



Considerations for Large Group Housing of Finishing Pigs

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Executive Summary

Composition of the VIDO Swine Technical Group

The VIDO Swine Technical Group is a unique association of people directly involved in the swine industry who voluntarily give their time and expertise in a wide variety of specialty disciplines. The members of the group change from time to time, and have included hog producers, veterinarians, agricultural economists, agricultural engineers, nutritionists, farm extension workers and VIDO research scientists.

Goals

The objective of the Swine Technical Group is to investigate and discuss some of the production challenges which relate to management and affect the profitability of hog production. These discussions have led to targeted research projects and development of a variety of education materials for swine producers.

Project

Many questions have been asked about facility design and management of grower/finisher hogs in large groups. This document provides a practical evaluation of the raising of finisher hogs in large groups and encourages further evaluation of the appropriateness of this housing and management strategy for swine production.

Finishing pigs in large groups provides good results in the many weight categories of production. By using a one-way gate and a weigh scale, the pigs will sort themselves daily into categories that are programmed into the scale. A good facility design with good equipment will:

1. Reduce labour associated with weighing pigs
2. Increase the number of pigs marketed in the ideal weight range
3. Reduce overall production/operating costs
4. Enhance animal welfare

This document focuses on the parameters of 250 pigs per group on fully slatted floors, with weighing and sorting utilizing an automatic sorting system. Capital cost considerations of facility design and operation, equipment and building cost are considered. Operating costs and labour/skills are reviewed.



I. Introduction

Large group housing of grower/finisher pigs has had a tremendous growth in popularity in recent years due primarily to increases in herd size, available automation in sorting and positive producer experiences with increasing the size of groups. Many questions have been asked about facility design and management of grower/finisher hogs in large groups.

This publication was designed by pork producers, veterinarians, research scientists, extension personnel, and industry suppliers, to provide a one-stop source of the current information available on the subject and an evaluation of current knowledge. Our goal was to develop a checklist approach that pork producers and their advisors could use when evaluating the potential for large group housing on their farm. The document poses the questions any operator should ask before investing in LGH, and where available provides answers and the combined experience of the group.

LGH is still in its infancy, representing only a small but rapidly growing percentage of the finishing hog housing in Canada. As such, our knowledge, gleaned from controlled research studies and pork producer experience, is evolving. This document is designed to evolve with the industry, providing regular updates as the information becomes available. The on-line nature of the document allows for easy updating. For the most recent version, please check the producer's section of the VIDO website: www.vido.org.

II Objectives of Large Group Housing (LGH):

This document is intended to increase awareness with regard to the questions that must be answered when considering construction and operation of large group housing (LGH). It will focus on the following parameters:

1. Group size of 250 or more pigs
2. Weighing and sorting utilizing an auto sorter system
3. Floors that are fully slatted*
4. Reduce labour associated with weighing/handling pigs
5. Increase the number of pigs marketed in the ideal weight range
6. Reduce overall production/operating costs
7. Enhance animal welfare

* Fully Slatted Floors versus Partially Slatted Floors

We fully recognize that producers will consider converting existing partially slatted floor barns to large group housing. Many of the points in this paper can be applied to partially slatted floors. In our final draft we decided that we should maintain the focus on a fully slatted floor system, the most typical system used in Canada for LGH. It was also felt that, except for challenges with dunging patterns, most aspects of fully and partially slatted floors would apply to large group housing.



III Facility Design and Operation

Positives:

- Pigs will have a greater opportunity to choose an appropriate comfort zone within the larger pen layout
- Pigs are able to avoid aggressive pigs
- There is better observation because of less penning and more room to move pigs within the pen
- It is easier for the herds person to move around pens checking pigs and equipment
- The design forces more intimate observation of pigs, feeders and waterers since the operator must physically enter the pen
- Size of groups is flexible
- Specialized handling and weighing areas/rooms within the barn are not required for sorting at market time
- Construction of barn is easier due to less penning being installed
- Initial building cost is lower than conventional pen barn
- Less maintenance because of less equipment and fewer places catching dung
- Ease of managing equipment (for example, feeders can all be located in one area known as the food court; this avoids the need for climbing over pen dividers to check feeders in multiple pens)
- Pig management improves because decisions can be based on real pig weight data as collected by the autosorter

Negatives:

- Air speed may need to be reduced in order to minimize the movement of air under the slats. There is a concern this may increase gas and odour levels in the room, compared to rooms with solid pen dividers used for small groups which buffer air speeds at slat level
- Partially slatted floors are not recommended at this time because of the uncertainty of control of dunging patterns
- Renovation of any room is difficult; dunging patterns are often hard to control and variable
- Differentiation of the pen into eating, dunging and sleeping areas results in uneven distribution of urine and spilled water, possibly resulting in pits not flushing properly and build-up of solids or production of higher ammonia levels

