

Turning Loose on Sow Housing

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■ Introduction

The VIDO Swine Technical Group produces informational resources for pork producers. These resources can be in the form of factsheets, booklets, presentations and producer surveys in printed form or at our website www.VIDO.org. Primarily, our information reflects the discussions of experiences gained in production management and best management practices on a range of topics of importance to commercial pork producers, including disease management, housing, feeding and handling pigs.

This workshop is the accumulative knowledge of our members on the subject of alternative sow housing, and the barn design, management, equipment and renovation ideas that work, or don't. We will discuss the two most common methods of managing sows in groups; using electronic sow feeders, and using floor feeding. Other methods using free access stalls, cafeteria system, and biofixation feeding stalls will be explored in less detail since our members have less personal experience managing these systems. Our objective is to assemble a review on each type of housing so that pork producers considering a change will know what challenges await them, and how others have solved problems to achieve excellent results.

■ Loose Housing with Electronic Sow Feeding

Electronic sow feeding (ESF) has been in existence for over twenty years, and is now widely used in Europe, as the EU move to a total ban on conventional stalls by 2013. In the UK, deep straw based systems are the most popular, whereas in the rest of Europe solid floor/slatted floor designs predominate

using varying levels of straw. EU legislation is in place that requires that all systems should allow sows access to some form of roughage on a daily basis.

Mechanics of ESF

A schematic of an electronic sow feeder is shown in **Figure 1**.

Figure 1. Mechanics of an electronic sow feeder (ESF).



Each sow carries a unique identification in an Electronic Identification Tag (EID) in her ear. When the sow enters the feeder, a motion detector mounted on the rear entry gate will close the gate behind her. As the sow starts nosing around the feed trough, an antenna on the rear of the trough door “reads” the EID tag, relays the information on that sow to the central computer, and the trough door is opened.

Feed and water are dispensed automatically in small portions until the pre-programmed daily amount for that sow is reached. At that point the trough door closes, and the sow cannot access any further feed. The sow will then move through the exit gate (spring loaded) beside the feeder, back into the loafing area. The rear entry gate will then re-open to allow the next sow to enter. In most systems, compressed air drives the actuators that operate the entry gate, feed trough door, and feed delivery system. A solenoid valve controls water flow.

The computer controlling these processes can be programmed to vary the timings of all the events outlined above, and can be programmed to deliver two different types of feed on different feed curves for the duration of gestation. Sows that do not finish all their feed at one visit may return and eat the balance of their daily allowance later in the day. Sows that do not feed at all, or only partially feed, are listed on a daily printout, so staff may look for an animal that maybe sick or lame, or possibly have lost her EID tag.

Practical experience

In 2001, Alberta Pig Company decided to build a 2600 sow unit utilizing loose housing, and following that unit, in 2004, a parity-segregated gilt production unit with a capacity of 1800 gilts and sows. The final design showing the layout and crosssection are shown in **Figures 2 and 3**.

