

DESIGN OF ANIMAL HANDLING SYSTEMS TO REDUCE STRESS

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INTRODUCTION

A well designed lairage, unloading ramp and races can help reduce stress in cattle, pigs and sheep. Animals which move through a system easily are less likely to become excited or stressed. Excitement prior to slaughter and the excessive use of electric prods is detrimental to pigs, (Hedrick 1965) (Grandin 1980a) (Calkins et al) (Van Putten & Elshof 1978). When strange animals are mixed they fight to determine a new social order. Stress from fighting and mixing in the lairage can produce either PSE or DFD meat in pigs or DFD meat in cattle or sheep, (Tennessee 1980) (Grandin 1980a) (Moss & Robb 1978) (Puolanne & Aalto 1981). Tethering and resting cattle reduced the incidence of DFD meat (Puolanne & Aalto 1981). In the large cattle producing countries such as the U.S.A. and Australia, tethering and individual penning is impossible. When cattle or sheep have to be held in group lairage pens, stress problems can be reduced by designing pens to hold truck load groups and truck compartment groups. For pigs each group pen should hold one farm fattening group in order to avoid mixing strange pigs. In large U.S.A. slaughter plants where this is not practical each pen should hold one truck load. The use of long narrow holding pens may help reduce stress. Kilgour (1976) reported that bulls spread out and fought less in a rectangular pen. Observations indicate that cattle and pigs prefer to lie along the fences (Grandin 1980b) (Stricklin 1979). A narrow pen maximizes fence line length in relation to floor area. Animals in a long narrow pen utilize available floor more efficiently. Another advantage of long narrow pens is that they provide a smooth traffic pattern. The animals enter through one end of the pen and leave through the other.

MATERIALS AND METHODS

Observations were conducted by the author in over 100 cattle, pig and sheep slaughter plants in the U.S.A., Australia, Canada and New Zealand. In many of the plants the author actually worked with the employees in order to gain a more complete understanding. The author also designed new handling facilities and then made observations and worked in the new systems.

RESULTS AND DISCUSSION

Observations, practical experience and a literature review (Grandin 1980abc) (Braathen 1980) (Kilgour 1971) indicated the basic principles which will facilitate the movement of cattle, pigs and sheep through the lairage and stunning area.

1. Install solid fences on single file races, unloading ramps, and crowding pens. The crowding pen gate should also be solid to prevent the animals from turning back towards the crowding gate instead of facing the entrance to the single file race. Solid fences prevent animals from seeing distractions with their wide angle vision, (Fig. 1).

2. Encourage following behavior by constructing sliding and oneway gates which are located in the single file race out of expanded steel. This permits approaching animals to see other animals through the gates.

3. Install shields and remote control gates to prevent approaching animals from seeing motion and people ahead of them.

4. The crowd pen which leads to the single file stunning race must have a level floor, except for a small drainage slope. A sloped floor in the crowd pen can cause injuries and pile ups. A level floor equal to the length of one animal should be installed if a ramp is used in the following locations: top of the unloading ramp, and in the first section of single file race where it joins the crowding pen. The level areas help prevent balking, slipping and falling down. At the entrance to a cattle stunning pen or conveyor restrainer install a section of single file race with a level floor which is equal to the length of one animal. For sheep and pigs the restrainer and the ramp may be built on the same angle. If the angle of the ramp is steeper than the angle of the restrainer conveyor, install a section of single file race at the restrainer entrance which is equal to the length of one animal. It should be on the same angle as the restrainer conveyor.

5. Animals move up hill more readily than downhill.

6. Reduce noise as much as possible because it is stressful to animals (Falconer & Hetzel 1964). Air cylinder exhausts should be muffled and use welded steel construction instead of bolted steel. Pad clanging gates with rubber.