Discussion - Facility Design

If differentiation of eating, dunging and lying areas has caused uneven distribution of urine and spilled drinking water, you may need to add water to specific areas to improve flow in flush gutter. Fully slatted floors can lead to an increase in ammonia over partially slatted floors since there is greater area for evaporation. Alternative slot arrangements could be used to supply some increased solid floor for improved pig comfort. Some research is needed to define ventilation opportunities that can be captured with large group housing. There may be opportunities to create some very specific climate zones



within the large group pens. These specific zones can better meet the variation of temperature needs within the population.

The equation $0.034XBW^{.66} = m^2$ (for full slats) for calculating predicted floor space works well regardless of group size for pigs on fully slatted floors where BW (kg) is the market body weight of the pig. The conversion factor is 10.73 to adjust from square meters to square feet. (Source: Dr. Harold Gonyou, Prairie Swine Centre).

The art is to design a load-out area that is flexible for a variable number of pigs.

If using a feeding area or food court design, the experience of the group is to provide 2.5 sq. ft/pig in this area. This area is designed to be intentionally small so as not to encourage pigs to lie and sleep in the area. (Source: Dr. Gary Parker, University of Kentucky - recommends 25-30% of floor space for feeding)

IV Equipment

Positives:

- Less penning means less maintenance and replacement costs in the future
- Reduced feed system cost and maintenance (i.e. reduced auger length since all feeders can be grouped in one area or at least on one side versus both sides of the barn)
- Reduced water system delivery cost and maintenance (less pipe)
- Reduced cost of ventilation equipment (i.e. may not need re-circulation system with less penning and because the pig chooses the most comfortable area to lie)

Negatives:

- Adds equipment requiring more maintenance - sorter, compressor, scale, and electronics. In addition the system requires the installation of one-way gates from the feeding area to the common area.

Discussion:

It may be easier to achieve good operation of the ventilation system because pigs will find their comfort area. Auto sorters equipped with automatic spray markers could be used to identify pigs that are underweight for the current shipping event but that would probably be acceptable for the next shipping event, making it easier to predict shipping numbers for the next week's shipping. Although the record of equipment performance has been good so far, most sources are less than three years into operation. Note that the sorter used for 500 hogs, making 3-4 trips through the sorter each day, results in the sorter operating 1750 times per day. If operated 365 days a year, this is approximately 640,000 sorting events – the life of the equipment for this level of usage is unknown.

The design of the facility will determine the equipment required. There are two basic forms of LGH management; Event Sort and Continuous Sort.



“Event Sort” - An event sort is a sort that is facilitated by the use of an auto sorter and is initiated by having the barn operator move the pigs towards and through the auto sorter such that all pigs in the large pen group are weighed and sorted. An individual pig will only travel through the sorter once per event. An event sort design requires less capital investment in the actual weighing and sorting equipment because it will sort perhaps as many as 1,000 pigs per sorter rather than 500 in a continuous sort system. (See Appendix, Figure 2)

Continuous Sort” - This is a process that occurs on an ongoing basis and is driven by the natural behaviour of the pig to move from the lying area of the room to the feeding area or watering area. Sorting using the continuous sort system allows separation for market weight, sorting for lights for special treatment, or phase feeding.

The portals that allow the pigs to return to the non-kitchen or resting area must be managed to ensure that they are working properly. If there is some restriction due to a blockage or mechanical failure, there will be a problem with overcrowding in the food court. (See Appendix Figures 1, 2, 3)

A. Equipment used in sorting

i) **Gate:** Return gate design continues to evolve.

Checklist:

- Consider robustness
- Trapping or injuring pigs
- Ease of operation for all weights of pigs
- Ensure that pigs can't use it in reverse
- Potential for bruising near market weight
- Overcrowding in the sorting area could be a major problem.

ii) **Feeder:**

Although we have changed the fundamental layout of the pen there is no indication to believe that feeder space allotment has to change. It is not clear if costs associated with feeder space that must be made available in LGH will decrease, remain neutral or increase. Design must include adequate feeder space available to the sick pen and the variable dimensions of the staging/holding area for near market weight pigs prior to shipment.

iii) **Sorter:**

Checklist:

- Strength
- Dependability
- Mechanical reliability
- reliability of software and electronic components
- ease of software operation for staff
- easy to clean
- provide protection for animals in the sorter



- location of weighing mechanisms (above the pig)
- location of sorter so that exit area is unrestricted (i.e. 8-10 foot separation between the exit gate and the nearest closest obstruction).
- operation and design of gates - there are several proven entry gate designs
- flexibility of sorting options with hardware/software (spray paint for color, moving gates, capping the number of pigs in a particular group)
- maintenance/cleaning requirements
- good dealer support

iv) Waterer:

It is not evident from information available whether additional waterers are required when space is restricted. Access to water in the feeder or near the feeder is important to reduce the number of times the pig must exit and enter the feed court area to meet its daily needs.

