



Crush Design & Safety

(A review of current literature)

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Ohio State University (2002) provides a great introduction and summary to ‘design of cattle crushes’: *“to get cattle to do what you want takes knowledge of animal behavior, access to good facilities, and proper handling techniques.* This is reiterated by Work safe Victoria (006). *All of this together adds up to cow sense! Animal-related injuries to employees can be due to preoccupation, impatience, or anger by the animal or the handler! During these moments, a livestock handler really needs to understand animal behavior. **Well- designed facilities won’t make up for a lack of cow sense at this point**”.* Cattle that are overexcited or alarmed pose a greater handling risk. This is why it is important to handle cattle appropriately in the ‘back’ yards so they are easier to handle by the veterinarian in the crush. An understanding of the principles of animal behavior gained through experience and training will help predict the way an animal will behave in any given situation. It is one of the most important controls to reduce injury. Avoid handling cattle when tired as lack of concentration will increase the risk of injury. Similarly, according to ACC Think safe (2009), there is no such thing as the “ideal” yard or crush. It depends on your needs and the cattle you’re handling. This is supported by the membership of the ACV. It varies from dairy vets to vets that deal with predominantly *Bos taurus* cattle in southern Australia to vets such as Ian Braithwaite that deal with predominantly *Bos indicus* cattle in northern Australia. If you are talking ‘ideal’ producers should have at least 4 crushes for vets to work in – those for mature cows; those for bulls; those for joiner heifers; and those for weaners. Alternatively, if there is only one crush it should be adaptable so it can be adjusted depending on what class of cattle are being examined.

Yet again, Turner 2004b states that a highly expensive handling system may function poorly if it does not obey the design principles outlined above and fights against cattle behavior. In conclusion, greater access and uptake of information on the principles of animal behavior would improve design amongst livestock equipment manufacturers Turner S, Lawrence A and Lowman B 2004)

The flight zone (comfort zone) is the animal’s personal space. The flight zone may be five to 25 feet for tame cattle or feedlot cattle and 300 feet for some wild cattle. The flight zone increases when the approach is from the head, and the flight zone also increases when cattle are excited. The flight zone decreases when animals are in a single file chute. Cattle will normally move effectively if the handler works on the edge of the flight zone. Deep invasion of the flight zone can cause animals to panic. Livestock handlers, including veterinarians, need to understand the flight zone and the point of balance for working both in the paddock AND the yard. The point of balance for cattle is typically at the shoulder. To make an animal move forward, the handler should stand behind the point of balance. If the handler is front of the point, the animal should move backward. The animal may try to turn if the handler enters the animal’s blind spot. Therefore, don’t walk directly behind an animal, but off to the side so you can be seen. (Ohio State University Extension 2002). The staff from Ohio State University Extension 2002 continue on to say Careful, quiet handling of cattle will help improve productivity. Stress imposed by handling and transport can have detrimental effects on weight gain, rumen function, reproductive function, and the immune system. Quiet handling reduces stress-related meat quality problems such as dark cutters. The amount of stress imposed on an animal is an interaction involving previous experience and genetics.

In contrast, the summary points from the article authored by Lawson et al (32006) included:

- “There is increasing pressure from contractors and outside workers such as veterinarians (vets) to have safe cattle handling equipment, otherwise they could refuse to work on farm”
- “When buying a crush consider cattle throughput and the type of work, available labour, veterinary requirements and safety.
- “Crushes that can hold and restrain cattle comfortably are less stressful for the animal and operator.”
- “Note the height and length of a crush with respect to animal and operator size to decide if it is suitable for the enterprise.”
- “Ensure the head bail and squeeze are easy to use, animals are accessible and can be released easily if they fall and latches are secure.

After extensive trialing of 6 popular crushes, Lawson et al (2006) stated *“the tests showed there was room for improvement as faults such as poor animal safety and squeeze maintenance only became evident when the crushes have been used under farm conditions for some*

time.” They also mentioned that with the extensive expenditure (>\$10,000), “it is vital for the unit to meet cattle handling requirements now and in the future”.

In the Kondinin trial the best performed crush for operator and animal safety and ‘gates, back, vet and side’ was the Thompson Longhorn Super All-purpose. The negative part of this crush was its cost! “Overall panel members in this trial said “the best buy depended on the type of work and how often the crush would be used and its longevity”. The frightening thing is that 17% of cattle producers have homemade crushes!!

In summary, cattle crush needs to be safe, easy to use and not restrict a person from performing their job. It is interesting to note, and vets should advise their clients of this, that EMPLOYERS ARE RESPONSIBLE FOR PROVIDING SAFE WORKPLACES (Lawson et al 2006, RIRDC 2005)!!! The person in control of the cattle yard workplace (e.g. veterinarian) has responsibility to provide a safe workplace for all people in the workplace, hence veterinarians should ask that children and elderly or incapacitated people should be removed from the workplace if the veterinarian rather than the client is considered to be ‘in charge’.

Other attributes that must be considered include height and closing ability of the vet gate- height should be between 750 and 840mm depending on cattle to prevent vet being kicked or having beast come down on the vets arm; head clearance for operator; gap between the bottom rail and the ground; presence of floor; operating noise (According to Lawson et al (2006) noise is often associated with the quality and thickness of steel paneling and the amount of slack in gate latches); non-slip floor; round tubing v square sections; head bail design including type of operating lever and height.; gate latches; cleanability; maintenance; head lifting/restraining devices; squeeze (immobilizing animal safely for animal and operator; ease of access to animal (visibility) for treatment (e.g. neck injecting gap) and release if down; quality; rear sliding gate; split side gates (horizontal or vertical bars); forward view for cattle; protruding obstacles; length and width of crush; ease of operation when initially exposed to the crush and padded grip handles.

The downside to the test done by Lawson et al (2006), on behalf of Kondinin was the limited number of cattle and breeds tested per crush.

Jones T - Cambac JMA Research (2009) listed “Human factors” that need to be considered when clients / producers altering their handling system:

- Is it safe for humans?
- Is handling made easier?
- Can all parts be reached?
- Have staff approved it?
- Do staff understand the reasons behind it?
- Does it cater for worst case operators?
- Are there operator escape routes?

Jamey Cupples, from Farm Safe Queensland (Q ld), at both meetings with the executive of Australian Cattle Vets (ACV) in 2006 and 2009, believes any concrete design of cattle crushes should be taken down the Australian Standards route to enforce standards across all manufacturers. Jamey also quotes that through some statistics he had recently done in 2009, injuries in cattle crushes were not significant when compared to other causes of injury in workers in the cattle industry. Jamey has done a Risk assessment on cattle yards. His identified hazards on the cattle crush include (and is similar to other opinions of referees read for this mini-publication):

- 1. Is the crush design and size appropriate for the classes of cattle being handled and tasks undertaken?**
- 2. Can the crush effectively restrain animal and allow safe access to the animal for veterinary tasks to be undertaken.** One of the big issues for many producers and veterinarians is the ability of animals to move their head while in the crush, causing a hazard to the operator (see on Newsome’s opinion quoted later in this literature review). Many manufacturers fit some form of head restraint to the outside of the head bail (chin bar) to reduce head movement.



There is also equipment with top and bottom arms which swing into place and clamp the animal's head. For both the safety of the operator and the animal these devices must be able to be released easily and quickly in case an animal falls down in the crush and starts to choke itself.

- 3. Does the head bail restrict safe access to the animal's neck for the administration of veterinary injections?** With current quality insurance all injections, including vaccinations are preferably given in the neck (Evans 1998).
- 4. Is the crush sound and secure, with no projections, which may injure humans or animals or animals,** e.g. head bails handles, gate latches etc
- 5. Do gates and head bails operate properly in capturing and securing stock** and do not fly open when kicked or struck?
- 6. Can animals that go down or become jammed be quickly released safely without risk of injury to the operator?** Select a crush with handles which can be disengaged so they drop down out of the way or can be swung up and placed into a bracket where they do not pose a danger to the operator (Evans 1998).
- 7. Are the crush gates, bail and latches free of nip or crush points?**
- 8. Are exit yards of sufficient size to allow processed animals to clear from the work area and settle down where they pose no threat to operators and equipment?**
- 9. Is the crush work area free of projection, slipping, tripping or falling hazard?**
- 10. Are the crush handling areas designed so as to eliminate dust, slips, trips and fall hazards in the work areas around the crush?**

Once operators have read these statements they must relate them to their own workplace and tick one of 5 boxes.

The 5 boxes indicate

- 1. OK or not applicable.**
- 2. Extreme risk (act now)** i.e. do something to manage these risks immediately and stop the task until the hazard is controlled and the risk managed.
- 3. High (ASAP)** – do something to manage the risk as soon as possible. Consult with management.
- 4. Moderate (plan)** – plan to manage these risks / note any suggestions on how these risks might be changed. Consult with management.
- 5. Low (Review)** OK for now. Review if any equipment / people / materials / work method or procedures change. Consult with supervisor.

Turner (2006) made recommendations for the design of handling facilities that improve animal welfare, efficiency of handling and human safety tailored to the UK situation. Turner (2006) recommended maintenance and working with cattle behaviour. According to Turner (2006) cattle tend to move toward other herd members; prefer to return in the direction from which they came and tend to circle a handler so facilities should be designed with this behaviour in mind. For example to minimize assistance, facilities should be designed to gradually guide the animal towards the only obvious exit and distractions (including the sight of humans) should be minimized (use solid sides to pens, races, crushes and curved races and catwalks)). Other recommendations include using non-slip flooring under crushes; both sides of the crush should be accessible; the crush should be designed to minimize opportunities for entrapment of limbs; the area around the crush (particularly the working side) should be free of cattle; the use of sticks and noise should be discouraged.

