lighting will need to be installed.
- There should be no sharply contrasting shadows or bright patches that may baulk cattle.
- Cattle should be able to see well ahead.
- There should be no distractions to forward movement.
- The crush exit is designed to allow processed animals to be separated from the work area.
- Solid and secure anchorage points (preferably set in concrete).
- Access to pressurised water supply.
- With a roofed area, the floor surface needs to be able to be thoroughly cleaned and disinfected as required.

Features

There are many crushes commercially available that have varying configurations. A basic crush consists of: a head restraint (head bail), side squeeze panels, associated animal control equipment (e.g. chin bar and squeeze), veterinarian section and access gates. Although some crushes have a reverse-out configuration, a walk-through design is essential when handling large numbers of cattle.

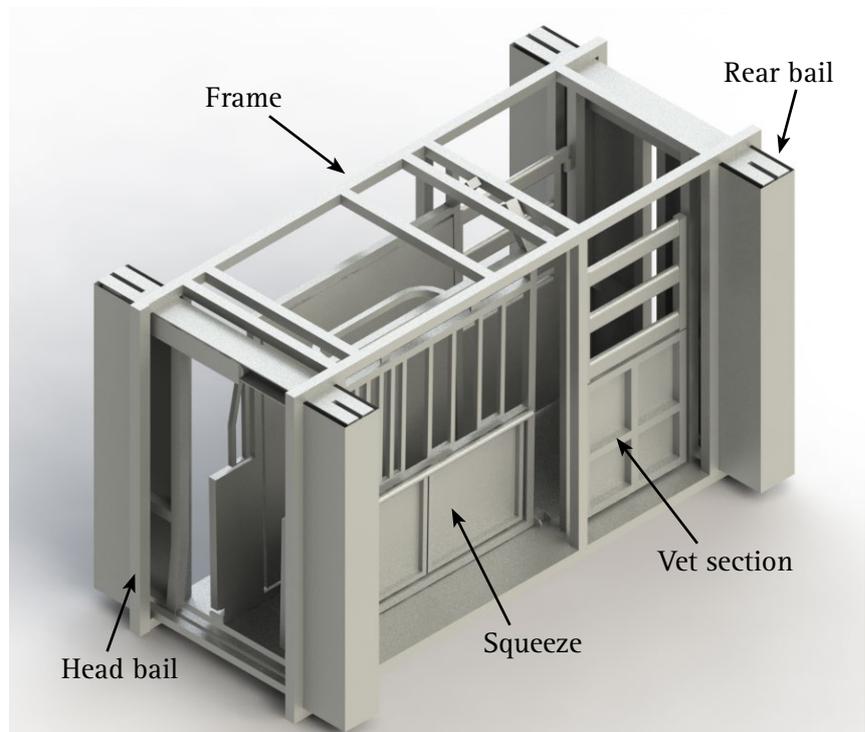


Figure 2. Features of a crush

Head bail

The front end of a crush has a head bail (or neck yoke or head gate) to initially catch and restrain the animal. The head bail is operated manually using a side lever, or mechanised using a remote control. It is often adjustable to accommodate animals of different sizes. It may incorporate a chin or neck bar to hold the animal's head up and still.

Regardless of the configuration, the head bail should

- Be safe and easy to operate – with no holes in which hands or fingers could be caught.
- Provide adequate head control without causing injury to cattle.
- Have incremental adjustment for different classes of stock.
- Have a positive locking system that can be operated with one hand only.
- Be quiet when being operated.

Head bails may have a V-shaped or parallel opening, with or without additional head restraint (e.g. neck extenders and/or chin lifters). The advantages and disadvantages of each type are outlined below.

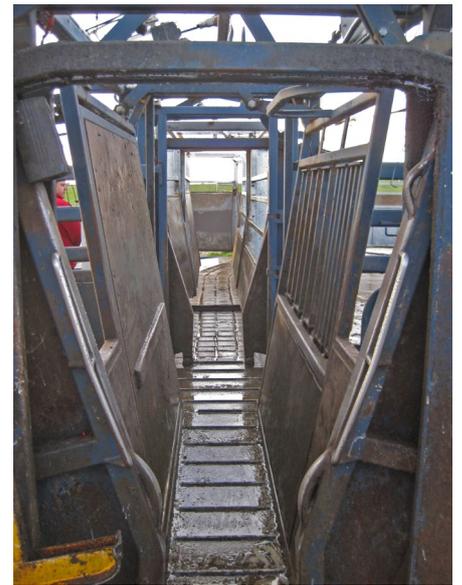
V-opening

The V-opening head bail consists of two bi-parting halves that have pivots at the bottom. After release, the animal walks out through the head bail. Halve bars that make contact with the animal's neck may be curved or straight. The V design has fewer moving parts and requires low maintenance.