V BUILDING COST

Positives:

- Reduced cost of pen partitions
- Reduced cost of unusable floor space associated with pen dividers
- Reduced cost of floor space used as alleyways. (approximately 5% of floor space)
- Reduced cost of augers and water lines when feeders and watering devices are concentrated in specific areas of the pen
- Eliminates need for a dedicated shipping room which is present in some conventional barns
- Possibility of reduction of cost in ventilation
- A simpler ventilation system may serve a large group housing design (i.e. Because of better air distribution within the barn, it has been suggested that no re-circulation vent is required).

Negatives:

- Construction costs of \$25-\$30 more per pig space for fully slatted over partially slatted design
- This cost may be partially offset by higher stocking densities on slatted floors
- Cost of automatic sorter

Discussion:

Not all pen partitions will be eliminated. It is recommended that some pens would continue to be available as sick pens, sort pens, market hog sorting and feed area



segregation. Some stub walls or parking curbs could be made available as pigs prefer to sleep with their back against a wall or another pig.

Space that is normally set aside for handling, sorting or holding pigs will be made available to the pigs as they grow. The automatic sorter expense would be in the range of \$6,500 to \$10,000. It appears that the limits are approaching 500 pigs per automatic sorter. Dr. Mike Brumm, University of Nebraska, has suggested that possible savings of 0.5 sq ft per pig can be achieved in the LGH system because the pig can make better use of the space; for instance, less space is used for dunging compared to the percentage of space used in conventional pens.

VI Labour/Skills

Positives:

- There is reduced time spent in weighing of pigs with the use of automated sorting equipment. The job of weighing pigs has been identified as one of the least desirable jobs in the finishing barns.
- There is reduced time required to check feeders and watering devices if concentrated into a specific feeding/watering area. This is especially advantageous at the beginning of the batch when numerous adjustments must be made to accommodate the new incoming pigs and another unpleasant job is eliminated.
- Reduced time spent climbing over partitions or opening gates to access pigs encourages more thorough and frequent observation of the pigs. This may translate into more quality time available for herd health.
- Time spent in washing the room is reduced because of fewer pen partitions.
- Predicting the number of pigs to ship each week is easier because more data is available on pig weights.
- Reduced risk of injury to stock people from handling market weight hogs at weighing.

Negatives:

- Maintenance could be more difficult with pigs still in the pens. There is no opportunity to empty an individual pen in which maintenance is required.
- Pigs "swarm" around the operator as they are working in the pen. Some people find large groups of pigs to be intimidating.
- Training methods will be required as barn operators become accustomed to observing and handling pigs in larger groups.
- Removing a single pig from these large groups may be more time consuming.
- Removing dead pigs may be more difficult.
- The use of the fully slatted floor may contribute to increased ammonia on average and this may be a labour issue in the future.
- Training requirements are needed to acquire a different skill set and workers have to embrace the technology.
- Training of pigs to use the sorter will be an added responsibility of stockperson



VII Operating Costs

Positives:

- Reduced labour costs are associated with weighing, sorting, washing and maintenance of pens
- Reduced wash water volume associated with less penning
- It is easier to restrict feed, resulting in reduced cost of feed in the pig's gut at the time of shipping (approx. 3 kg)
- Sprinkler systems used for establishing dunging patterns could be eliminated
- Reduced maintenance on equipment, especially penning

Negatives:

- Maintenance costs may possibly increase, depending on sorter and return gates

VIII Performance and Productivity of Animals

Positives:

- It has been reported that some farms have achieved as much as \$10-15 / pig in improved revenues when tightening the number of pigs shipped within the targeted carcass window. The net result on one survey of 2,500 head was an increase of \$3.50 per pig on the entire barn when we achieve over 90% in core of market grid.
- The uniformity of market weights would not necessarily be better than weighing and sorting all the pigs manually, but will in all probability be better than weighing a few pigs and 'eyeballing' the rest. There are at least some operators that are exceptionally proficient at estimating market weights by visually assessing the pig and for these operators there may be fewer advantages.
- Average daily gain (ADG) remains similar to conventional groups (Source: Dr. Harold Gonyou - review showed less than 2% decline in ADG in LGH)
- There is no apparent increase or decrease in pen body weight variation using LGH.