7. Provide even lighting and eliminate shadows and bright spots. Animals will also balk at flapping or moving objects. Illuminate the entrances of the single file races and stunning pens with lamps. Position the lamps so they illuminate the area but do NOT shine into the eyes of approaching animals. Confinement raised pigs will often balk and refuse to approach bright sunlight.

8. Use long narrow pens to hold animals which are held in groups in the lairage. Install the pens on a 60 degree angle to eliminate corners and promote animal movement. Fig. 2 illustrates a beef lairage and race system. Each pen holds one U.S.A. truck load of 45 to 48 head of 453kg steers.

9. NEVER install the wall that separates the lairage from the slaughter hall at the junction between the single file race and the crowd pen. This mistake will cause SERIOUS BALKING problems. The single file race must extend at least the length of one animal beyond the wall or the entire crowd pen and single file race should

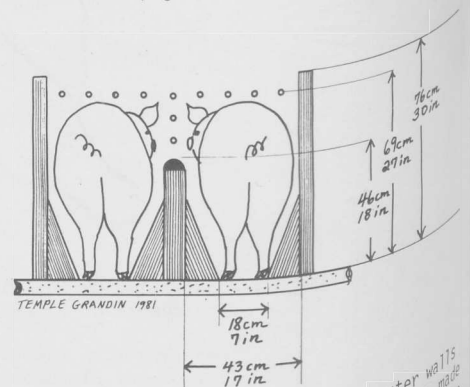


Fig. 1. Double single file race. The outer walls are solid and the inner partition is made from bars to encourage following behavior.

be behind the wall.

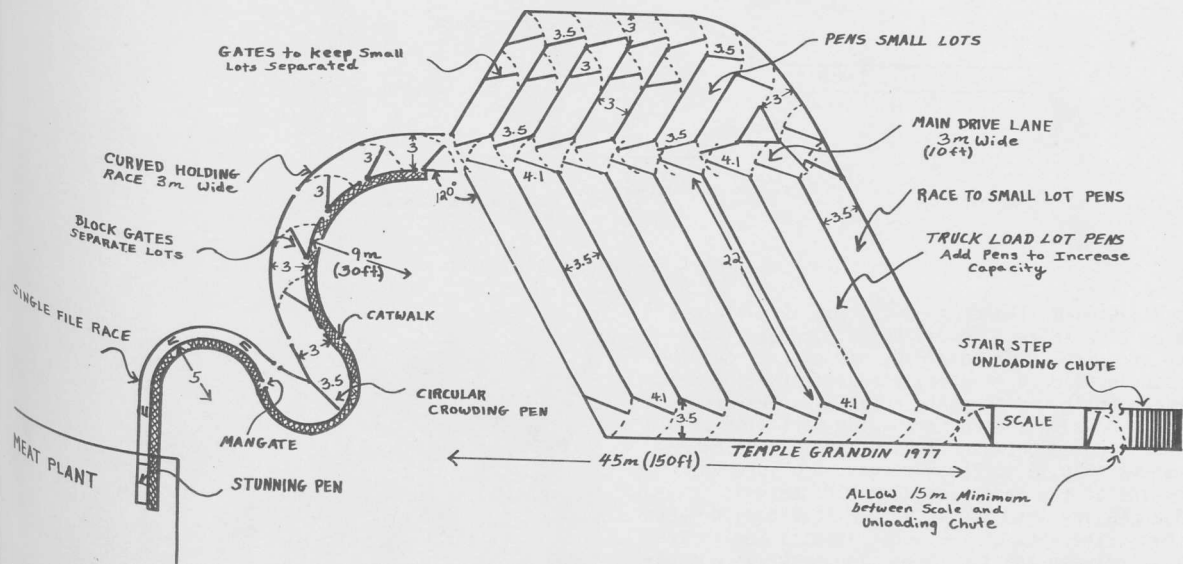


Fig. 2. Beef lairage and race layout utilizing narrow diagonal pens on a 60 degree angle, curved races and a round crowd pen.

