Recommendations for the design of new, safe and efficient cattle handling systems

Technical Note

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SUMMARY

- **Constructing a new handling system is a major and long-term investment and it pays to design the system correctly from the start.**
- **Human and animal safety, and the efficiency of movement are maximised by encouraging the calm movement of animals**
- **Several basic principles are outlined which encourage cattle to remain calm and suggestions are made on how these principles can be designed into a new system.**

The value of planning

Investing in a new handling system is a major commitment and design faults will either have to be corrected at a later date or contended with for the life of the system. Spending time at the outset developing a safe and efficient design appropriate to your needs is therefore easily justified. As the ease and safety of handling depends largely on how well the behaviour of the animal is exploited, the starting point in the design process should be understanding what features encourage calm movement. Uptake of information on the principles of animal behaviour therefore has a significant role to play in facilitating cattle handling.

Incorporating basic design features which encourage calm movement

The basic principles of successful design which make maximum use of cattle behaviour to promote calm movement are the same irrespective of the scale or the purpose for which the facilities are required. Many of these principles are routinely incorporated into designs used in other cattle-producing countries. A survey of 139 Scottish beef farmers conducted by SAC suggests that many handling facilities currently in use in this country do not take advantage of these principles. The principles include:

Use of curves

Research in the USA has shown that cattle are less hesitant when moving along a curved than a straight sided race. A curved forcing pen also funnels cattle into a race more efficiently than a straight-sided forcing pen.

Minimising visual disturbance

Sheeting the sides of a forcing pen, race and crush has been shown to speed cattle movement by eliminating visual disturbances caused by nearby cattle and handlers. It can also help to eliminate intermittent shadows cast by open hurdles which cattle tend to investigate before crossing.

Eliminating sharp bends

Cattle often perceive 90^0 corners as dead-ends. The exit from a pen into a lane should be angled gradually, and some suggestions on how this can be achieved are described below.

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Preventing the opportunity for escape

The construction of long, narrow pens makes it easier for cattle to be moved through the exit without attempting to escape past the handler. Overly large, wide pens should be avoided, as should the temptation to use large forcing pens. Escape from the race can also be prevented by the use of blocking gates positioned at intervals along its length.

Correct handler position

Cattle move forward most willingly when the handler is located 45-60^0 back from the animal's shoulder[1]. Designs which encourage the handler to adopt this position are beneficial, particularly when moving cattle along a race.

Slip-resistant floor surfaces

Slipping during handling is a common cause of injury to both handlers and cattle and causes cattle to hesitate when walking. Floors should provide adequate grip, particularly at bends and in high-traffic areas.

Design suggestions

In the following paragraphs, suggestions will be made on how these principles can be incorporated into the design of new permanent handling systems. Figure 1 provides an overview of how the various components of a system can be orientated.

Location

Around 80% of yard-based permanent handling facilities in Scotland incorporate some feature of a pre-existing building in their design, usually to form one side of a race or pen. Whilst there are obvious benefits in placing the handling system in the most convenient location, this can severely constrain the design and it may be more appropriate to install a less constrained design at a different location and improve access to the site. Consideration should also be given to slope angle. Adequate drainage of the site is necessary but inclines greater than 5% should be avoided. Cattle have an aversion to descending slopes during handling. Consequently, the slope aspect should require cattle to move up hill from the forcing pen to the crush.