Figure 2. ESF pen layout

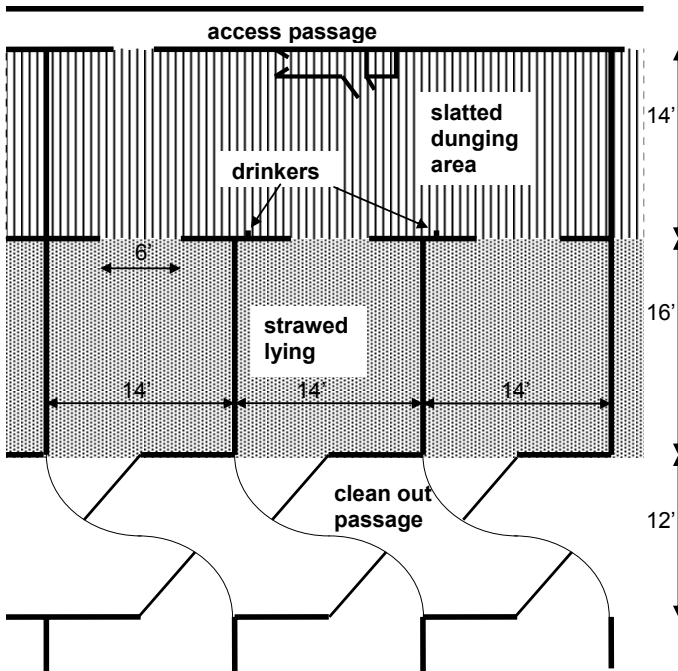
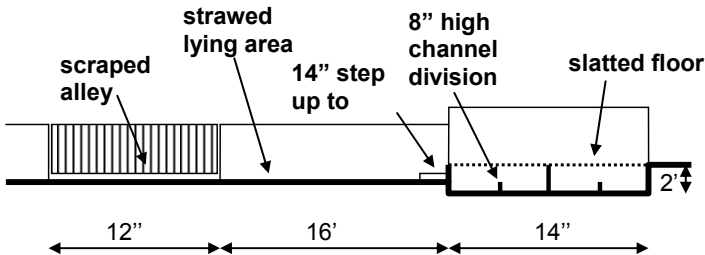


Figure 3. Crossection of ESF pens



Design criteria

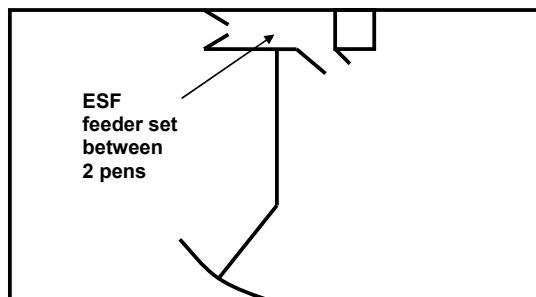
- Before entering the ESF pens, sows are held in stalls from weaning to 28 days pregnant
- Sows moved to the ESF pens which hold 65-70 sows each from 28 days to point of farrowing.
- Manure is on a straw based system
- Pens for boars, and hospital pens for lame and sick sows withdrawn from the group pens

We settled on a combination of stalls and group housed pens because:

- Stalls give the individual attention and housing during the critical periods of post weaning, post breeding, and early fetal development. It also gave the advantage of putting known pregnant females into the group-housed pens.
- By having a “static” group (i.e. no additions to the group after entry), there is no continuing aggression, by comparison to a dynamic group where additions and removals are made weekly.
- ESF is the only loose housed system that allows true individual feeding
- 65-70 sows in a group maximizes the use of the expensive ESF feeder
- A straw based system gives greater comfort to the sows over a concrete only system.
- Straw gut fill increases contentment, and reduces aggression
- Straw increases gut capacity and helps with lactation feed intake
- The availability of hospital pens is more important in a loose housed system as the sows have neither food nor water immediately in front of them, as in a stalled system, and need to be separated from the group quickly to aid recovery

Gilt introduction and training

Figure 4: Gilt training pen



At 175 days of age, selected gilts are given two weeks exposure to boars whilst in the gilt receiving area. Spindle penning, ad-lib feeding, groups of 17 gilts, and three hours exposure to boars/day aims to encourage estrus.

Training of the animals caused considerable problems in the early days. We thought that we should operate the feeder in its totally automatic mode-that is the rear gate should open and close automatically, and the feed trough should be opened by the EID tag in the gilt's ear and close automatically when she left the feed station.

This approach seemed correct, but too large a proportion of gilts were afraid of the enclosed feeder, and the noises of the actuators opening and closing. In turn, this meant taking a list from the computer showing which gilts had not eaten the previous day, identifying them in the pen, and then maneuvering them into the feeder, and waiting for them to eat. This was a labour intensive and time consuming task often not enjoyed by the gilt, and certainly not by staff who undertook it!

