

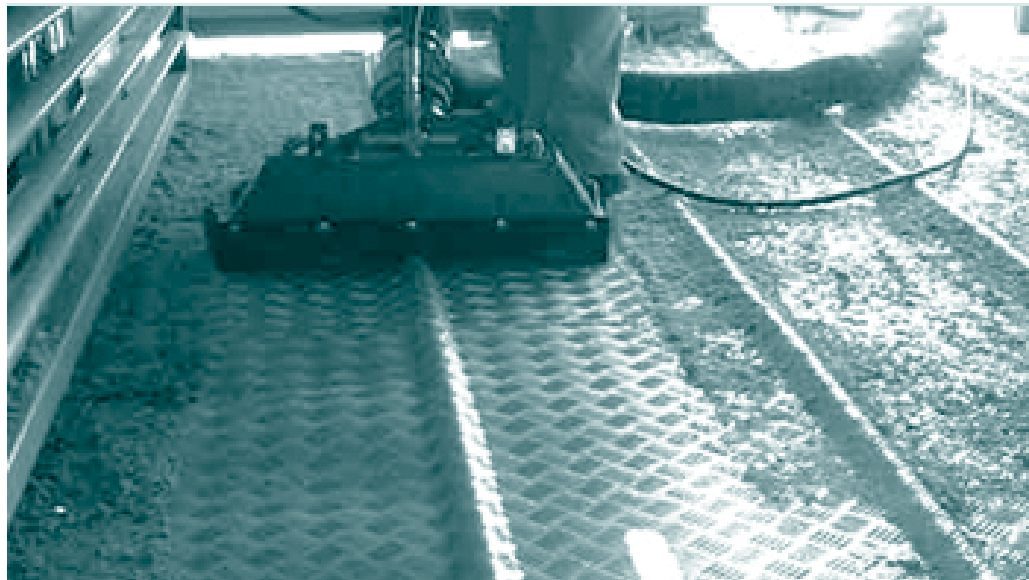
Improving biosecurity in swine transport



Sarah Ethier



Jennifer Brown, Ph.D.



As pork producers watched the spread of PEDv in North America in the summer and winter of 2014, it became increasingly apparent that even when good on-farm biosecurity procedures are in place, there may be serious gaps in biosecurity, particularly related to transportation. Transport of pigs can be a major vector for disease transmission in swine, and improved sanitation can be a key component in reducing disease transmission. The need for better cleaning and sanitizing procedures, and development of easier to clean trailers for the swine industry has become clear, both to reduce the spread of PEDv, and to control other potential disease risks. A number of problems have been identified which hinder the efficient and thorough cleaning of trailers currently being used within the industry. These include a limited number of (hog) transport trailers available, downtime required between loads, and capacity of truck wash facilities. In addition, current trailer designs are difficult to clean, requiring the use of manual labor which increases cost, and potentially leading to problems with cleaning consistency.

The initial phase of the project investigated current trailer designs used in Canada and ranked relative trailer attributes related to animal welfare and ease of cleaning. Information collected from this phase was analyzed with trailers being ranked according to ease of cleaning and animal handling

followed by recommendations for improvement in both areas. This information provided will also be used as a basis for the development of an automated cleaning system.

Trailer Design

Trailers used by the Canadian swine industry for transporting market hogs feature manufacturers Wilson, Barrett, Merritt and Eby. One transporter, Luckheart transport in Ontario, has recently begun importing Pezzaioli trailers from Italy. In western Canada, the majority of trailers used for market hog transport are dual purpose cattle and hog trailers with a tandem or triaxle spread. These specific trailers are popular due to standard features such as cleaning ease, durability and individual manufacturer's willingness to customize livestock trailers based on requests of drivers and dealers.

The most commonly used trailer design is a double deck potbelly trailer with a belly rail installed between the pot and top deck. Removable flooring is inserted in the middle deck in order to convert the trailer from a double

to triple deck design (two decks for transporting cattle, three decks for pigs).

Other commonly used trailer designs include straight deck trailers for transporting market hogs and quad deck trailers which are used exclusively for transporting isowean piglets. In Ontario, Luckhart Transport Inc is working to introduce the Pezzaioli livestock trailer which is manufactured in Italy. The Pezzaioli trailer features flat hydraulic floors, no ramps or step-ups, active ventilation (fans), misters and heated drinkers (nipple drinkers for pigs and bowl drinkers for cattle). These trailers are specifically designed to meet EU transport regulations which require the provision of food and water on all transports longer than 8 hours.

Ease of Cleaning

In general, straight deck trailers have been ranked as the overall easiest to clean due to presence of fewer complex floor surfaces and greater head room, while quad deck trailers (used for isowean transport) are rated as the most difficult to clean. As the amount of removable

decking increases in a trailer the process of cleaning becomes more difficult and greatly increases the amount of labour required to clean the trailer.