Work safe Victoria (006) similarly concluded that understanding cattle behavior is important in reducing the risk of injury to the handler, the animal and other people, such as veterinarians, who maybe nearby. Rough cattle handling also can increase carcass damage. Work safe Victoria (2006) state that experienced and competent cattle handlers use their knowledge to get cattle to do what they want quietly, efficiently and safely. Veterinarians should note that the *Health*

and *Safety Act 2004* requires that employees, other persons at work and members of the public be given the highest level of protection against risks to health and safety that is reasonably practicable therefore veterinarians should expect that farmers / livestock producers should provide them with safe facilities to work in. Working with cattle requires a certain amount of fitness, general health and agility. Similarly, a thorough understanding of the behavioural traits of cattle is the first step to safe and efficient cattle handling. Young veterinarians should be fit and healthy and trained to understand cattle behavior and cattle handling before they treat cattle in a crush. Work safe Victoria (006) also concluded that cattle have minds of their own, a huge weight advantage and the ability to move surprisingly fast so it takes skill and practice to handle them safely. Most injuries or mortalities to people from working cattle are due to being kicked or crushed. Work safe Victoria (006) state '*don't underestimate the speed, reach and accuracy of an animal's kick*'. Stand well back and out of range, unless you are working close to the animal, then you turn side on and get right in against it. According to Ohio State University Extension (2002), Cattle are "roundhouse" punchers. Cows kick forward and out to the side. Cows also

have a tendency to kick toward a side with pain. So, if a cow is suffering from mastitis in one quarter, consider approaching her from the opposite side of the affliction. Calves can kick directly backwards and can have a quick "round-house" punch.

Work safe Victoria (006) listed important tips for cattle control and minimum injury as follows:

1. **Know the cattle** – a % may be aggressive or flight; they may react differently under stress or at different times of the year?
2. **Keep cattle calm** – cattle need time (at least 30 minutes) to adjust when they are mustered into the yards or unloaded off a truck. It can be advantageous to move cattle through a yard before handling them. This also makes all gateways more familiar.
3. **Assess the type of stock and their behavior**, for example weather (cold, windy), age, breed, sex (bulls – never trust them), horn status, temperament, training, weight, number (never isolate animals), number and age of calves (cows with young calves should not be trusted)
4. **Keep an eye on what is going on around you** – Stockmen: only half fill the yards; use the gate so they do not get hit by it; pack the race firmly to stop the cattle moving back and forth; don't put arms, head or legs through race or crush rails; to get the cattle to move forward, walk inside the flight zone from the front of the race to the back; in a crush, when using a hock bar, stand at the end of the bar, not at the side, and keep it at arm's length in case it jerks upwards
5. **Know when, if ever, to use voice or stick or electric prod or dogs.**
6. **Check the yards for hazards before working cattle** – stray posts and timber; stones; nails; bolts; wire; catwalks; gates; head bail and crush; weld mesh; dust; flapping clothes; bright light, sun or shadows; smell, e.g. blood
7. **Operating a crush** – when performing tasks such as vaccinations, beware of sudden movements that could crush your arms or hands and frighten the cattle; take care when using brands, knives, surgical instruments or injections; beware when opening side gates on a crush, as an animal's weight can force the gate on you
8. **Operations and protective clothing** – consider a pour on rather than an oral or injectable drench; wear boots with steel caps; always have sharp needles on a vaccinating gun –(replace them frequently; use the vaccinating gun when you are close to the animal; needles should be placed in a sharps container; use a good head restraint and scoop when dehorning; good strong pair of trousers and leggings can reduce the severity of kicking injuries; remove your watch or loose jewellery; wear personal protective equipment (PPE) when using chemicals; wear sunglasses and a broad brimmed hat when exposed to uv radiation; turn off the mobile phone.
9. **Dos and Don'ts** – do not lean over an animal's head or bend down over it under a cross tie. In dangerous situations, turn side on to cattle. It makes you look smaller and less threatening. Plan your escape route. Cattle should never be chased. Where practicable separate humans from animals.
10. **Monitor hunger and thirst.**



11. Zoonotic disease – practice good hygiene such as frequently washing hands to prevent Q fever, leptospirosis, ringworm. Cattle should also be vaccinated against leptospirosis and humans against Q fever.

In summary, Work safe Victoria (2006), as with Ohio State University (2002), consider correct training of staff and visitors, availability of protective equipment; appropriate handling of stock and well-designed and constructed yards will result in less injury to stock handlers and better quality beef.

According to Work safe Victoria (2006) cattle yards should ideally be:

- Well drained to reduce slips, trips and falls.
- On level ground or slightly uphill (cattle resist going downhill).
- Oriented so cattle in the race or on the loading ramp aren't moving into shadows and that the handler is not looking into the sun.
- Built strong enough for the type of cattle to be handled. Located so that livestock carriers do not reverse on or off properties on to a (or park) public road.
- A firm dry base in the pens, race and crush, with at least 3% of surface fall for effective drainage.
- A clear trafficable yard entrance.
- Strengthened yard gate posts with ties to reduce gate dropping or lifting.
- Gate latch handles and latch design with minimal obstruction or protrusions.
- Slam-shut latches in forcing areas. The use of spring-loaded latches are believed to be an essential component (Evans 1998).
- A sheltered spacious barricaded working area to protect handlers, visitors (e.g. veterinarians) and equipment (e.g. veterinary equipment and drugs)
- A suitable, lockable storage facility to secure chemicals. Where vaccines and antibiotics are used these may be stored in a small lockable fridge.
- Plenty of access ways and emergency escapes between and around yards and crushes.
- Race insides covered up to reduce distractions that may impede forward movement of cattle and unnecessary damage to handler's arms.
- A race side panel release system, to allow for the safe and easy escape of any livestock should they go down.
- If work is required between rails, race and crush designed to prevent cattle pushing handlers' or veterinarian's arms against posts.

Also according to Work safe Victoria (2006) cattle yards should be maintained as follows:

- Concrete frequently used areas to provide non-slip surfaces
- Build cat walks where appropriate.
- Angle corners in pens to improve cattle flow.
- Locate water troughs in inactive areas of the yard.
- Provide sprinklers to reduce dust and therefore respiratory disease in cattle and handlers and clearer vision between cattle and handlers which reduces possible injury.
- Provide shelter over the working area to reduce sunburn and dehydration in the handlers and stress in the animals.
- Install sliding gates in race ways.

- Grease and maintain slides, catches and hinges in yards, gates, and crushes /head bails..
- Remove or modify head-high projections such as gate slides, crush handles and low gate ties.
- In conclusion, Work safe Victoria (006) advises to choose cattle crush with the following feature:
- Access gates on both sides
- Slam-shut gates or catches
- No overhead protrusions
- Rear bail head operation
- Safety locks on the bail release
- Easy, quick and quiet operation
- A positive head bail locking system capable of being operated with one hand only.
- No sharp edges, protruding catches, bolts or wire.
- A slide through hock or backing bar.
- A slide squeeze facility for safer cattle control.
- Split side opening access gates, preferably with catch at rear.
- Lower panels closed in to avoid kicks and animals legs getting caught between rails.
- Ease of maintenance with greasing points.
- A crush exit design to allow processed animals to be separated from the work area.
- Crush gates, bails and latches free of nip or crush points.
- A design allowing for a safe and easy release operation should an animal go down.
- Solid and secure anchorage points (preference to be set in concrete).
- Gates and head bails that operate effectively in capturing and securing stock, and do not fly open when kicked or struck.
- Equipment that has the proven ability to effectively restrain the classes of cattle being handled.

In 2006, the Australian Cattle Veterinarians (ACV), a special interest group of the Australian Veterinarian Association, funded a survey on Bail Injuries amongst all their members (ACV (2006)). The survey, designed by me (when I was president of ACV) and other members of the executive was confusing hence there was a limited response (6% of vets surveyed). Even though the response was limited *“there was a good spread covering practices involved in Dairy, Southern beef, Feedlots, Research, Overseas experience, Hobby farmer.”* (ACV 2006). In summary, most work carried out in bails was not ‘vet work’ but most work carried out by vets in bails was vet work. Of the vet work carried out most of it was female reproductive tract examination including artificial breeding; soundness evaluation; veterinary surgery; and bull breeding soundness examination (BBSE). Surprisingly, in this survey, BBSE only takes up 8% of the time vets use a crush. According to a summary given by the administrative staff of the ACV including the EO, Anne Cover, *“the major feature of vet crush design for vets should be towards pregnancy testing and surgery”* (ACV 2006). Within the survey there was a section on *“injury and design”*. A summary of the response was that *“80% of the 64 respondents had sustained some in bails; comments from the lucky 22% included ‘more by luck than good management’ ; ‘plenty of near misses’ and ‘haven’t been working in them long enough’. Finally, some people did not record their injuries because they hadn’t taken time off work.”*

Working in hot conditions can cause heat stress for cattle and handlers, covered yards, particularly crushes, are more comfortable and stress-free for handlers and preserve crushes from rust for longer periods. Similarly, design yards and facilities to reduce shadows, dappling and undue noise which balk cattle. The roof over the crush should be supported by separate posts to the race structure to reduce resounding noise. Animals often balk on entering shaded areas: this problem is reduced by starting the roof at least one panel after the forcing pen or one panel before the crush (Evans 1986).



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Dust generated during work in cattle yards can cause respiratory disease and Q fever in handlers. Cattle may also physically damage handlers if they cannot see each other. Sprinklers and selecting the correct floor surface can reduce dust. Cattle yards on a site with drainage, firm footing and quick drying in wet weather is ideal for safety of handlers. Direction of wind, the slope of the site, and cattle movement in relation to their home paddock all should be considered when designing a yard or working in a yard. A design that has cattle moving back towards the entrance through the fencing pen and race will help achieve smooth movement.