Over time we learned that in the initial training period of one week, we would hold the gilts in one half of the pen, leave the entry gate open, the feed trough door open, and even part of the exit gate open. In this way gilts could investigate the feeder, feed if they wished or go straight through to the empty side of the pen.

The process of returning them to the entry gate side of the pen is now repeated two or three times per day. This has dramatically reduced the number of gilts that have to be "pushed through" the feeder to about 10% - 15% of the original number.

Gilt breeding

After training is complete, gilts are heat detected twice-daily using V-boars that are taken into the pen. Gilts found to stand to the boar are removed to a stall in the AM, are bred the PM and the following AM and PM. Gilts that are found standing in the afternoon are removed to a stall, bred the following AM and PM and the day after. Average age at breeding is 210-220 days, with a body weight target of 135kg.

After pregnancy testing, gilts are moved in groups of 70 to the gestation pen, where most of them face a fully automated ESF for the first time. We believe that with our current training program the reason that we have so few to push through the feeders is that the gilts are confident, and do not fear the feeder or the noises that it now makes. Gilts are pregnancy-tested again at 10 weeks and vaccinated at 12 and 14 weeks, all whilst loose.

The layout of each pen is for three strawed lying areas, with a fully slatted dunging/loafing area to the front. The lying area is 14" below slat level to allow for bedding material to increase in depth over time, and reduce its dispersal over the slats. Each sleeping area is cleaned out after the gilts are moved out to farrow, and a single round bale is placed in each sleeping area for the new batch. Thereafter each week a bale is split between each of the three sleeping areas to top up the bedding, so each gilt pregnancy uses approximately $\frac{1}{4}$ of a bale.

Table 1. Design Parameters for Loose Sow Housing

Statistics	Lewisville	Paradise Valley (gilts only)
Lying area, sq. ft.	13.7	9.4
Dunging area, sq. ft.	7.0	8.2
Total pen area/sow, sq. ft.	20.7	17.6
Total including passages, sq. ft.	24.0	22.5
No of sows/drinker	22	18
Straw usage/pregnancy	$\frac{1}{4}$ round bale	$\frac{1}{4}$ round bale
Slat size	5" with $\frac{3}{4}$ slot	5" with $\frac{3}{4}$ slot
Labour in breeding	+20%	+20%

Table 2. Sow Production in Loose Housing, to end of August 2007, for 3 Farms

	Paradise Valley Gilts only	Lewisville	Poundmaker conventional stalls
Born alive/litter	11.5	12.5	12.2
Farrowing %	87	87	90
Weaned/sow/year	Gilts only	27.3	26.9

Manure Management

Muck disposal is carried out using a Bobcat in each of the farms, with the muck being carried to the end of the building by the Bobcat to an external loading out area. The load out area is emptied using a tractor, which has no

access to the pig area. Straw is brought to the external loading out area by the tractor, and distributed to the pens by the Bobcat.

Where slats are combined with straw there is the choice of sluicing recycled slurry or a scraper system. Under the slats are two sets of paired channels, which can be sluiced down every second day using pumped recycled slurry from within the gestation area. This system works well only if routine sluicing is carried out because the channels that run parallel to the sleeping area will block with straw. Scrapers can be used, but if a scraper cable breaks under the slats, it can be a major undertaking to repair.

Non straw or low straw ESF systems

When considering these systems it is important to remember that EU legislation is already in effect that straw/roughage must be available to sows on a daily basis. A recent EU wide survey of consumers found that 87% of consumers said that imported meat should come from farms that had the same welfare standards as those in their own countries. Whilst there is no legislation contemplated in North America on the use of straw, it is likely going to become an issue with retailers and consumers in the future.

Low straw systems are commonly used in Europe, and most combine solid floor lying areas and slatted dunging areas. The buildings are insulated, and some will have under-floor heating in the lying areas, depending on regional temperatures. **Figures 5 and 6** show two examples of low straw systems – a dynamic system and a static system.