The curved bar is one of the most popular general purpose designs, with the curved bars forming a diamond shape when closed. This provides better head control because it prevents the animal from sliding its head up and down - and so reduces the need for a neck extender.

The straight bar provides poorer head control because the animal can slide its head up and down. But choking is almost impossible because the straight bars cannot press on the throat.

A curved bar V-opening is recommended for general cattle handling in feedlots. A straight bar V-opening is recommended where an animal must remain in the head gate for a long period.



V-opening crush – looking back into lead-up race.

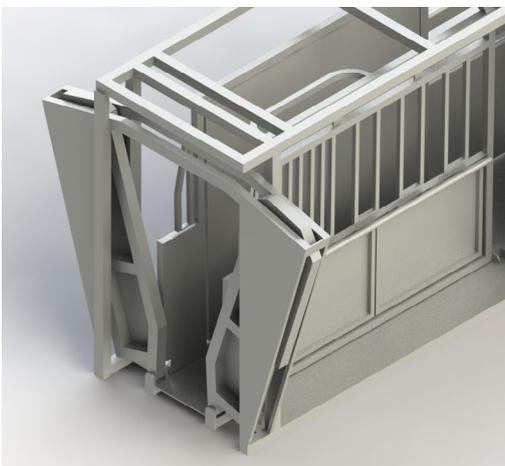


Figure 3. Schematic example of straight bar V-opening crush



Parallel-opening crush.

Parallel opening

This consists of two bi-parting halves that open and close similarly to a pair of sliding doors. Halve bars may be straight or curved.

The parallel opening head bail allows large animals to walk through more easily without knocking their hip bones. But the sliding mechanism is more complicated.

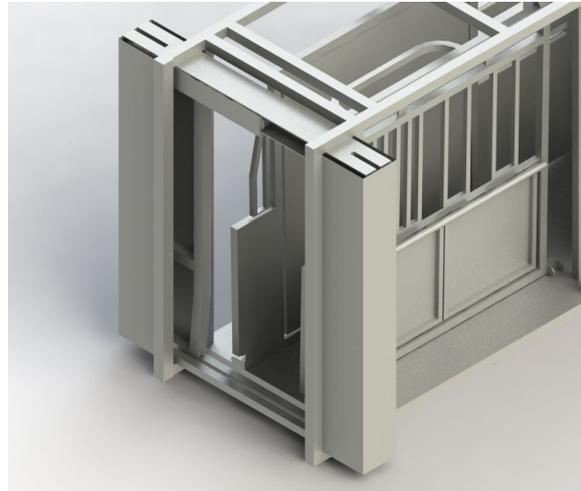


Figure 4. Schematic example of straight bar parallel opening crush



Neck extensions on head bail doors.

Neck extenders

A neck extender is an additional neck restraint that can be attached to the head bail to reduce head movement. All neck extenders put pressure under the throat, which may hinder some tasks. Caution is required during operation, as the animal may fall in the crush.

Baulk gate

At the front of the head bail, a crush may have a baulk gate that swings across to inhibit an animal's forward movement after it enters the crush and to prevent it from passing through while the head bail is being closed.

The key design requirements include that the baulk gate is simple and easy to latch, folds back out of the way and that rail spacings are adequate.



Manual chin lifter in operation.

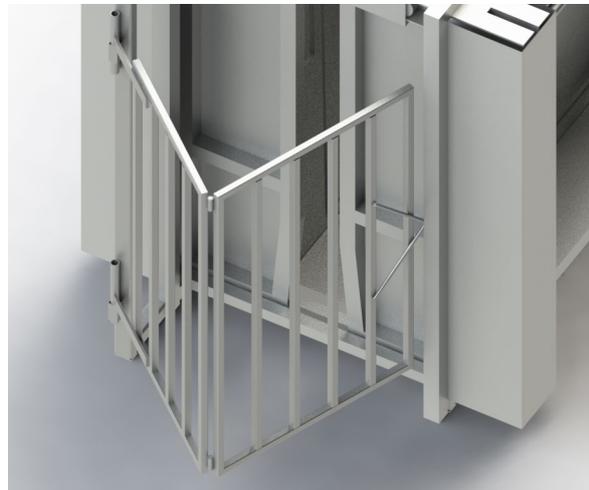


Figure 5. Example of a baulk gate

Head restraint

Head restraints are additional to neck extenders and are designed to reduce head movements for operations such as tagging ears and implanting Hormonal Growth Promotants (HGP). Common types are chin lifters or neck bars. A chin lifter is a cup, or bar, that raises the head of the animal to a suitable, safe position. A neck bar has two parallel bars, one above and one below the head, to restrict all head movement.