Longevity of crushes can be extended in high rainfall areas by using galvanized high-tensile steel with the frame and gates gusseted and braced for strength (Evans 1998).

The race should be packed as tight as possible to prevent the cattle moving back and forth. The race should lead to scales and crush that are in a straight line so that cattle are invited to the non-threatening view through the head bail. Yards that are not designed to encourage cattle flow will result in balking and an increased anxiety level in the cattle that increases the risk of injury to handlers. Boarding up the walls of the race to block out distractions focuses the attention of the animal to the only way out – through the scales and crush (Work safe Victoria 2006).

Weighing systems are often incorporated under crushes. Stewart (2009) has serious reservations about this practice as the crush is an area that puts the animal under a lot of stress. This can put a lot of pressure on delicate electronic load bars, which will require load cells that are far more robust and cost accordingly. The blood and excrement of a stressed animal smells quite different to a placid animal. Stock recognize this and react accordingly.

Also if the crush is separate to the weigh scales cattle that need to be attended to in the vet crush but they may not need to be weighed. Can be attended to by a vet while other employees can be weighing cattle if necessary. Alternatively, if the scales are placed under the crush they can be removed and stored appropriately when not used. An expendable item such as a wooden platform can be placed under the crush if needed when the scales are not there (Evans 1986).

Access to the cattle yard area for all workers and visitors, such as veterinarians, should be clearly defined and separated from vehicular traffic and cattle movement.

According to RIRDC (2005), a cattle crush can be assessed on the major features of:

- **Versatility and suitability for all the jobs to be done on the cattle**
- **Safety for handlers**
- **Durability**
- **Price**
- **Serviceability (maintenance)**
- **Noise**
- **Light variation**
- **Stock – choking and leg damage; head control; baulking gates; adjustment for different classes of stock**
- **Non-slip flooring**
- **Split vet gate and side gates.** Aim is to provide maximum restraint to the animal while allowing unobstructed access to all parts of the body.
- **Strong rear gate with a kick shut latch.** A split gate should only open the same as the crush width to act as a semi-anti-kick gate. A T-bar can also be used as an anti-kick mechanism – it allows the gate to open in but not out (Evans 1986). An Australian alternative to the rear 'kick' gate is the Tindall chain. One end of the chain is attached to the off-side of the race. The slotted pipe is attached to the near side. The chain is passed behind the animal and pulled tight through the slotted pipe (Evans 1986). Evans (1986) makes an incorrect claim that the Tindall chain is anti-kicking de-

vice. I have been kicked several times pregnancy testing cattle that have been restrained with a Tindall chain. Another problem with the Tindall chain is that the handler that is operating it needs to wear gloves or they can get very sore hands.

- **Simple to operate squeeze.** Care should be taken to avoid unnecessarily harsh use of the squeeze. Squeeze, used properly, can reduce kicking. Squeeze can be operated mechanically through a ratchet bar or automatically by hydraulics or air (Evans 1986). Parallel and V squeezes provide a greater holding power compared with a single side operation such as a ratchet (Evans 1998).
- **Positive gate latches and gates operate easily**
- **Unit is secured to the ground**
- **Adequate head clearance**
- **Good access for handlers, including veterinarians**
- **Escape routes**
- **Head bail is easy to operate, is walk through and has front/ back operation.** When operating the head bail, handlers should stand at the end of the lever, not the side and keep it at arm's length in case it jerks upwards. If curved bars are used for the animal's head and to minimize movement above and below the head, handlers should watch carefully that animals do not choke. It is essential that cattle are never left unattended in a crush. It should not be possible for cattle to knock a long bail lever or any other levers (Turner S, Lawrence A and Lowman B 2004). It may be ideal that the head bail can be operated as a slide gate to full open width when the cattle do not need to have their heads caught (Evans 1986).

Cattle will struggle excessively in a head bail that chokes or that does not hold the head with the neck in line with the back. Held too low, the animal tends to go down on its knees and kick with its back feet. Heads held too high results in the animal attempting to rear, with the back legs going down under the body (Evans 1986).

Stroud and Walsh (1997) suggest that a crush design which has inside walls that are angled inwards at the base will reduce the opportunity for cattle movement and kicking. They also recommend the use of a sheeted insert which can be placed within the crush to reduce the width and hold young cattle towards one side.

As with all working equipment it is very important **KEEP UP MAINTENANCE**, for example nails should be hammered down and fattened off; bolts that are too long should be sawn down; loose timbers should be fastened; head-bail should be kept lubricated; gates should be kept well oiled and free-swinging.

RIRDC (2005) continues on to conclude that hazards associated with cattle handling occurs because of their size, speed and potential aggression. The life threatening hazards are associated with kicks and charging. Inadvertent crushing of a person against the side of a yard or crush and jamming a body part in a moveable item such as a gate or squeeze are also not uncommon.

RIRDC (2005) gives four important tips for successful and safe cattle control. It is not just the design of the crush!

1. Check the yards before working them.
2. Keep cattle calm.
3. Keep an eye on what is happening around you.
4. Use your voice.

Good stock handlers use their voice constantly in different ways – to soothe and calm; to assert authority; and to let cattle know where the handler is. This is important in light of their different vision from humans.



Cattle should optimally be allowed to settle for >30 minutes before work in the yards and reduce their arousal levels post-mustering. Cattle herd size should suit the size of the yards and the number and skill of the handlers. Conversely, cattle are herd animals so they should never be handled in very small numbers.

The use of pour on drenches rather than injectable or oral should be safer for the operator, if they select the least toxic chemical and where PPE if necessary, due to eliminating the risk of needle stick injuries or being hit by the head of an animal. It is also less stressful for the cattle.

Risks associated with veterinary procedures in crushes includes injury from the crush or the cattle; burns from liquid nitrogen; zoonotic diseases; needle stick or surgical instrument cuts; manual handling injury. Prevention includes the correct crush; well handled cattle with a good temperament; experienced and trained staff ; sharps container; being alert; handling equipment correctly and with respect; being vaccinated; use appropriate protective equipment such as recal gloves, steel capped boots, sunglasses; regular washing of hands etc. ; sunscreen.

All young veterinarians that intend to work in rural mixed practice should undergo a specific safety induction including safe work methods particularly related to working in cattle yards.

ACC Think safe (2009) says that the primary principles of yard/crush design are 1. Provide the appearance of clear space and minimize distractions to draw cattle and remove the need for the handler to be in direct contact with the animals to encourage them to move (Turner S 2004b).; 2. build in features for the convenience and safety of cattle handlers. This would include gates that shut easily and securely; regular maintenance; no obstructions such as runners for slide gates or levers for head bails that can easily damage an operator; crushes that are built from material that is strong enough to withstand the pressure from the cattle that are being handled; crushes that are securely bolted (or equivalent) in place; and minimize noise, dust and sun affecting vets working on cattle in a crush. ACC Think safe (2009) states the obvious that “confined spaces and close proximity to cattle are a potentially explosive mix”. This statement is supported by Fordyce G (2007) when he states “ a crush / head bail can be ideal when performing one procedure within a specific environment for specific class and breed of cattle that are managed in a specific way, and this complements the rest of the yards”.

Fordyce (2007) developed a good table (Table 1)in his document that summarises the multitude of processes that can be carried out by vets or non-vets in vet crushes / bails:

Table 1 Processes that can be carried out by vets or non-vets in vet crushes / bails (Fordyce 2007)

Monitoring	Surgery	Medication	Other
Weighing	Dehorning	Ear implants	Artificial breeding
Checking dentition	Spaying	Rumen implants	
Faecal sampling	Castration	Vaccination	
Jugular or tail bleeding	Branding	Administering medications – im, iv, sc**, ORAL	
BBSE*	Ear tagging		
Body composition scan	Dystocia – surgical and non-surgical		
Female reproductive tract examination	Hoof care - treatment and prevention		
ID scan	Wound treatment		
Height measurement	other		

* Bull breeding soundness examination ** IM intramuscular; IV intravenous; SC subcutaneous

Fordyce (2007) expands by stating that most cattle crushes used by beef producers are made by professional fabricators rather than being home made. According to dairy veterinarian, Ian Bradshaw and others, dairy farms tend to use more homemade crushes. Engineers, steel fabricators, and cattle producers generally design and make cattle crushes. This occurs in the absence of recognized standards for cattle crushes (Fordyce 2007). Due to the variation in size, breed and class of cattle being seen by vets in crushes any 'standards' developed need to provide a range to suit all situations faced by veterinarians and producers.

The problems of no crush being ideal and poor linkage between the makers and users of crushes (Fordyce 2007, results in both a proportion of crushes being unsuitable for safe and efficient conduct of procedures for workers or the animals, and, conversely a proportion of crushes being suitable for safe and efficient conduct of procedures for workers or the animals. Even though there have been a number of veterinarians injured when treating or monitoring cattle in crushes, if you consider the number of cattle veterinarians seen in a crush, the number of vets injured would be a low %. Examples of these include the currently perfectly healthy Dr Ian Braithwaite who pregnancy tests and spays >100,000 head in varying crushes across northern Australia annually and the similarly healthy Dr Jakob Malmo who monitors and treats thousands of dairy cows in varying situations in dairies in Victoria. The answer to their health is experience and judgment of cattle behavior; ability to assess the facilities and confidence to stop and fix it; and health and fitness to perform the job required. There are a lot of things that contribute to injuries at crushes other than just crush design.