Negatives:

- Vices may affect a greater proportion of pigs in the LGH building, as more pigs are at risk than in small groups. The pig that is biting or nuzzling potentially has more pigs available on which to express the undesirable behaviour.
- There has been no apparent increase or decrease in variation of body weight when comparing LGH vs. small pen groups.



IX Health

Positives:

- Disease-causing agents such as Salmonella can be harboured in hard-to-clean cracks such as those under pen partitions that are difficult to clean. LGH has fewer pen partitions.
- Animals can escape within the pen and avoid injury.
- Hospital pen plays a prominent role within the room facilities and it is easier to reintroduce pigs into the main group once treatment is complete.
- Early detection of health problems is enhanced when pigs are up and moving

Negatives:

- There may be an increased risk of health problems spreading throughout the barn. Diseases that rely on nose-to-nose contact or oral/fecal contamination may present more risk because of the increased number of pigs that can be contacted by the initially infected pig.
- Vaccination is more difficult and there is a need to develop a system for ease of handling for efficient vaccination.
- The daily health check must be more intensive in order to observe sick pigs in the larger group.
- Sick pigs may be harder to handle when they are being moved to a sick pen.
- Early detection of health problems is enhanced when the pigs are up and moving about.

X Animal Welfare

Positives:

- The pen space associated with LGH is more spacious and environmentally enriched. There is more room for the pig to explore and to escape another pig's aggressive behavior.
- It has been proposed that the public perception of LGH may be more positive due to the perception of more space per pig.
- It appears there is a reduction in the amount of fighting when stocking an LGH configuration.
- Ease of animal handling is enhanced and there is less stress associated with moving animals into and out of the large groups.
- Regrouping of pigs for ease of loading at marketing results in little or no fighting.
- Co-mingling at close-out is easier when pigs come from large groups and are moved into small pens.
- Livestock transporters have reported that group-housed pigs are easier to handle at loading and unloading.
- There does not appear to be any increase in the incidence of social vices such as tail biting in LGH.



Negatives:

- Injured animals may be more difficult to find.

XI Pork Quality/Food Safety**Positives:**

- Better carcass quality due to:
 - Less stress and fighting when pigs are co-mingled prior to shipping
 - Barn managers and truckers report handling and movement of pigs from large groups is easier than pigs housed in small pens
 - Potentially fewer carcass demerits at processing with easier handling at market
 - More pigs shipped in the desired weight range provide a more uniform carcass at processing targets the size of cuts that the consumer desires thus increasing true demand for pork
 - The removal of feed prior to marketing reduces porcine stress syndrome (PSE) meats and this is facilitated more easily with the LGH configuration

Negatives:

- It is more likely that a treated pig will need to be removed from the large group when medicated so the quality assurance requirements are satisfied and marketing can continue

XII Economics

The economics of incorporating LGH into your operation will depend largely on whether you have suitable facilities for renovation, or if new construction is required to accommodate this management system. Figure 4 shows some of the potential costs and savings resulting in an advantage of about \$4-5 per pig using LGH by taking advantage of lower barn and labour costs through reduced penning purchase or replacement costs and the purchase of an auto sorter. Additional details on costs and benefits can be found in the Appendix.

XIII Conclusions

Large group housing offers significant benefits in the areas of better space utilization, reduced labour, improved stockperson working conditions, and improved ability to select more pigs within the marketing grid core.



APPENDIX

Note that in each design a sick pen needs to be incorporated into the feeding/staging area, and access to feed and water provided for pigs separated from the larger group for further treatment and observation.