10. Use a wide unloading ramp to provide the animals with a clear unimpeded exit from the truck.

Cattle and Sheep Recommendations

Use curved single file races to the stunning area. The handlers should work along the inner radius to take advantage of the animal's natural tendency to circle around the handler. Avoid the use of overhead walkways, the handler should work along side the single file race and crowd pen. To encourage following behavior single file races should be 6 to 15m long. Single file races for cattle should be 20-50 head/ hour= 15m; for sheep 22m; 100 head/hour= 30m. For 100 head per hour build two 15m single file races side by side. For cattle the maximum ramp slope for unloading or going to the stunning area is 20 degrees. Build ramps with stairs with a 10cm rise and a 30cm tread width. For sheep the maximum ramp angle for unloading from the truck is 30 degrees. The maximum ramp angle to the stunning area is 30 degrees. Crowding pens for sheep and cattle should have one straight side and one side on a 30 degree angle (Fig. 3). NEVER use this design for pigs.

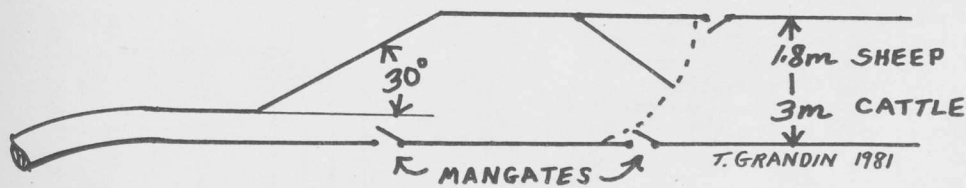


Fig. 3. Funnel crowd pen for cattle and sheep. DO NOT use for pigs. The crowd pen is 3m wide for cattle and 1.8m wide for sheep.

Fig. 2 illustrates a 3m wide curved race which is used for holding and moving groups of animals to the round crowding pen. The round crowding pen assists in the movement of cattle into the single file race. For sheep, remove the round crowding in Fig. 2 and replace it with the crowding pen shown in Fig. 3. The 3m wide curved race should gradually narrow down to the 1.8m width of the sheep crowding pen. The single file race should continue curving in the same direction as the wide 3m curved race. The basic layout utilizing the narrow pens on a 60 degree angle works well with cattle, pigs or sheep.

Pig Recommendations

For pigs, the single file race may be either straight or curved. Curved races provide no advantage for pigs, except as a method for eliminating corners. Bunching up and jamming at the single file race entrance is a serious problem in many slaughter plants. Hoenderken (1976) reported that replacing the funnel crowd pen with a stairstep design reduced jamming problems. The stairstep crowding pen starts with a race which is one pig's width wide and then graduates to two pig's width wide and then three pig's width wide. The principle is to allow one pig to step aside to allow another pig to enter the single file race. Several slaughter plant owners with stairstep crowding pens have improved them by rounding off the corners of the stairsteps or replacing quarter circles with a 43cm radius. This prevents the pigs from lingering in the stairsteps. The quarter circles were superior to both the funnel and stairstep crowd pen designs. Fig. 4 illustrates a modified single stairstep crowd pen equipped with a roller. Another good design is a single quarter circle which is equal to the width of one pig. 600 or more pigs per hour can be moved through Fig.4.