With minimal research the ACV contacted 20 or so 'crush companies' regarding design of cattle crushes. These include: Bahcon Steel P/L; Leicht's C.I.A.; Norton Gates Pty Ltd; Thompson Longhorn; Trethewey Industries ; Warwick; Commander Ag-quip; Metalcorp Steel - Carinya Head Bails and Cyclone Crushes; Breckon Cattle Equipment; Farm Gear; John Berends Implements Pty Ltd; StudMasta Gympie Welding Works; Daniels Manufacturing Co.; Allenspach Steel; Kattle Gear Australia Pty Ltd; Douglas Stockyards; Arrow Farmquip; RPM Rural Products; Black River Cattle Equipment Co; Ramage Engineering

Of course, crushes from these companies vary in price and quality so it is important that producers buying crushes examine them thoroughly and ask the opinion of other users before purchasing them. Fordyce G (2007) quotes injuries suffered by many vets in north Qld. These include the possibility of breaking on arm when a cow goes down on a 'kick gate' that is too high; another is a jigger being used on a beast when the vet is still behind the kick gate. This resulted in the vet being kicked in the throat collapsing the trachea. Morale of the story – nobody uses a jigger in front of the vet. Other injuries include having part of a finger kicked off and other injuries from cattle kicking over the top of gates 720 – 740mm. The solution to the problem is to try and predict and fix the problem BEFORE it occurs. It will be safer and save time in the long run if you stop and fix the problem rather than continue working in sub-standard facilities.

Examining a different group of professionals and in a different country and not specifying crushes, it is apparent that there has been no reduction in the number of human fatalities whilst handling cattle in the UK since the 1970s, despite a reduction in the total rate of agricultural fatalities. (Turner S 2004b). Based on a sample of 314 producers surveyed in 1994 and 1995, it has been estimated that around 19% of producers in the UK receive injuries while handling either beef or dairy cattle, although most of these injuries were bruises (Turner S 2004b). During the 12 month period of April 2002 to March 2003, the cost of all agricultural injuries to Scottish producers was £13.7million (Turner S 2004b). Handling systems can greatly reduce the risks to human safety when designed and operated correctly. The other ongoing benefits of improving crush design for improved safety include reduction in labour; reduction in bruising, traumatic injury, stress and dark cutters in cattle; and improved growth rate in cattle (Turner S 2004b). Turner S 2004b adds to primary principles of yard/crush design provided by ACC Think safe (2009) with points such as:

1. Provide a solid barrier between the cattle and handler and
2. Minimise points where limbs can be trapped.

The basic principles outlined by (Turner S 2004b), ACC Think safe (2009) and others can be implemented as follows:

- Making use of cattle behavioural tendencies to encourage calm movement



Exits from pens and crushes should be obvious to the animals

Gates should open fully and lie flat against the fence line or equivalent

Reduce the size of a pen if necessary

- Cattle are easily influenced by the sight of other animals and humans standing alongside the crush.

While solid sides encourage cattle movement and reduce the possibility of cattle legs becoming caught between the crush supports, they can also reduce access to the animal for treatment and access for removal of animal if they get down and trapped. There should be a minimum number of frame supports against which a hand or arm may be trapped. Ideally, upright structural supports should be located on the outer surface of a wall or partition (Turner S, Lawrence A and Lowman B 2004).

- Incorporation of a gentle bend into the end of the race will prevent cattle from seeing the crush until they are almost inside it. It also encourages cattle to move towards other cattle that they can see moving and disappearing = escape route. Minimising visual disturbance

- Cattle are hesitant when walking over slippery surfaces or floors with strong contrasts in texture, colour, or lighting. Cattle have a very poor field of binocular vision (25-50°) resulting in poor depth perception making it difficult to differentiate between a shadow and a deep hole in the ground. Furthermore, as they have only 60° of vertical vision, the head must be lowered in order to focus on something on the ground. Consequently, shadows and objects which present a colour contrast cause cattle and sheep to pause. Crushes should have an adequate diffuse light. (Turner S, Lawrence A and Lowman B 2004). Cattle don't see the world as clear and sharply focused as humans, and it takes them more time to process what they have seen. Cattle have panoramic vision in excess of 300 degrees and only have a blind spot directly in the back of their heads. Human vision, by comparison, is roughly 180 degrees, and we have a much larger blind spot (Ohio State University Extension 2002).

- Worn out floors should be grooved.

- Old wooden crush floors should be replaced

- Boarding can minimize shadows

Cattle will hesitate when alarmed by sudden noises

- Use rubber strips to prevent metal to metal contact

- Minimize or eliminate shouting

Fear and stress are common responses to novelty (e.g. noise) or a previous negative experience (e.g. associated with a noise). Cattle hear well, but are poor at locating the source of the noise. Some degree of habituation to a noise is evident after 5 consecutive days of exposure (Turner S, Lawrence A and Lowman B 2004). Cattle can hear both lower volume and higher frequency sounds better than people (Ohio State University Extension 2002).

Cattle will tend to collect in a corner

- Place a board across the angle of a corner

Provision of a solid barrier between the cattle and handler

- Calm flow of cattle

- If a forcing gate is used, a latch should prevent the gate from being pushed against the handler

- Catwalk

- All equipment should be securely fixed and well maintained

- A sheeted gate should allow the end of the race to be closed to prevent waiting cattle from making contact with a vet positioned at the rear off the crush. Bradshaw I (2008) cites a situation here the 'waiting' Santa cow attempted to jump the slide gate behind him and smashed his ultrasound. Luckily he was not hurt. The gate must be sheeted and high enough.
- Minimising points where limbs can be trapped
- Crushes should open fully on both sides with split gates. They should be able to open independently or in unison (Evans 1986). On the near side the bottom of the split gates should be low enough not to interfere with caesarians but not too low as to allow 'cow kicking'.
- Position the crushes for easy access on both sides

Turner S 2004a continues with design suggestions. Easy access and adequate drainage of the yard site is necessary but inclines >5% should be avoided as cattle have an aversion to descending slopes during handling. A sharp angle between the exit from the forcing pen and the entrance to the race should be avoided.

The combination of a curved race and a circular forcing pen, both with sheeted sides has been shown by work in Australia to reduce the time needed to move cattle by up to 50%. Forcing pens function most efficiently when they handle no more than 8 – 10 cattle. In the survey of Scottish producers conducted by SAC (Turner S 2004a), the greatest handling difficulty associated with races was the tendency of cattle to turn around. The race should be 40mm wider than the largest animal which will enter it, equating to 660 -710mm for adult cows and 510mm for calves in a straight sided race. When the race is to be used to handle cattle of varying weight, it should ideally be tapered into a 'V' shape, either for its full height or for its lower half only. Side panels which can be released rapidly are popular to free animals that become trapped in tapered races. When handling calves, a calf race should be constructed alongside the main race. An alternative low cost method of reducing the width of a race for handling calves is the use of inserts which narrow the width by 150mm and hang over one wall.

According to Stewart (2009), the most important factor when looking at crushes is to find the one that does the job in the least cluttered and simplistic manner possible. He also states that cattle have not changed over the years – small, large, crossbreeds, hybrid vigour. What has changed is regulatory testing, animal health, fertility assessment, and traceability ID.

In the study carried out by Fritschi et al (2006), they found that of 2800 veterinarians, over half (51%) reported a significant work related injury during their career. Chronic work-related musculoskeletal problems were reported by 49% of respondents. Large animal veterinarians (cattle and horses) were most likely to have chronic or significant injuries – 65%. Practitioner in large animal and mixed practice were >10X more likely to have had a recent injury. Graduates from the previous 10 years were more likely to report an injury than earlier graduates. This would support my recommendation that the ACV should encourage Universities to include a course on animal behavior. Working with livestock in general continues to be associated with high injury rates. In one Canadian report, farm workers who worked with livestock had rates of injury 1.9 – 4.4 times higher than those that did not, even when other factors such as age and stress levels were considered. The US 1993 Traumatic Injuries of Farms report identified a work-related injury rate among farm workers of 32.5 lost time injuries (LTI) per million hours. Western Australia 2002 – 03 Injury Statistics summary rates for the sector incorporating veterinarians reports work-related injury rates of 22.7 LTI per million hours in males and 19.7 in females suggesting injury rates in this category are high and of on-going concern (Fritschi et al 2006). ACV could approach Fritschi et al (2006) to conduct another study or tease out the data they collected from the 2006 publication. Further statistics we would like to know include 'amongst the high rate of injury in large animal veterinarians, how many were due to horses and how many due to cattle? Amongst the cattle induced injuries, how many were done in the yards, and more specifically the crush? With the crush related injuries, how many were due to design of the crush; how many were due to poor staff and/or veterinarian training; or alternatively how many were due to poor cattle temperament due to breed, poor yard design, bad handling?

Fritschi et al (2006) found that large animal practitioners were more likely to report recent and significant injuries than veterinarians in other types of practice. In Finland, equine practices seem to have the highest injury rate, while in the US large animal practitioners did not report significantly more injuries than other groups. **There has been a general improvement in the veterinary facilities used for large animals, especially yards and crushes and so the probability of injury may have decreased over time.**

Fritschi et al (2006) study adds to the evidence that recent graduates are more likely to have had a recent injury than earlier graduates. **This may relate to inexperience, temporal changes in training or differential reporting in injury occurrence between earlier and recent graduates.**

In conclusion, this large study of veterinarians by Fritschi et al (2006) has shown that injuries are common and serious in the profession. The causes of these conditions need to be examined to determine how to prevent them. (Fritschi et al 2006).

According to Turner and Riddell (2004) SAC (Scottish Agricultural College) now promotes the uptake of information on cattle behavior when designing new handling systems and modifying existing ones. This advice has originated from pioneering work done by leading cattle behaviorist; yard designer, scientist and author, Dr Temple Grandin from the USA. Turner and Riddell (2004) also recommend that a crush should be positioned to give the impression that cattle are being returned to where they entered the system.