Squeeze

Most cattle will settle better if movement is restricted. A side squeeze immobilises the animal for safer animal control and operator safety.

Squeezes range from a side gate held against the animal with a simple drop-down rod to powered, adjustable single-sided and double-sided parallel or V squeezes.

In a single-side squeeze, the width of the crush is altered by moving one side panel of the crush—manually, hydraulically or pneumatically. This may push the animal off balance and the operator could be injured if the ratchet system intrudes into his or her space.

Parallel and V squeezes provide greater animal holding power.

The best designs are V squeeze crushes that have two movable side panels hinged at the bottom and pulled together by a lever system at the top, with both sides moving in evenly. The animal remains standing in a balanced position supported by the V shape. Correct adjustment of the space between the squeeze sides at the floor can reduce overt pressure on the lungs of cattle being restrained.

The squeeze mechanism should be simple to operate.

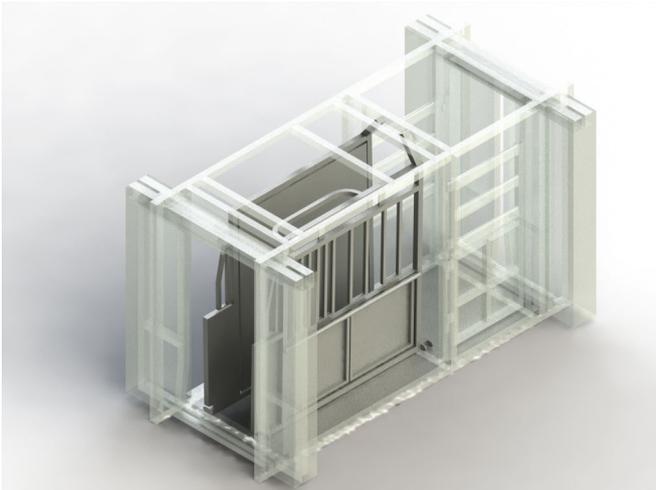


Figure 6. Schematic example of the squeeze mechanism of a crush

Veterinary section

A veterinary section is an access panel that is required for any operations at the rear end, or side, of an animal. It provides protection for operators against being kicked and should be able to be operated by either a left or right-handed person.



Pneumatic head restraint and pneumatic chin lifter. Yellow panels highlight nip/crush points and moving parts to handlers.



Full-length squeeze where animal can stand freely without being head bailed, but this does not provide safe access to the head.



Veterinary gates allow access for operations at the side and rear of the animal.

Rear bail

A rear bail can be the same style as the head bail, particularly if it is powered in the same way as a split sliding gate or solid slide in manual operations. The rear bail can be used to quickly trap an animal in the crush before it is caught with the head bail, while stopping the next animal in the race from entering the crush at the same time.

Design

Types

Most feedlots with high throughput of cattle use hydraulics or pneumatics, instead of manual power, to operate the cattle crush in the main cattle processing facility. Other facilities that handle fewer cattle, such as hospitals, may install manual cattle crushes.

The pneumatic system has better pressure control, less maintenance, and better safety and economy. The hydraulic system provides quiet, solid and more accurate control.

A correctly adjusted hydraulic or pneumatic crush is usually safer for animals and operators. Most have a factory adjusted pressure relief valve that prevents excessive squeeze pressure being applied to the animal. Operators are less likely to tire and make errors that can result in an accident.

With crushes powered by hydraulics or pneumatics, the pump, motor or compressor should be located away from the animal handling area and the plumbing designed to minimise noise.

Width

A crush is typically between 680mm and 750mm wide internally, with the narrower crush used to handle smaller animals. Animals should not be able to turn back.

The shape of a V squeeze helps to support the animal. The inside width at the base of the squeeze is 280–400mm to allow for an animal slipping, or losing its footing, while in the crush.

Height

The internal height is usually measured in the head bail, as this is typically the lowest point in the crush.