Figure 5. Dynamic system

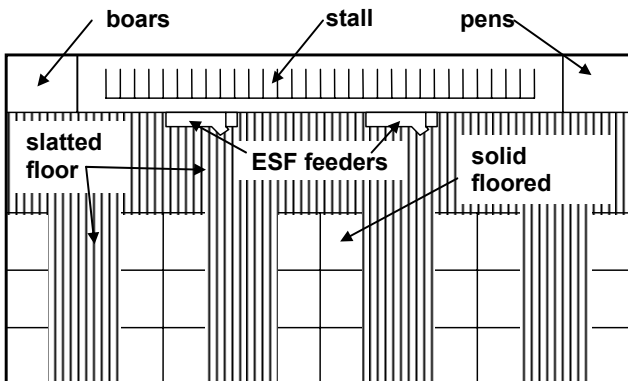
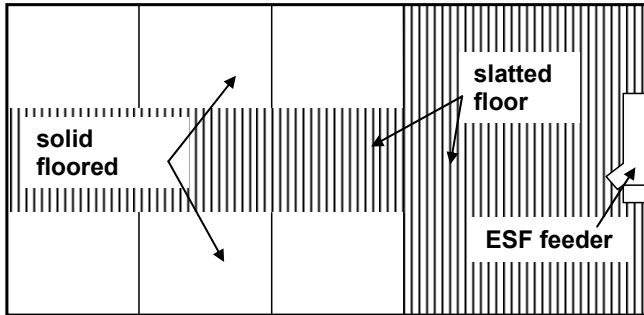


Figure 6. Static system

An initial choice must be made between having “dynamic groups” where bred sows are added to the group each week or “static groups” where the group is all in the same stage of pregnancy and stay together for the duration of their pregnancy. As each feeder can only accommodate a maximum of 70 sows, producers with less than 700 sows are likely to choose the dynamic group system in order to maximize the use of each feeder. Those with larger herds will be able to use the static system.

Strengths and weaknesses

Strengths

- Sows do remain productive for longer, because muscle tone is maintained, and % born dead is reduced. Sow longevity is only improved if the gilt is well reared.
- Apart from aggression at entry to the group pen, there is little subsequent fighting.
- Sows can be individually fed according to condition and size.
- Minimal feed wastage
- Sows are more docile and easily handled.
- Staff prefer working in the loose housed environment
- Output on our ESF farms is equal to, or greater than our stalled units

Weaknesses

- Single large lying area means sows dung in lying area (straw based.)
- The system requires a higher degree of stockmanship and attention to detail than for a stalled unit.
- It is more labour intensive (+20% in breeding area in a straw based system)

- The mechanics of ESF are complex and require competency with computer software, and electronics.
- Wiring must be well protected from the elements, especially mice in a straw based system.
- At present most ESF manufacturers are European, and whilst their products are tried and tested, their representation in Canada can be limited, resulting in a lack of service and/or spare parts.
- Bio-security can be compromised by the use of straw bedding.

Reliability/Durability/Flexibility

Feed stations servicing 70 sows are probably visited 200 plus times a day. Construction has to be rugged. With nearly 60 feed stations between our two ESF farms, we have learned that active preventative maintenance is important, and just because there are no alarms from the central computer, does not mean that daily inspection can be ignored.

Air line leaks, actuator seals wearing out and feed dispensers sticking are the most frequent problems, but are easily remedied with a little experience. Electrical problems are often difficult to diagnose, and will need an experienced technician to advise or visit. The steelwork on our feed stations has generally stood up well, with the exception of the springs on the exit gates, which were a weakness of the design.

Conversion from an existing conventional sow stall system to ESF would not be as easy as conversion to some of the other systems because of the very different pen configuration that is required for ESF. Many producers who have built ESF have done so with new facilities, and converted their old sow accommodation into additional farrowing, nursery or finishing accommodation.

Summary Electronic Sow Feeder

ESF is a proven method of loose housing of sows, which has been under development over the last twenty plus years, mainly in Europe. It provides a substantial improvement in welfare to the sows under good management, if management pays attention to the details. Productivity figures can be equal to or better than those of stalled units.