As a model for where the ACV should be focusing their energy with regard to the health and safety of their veterinary members, the 'Rationale' in the paper produced by Turner, Lawrence and Lowman (2004) highlights that the UK Health and Safety Executive (USE) identified a need to "*reduce the number of fatal and serious injuries in agriculture from cattle handling*". Several mechanisms were proposed to achieve this including:

1. Critically examining cattle handling practices and the facilities / equipment provided. This may have already been done in Australia by one of the work place health and safety groups or one of the agricultural groups such as Agforce or one of the research groups such as Universities, Meat and Livestock Australia (MLA). ACV should research what has been done before they spend money repeating the process. If research has already been done in other agriculture industries, it may be able to be extrapolated for the cattle veterinarians.
2. Increasing the level of awareness of practical hardware solutions for manual hardware solutions
3. Ensuring that adequate training in cattle handling is provided. ACV can encourage this through liaison with Universities that have a vet school and development of cattle handling courses for vet students.

Turner S, Lawrence A and Lowman B (2004) continue on to state that "*the challenges to human safety has been exacerbated in recent years by the increasing ratio of cattle to handlers, the need to handle animals at sensitive times to satisfy traceability and meat hygiene requirements and lack of investment in handling facilities. The use of inadequate facilities by over-stretched handlers also contributes to cattle injuries and poses a threat to animal welfare*". Another challenge to human safety in the Australian beef industry is the significant reduction in people of all ages, including veterinarians, that have had extensive experience handling cattle and understanding cattle behavior. The opportunities for employing additional skilled staff are restricted by the low profit margin of beef production. This low net income also limits the opportunity to upgrade old or damaged handling facilities. Similarly, the increasing number of beef producers that agist cattle or lease land limits the opportunity to upgrade old or damaged handling facilities (Turner, Lawrence and Lowman 2004).

Appropriate handling of cattle benefits animal welfare by reducing the number of accidental injuries sustained from contact with the facilities and reduces the tendency of producers to use punishment as a means of encouraging movement (Turner, Lawrence and Lowman 2004).

Between April 1992 and March 1994, 71% of all non-fatal injuries sustained whilst handling livestock were caused by cattle, This pattern is not unique to the UK but it is shared by the USA, Canada and New Zealand. P Stroud and A Walsh who were paid in 1997 to write a report on the Manual Handling of Live Animals in the UK found that veterinary surgeons experienced a mean of 1.3 injuries per person per year during 1994 (n=330 responses) and 1995

(n=333 responses). P Stroud and A Walsh found that 29.4% of veterinary surgeons classified their worst injury sustained whilst handling cattle as serious or very serious (Turner, Lawrence and Lowman 2004).

Table 2. Nature of non-fatal injuries sustained whilst handling cattle (Stroud and Walsh 1997)

<i>Injury</i>	<i>Frequency</i>	<i>%</i>
Bruising	171	44.4
Fracture/ Dislocation	48	12.5
Laceration	80	20.8
Sprain/ Strain	19	4.9
Internal/ Concussion	24	6.2
Other / Unknown	43	11.2
TOTAL	385	

Table 3. Body area injured whilst handling cattle (Stroud and Walsh1997)

<i>Body area</i>	<i>Veterinary surgeon %</i>	<i>Producer %</i>
Head	18	6
Torso	18	21
Arm	9	16
Hand	24	17
Leg	27	19
Foot	4	21

As seen in the table above Stroud and Walsh (1997) collated information on the body areas affected by injury from 59 accidents involving producers and 337 accidents involving veterinary surgeons. Both groups appeared to receive a high proportion of injuries to a hand, leg or the torso and these areas also sustained the most injuries amongst US beef, pig and sheep farmers. In the British study (above), however, there is considerable disagreement in the proportion of injuries sustained to the head (producers = 6.1%; vets = 18.4%) and feet (producers = 20.7%; vets = 3.6%). This implies that the different duties performed by producers and vets are associated with different risks and that design features should offer dual protection. If the ACV design a crush, will producers consider our opinion?

Table 4. Actions causing non-fatal injuries to producers and veterinary surgeons (Turner, Lawrence and Lowman 2004)

<i>Action</i>	<i>Veterinary Surgeon</i>	<i>Producer</i>
Kicked / hit with head	41.6	31.3
Entrapment	10.3	28.1
Trampled	12.8	20.3
Knocked over	7.8	20.3

Injuries recorded under the category of entrapment include both those where the victim was pinned either between an animal and a solid object or between two solid objects whilst handling cattle. Cases of trampling include instances where

the victim was stood on, repeatedly butted or repeatedly kicked. Those where the victim was knocked over have been separated to indicate the action which caused the principle injury. A single kick or hit from the head of an animal was the most frequent cause of non-fatal injury to both producers and veterinary surgeons.

The danger of bulls is confirmed by Turner, Lawrence and Lowman 2004, as in the UK between 1992 and 2003, 36% of fatal accidents were attributed to bulls and nearly 16% of non-fatal injuries were attributed to bulls.

Table 5. Areas of greatest handling difficulty and perceived danger in purpose-made handling facilities (SAC – Scottish Agricultural College Survey, n=139) (Turner, Lawrence and Lowman 2004)

Scored 1 (no risk) to 5 (severe risk)

	<i>Handling difficulty av score</i>	<i>Perceived danger av score</i>
Access to pens	1.8	1.7
Collecting pen	1.8	2.2
Forcing pen	2.2	2.4
Race	1.8	1.9
Crush	1.8	2
Dispersal pen	2	1.5

The forcing pen was associated with the greatest risk of injury and was also the area in which handling was felt to be most problematic.

Stroud and Walsh (1997) showed that foot trimming, health inspections, castration, surgery and calving were all felt to be associated with a substantial level of risk for veterinary surgeons. Stroud and Walsh (1997) also support the difference in opinion between vets and producers on the required quality of crushes. Considering >90% of crushes that vets work in are owned and purchased by producers, will our recommendations have any affect? Stroud and Walsh (1997) found in a survey of producers and vets, the use of suitable handling equipment was regarded as second in importance for the safe handling of cattle after a high level of experience. Only 6.7% of producers attributed their most serious accident to poor handling equipment. In contrast, veterinary surgeons rated suitable handling equipment as the most important requirement for safe cattle handling and failure to use adequate facilities as the greatest cause of their worst injury whilst handling cattle. Veterinary surgeons in the UK regarded an improvement in farmer attitude to safe handling as the means by which most progress could be made in improving safety (Turner S, Lawrence and Lowman 2004).

Turner, Lawrence and Lowman(2004) lists the requirement for safety around a crush. Their list is very similar to other referees:

1. Encourage animal to enter – barred gate at rear of crush to encourage entry from the forcing pen into the race. A solid gate between the crush and the race will prevent waiting cattle from damaging the vet working on the cow in front of them.
2. Restrain animal securely and without injury
3. Prevent slipping
4. Allow safe access to the animal's body
5. Allow controlled release of animal.

Ohio State University Extension (2002) adds that *“The working chute is a common location for the use of electrical equipment. To avoid exposure to electric shocks:*

Use a ground fault circuit interrupter with water heaters, clippers, and other equipment.

Use moisture-proof electrical outlets in wet or damp areas.

Portable battery systems can be used as well. Boat batteries may have the most storage capacity”.

Lane et al (2009) from the University of Tennessee Institute of Agriculture, U.S have a series of questions to give producers to answer about the efficiency of their crush (NB. Americans call races/crushes 'chutes'). It also has a ranking system.

- How wide is working chute? (26" or less __ 5, 26" to 28" __ 3, 30" or more __ 0) _____
- Is the bottom half of the working chute built with solid walls?(Yes __ 1, No __ 0) _____
- Is the chute tall enough to keep animals from jumping over?(Yes __ 1, No __ 0) _____
- Is a blocking gate in the chute?(Yes __ 1, No __ 0) _____
- Is a cutting (castrating?) gate in the chute?(Yes __ 1, No __ 0) _____
- Is there a gate in the chute to allow access for pregnancy checking?(Yes __ 5, No __ 0) _____
- How many cows will the chute hold? (3 or more __ 3, 2 __ 2, 1 __ 0) _____
- Are overhead braces in chute high enough to prevent head bumping?(Yes __ 4, No __ 0) _____
- Is the bottom of the chute concreted or filled with packed gravel?(Yes __ 1, No __ 0) _____
- Is the chute arranged so cattle move toward light?(Yes __ 1, No __ 0) _____
- Headgate (or Bail)**
- Is the headgate adjustable for different-size animals?(Yes __ 2, No __ 0) _____
- Is headgate the walk-through type?(Yes __ 1, No __ 0) _____

Rate Your Facilities As Follows (there are several other sections to this ranking system.

- 67 - 74 points — Excellent
- 57 - 66 points — Good
- 48 - 56 points — Fair
- 37 - 47 points — Poor

Below 37 points – Are you sure you have a cattle-handling facility?

If your client is not satisfied with their score, producers should make plans to renovate or rebuild with your encouragement.

Health and Safety Executive (HSE) UK (2006) further states:

“To reduce the risk of injury to you and your employees, as well as visitors, such as vets and statutory inspectors, when handling cattle you should have:

- proper handling facilities, which are well maintained and in good working order;
- a race and a crush suitable for the animals to be handled;
- trained and competent staff; and
- a rigorous culling policy for temperamental animals.

What are the risks?

- Handling cattle always involves a risk of injury from crushing, kicking, butting or goring.
- The risk is greater if the animals have not been handled frequently.
- Certain jobs may increase the risk, eg veterinary work.
- Never underestimate the risk from cattle, even with good precautions in place.