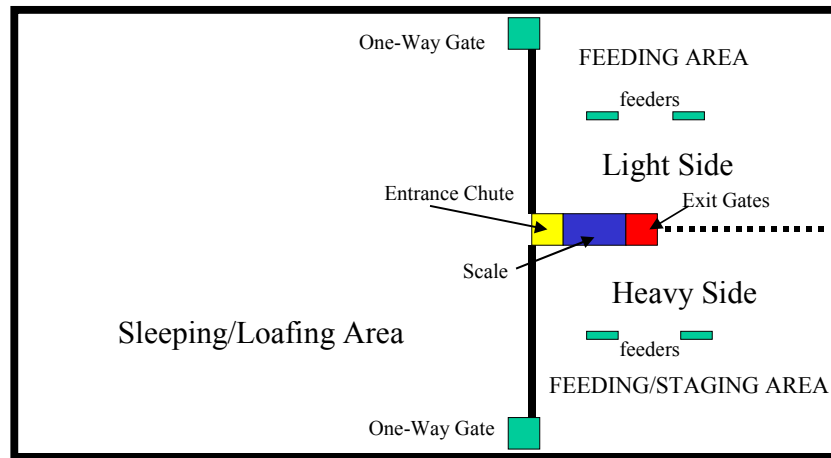


Figure 1: Large Pen Continuous Sort Design



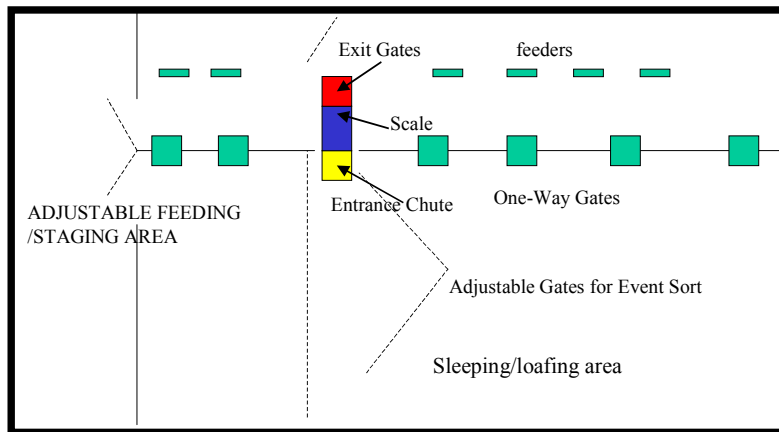


Figure 2: 500 Head Continuous Sort or Event Sort Design



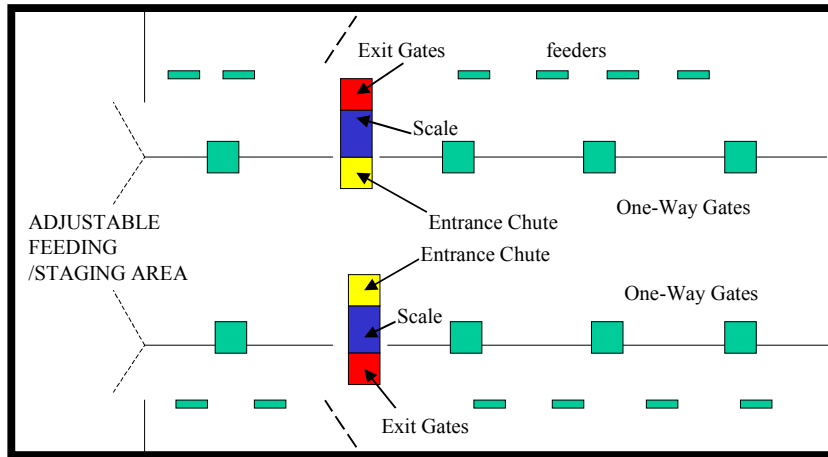


Figure 3: 1000 Head Continuous Sort



ECONOMICS SUMMARY

Item	Value / pig
Sort Loss Reduction	\$3.50
Demerit Reduction	\$0.38
Feed budget by weight	\$0
Phase feeding	\$0
Feed restriction at market	\$0.48
Stocking density \$0.37, reduced alley \$0.33 and pen divider space \$0.13	\$0.83
Labour at loading	\$0.16
Less penning	\$0.53
Less feed auger	\$0.05
Full slat	-\$0.61
Sorter	-\$0.55
NET Savings	\$4.77

Assumptions:

- 500 head barn, \$330/ pig space construction cost, 3.3 turns/yr, \$110/kg market price, \$15/hour labour rate, \$160/t feed cost, 10 yr amortization on equipment and 15 yr amortization on building costs
- Sort loss of \$3.50 is based on moving from 70% in core of marketing grid to 90% in core
- Demerits savings assumes reduction of 50% of demerits due to improved handling pre-market (typical demerit of \$0.75/pig)
- Improved efficiency by better feed budgeting and improved efficiency with more rigorous phase feeding has not been included but previously has been reported to be in excess of \$2.50 per pig
- Feed restriction at market assumes 3kg saved in last 12 hour feed withdrawal
- Stocking density assumes 0.5 sqft less space required per pig vs conventional penning at 9.0 sqft (reduction of 5.5% space)
- Labour saving at market time only – uses experience of 4 man hours vs 1.5 man hours required to load 240 pigs
- Penning value of \$7800 for 500 hd room, assume holding pens require about 17% of original penning
- Save one feeder line and auger per room of 500 hd, approx. value \$850. Slatted floor adds \$30/pig space. Sorter costs \$9,000 installed.



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