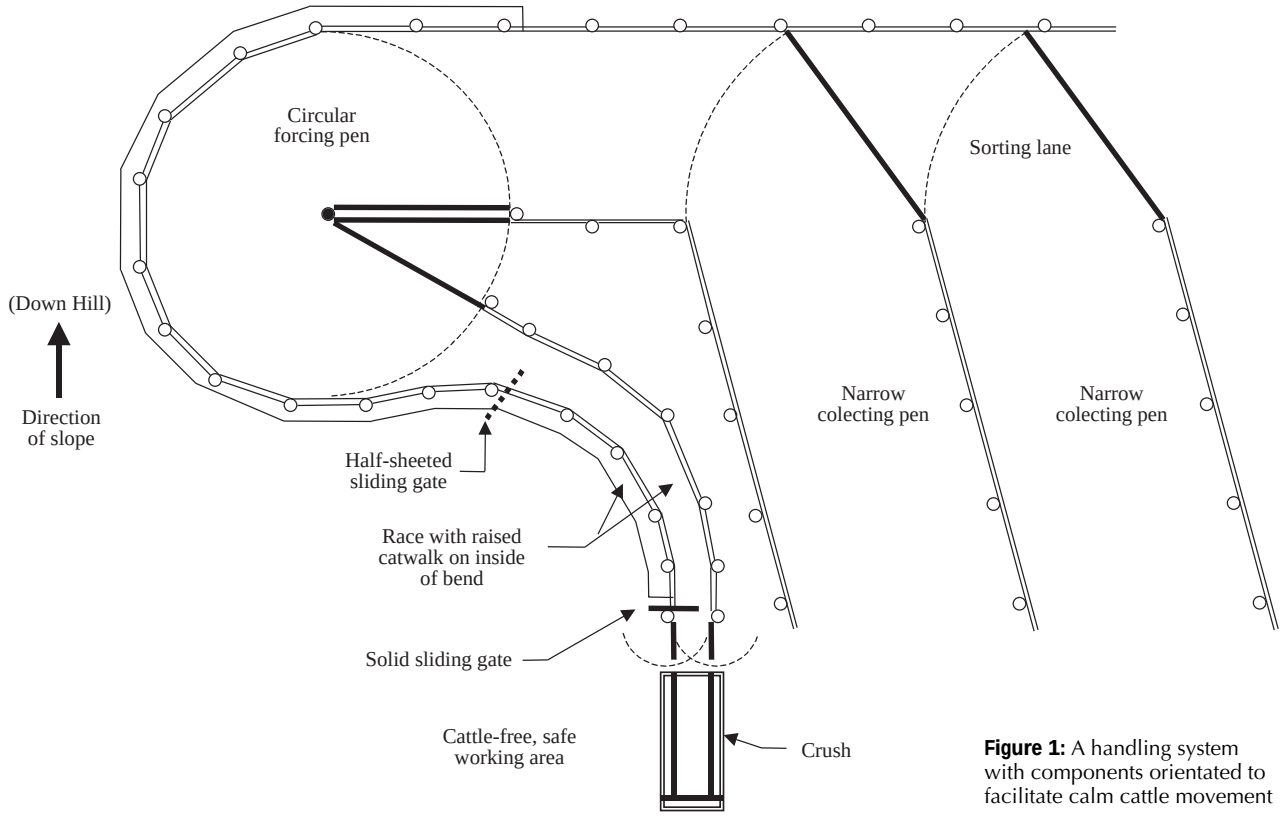

Figure 1: A handling system with components orientated to facilitate calm cattle movement

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Collecting pen

The most common criticism of collecting pens is their excessive width. Although they are more costly to construct, it is easier to handle cattle in two long rectangular collecting pens rather than one large square one where there is greater opportunity for the animals to escape past the handler. Recommendations from the USA suggest that each pen should hold around 30 cows, be around 15m long and 3.5-4.0m wide. Additional space may be required for large European breeds and when holding cows with calves. When collecting pens are set perpendicularly to the exit lane, a sharp 90^0 corner is created. This may appear as a dead-end, as in Figure 2. Where possible, the collecting pens should be set on a more gentle angle, as in Figure 1. If the exit lane is narrower than the collecting pen, a long exit gate can be used to further reduce the angle and guide cattle into the lane (Figure 1).

Figure 2: Collecting pens set at 90^0 to the exit lane may appear as a dead end

Forcing pen

Cattle move more slowly through straight-edged forcing pens. However, if a straight edged design is required to fit into an existing confined yard layout, one side should be flush with the race and the other should angle towards the race entrance at 30^0 (Figure 4). Whatever plan of forcing pen is adopted, a sharp angle between the exit from the forcing pen and the entrance to the race should be avoided or the efficiency of movement will be reduced. Furthermore, any gate used to close the entrance to the race should be barred, not solid, to encourage animals to face in the correct direction whilst waiting in the forcing pen.

The combination of a curved race and circular forcing pen, both with sheeted sides, has been shown by work in Australia[2] 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 at any one time. This requires a 3m long forcing gate. A large gap between the forcing gate and the ground should be avoided as this has been identified as a cause of fatal injuries to calves which attempt to escape. Additionally, the forcing gate should be solid to prevent animals attempting to retreat and should be fitted with an automatically catching non-return latch to prevent it from being pressed back against the handler (Figure 3).

Figure 3: A curved forcing pen with holes for a spring loaded pin to prevent accidental movement of the forcing gate.