The crush

A crush should allow most straightforward tasks to be carried out in safety. It should:

- have a locking front gate and yoke (ideally self-locking) to allow the animal's head to be firmly held.

Additional head bars will prevent the animal tossing its head up and injuring people;

- have a rump rail, chain or bar to minimise forward and backward movement of the animal. Make sure this is always used;
- be secured to the ground or, if mobile, to a vehicle;
- be positioned to allow you to work safely around it, without the risk of contact with other animals, and have



good natural or artificial lighting;

- allow gates etc to open smoothly with the minimum of effort and noise. Regular maintenance will help;
- have a slip-resistant floor, made of sound hardwood bolted into place (nails are not suitable)

Work around the crush will be more convenient if it is under cover with a workbench nearby (for documentation, veterinary medicines, instruments etc).

Specialised tasks, such as belly or foot trimming, require a purpose-designed crush with adequate restraint and enough room to work safely.”

Specifically designed cattle crushes are particularly important for vets to maintain and treat feet in intensively managed and heavy cattle such as dairy cattle; feedlot cattle and stud bulls. In the Full Risk Assessment put out by the UK Healthy Feet Project (2009) for dairy farms some of the questions to be answered included

TREATMENT AND CLAW TRIMMING RISK LEVEL

It is essential that cows showing signs of lameness are promptly examined and where necessary receive appropriate treatments

High/ Medium/ Low

Is it difficult to trim the feet of cows in the cattle crush?”

This question specifically relates to crush design and access. Along a similar audit line, Farmsafe Queensland (2009) has developed the following 2 spreadsheets. It may

Farmsafe Queensland (2009ab) further developed check list sheets on cattle yards. The listed questions outlined below are followed by 8 columns with headings as follows - yes/no; risk level; action planned; cost; target date; action date; person responsible; and notes.

Race

Is the race and crush covered?

Is there a raised catwalk to allow work to be done from outside the race?

Is the surface of the catwalk non slip and wide enough to walk along freely and safely?

Are catwalk hand rails sufficient height and in good condition?

Is the race height, width and rail spacing appropriate for the classes of cattle being handled?

Is the race and crush in a straight line so cattle can see through to the head bail?

Is the race sound and secure, with no projections that may injure humans or animals?

Are the race and gate caps secure and swing at a safe working height so as not to interfere with handling operations?

Are all sliding gates easily operated and capable of being secured so that they will not open if kicked?

Are there any excessive or large gaps between sliding gates and support posts that could be nip or crush points?

Is there safe access to remove animals that go down or become jammed?

Crush

Is the crush design and size appropriate for the classes of stock to be handled?

Can the crush effectively restrain animals and allow safe access for all tasks to be undertaken?

Is the crush sound and secure to the ground, with no projections that may injure humans or animals? eg head bail handles, gate latches etc.

Is there adequate head clearance from all protrusions?

CRUSH	Risk class	Act now	Act ASAP	ok	Recommended action
Is the crush design and size appropriate for the classes of cattle being handled and tasks undertaken?					
Can the crush effectively restrain animals and allow safe access for the tasks to be undertaken?					
Is the crush sound and secure, with no projections, which may injure humans or animals? e.g. head bail handles, gate latches, etc					
Do gates and head bails operate properly in capturing and securing stock and do not fly open when kicked or struck?					
Are all hydraulic hoses on the crush free from nicks cuts or leaks?					
Can animals that go down or become jammed be quickly released safely without risk of injury to the operator?					
Are the crush gates, bail and latches free of nip or crush points?					
Are exit yards of sufficient size to allow processed animals to clear from the work area and settle down where they pose no threat to operators and equipment?					
Is the crush work area free of projection, slipping, tripping or falling hazards?					
Are the crush handling areas designed so as to eliminate dust, slips, trips and fall hazards in the work area around the crush?					
INDUCTION SHED					
Are all catwalks clear of obstructions?					
Does the induction area have blind spots or areas where stock flow is restricted or cattle baulk?					
Are gates designed so that they will not fly open when being closed behind a mob of cattle?					
Is the cattle induction area designed so as to eliminate dust, slips, trips and fall hazards?					
Is the race height, width and rail spacing appropriate for the class of cattle being handled?					
Are the crush, gates, bail and latches free of nip or crush points?					
Does the hydraulic crush facilities operate efficiently and restrain animals effectively, allowing safe access for the tasks to be undertaken?					
Is the general work area free of projection, slipping, tripping or falling hazards?					
Are gas cylinders and branding furnaces properly positioned, secured and placed out of pedestrian walkways, in an area clear of flammable materials?					
Are exit yards of sufficient size to allow processed animals to clear from the work area and settle down where they pose no threat to operators and equipment?					
CATTLE INDUCTION POLICIES AND PROCEDURES					
Is it practice to pressure test hydraulic hoses on crush monthly					
Is there an effective communication strategy between the person controlling the crush hydraulics and the person working on the head bale.					



-
- Do gates and head bail operate properly in capturing and securing stock and do not fly open when kicked or struck?
 - Can animals that go down or become jammed be quickly released safely without risk to the operator?
 - Are the crush gates, bail and latches free of nip or crush points?
 - Are exit yards of sufficient size to allow stock to clear the crush and settle down where they pose no threat to operators or equipment?
 - Is the crush work area clear of projections, slip, trip or fall hazards?
 - Is the crush area and yards designed to minimise dust?
 - Does the rear kick gate have a kick shut latch?
 - Are weighing scales easily removed to reduce pinch, crush points and manual handling injury?

Policy and Practice

- Have all workers been inducted to undertake tasks safely when working in cattle yards on this farm?
- Are all people who use yard equipment trained and instructed in their proper use?
- Has appropriate PPE including gloves been supplied where necessary?
- Are mechanical lifting aids available for lifting heavy objects?
- Is the gas regulator on the branding fire regularly inspected and serviced?
- Are gas hoses and fittings to the branding fire-box in good condition?
- Where cold branding or artificial breeding is used, is liquid N stored securely?
- Are safety goggles used when decanting liquid N?
- Are electric clippers and power cords inspected and in good condition?
- Are veterinary drugs kept in a cool place and separate from other pesticides and foodstuffs?
- Have workers been made aware of the risks of zoonotic diseases including Q Fever, leptospirosis?
- Have workers been vaccinated for Q Fever?
- Have dogs been routinely wormed for the control of hydatid and other parasites that may be transferred to humans?
- Are the yard power circuits fitted with a Residual Current Device (RCD) to prevent electrocution?
- Are portable RCD units available for use with portable generators and not being used on protected outlets?
- Does the person supervising the use of veterinary chemicals and drugs hold a current ChemCert Veterinary Chemical Certificate?
- Are cattle allowed to settle after mustering before undertaking any further work (30 minutes)?
- Is all cattle work undertaken with at least two handlers?
- Is there a policy that No Children are allowed in the cattle yards?
- Is there a policy that only visitors are allowed in the yards with proper supervision?

Crush and yard measurements

Yards need to be adequate for the number of animals to be handled. Overcrowding leads to increased risk for beast and handled. Cattle stressed by being overcrowded will be more agitated when the veterinarian handles them in the crush. The recommendation is to allow 1.5m² per adult. Recommendations from the USA suggest that each collecting

pen should hold around 30 cows and measure around 15m long and 3.5 – 4.0 m wide. Ohio State University Extension (2002) suggests to allow 20 square feet for each cow and 4 square feet for each calf.

For British breeds a race or crush fence height of 1.52m has been recommended in the UK, increasing to 1.67 – 1.83m for Continental breeds (Grandin 2009). Where yards have less pressure, height should be 1600mm. With increased pressure this is increased to 1800mm. If at all possible, yards should be circular and not have corners. Race that are too wide allow cattle to turn around or drop their heads out of access. Depending on the breed and class of cattle being handled, races should be between 660 and 710mm wide. Races that are too wide or too narrow means the handler is intervening more often which increases the likelihood of injury.

Evans (1986) outlines that the gate on the nearside of the crush is hinged at the head bail end to enable operator access and drafting. Drafting gates in front of a crush should be between 2.4 and 3m wide. A handle on the gate will separate the handler from the animal for safety and for sight. Also the gate should be able to be moved far enough to allow access to the head. Race and gate over head ties that are secure and at a safe working height – a minimum of 2.6m.

For any reasonable size operators (>1000 breeders) a ‘waiting bay’ is required before the crush for speed and veterinarian safety. Crushes are generally made out of square or round hollow-section metal. Pipe in gates should be 38 – 50mm diameter. A rough cleated concrete floor is recommended for regularly used crushes. Minimum height of caps and clearance under slide gate runners should be 2m Evans 1986.

Maximum space between horizontal rails should be 220mm. This is to prevent animals getting their head caught (Evans 1998). To prevent animals kicking through, pipe gates should be blanked with plate steel to a height of 850mm from the ground (Evans 1986).

Crush length should be made according to the average length of the cows on the property. An adjustable backing bar will also help with varying length of animals. For reproductive work in females cows should fit comfortably in the crush with the vet/back kick gate closed and their head NOT caught. When the vet is shutting the back kick/ vet gate, a handler can ‘tease’ the animal forward with an open head bail. Heifers in their first gestation should NOT be able to move freely in the crush if the vet/back kick gate is closed and their head is not caught. Crush length – from the head bail to the rear slide gate should be at least 2m long. Prattley produce the longest crush at 3.53m. The crush roof or upper bars and slide gate rails should be at least 2m high (Evans 1998).

For good easy movement cattle should be able to see at least 6m of unobstructed space beyond the crush (Turner S, Lawrence A and Lowman B 2004). The stanchions (either side of the head bail) should be constructed of round pipe with a minimum diameter of 6.2cm to limit bruising to the animal’s shoulders.