A height of 1600mm is acceptable for most breeds of cattle, but larger-framed or fractious cattle may need a height of 1800mm.

Length

The length is commonly referred to as the squeeze length, which is the distance between head bail and rear bail for crushes without a veterinary section, or the distance between the head bail and kick gate in crushes with a veterinary section.

Crush length is normally 2000–2400mm, with the shorter length acceptable if all animals are caught in the head bail.

Construction

Construction materials not only need strength and durability, but also properties that minimise injury, bruising and stress to animals.



Split-side gate for release of an animal if it goes down.

Most lower cost, quality crushes are built using standard heavy steel pipe that is welded together. There are higher quality crushes manufactured using doubly-symmetric oval tubing for superior bending strength and rigidity and to minimise bruising of cattle.

Cattle crush construction should also ensure

- Quiet operation by limiting undue noise (such as from a metal floor).
- Minimal dirt build up (thus reducing corrosion).
- Ease of cleaning.
- Moving parts are physically easy to operate and guarded for operator safety.
- Ease of maintenance with accessible greasing points.
- Railing that is strong, yet quiet when knocked by cattle.
- Rust prevention measures, such as galvanising, undercoating and anti-corrosive paint.
- An ability to add additional items (e.g. load cells, chin lifter, automated vaccination or drenching mechanisms).

Gates and latches

Gates and latches are an integral component of all crushes. Gates provide access for various animal operations to be carried out. Gates of various configurations can be provided at almost any location around the crush. These are generally named after the operation, or access points, such as side gates, split gates, veterinary gates, vaccination gates, branding gates or sliding gates.

Side gates and split side gates provide access to the sides or underside of the animal and are easily released if an animal falls in the crush.

Vaccination gates (with auto catch) are located at the head bail end of the crush and provide access to the neck for vaccinations. Veterinary gates at the opposite end of the crush to the head bail provide access for veterinary procedures.

Latches ensure that gates and head bails do not release when kicked or struck. These should operate easily, be positive catching and lock securely without undue time or effort. Worn latches should be easy to replace.

Manually operated head bails and squeezes typically have a ratchet latch that locks into a definite notch as the head gate or squeeze is closed. It may be noisy, but is safer because it is less likely to be released accidentally or under pressure.

Hydraulically operated head bails are locked by the hand valves, but pneumatically operated head bails need a secondary ratchet or friction brake because air is compressible.

Controls

Controls differ between manually operated and power assisted crushes and are located on the operating side of the crush (on the near-side or off-side).

Manually operated crushes have a handle at the head bail and one for the squeeze - mounted near the rear of the squeeze. Some crushes also have a secondary handle for the head bail at the rear of the squeeze.



Side access gates for scanning and veterinary procedures.



Grease nipples on hinges for easy movement.



Hydraulic controls for a crush.

Handles should be able to be disengaged to reduce the risk of operator injury and provide better access around the crush.

Power assisted crushes may have either a control arm mounted to the side of the crush or suspension frame, or a control table. Control arms are typically able to pivot, allowing the operator to change location to get the best view of the operations. A control table can also be used to manage the crush from a distance and is recommended when load cells are mounted under the crush. Moving a control arm could interfere with the animal's weight.

Electronics

NLIS readers

The NLIS has been developed to enable lifetime identification of all Australian cattle. This enhances traceability in the event of a disease outbreak, food safety or residue contamination issue.

NLIS uses radio frequency identification devices (RFIDs) and a national database to record individual animal movements. NLIS devices for cattle can be a visual ear tag with an RFID embedded, or combined with a visual ear tag

Feedlots need equipment to electronically scan and read the NLIS tag and transfer the movement records to the NLIS database. Electronic scanning equipment is commercially available in several forms and with the ability to perform a range of functions. Electronic scanning equipment may be either hand-held or race readers.

Electronic scanning readers may have different functions across four basic areas of

- **Display** – display the RFID number as it reads.
- **Memory** – retain the RFID number or simply read and transmit the number.
- **Additional fields** – capture the RFID number and information such as feedlot ID number, pen number or lot number.
- **Transmission** – communicate using either a serial RS232 cable or a wireless connection.

Race reader

A race reader mounted on the side of a crush or race, either permanently or as required, can be used to automatically read the RFID of individual animals as they pass. Race readers can read across a race, cattle weighbridge and loading or unloading bay. With a larger antenna, race readers have a typical read distance from 20cm and up to 1.2m. A race reader is also commonly referred to as a panel reader, using a panel antenna and fixed reader.