The average trailer takes approximately 5.5 man hours to clean, and usually consists of 2 employees working together to complete a full trailer wash and disinfection. The more material in a trailer the longer to wash, this means a quad deck trailer can take up to 6.5 hours to complete, especially since the floor needs to be removed in order to be adequately washed

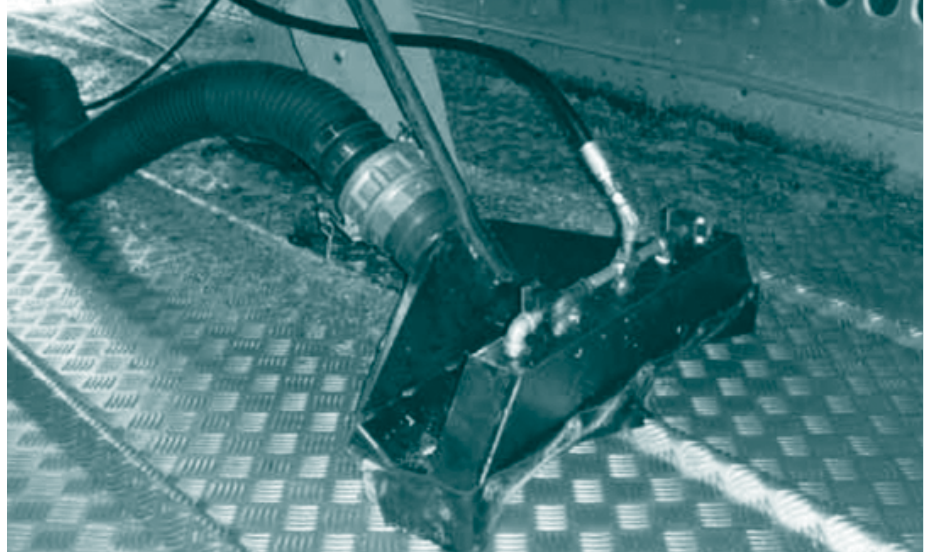
Various aspects of livestock trailers impact the overall cleaning ease of trailers due to subtle changes in trailer design. Key factors that influence the ease of manual cleaning include:

- i. **Floor plan.** Straight decks are simpler to clean than pot trailers which have multiple ramps and floor surfaces.
- ii. **Flooring type and pattern.** Removable decking increases the flexibility of trailer use, but must be completely removed for proper cleaning. Smooth floors are easier to clean, but texture (eg checker plate) and cleats provide animals with more secure footing.
- iii. **Support beams.** Some beams are encased, whereas others are open I-beams which collect dirt on side ledges.
- iv. **Deck height.** Low ceilings make cleaning difficult, as cleaners need to bend over to access the compartment.
- v. **Design of fixtures.** Sealed lights and tubing, angled gating, conveniently placed and easy to clean gate latches reduce buildup of organic matter and facilitate cleaning.
- vi. **Access doors and drains.** Placement of doors and drains that are well placed and easily flushed.

Animal Handling

Stress associated with handling and transport can lead to heat stress, heart failure and high levels of stress. Particularly on hot summer days, heart failure can occur in pigs moving up ramps, or following strenuous exercise associated with mixing and handling. There are many trailer features which affect difficulty the loading and unloading of market hogs, as well as their comfort during travel and risk of injury due to trapping, pinching or impact with trailer components.

- i. Ramp design. Number of ramps, ramp length, angle and surface (cleat height and spacing).
- ii. Loading density.
- iii. Head height. Handlers
- iv. Protrusions. Sharp corners and edges, and ribbing on walls or floors can cause bruising.



- v. Pen layout. Turns and distance travelled to each compartment.
- vi. Flooring. Adequate ribbing to minimize slipping. Removable decks are typically smoother than permanent flooring.
- vii. Gates and ramps. Crevices where feet or other body parts may be trapped. Temperature control. Hot or cold areas vary with season, ambient temperature, compartment (air flow/ventilation/boarding/bedding/contact with cold metal)
- viii. Suspension and vibration. Previous research suggests that suspension in the rear of the trailer may cause greater bounce in these compartments. Pigs were more reluctant to lie, and spent more time standing in rear compartments.

One of the difficulties in ranking specific trailer models for animal handling and welfare is the ability to customize trailer design. Transporters have the option to customize trailers to their preference by pre- or post- market modifications. Two trailers from the same manufacturer and of the same design may have different features which impact animal handling within the trailer.

Retrofit opportunities to improve animal welfare and ease of cleaning:

Due to multiple trailer types and configurations retrofitting trailers to increase ease of cleaning an animal welfare need to be considered on a trailer by trailer basis. However there are several key recommendations that should be considered in the development phase of any trailer use for the transport of hogs.