The system, however, is more labour intensive, and is reliant on complex electronic and mechanical parts, which need to be well protected against a hostile environment, mice in particular. Special care should be taken in choosing an equipment supplier who has adequate technical back up, and spare parts availability.

■ Group Pens with Floor Feeding and Liquid Manure

History of group pens

Group pens were used after the move to liquid manure and before the move to stalls (during the 1960's and early 1970's). Most often, there were only 4 to 6 sows per pen in sow herds of 50 to 100 sows (1 to 2 weeks of farrowings). Fighting and variable condition of sows was common and lead to the widespread adoption of stalls for dry sows.

In the 1990's, the 3 site production system was introduced. Many 100 sow farrow to finish operations were converted to a 400 sow farrowing only. As an economical conversion, the finishing area was used for late gestation dry sows with only modest modifications while the existing stalls were used for early gestation until the sows were pregnancy checked.

These systems usually performed much better than the group pens did 25 years previously. The larger number of sows in a group (now 12 to 20) meant more room for sows to get away from aggressive pen mates. And delaying the mixing of sows until they were confirmed pregnant, led to larger litters and fewer lost litters.

Options for floor fed group pens

Figures 7 to 10 show options for group pens with floor feeding. These layouts progress from a simple rectangular plan to more complex designs.

Figure 7. Simple pen layout

- Similar to conventional slatted floored pens
- Feed dropped on solid floor from overhead auger
- No added protection for sows from fighting

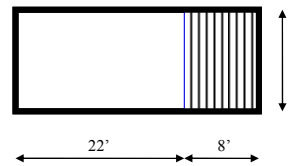


Figure 8. Pen with half walls

- Layout adds short stub walls extending out from front of pen & side walls
- Creates 4 feeding zones to reduce conflict at feeding
- Also adds more wall length for sows to lie against

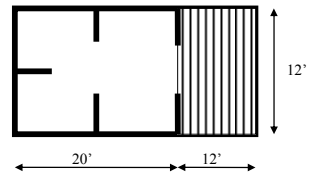


Figure 9. Pen with central wall

- Central wall provides some visual protection for sows
- Wall stands alone in the pen to avoid dead ends for sow fleeing aggressors
- Central wall can be a piece of rubber belting hanging from ceiling which would be softer and may lead to less injury than a concrete barrier
- Could be only 1 or 2 pens in the room like this used only immediately after mixing and then sows are moved to the simple pen style

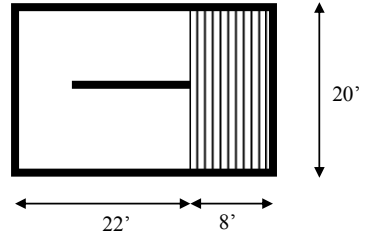
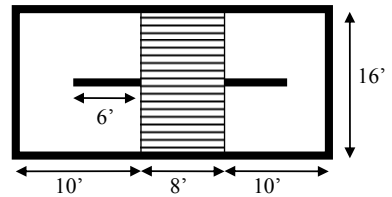


Figure 10. Pen with slats in middle with 2 central walls

- Slats in middle of pen with feeding floors at either end
- Central wall added to both feeding areas to split up both as well as add wall length
- Feed not dropped simultaneously but on one end first to attract the aggressive sows
- Non-aggressive sows hold back and then go to other end when feed drops 15 seconds later
- Natural separation of aggressive from non-aggressive sows



Floor slopes

Floor fed sows generally stay clean because of the floor feeding. Floor must be sloped towards slats to get urine to drain off quickly. If liquids should puddle, it will encourage dunging on solid floor. Floors should slope 5%. A step down to the slatted area of 2" will encourage manure to stay on slats

Slatted floors

Figures 11 and 12 shows slat details that are important for dry sows in pens. 8' of slatted floor width is a good width to keep sows clean. Any less and there will be some risk of manure on the solid floor. Slot width should be $\frac{3}{4}$ ". The top portion of slat should be straight to avoid chipping off.