Dr Temple Grandin has found the use of ‘V’ shaped grooves of 2.5cm depth arranged in a 20cm diamond or square pattern is effective to prevent cattle slipping on concrete floors. Dr Grandin has found a similar effect with 2.5cm diameter steel rods raised slightly above the level of a concrete floor.

Dr Temple Grandin recommends an inner curvature race radius of between 3.5 and 6m. Dramatic curves are not necessary to create the illusion of a potential exit to the animals. Indeed work in the USA suggests that curves with a radius below 5m should be avoided. In a curved race design, a straight section may be needed where it leaves the forcing pen to prevent the appearance of a dead end. According to Dr Temple Grandin, the race should be between 6 and 9m long so the race does not appear as a dead end. Ohio State University Extension (2002) suggests making single file race at least 20 feet long. Ohio State University Extension (2002) also suggests that *“although they are harder to build, races with solid, sloping sides are better than those with vertical sides. A general recommendation is to build a five-foot-high race 26 inches wide at the top and 16 inches wide at the bottom. Widths may need to be increased 2 to 4 inches for some large, exotic breeds.”*

Research has shown that boarding the sides of an open race or crush will improve the ease of moving cattle. The inclusion of a toe slot in high-sided solid walls to facilitate escape has been recommended. Alternatively, use a wooden strip fitted 0.6m from the bottom of solid walls as a step ladder for escape. Also a gap of 8cm at the bottom will allow drainage (Turner S, Lawrence A and Lowman B 2004).



Occupational Health and Safety (OHS)

Work safe Victoria (006) has provided safe tips for cattle handlers, including veterinarians, in the yards. The Most important thing is to inspect the yards before using them. There should ideally be at least two people working the yards. Training and supervision of inexperienced employees or contractors, including veterinarians, is essential.

Other safety issues veterinarians and cattle producers should be aware of (Work safe Victoria 2006):

1. Keep cattle and people separate.
2. Keep children away from the cattle yards.
3. Turn off electric fencing off when visitors, including veterinarians are on the property.
4. Employ or generate experienced and trained staff.
5. Sign post areas clearly.
6. Provide adequate lighting.
7. Do not let the pen or crush floor to build up as this reduces the height of the fence.
8. Maintenance is key.
9. Ensure insurance is up to date and appropriate.
10. First aid kits should be readily available.

There are a variety of chemicals used on cattle (Work safe Victoria 2006). Veterinarians should be aware of these and their poisons schedule and be prepared to wear PPE when necessary and also be aware of how the animal will react to the chemical being administered. Cattle may have a chemical administered by a farm employee at the same time as the vet is performing a procedure. If veterinarians are not familiar with the chemical being used, they should read the label on the container. The farmer should also have a material safety data sheet (MSDS) available for the vet to scan. Prior to the vet visit, the vet and farmer should have an agreement that staff will be trained as needed while the vet is there, for example safe handling of cattle; correct administration of chemicals; regularly using new needles and syringes; ensuring the 'gun' used for administering chemicals is cleaned appropriately before starting and it is calibrated; wearing of PPE to minimize chemical exposure; prevention of zoonotic diseases e.t.c .

Chemicals are generally used in cattle for one of the following reasons (Work safe Victoria 2006):

1. Prevention and treatment of diseases
2. Treatment of wounds
3. Control and treatment of internal and external parasites
4. Control of oestrus and preparation for artificial breeding
5. Storage of the semen.
6. Growth promotion
7. Pregnancy control
8. Other veterinary procedures

RIRDC (2005) makes the following declaration:

"State OHS Acts are similar in all states in that they lay down the responsibilities of key parties involved in reducing risk of injury and illness associated with work:

- *Consultation with workers to implement OHS program*

- *Provision of a safe working environment*
- *Organisation of safe systems of work*
- *Maintenance of work areas, machinery and equipment in a safe condition*
- *Ensuring safe use, handling, storage and transport of plant and hazardous substances*
- *Assessment of health and safety risks to employees and others in the workplace, and institution of effective risk control measures*
- *Provision of adequate information, induction, instruction, training and supervision to employees*
- *Provision of adequate facilities for the welfare of workers.*

According to RIRDC (2005) employees (including contractors such as veterinarians) also have responsibilities. Workers etc must take reasonable care of the health and safety of themselves and others, and cooperate with management in its efforts to comply with occupational health and safety requirements. Employers and self-employed persons must ensure the health and safety of people visiting or working at their places of work, who are not their employees, by not exposing them to risk, this includes contractors. Similarly, Manufacturers, designers and suppliers of plant and substances for use by people at work must make sure that they are safe and without risks to health when properly used. They must also supply adequate information to ensure safe use.

Further, according to RIRDC (2005) the key processes that must be set in place to manage OHS risk are:

1. Involve your workers or clients – *Consultation*

For example regular meetings or formal discussions and clear commitment by ‘person in charge’ to safety.

2. Look for unsafe conditions and unsafe practice – *Hazard identification*

Hazard identification should be ongoing and carried out at least annually. When systems are changed, e.g. the vet makes a visit, all workers, contractors, visitors should be actively encouraged to report anything considered hazardous.

3. For each hazard consider the likely outcome, *Risk assessment*

Risk associated with each hazard must be assessed in terms of the severity of the potential harm that could occur, and the likelihood that such an outcome could occur.

4. Control risk using the **hierarchy** of control approach – *Risk control*

Risks must be controlled to prevent injury.

a. Elimination of the hazard –Do not perform reproductive assessment in bulls or cows? Use artificial insemination and other artificial reproduction, not bulls as bulls are dangerous. Sell horned and poor temperament cattle. Implement control mating which will make it easier not to handle cows when they have young calves and are protective.

b. Substitution for a hazard of lesser risk, e.g. using Draxxin for treating bovine respiratory disease rather than Micolil which is a greater risk to veterinarians.

c. Isolation of hazard from worker and other engineering controls, e.g. separating cattle and humans; cat walks

d. Administrative controls

- Document of safe operating procedures including minimizing risk
- Organising work in such a way that reduces risk, e.g. handling weaners well so they are easier to handle when they are bigger and potentially more dangerous.
- Giving Safety induction and training to workers, visitors and contractors
- Supervising unskilled workers and providing safety information

5. Personal protective equipment (PPE)

This includes providing helmets for riders of horses and motorcycles / ATV

These guidelines suggest the high order controls in the first instance, with the lower order less effective controls that depend on individual behavior, lower in the list. Best practice in OHS risk management will require a mix of controls for the high risk hazards.

6. Keep a written note of your OHS activity – Record meeting and all activities

Successful businesses invest significantly in OHS in terms of time, money and commitment at all levels. These businesses understand that overall performance of the business benefits from good OHS practice.

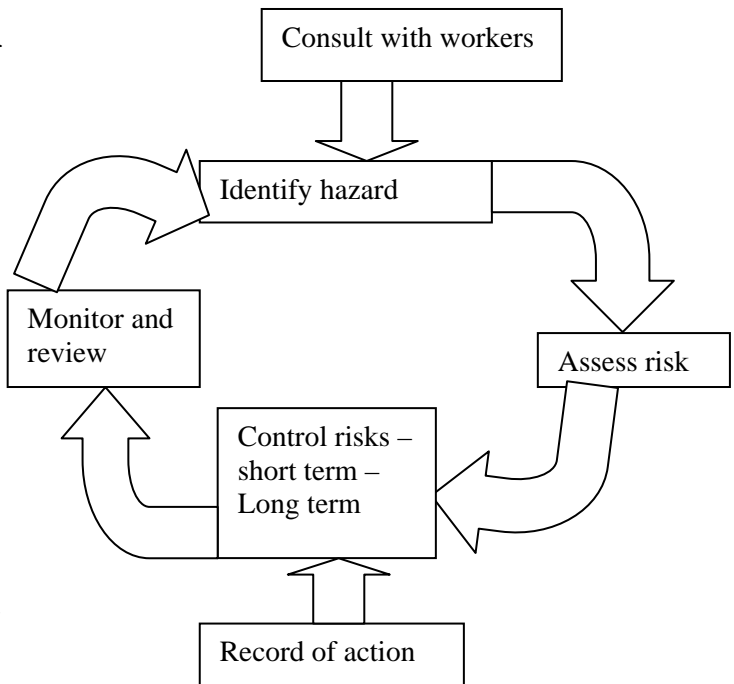
It must be noted that OHS Acts and Regulations require that hazards are identified, risks assessed and controls be based on maintaining a safe system of work. For cattle properties, that includes the design of cattle handling facilities to reduce risk of injury.

RIRDC (2005) defines risk control for hazards and risk in cattle yards as follows:

The comfort and health of animals is directly related to productivity and safety of handlers. The first principle is to design cattle yards, including bails and crushes, for the way cattle behave - providing appearance of clear space ahead to “draw” cattle. The second principle is to design for the safety and ease of work of the people.

Ohio State University Extension (2002) state that “to reduce exposure to a kivistick accident or illness:

- Understand animal behavior
- Provide proper and safe facilities
- Protect against disease by using good sanitation practices
- Wear appropriate attire



Quotes from respected Cattle Veterinarians and livestock handlers in Australia and New Zealand (NZ)

Ginny Dodunski (2009), a dairy and sheep veterinarian from New Zealand, believes “*dairy facilities vary enormously – many of the bigger farms now have the CIA type crush with access from both sides and drop down sides for access to the abdomen on both sides. The most common though is a steel pole race with a too – low head bale at the end and a bar slid behind the cow just in front of the vet gate*”.

Dr Helen Fairnie did a thesis including some major injuries caused by inadequate cattle races. Dr Fairnie(2009) stated that “*some vets got horrendous injuries because farmers ran cattle in on top of them without there being any escape route for them*”.