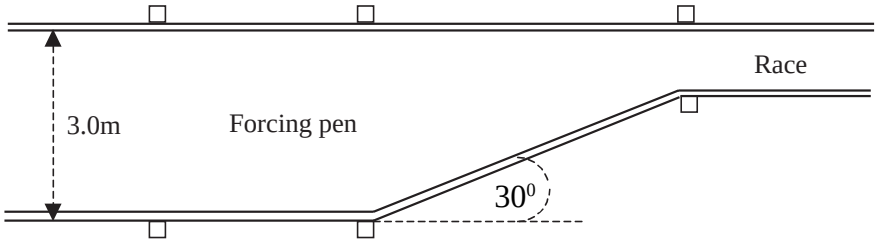

Figure 4: A straight-sided forcing pen with one wall converging at an angle of 30^0

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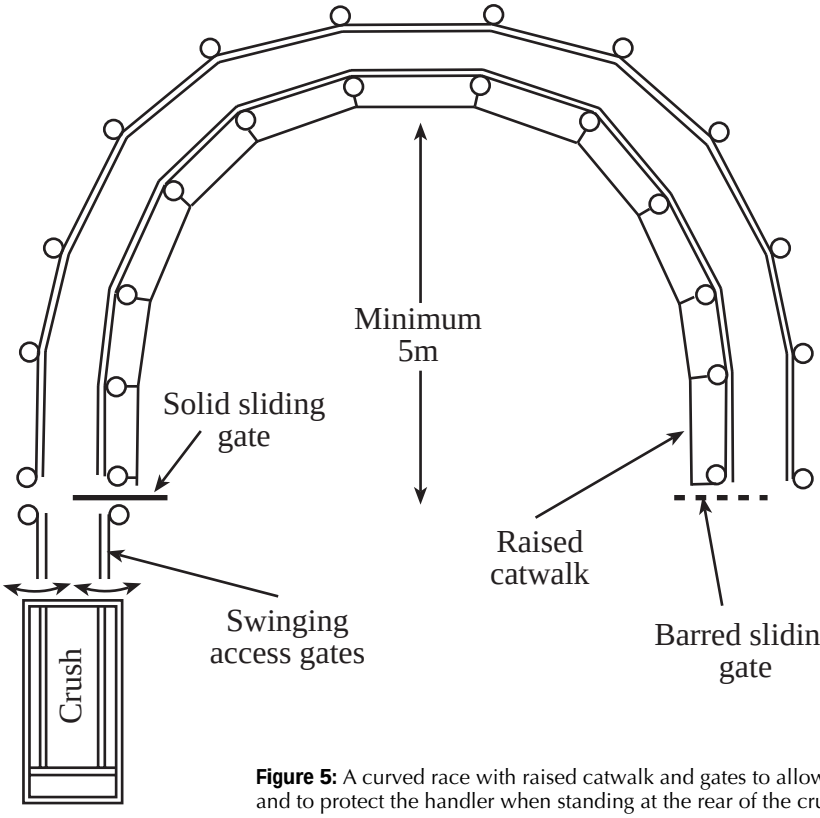

Figure 5: A curved race with raised catwalk and gates to allow access and to protect the handler when standing at the rear of the crush.

Race

The benefits of a curved and sheeted race have been mentioned above. Dramatic curves are not necessary to create the illusion of a potential exit to the animal. Indeed work in the USA suggests that curves with a radius below 5m should be avoided[1]. Using standard straight hurdles to create a gentle curve is perfectly acceptable, although bolting flexible sheeting onto a curved frame probably encourages the most efficient movement. 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. The sides of the race should be higher than typically used in the UK. For British breeds a height of 1.52m has been recommended, increasing to 1.67-1.83m for continental breeds. This height limits the animal's ability to see out of the race and prevents disturbance from nearby cattle and humans. A parallel raised walkway located on the inside radius of the curve will allow the handler to move cattle safely and will encourage them to stand at the correct position with respect to the animal (Figure 6).

Figure 6: Raised catwalks are necessary with high sided sheeted races

In the survey of Scottish producers conducted by SAC, the greatest handling difficulty associated with races was the tendency of cattle to turn around whilst in them. The race should be 40 mm wider than the largest animal which will enter it, equating to 660-710 mm for adult cows and 510 mm for calves in a straight sided race. When the race is to be used to handle cattle of varying weights, it should ideally be tapered into a 'V' shape, either for its full height or for its lower half only, as common in the USA

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and Australia. The use of side panels which can be released rapidly are popular in the USA to free animals which become trapped in tapered races, but add further to the cost of construction and maintenance. When handling calves, a calf race should be constructed alongside the main race which would alleviate many of the problems associated with race systems. Where a separate race is not feasible, a low cost method of reducing the width of a race for handling calves is the use of inserts which narrow the width by 150 mm and hang over one wall.