Figure 11. Concrete slats for dry sows

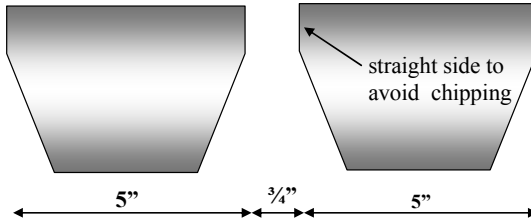
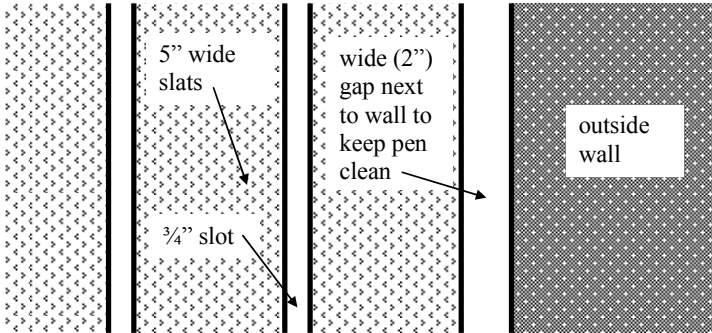


Figure 12. Concrete slat details



The slatted floor at the end of the pen next to outside wall is prone to manure build-up. Sows feet miss this area and manure does not get tramped down. An extra wide gap (2") between last slat and the wall will keep this area cleaner. This requires that the slat panels are placed parallel to walls and supported on cross beams. This wide gap has not proven to be a hazard for sows in getting their legs caught.

Area for sows

In practice, the area per sow has varied between 16 sq. ft. to 30 sq. ft. per sow. A large feeding floor reduces competition for feed. However, too large a lying area leads to dunging on the solid floor. Common practice has been to allow 12 sq.ft. to 15 sq. ft. of feeding/lying floor.

Feeding and waterers

Feed is delivered to pens with a flex auger or a chain and button feeder which fill volumetric drop feeders. Maximizing the area that the feed is spread over

will reduce fighting at feeding time. This will most often require 2 feed lines. Increasing the spread can involve adding a feed line, adding more drops or adding elbows to the end of selected drops to redirect the feed horizontally. All feed drops are set to the average amount of feed required per feeding. One or two drops per pen are adjusted for the variation in number of sows in pen.

Headroom for the movement of people working in the pen can be an issue depending on the height of the feed lines. If so, leaving the centerline of the pen from the front to the back of the feeding floor clear of drops will make it easier to walk the pens.

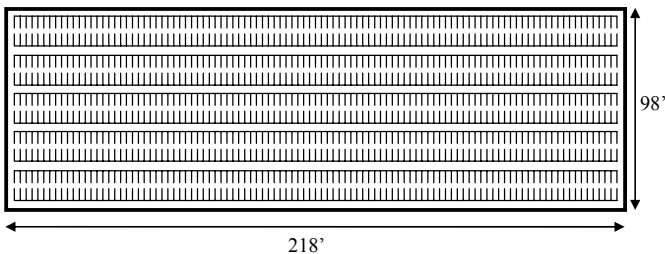
Some operations have installed time clocks on their feed lines and are dropping feed up to 8 times per day. The objective of this is to reduce aggression at feeding time.

Waterers are set over the slatted area. One waterer per 10 sows is most common.

Renovation of an existing stall barn

How might an existing stall barn be renovated to group pens with floor feeding? The barn as shown in **Figure 13** below presently has 1020 stalls in 10 rows with 6 feed alleys and 5 manure (or back) alleys.