In terms of ease of cleaning, the general rule is that trailers with more decks take longer to clean

One of the main features which pose a difficulty to hogs during loading and unloading is the number of ramps within a trailer, as an increased number of ramps and angle of ramps makes loading hogs more difficult. The maximum recommended ramp angle for market hogs is 20° (Canadian Agri-Food Research Council, 2001); however, hogs can navigate ramps with gentle slopes more easily than severe slopes. Through the use of hydraulic floors, Pezzaioli trailers have avoided the need for any ramps, making it especially welfare friendly.

Features to improve cleaning ease:

- Decrease the amount of removable decking
- Decrease the number of ramps
- Have fewer tight corners and enclosed spaces
- Avoid open ended tubing, I beams, ledges and fixtures that trap debris
- Have well placed and designed access doors and flush out openings

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Older animals generally prefer manipulable and destructible enrichments

A common problem with enrichments is that animals lose interest over time. This project will also examine if regular rotation of enrichments can increase their interest and value to sows, compared to constant provision.

Cameras are mounted over the pens and time lapse photos taken on selected days to determine the level of enrichment use, and the activities and postures of sows. Stereotypic behaviours are recorded by live observation of sows, and levels of aggression are determined using skin lesion scores, ranging from 0 (no injury) to 3 (severe injury) on both sides of the body.

Accelerometers are used as automated measuring tools to record the mobility of animals, similar to pedometers used to record fitness activities in people. Accelerometers are being used in this research to compare the activity levels of dominant and subordinate sows. Saliva samples are also taken in early, mid- and end of each trial to determine cortisol levels as a measure of stress.

While the benefits of enrichment are well known, determining exactly what enrichments are suitable at each stage of production, as well as the best methods for presenting them are still unclear. This research will help to fill these gaps related to sows, and will form the basis for practical recommendations to benefit sows and help producers meet the code of practice requirement. Enrichment is a new area for Canadian pig producers, and time is needed to clarify what is meant by enrichment and to implement these measures.

This research project will be completed in December 2017, with results available in 2018. This project is funded by Swine Innovation Porc within the Swine Cluster 2: Driving Results Through Innovation research program. Funding is provided by Agriculture and Agri-Food Canada through the AgriInnovation Program, provincial producer organizations and industry partners.



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Features to improve animal handling and pig welfare:

- Decrease the number of ramps, and floor levels
- Reduce the amount of loose equipment (chains, pins, etc)
- Reduce sharp edges or protrusions and areas where body parts may be trapped or pinched
- Increase door width
- Decrease the slope of ramps and minimize step ups
- Handle pigs using behavioural principles (approach and retreat, use of flight zone) in a low stress manner (use prods only when needed)
- Have adequate ceiling heights during handling
- Forced ventilation in summer, and bedding/insulation in winter
- Use sprinklers at loading and unloading (temperatures $\geq 24^{\circ}\text{C}$)

“Due to multiple trailer types and configurations retrofitting trailers to increase ease of cleaning and animal welfare need to be considered on a trailer by trailer basis.”

Summary

Although many livestock trailers may look very similar at first glance, there are in fact a wide variety of designs in use. Individual manufacturers offer a variety of options on trailers, and transporters often do aftermarket custom work, making it difficult to define the exact features present on an average livestock trailer. These include variations in trailer siding, ramp length and angle, step design, light housing, gating, latches, sprinklers or misters as well as other features.

In terms of ease of cleaning, the general rule is that trailers with more decks take longer to clean, and that flat deck trailers are easier to clean than pot trailers. The new hydraulic deck trailers fit between these categories, as while the decks themselves are relatively easy to clean, the chain drive, locks and controls are all complex components and difficult to clean thoroughly.

Animal handling is clearly improved on straight deck trailers as the use of ramps is minimized. Handling of pigs on hydraulic deck trailers is even better as there are no ramps involved. However, pot belly trailers (either dual purpose or dedicated for pig transport) remain the most commonly used trailer design in Canada. These trailers (especially dual purpose ones) are highly versatile, have high load capacity and are relatively low weight. However, these trailers are also the most difficult to clean and have poorest animal handling characteristics. Alternative designs are being used which are easier to clean and allow better ease of handling for animals, but these designs are less versatile, have reduced load capacity and/or are significantly heavier.

The trucking industry recognizes the need for innovation in this area, especially due to increased biosecurity concerns and the cost of cleaning trailers, however this change will come at a cost due to reduced capacity, less versatility, higher trailer weight and higher purchase cost. Regardless of these issues, improved technologies to aid in the cleaning process will assist the industry regardless of trailer design and are sorely needed.

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