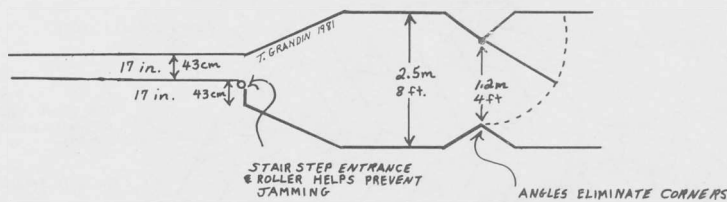


Fig. 4. Simple crowd pen with a single staircase

A double single file race consisting of two races side by side is recommended for slaughter plants which process 500 or more pigs per hour. Providing two single file races greatly reduces the incidence of pigs jamming in the entrance. To further reduce jamming, a wedge shaped triangular partition should be installed in between the two single file race entrances (Fig. 5.). The wedge is 66cm long and 25cm wide at the base. The 25cm wide base is installed facing into the crowd pen towards approaching pigs. The apex of the wedge is attached to the post in between the two races. The wedge is approximately half the width of a pig. It prevents the third or fourth pig from jamming the double entrance. A double single file race should have a minimum length of 6m but the optimum length is 7.4 to 10.5m. If a single race is used it should be 7.4 to 10.5m long in order to encourage following behavior.

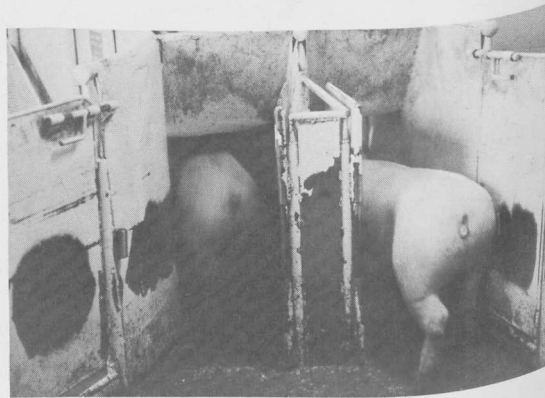


Fig. 5. A triangular partition which is half the width of one pig prevents jamming at the double single file race entrance.

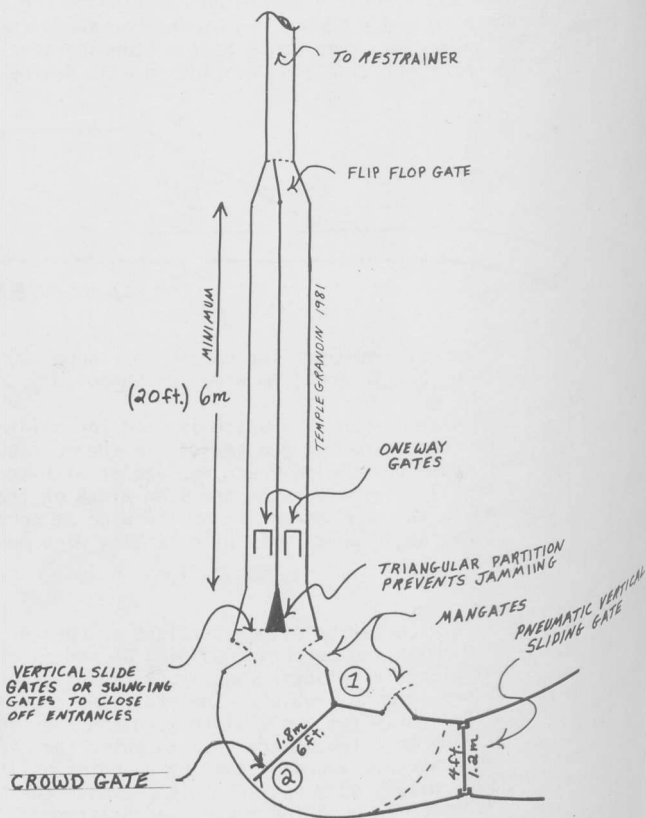
A maximum of 25 pigs should be put in the crowding pen at a time. A major cause of pile ups and injuries to many pigs in the crowd pen. Problems also occur if the handler attempts to push a large group of pigs from the rear instead of moving the leaders.

Fig. 6. Six hundred pigs per hour can be easily handled by one person in this layout.

Figure 0.28m² of space for each 90kg pig in the crowding pen. Figs. 6 and 7. illustrate crowding pens and double race systems which will fit into most slaughter plants. In Fig. 6. the handler stands in Position 1. while the crowding pen is being filled. From this position he can reach both the leaders and the pigs in the rear of the group. As the crowding pen empties the handler steps through the mangate and swings the crowd gate around until he is standing in Position 2. (Fig. 8.).