Figure 13. Layout of an existing 1020 dry sow barn



Assumptions made:

The following assumptions were made for the purposes of this renovation plan:

- The renovated barn will hold the same number of sows as the stall barn
- To keep the renovation costs to a minimum, the least amount of work would be done, i.e. no changes to the existing gutter layout, the existing slatted floor will be used, and the existing solid floors will be capped only to smooth them out.

- There will be 12 weeks worth of farrowing sows in this barn. Sows are held in a separate breeding room until checked pregnant.
- The herd operates on a twice-weekly schedule. Therefore, twice a week there is a group of roughly 41 sows out of this room to the farrowing rooms and replaced with another group of pregnancy checked sows from the breeding room. The incoming group needs 2 pens to allow for sorting of the sows into large sows and smaller sows. This being the case, there needs to be $2 \times 2 \times 12 = 48$ pens in the room.
- The existing feed lines and drops will be used although not necessarily all of them. The feed lines may be moved laterally if necessary.
- The alleys should be 5' wide for ease of moving large groups of sows

Layout

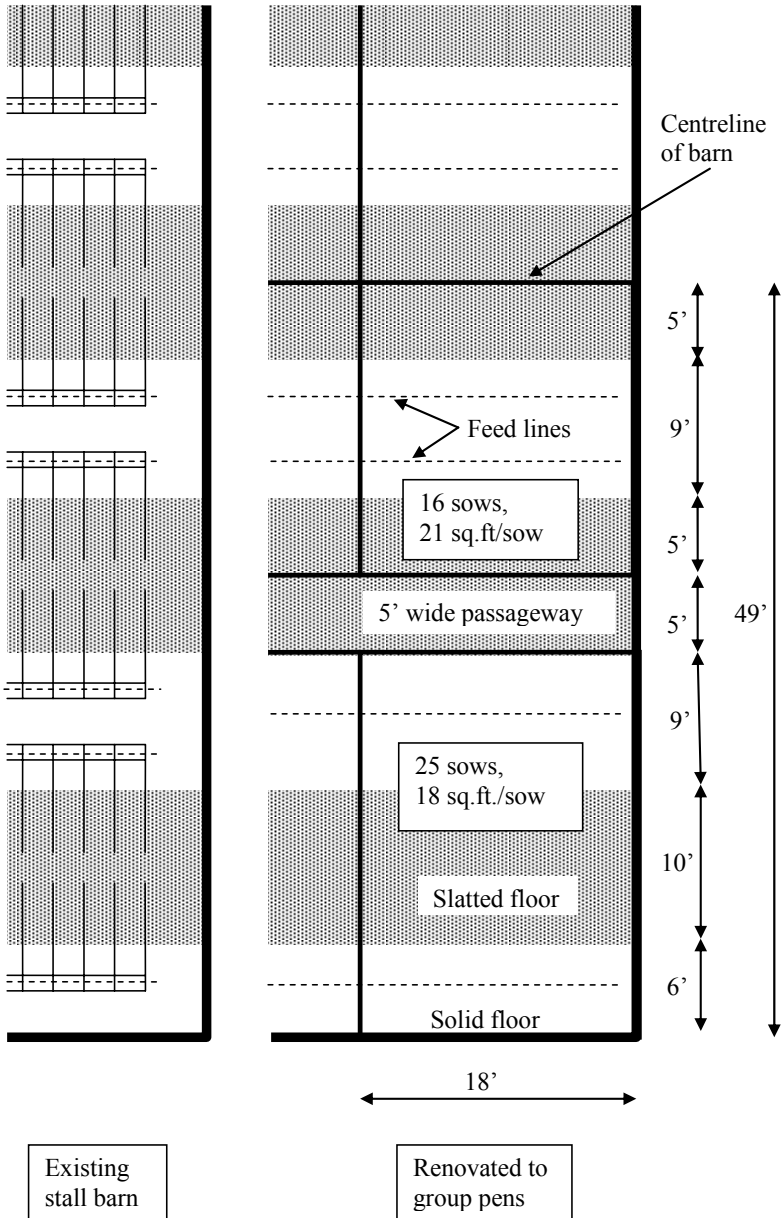
Figure 14 shows the conversion of the 1020 stall barn and was developed using the above assumptions. The partial diagram on the left is of the existing barn and on the right how it would look after renovating.