Hand-held reader

A hand-held reader is operated manually and usually consists of a wand that is activated by pressing a button when it is positioned near the identification device to be read. Hand-held readers typically have memory and download capacity.

These are commonly referred to as portable wand readers, or stick readers. A hand-held reader will typically have a read distance of up to 600mm, with a minimum of 50mm for reading ear tags.



Operating console for a pneumatically-operated crush.

Read distances provided by manufacturers for different types of readers should be confirmed and a performance agreement made with the manufacturer providing the expected performance once it has been installed.

The full benefits of the electronic scanning equipment can be realised with an advanced system that can also measure performance and health status.

Weigh scales

Accurate assessment of cattle performance and treatments rely on accurate weighing.

Scales are often incorporated into the cattle crush. Using the squeeze mechanism to reduce animal movement will speed up weighing, while allowing animal husbandry to be conducted at the same time. But a separate weigh box may be needed if more accurate weighing is required (see *Section 23 – Cattle processing*).

A weigh system comprises weigh bars (or cells), cables, plugs and displays. The weigh platform sits on the weight bars and its electrical resistance changes in proportion to the weight applied.

Cables carry the current from the power source (usually the display) and the current signal back to the display. As most problems with scales arise from damaged or faulty connections, shielded cables should be protected from physical damage by livestock, birds and rodents. Connectors should be marine or military grade to prevent water entering the cables. Screw-type caps and 'O' rings will reduce the chance of moisture entering the display.

Displays with more features are more expensive, but can carry out a wider range of tasks. Many systems have data logging capability.

The type of weighing system used depends largely on the level of information required. The factors to consider when implementing a weighing system include

- Weighing capacity – appropriate for the range of cattle to be weighed (taking into account the weight of the cattle crush or weigh box).
- Shock absorbing capacity of the weigh bars – rubber mounts protect the weigh bars and maintain weighing accuracy.
- Waterproof and dust proof displays.
- Power supply options – more than one (e.g. 240V and 12V) is an advantage.
- Display contrast and size of numbers – variable contrast depending on lighting and large numbers for ease of viewing.
- Cable protection and quality of cables and plugs.
- System integration with cattle management software (e.g. datalogging, data format and software).
- Ease of setup, use and troubleshooting.
- Whether the cells will be located under the crush, or the crush will be suspended.

The potential installation of weigh scales should be included in the design of a cattle handling system so that these can easily be added later if required.



All cabling for control and electronics should be protected from damage.



Crush mounted on load cells for weighing.



Wear pads reduce wear, and rubber stoppers reduce noise, shock and fatigue.



NLIS reader on race.

Operator safety

Cattle crushes should be designed to reduce injury risk to cattle and handlers. In terms of handler safety, the crush should have

- No sharp edges, protruding catches, bolts or wire.
- Gates, head bail and latches that are free of nip or crush points or have shields fitted.
- Work areas free of protruding obstacles and obstructions.
- Latches that are positive catching.
- Flooring that is non-slip.
- The unit secured to the ground.
- Adequate head clearance for operators.
- Adequate escape routes.
- Protection to minimise the risk of operators being kicked.
- Standard operating procedures.
- Adequate lighting.
- Adequate shade.

Maintenance

A crush will typically have the most moving parts of all of the animal handling equipment used in the yards. Routine checks and maintenance must be carried out to prevent down time and potential injury to operators. The following factors should be considered

- Are all greasing points easily accessible?
- Can replacement parts be easily purchased?
- Are there operator manuals?

Quick tips

- The type and frequency of operations to be performed will dictate the configuration and features of the crush.
- There are numerous designs and configurations of crushes available. Functionality, cost, ease of use and construction quality are important selection criteria.
- The cattle crush must be able to restrain cattle and minimise injury to cattle and handlers.
- A walk-through design is essential when handling large numbers of cattle.
- Ensure latches operate easily, are positive catching and lock securely.
- Feedlots require electronic equipment to scan and record NLIS data and animal performance data.
- Confirm read distances provided by manufacturers for a range of NLIS readers and instigate a performance agreement with the manufacturer once this equipment has been installed.
- Always plan for a weigh system when designing and installing the crush.
- Scales are often incorporated into crushes. Weighing will be faster if the animal is restrained by squeeze sides to reduce movement.

Further reading

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

Cattle Crush Company – www.cattlecrushco.com.au

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

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