In Fig. 7. the handler stands inside the crowding pen and makes the pigs circle the fence. He should NEVER push them from the rear of the group. It is recommended to use vertical sliding gates with remote controls to admit the pigs into the crowding pen. This avoids the problem of swinging a gate out into the next group of animals. There should be a staging area adjacent to the crowding pen. It should hold one to two crowd pen loads of pigs. Pigs will sometimes refuse to enter the crowding pen directly from the big lairage pens. This is why the staging area is recommended.

Ramps should be avoided if possible in pig handling systems. A pig's heartrate increases as the angle of the ramp increases (Van Putten & Elshof 1978). The maximum angle for pig unloading or loading ramps is 20 degrees. The maximum angle for a ramp leading to the conveyor restrainer is 10 to 15 degrees. Pigs have been observed tipping over backwards when left standing in steeper single file ramps..



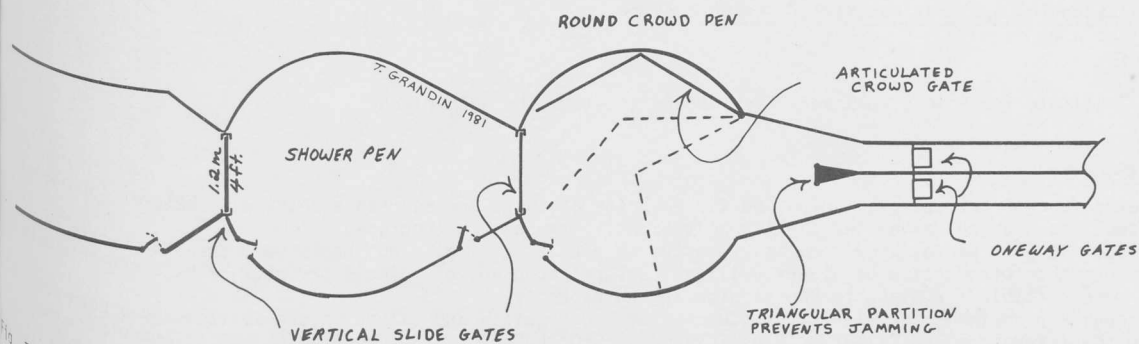


Fig. 7. Round crowding pen layout with double single file races. The round pens eliminate corners where pigs can bunch up.

Trials with a cleated rubber conveyor installed on the floor of the single file race to the restrainer indicated that it may help reduce the usage of electric prods. Moving or "jogging" the conveyor belt approximately 30cm would start the pigs moving when they were standing still. Attempts to operate the conveyor continuously were not successful and resulted in jamming the race. The use of a noncleated smoother conveyor belt may reduce the jamming problem. The use of wide conveyors as a "prodding" device was successful. Slow moving conveyors which move slowly in the alleys could possibly be practical for moving groups of pigs. Preslaughter crowding gates are used in many European slaughter plants to move pigs out of the lairage pens and into the alley.

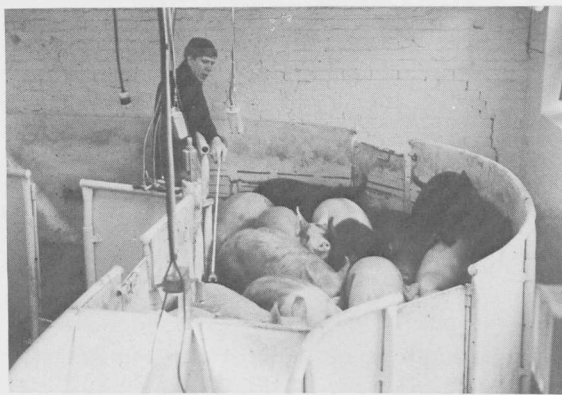


Fig. 8. The handler can easily reach and move the leaders in this round crowding pen.

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