Figure 14 shows 2 pens which would be filled with 1 group of 41 sows. These 2 pen styles are repeated 24 times in the room. They are of different sizes, one holding 25 sows and the other 16 sows. They provide slightly different square footage per sow since the holding capacity of the pens was based on the solid area in the pens rather than the total area. The solid area provides approximately 10.25 sq. ft./sow of feeding and lying area. One set of pens has slats down the middle with feeding floors on either end. The other set has the feeding floor in the middle with slats at either end.

Challenges

There are 2 details which are likely to be the most troublesome in renovating this barn economically. The first is achieving a smooth and crowned solid floor in the pens for feeding and sleeping. The details of the cross section of the existing troughs and the materials used (plastic pipe – both smooth and corrugated outer surface, concrete, clay tile, stainless steel) will vary from barn to barn. Do the troughs need to come out to level up the floor or can they be concreted over? Will concrete adhere to the troughs if they are left in? If not, how hard are the troughs to remove? Ideally, this area should end up crowned in the centre to allow liquids to run off and will have a modest step down onto the slats.

Figure 14 Conversion of a 1020 head stall barn to a group housing barn



The other area of concern will be the slats themselves. Some barns have slats with uniform slot widths which should also work well in a group pen situation. Other slats may have some extra wide slots at the back end of the crate to facilitate cleaning of the larger chunks of dry manure. These wide slots could prove to be a hazard if left in the group pens. An assessment of the slats as to whether they will be satisfactory for the sows in a group situation will have to be made with care. Replacement of some or all of the slatted floors will add significantly to the costs.

Feeding lines will to be modified slightly. Two of the 10 feed lines in the barn will be removed. Half of the feed drops will be eliminated so there is one feed drop for every 2 sows. Feed drops may also be relocated down the length of the line so that they are closer to the outside pen partitions. This will create a passage in the centre of the pens for the operators to move freely across the length of the pen. Any extraneous materials (rods, etc) on the bottom of the feed drops will be removed to increase head room. This should be a fairly simple modification.

The solid floor area is a little small. The pens with solid floors at both ends (slats in the middle) provide a natural separation of the feeding into 2 areas. In the other pens with only one feeding floor, it may be worthwhile considering adding some type of dividing walls on solid floor to reduce competition at feeding time. Some have added walls in the form of an X on top of the solid floor to create 4 feeding zones and it has worked quite well. These have been of concrete but as noted earlier (see Figure 9) rubber belting hung from the ceiling is a possibility.

The ventilation is the final point. Consideration will need to be given to whether the inlets are properly located so as not to create draft in the solid areas of the pen. If not, consideration will have to be given to moving the inlets.

One of the attractions of considering this simple renovation (as opposed to a complete remake of this barn) is that it is quite possible to do it in stages. If a group of 8 pens were added each week, the job would be completed over a 6 week period with only a reduction of 10 % in the size of the sow herd during renovations.

Summary Group Pens with Floor Feeding and Liquid Manure

Group pens for housing dry sows have been far less popular than stalls for the past 30 years. However, there have been a number of producers who have used group pens more successfully, than the early experiences in the 60's and 70's. There are a number of layouts that can be considered as shown in the first several diagrams. As more producers consider group housing, there will be a lot of consideration given to modifying existing stall barns. It may be

possible to do this economically, as shown by this example. The major challenges will be in the details of the existing solid floor as to whether it can easily be smoothed out and the suitability of the slats that are presently in place.

■ Conclusions

The two most popular options, their strengths /weaknesses and the design alterations to improve best management practices have been described. In addition, the other systems introduced in the beginning of the paper would offer additional options, these may be found on our website at www.VIDO.org and following the links to 'information for producers'.