Tom Newsome (2009), who has extensive experience with cattle crushes, being raised on a cattle property in northern NSW; working for, at that time the biggest cattle company in Australia; and currently being CEO for a com-

pany that provides electronic software to capture data from cattle on properties, livestock selling centres and research projects. Tom's experience suggests that *"the danger is in the head bail, vet gate and rear gate.*

- **Head bail:** ratchet head bails are good in that they hold the beast securely, except where they have worn teeth. The disadvantage of ratchet head bails (CIA) is the noise (causing industrial deafness). The other common mechanism is ram (RPM, Metalcorp) style crushes. These are quiet but can have issues with holding the animal, causing issues with people having to lean on the lever to hold the animal. Ramage engineering (Guyra) have a good head bail that is quiet and reliable.

- The other obvious danger at the head bail is the **lever**, which can rise quickly and hit an unsuspecting person, particularly if it is being operated from the back of the crush. This can also be an issue for a lever at the rear of the crush when being operated from the front.

- The **vet gate** can be dangerous when the locking mechanism does not lock properly when shutting or when a cow is down in the head bail and the operator opens the vet gate- the result is the same as the vet gate flies back and hits the operator. The back gate creates the issue relating to multiple animals getting onto the crush at the same time. There are new crushes where the back gate operates like the head bail and both sides close. I have not seen these but it would make sense that this would be a good idea.

- Mouthing and ear tagging can be dangerous as the **animals head is not secured properly**. I have a design for a chin bar that I have not seen out here but is apparently very good in restricting movement and allowing the operator to mouth or tag effectively. It is a single bar that comes from the lower offside to the upper near side, pinning the head high on the near side for processing".

Braithwaite (2009) who has consistently pregnancy tested or speyed up to 100,000 herd of *Bos indicus* infused cattle in northern Australia annually for the last 20 or so years, has the following statement: *" CIA vet crush is the best and safest crush around hands down. As long as it is the latest model (last 4 years) with the easy to use head bail lever. The modification it needs however is an adjustable height of the back gate d when doing heifers - Black River do modifications on their back gate The length of the crush is good and with the easy to use head bail lever can accommodate any size animal . In addition any one can operate it - had a Swedish girl at Miranda Downs cattle property last year do 6000 heifers in a 6 day session. Scales underneath are easy to accommodate. Even the basic models without the squeeze are good to use, I would stake my reputation on them . Next are the RPM -a distant second. Don't be fooled in recommending a Breckon-are unsafe and too physically exhausting if you are lucky enough to have to work the back gate as well as pregnancy test. I have gone off air/hydraulic operated head bails - can be cruel to cattle. I would opt to spend the head bail money on a manual CIA with a 6 way pneumatic draft instead.*

Morgan (2009) gives some great opinions from the Australian dairy industry:

"There is a range of handling facilities we get exposed to and some are better than others. Surprisingly there are many dairy operations that do not have any appropriate crush or handling facilities beyond the stall the cow is milked in. There are numerous brands of crush available with various feature. There are also a range of home grown units ranging from a simple head bale with a locked pipe thru to homemade copies of the commercial crushes. Also in some farms with feed alleys there are locked head stalls at the feed face. These are not very robust but enable the cow to be trapped for examination / palpation at the feed alley. There are the mobile handling units available also. We own a WOPA trailer, which is a light mobile crush designed for doing foot work on dairy cows. There are details on WOPA on the web, they originate in Holland. We also work inartificial insemination (AI) races that are capable of containing 10-30 cows in a run for palpations."

Alex Leonard, an experienced cattle man that has worked with cattle of varying breed and temperament from northern to southern Queensland has the following statement about cattle and yards: *"It shouldbe noted that excessive focus on 'work, health and safety' aspects of cattle handling facilities have taken the focus away from the main influencing factor on the welfare of livestock and workers, that is stockmanship or cattle handling ability. A good stockman can safely processs cattle through a poorly designed facility."*

According to Matthews (2009), a veterinary student from James Cook University and an experienced cattle handler, a cattle crush "is the primary piece of animal restraint within cattle yards. When handling cattlein a cattle crush it is advisable to have the animal restrained using the head bail at the front of the crush. This then restrains the animals to prevent them from moving forward or backward during any procedures. To also prevent this movement it is advisable to utilise a kick gate or if one is not fitted a bar across the rear of the animal to prevent it from moving or kicking the examiner during any treatment that may be taking place at the rear of the animal. It is also ideal to utilise side gates (if they are available) when working on the side of an animal through the use of the drop down Spey and flank access gate at the top or via the split bottom access gate. When these restraint options are not sufficient or the facilities for them are not adequate, it is always best to employ the use of ropes. For instance if a beast is inclined to throw its head around it is best to apply a halter to the animal to

hold the animals head in position, another option to this is the application of a pair of nose grips, which are useful for examination of the dentition of cattle. Other rope options can include the Reuff's or Burley method of casting. These methods are essentially useful if surgery is to be performed on the animal, particularly abdominal surgery where the tying up of the hind leg is essential to control the animal."

Fig Practical application of Burley's Method (Matthews 2009)



References

- ACC Think safe (2009) How to design better cattle yards. ACC Work safe (NZ)
- Australian Cattle Veterinarians (ACV) (2006) Survey on Bail Injuries. *Email circulation to all members plus publication in quarterly newsletter, The Australian Cattle Veterinarian.*
- Bradshaw I (2009) *pers comm.*
- Braithwaite I (2009) tmbwaite@bigpond.com Mt Isa veterinarian, Australia *pers comm.*
- Carr A (2009) twocarrs@iprimus.com.au Australian veterinarian *pers comm.*
- Lane C, Powell R, White B, and Glass S (2009) Evaluate Your Beef Cattle Handling Facilities. SP693. University of Tennessee Institute of Agriculture, U.S
- Cupples J (2006 and 2009) Farmsafe Qld. *pers comm.*
- Dodunski V (2009) Gimmy@totallyvets.co.nz *pers comm* dairy veterinarian NZ
- Evans M (1998) HANDLING THE HERD. The complete guide to cattle yard design and modification. *Kondinin Group Publication*, PO Box 913, Cloverdale, Western Australia, 6105. Supported by Rural Research and Development Corporation (RIRDC) pp 103-123.
- Evans P (1986) CATTLE YARDS: design, material and construction. *Queensland Department of Primary Industries Information Series; Q186014.* Veterinary crushes and Head bails pp 43-55
- Fairnie H (2009) h.fairnie@curtin.edu.au *pers comm.* Western Australian veterinarian
- Farmsafe Queensland (2009) Managing Farm Workplace Health and Safety – Feedlot Cattle Induction Area. *Cattle Induction Facilities audit sheet.*
- Farmsafe Queensland (2009ab) Managing Farm Health and Safety/ Hazard Checklist . *Cattle Yards audit sheets*
- Fisher EK (1976) Concepts of method of restraint of cattle necessary for veterinary procedures. *Control and Therapy Series, Post Graduate Foundation in Veterinary Science of the University of Sydney*, Volume 3, 413
- Fordyce G (2007) Cattle veterinary crushes – time to get them safe and effective. *Pers comm.*
- Fritschi L et al (2006) Injury in Australian veterinarians. *Occupational Medicine*, 56: 199 - 203
- Grandin T (2009) Beef cattle behaviour. www.grandin.com.au *pers comm.*
- Health and Safety Executive (HSE) UK (2006) Safe cattle handling equipment. Leaflet from www.hse.gov.uk/agriculture
- Healthy Feet Project (2009) Full Risk Assessment. www.cattle-lameness.org.uk
- Jones T - Cambac JMA Research (2009) Handling Cattle at Abattoir and Markets. Print out from Humane Slaughter Association info@hsa.org.uk
- Lawson, Lennon and Cullinan (2006) Kondinin Group puts the squeeze on crushes. *Farming Ahead*, 168 48 - 63
- Leohard A (2009) "Pinehurst" Condamine 4416 *pers comm.*

- Matthews J (2009) Animal Handling Report Cattle. Report done for 1st year Veterinary Science at James Cook University.
- Morgan (2009) bill@tvg.com.au *pers comm*. Well recognized dairy veterinarian from Victoria, Australia.
- Newsome T (2009) tom@outcross.com.au *pers comm*. CEO Outcross, Inverell NSW, AUSTRALIA
- Ohio State University Extension (2002) Beef Quality Assurance Cattle Handling and Working Facilities. Bulletin 906
Ohio State University Extension
- Rural Industries R&D Corporation (August 2005) Safe Cattle Handling – A Practical Guide.
- Stewart R (2009) *pers comm*. Stockyards Inc NZ
- Stroud P and Walsh A (1997) Manual handling of live animals: An ergonomic investigation. Health and Safety Executive. Her Majesty's Stationary Office, London.
- Turner S (2006) Design of beef cattle handling facilities. Improving safety, efficiency and animal welfare. Scottish Agricultural College website – www.sac.uk/knowledge/livestock/examples/beefcattlehandling
- Turner S (2004a) Recommendations for the design of new, safe and efficient cattle handling systems. *SAC Technical note 565*.
- Turner S (2004b) Modifying existing cattle handling systems to improve human safety. *SAC Technical note 564*.
- Turner S, Lawrence A and Lowman B (2004) Handling Beef Cattle: Identifying Research needs and knowledge transfer opportunities to improve human safety and animal welfare. *S.A.C. and the Scottish Executive* simon.turner@sac.ac.uk
- Turner S and Riddell I (2004) Designing safe and efficient beef handling facilities – a case study of Strathisla Farm. *Information note SAC*
- Work Safe and State Government Vic (2006) Beef Cattle Handling: Practical Safety Guide