Crush

A cattle-free safe working area should be designated around the crush to prevent damage to equipment and injury from loose cattle. Standing behind cattle to force them into crushes places the handler at risk of crush and kick injuries. To encourage entry, cattle should be able to see at least 6m of unobstructed space beyond the crush and space should be provided to allow handlers to stand clear of the front of the crush. Additionally, it should be possible for a handler to operate the head yoke whilst standing at the rear of the crush. Flighty animals are more willing to enter a crush if the sides are covered, thereby preventing sight of the handler alongside[3]. The use of solid sides also reduces the risk of an animal's leg becoming trapped between the crush supports. The operation of steel crushes is typically noisy, which cattle find aversive. When selecting a crush, consideration should be given to quiet operation. Consideration should also be given to ease of access to the animal's body. The sheeted sides of a solid-walled crush should open along its full length to allow unobstructed access and there should be a minimum number of frame supports against which a hand or arm may be trapped.

Sorting gate

Sorting gates located after the crush should be around 3m long to offer a gentle angle to cattle exiting the crush. In order to prevent the handler from standing directly in front of the animal during operation, the sorting gate should be controlled by a lever attached with a universal joint.

Loading ramp

The critical angle at which cattle start to slip on solid flooring is 22^0. Where the tailgates of transporters are lowered directly onto the ground, as common in the UK, the ramp angle frequently exceeds this value. This problem could be rectified by building a raised platform only 0.5m high with the aim of creating a ramp with a maximum angle of 15^0 (1 in 3.54). Steps are preferable to the use of raised cleats as animals tend to slip from cleat to cleat. The stairs should have a minimum horizontal width of 400 mm and have a deeply grooved tread pattern.

Where the ramp is to be used for unloading, a horizontal docking area approximately 1.5m long will prevent cattle from slipping as they step out of the transporter. For both loading and unloading, a self-aligning buffer should be used to eliminate the gap between the ramp and the transporter. Adjustable gates can also be slid into position against the rear of the transporter.

It is not advisable to build a loading ramp wider than the vehicles likely to use it. Where the width has to be adjustable, the use of a long gate hinged from one side of the loading ramp may be used to create a gentle funnel (Figure 7). Gates orientated at 90^0 to the direction of cattle movement are likely to disrupt the flow of animals and cause bruising.

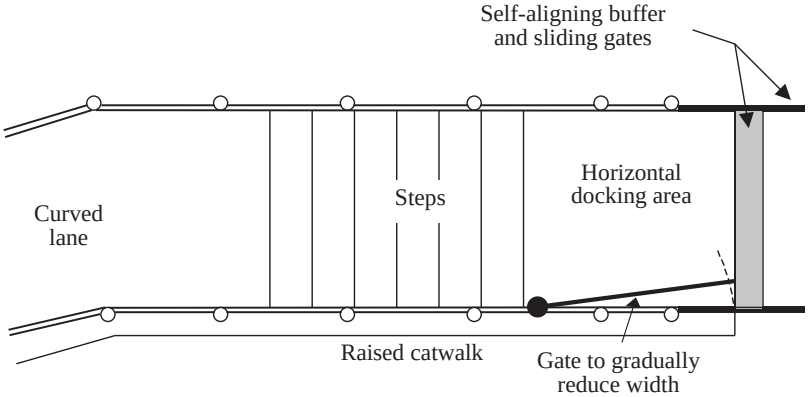

Figure 7: Suggestions for the design of a loading/unloading ramp

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As ramps which sound hollow cause cattle to hesitate, they should be constructed of a material which is unlikely to echo or move when walked on. Movement towards the ramp can also be encouraged by using a curved lane and solid fences of 1.52-1.83m height, depending on the breed of cattle handled.

Conclusions – weighing up the costs and benefits

Adoption of the principles outlined above may incur greater construction costs and require slightly more space than a conventional system. Some of these costs may be minimised by using mass-produced equipment, such as straight hurdles to create a curved race. On the other hand, a highly expensive handling system may function poorly if it does not obey some of these principles and fights against cattle behaviour. The costs of incorporating the principles outlined above must be offset against less easily quantifiable economic benefits. These include the labour savings, reduction in bruising and other cattle injuries and improvements in human safety likely to accrue over the many years that the system will be used. Many studies have also shown that cattle which do not become stressed during handling achieve a higher growth rate than those which do. The costs of constructing a new handling system should be viewed in light of these potential long-term benefits.

Further information

Recommendations for the design of handling facilities can be obtained from your local SAC Farm Business Service Office. Recommendations for the modification of existing handing facilities are also provided in Technical Note number TN 564 (TITLE: *Modifying existing beef handling systems to improve human safety*).

Further information on the use of cattle behaviour to aid movement, based on experience in the US beef inductry, is provided on Dr Temple Grandin's website: www.grandin.com

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